HILLSBOROUGH TPO ELECTRIC VEHICLE INFRASTRUCTURE PLAN

Final Report

October 2023

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"Car charging in downtown Tampa." Credit: Ryan Casburn, Kittelson & Associates, Inc.

KEY TERMS AND DEFINITIONS

Terms	Definitions
Electric Vehicle (EV)	A vehicle powered by one or more electric motors for propulsion. This plan focuses on BEVs and PHEVs, both of which can be plugged in and recharged from external sources of electricity.
Battery Electric Vehicles (BEVs)	Also known as "all-electric vehicles", BEVs are powered only by electricity battery and are charged by an external power source.
Plug-in Hybrid Electric Vehicles (PHEVs)	PHEVs have an electric battery that operates an electric motor in addition to a gasoline tank that fuels a gasoline motor. The electric battery can be plugged in to recharge and the gas tank can be refilled.
Hybrid Electric Vehicles (HEVs)	HEVs have an electric battery that operates an electric motor AND a gas tank that fuels a gasoline motor. The gas tank can be refilled, but the electric battery cannot be plugged in to charge.
Fuel Cell Electric Vehicles (FCEVs)	FCEVs use hydrogen to power an electric motor.
Vehicle-to-Grid (V2G)	Also known as Vehicle-to-home (V2H) or Vehicle-to-load (V2L), it describes a technology that enables energy to be pushed back to the power grid from the battery of an electric car using bi-directional charging equipment.
Electric Vehicle Supply Equipment (EVSE)	EVSE provides for the transfer of energy between the electric utility power and the EV. EVSE includes EV charge cords, charge stands (residential or public), attachment plugs, vehicle connectors, and protection.
Electric Vehicle Service Provider (EVSP)	Also referred to as EV supply vendors, EVSP delivers end-to-end EV charging, handling charging station installation, operations and maintenance.
Zero-Emission Vehicle (ZEV)	ZEV is a vehicle that does not emit exhaust gas or other harmful pollutants from the onboard source of power during vehicle operation. BEVs, PHEVs, and FCEVs qualify as ZEVs.

PLAN OVERVIEW

Introduction

In recent years, public awareness of electric vehicles (EVs) and EV technology has rapidly increased. Individuals, fleet operators, businesses, and government agencies are transitioning from gas powered vehicles to EVs. Planning for a charging network to support this transition will support those who have already transitioned and encourage greater adoption of EV technology.

The Hillsborough Transportation Planning Organization (TPO) is developing this Electric Vehicle Infrastructure Plan (EVIP) to provide a framework for developing widespread, convenient, and accessible EV charging in Hillsborough County, Florida. As EV technology evolves, this EVIP is intended to adapt and help the TPO continue to meet the needs of residents, workers, and visitors. The development of this EVIP will empower the TPO to access funding opportunities, inform the TPO's long range planning efforts, and provide near term goals and guidance to support communities in accessing EV technology and experiencing the benefits of EVs, as displayed in Figure 1. This EVIP is intended to complement the work of the *HART Zero-Emission Fleet Transition Plan* (adopted in 2022), FDOT's *Electric Vehicle Infrastructure Master Plan* (adopted in 2021), and other work by regional and national agencies.

Figure 1: Desired Outcomes of EVIP

Help Communities Experience Benefits of EVs

Inform Planning

Access Funding Opportunities

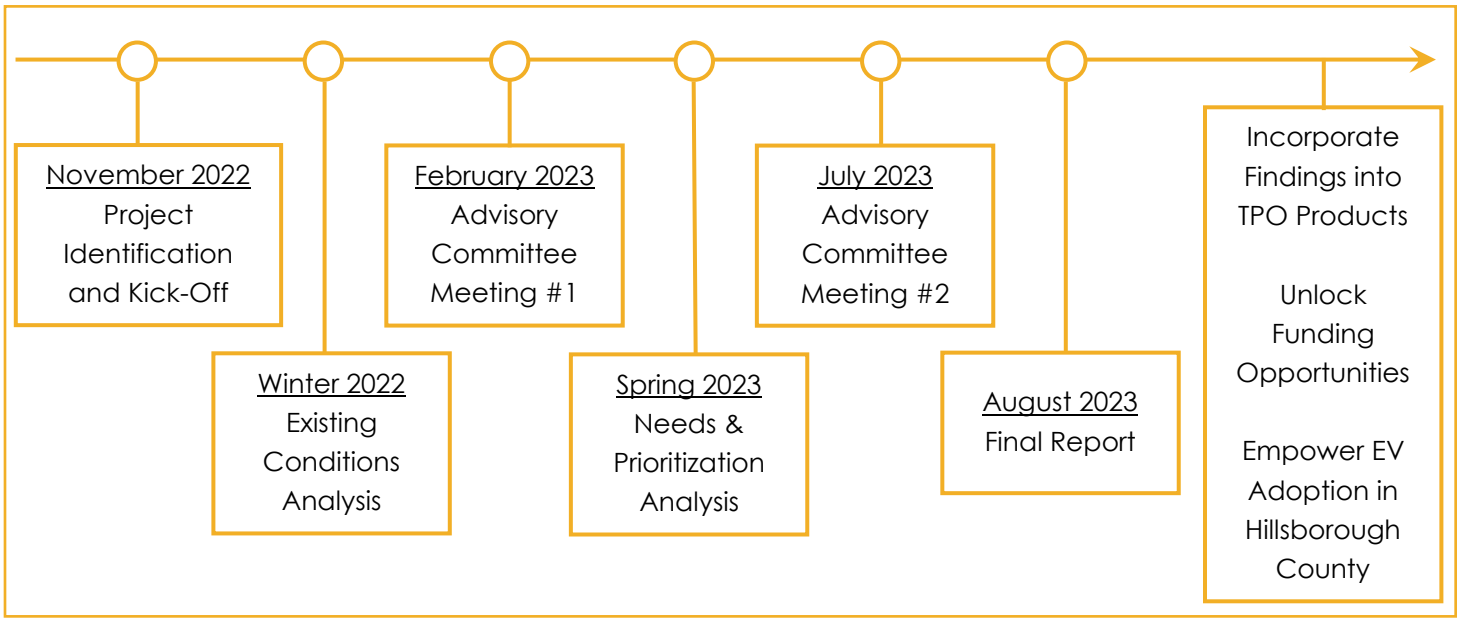
The development of this EVIP occurs at a time when EV adoption is trending substantially upward throughout Hillsborough County, the country, and world. In 2021, there were about 6,000 registered EVs within the County's overall total of 1 million registered vehicles (<1%). However, various forecasts anticipate EV adoption to range from about 5 - 30% of total vehicles by 2035. Beyond 2035, some agencies envision even greater numbers of private vehicles transitioning to EVs. For example, the City of Orlando expects 80% of light-duty vehicles to be EVs in 2050. Hillsborough TPO is preparing for this large transition in how Hillsborough County moves around.

EVs promise a slew of benefits to owners and the community, but residents and visitors in Hillsborough County also face barriers to adoption. One key barrier is a lack of visible charging infrastructure. People are accustomed to seeing gas stations on the corners of their neighborhood but may not see places where they can recharge their EV. This EVIP is intended to evaluate the existing charging infrastructure in Hillsborough County and identify gaps that can be addressed.

Timeline

Hillsborough TPO is developing this EVIP with the support of an Advisory Committee made up of local agencies and with the participation of various stakeholders. An overview of the process is shown below in Figure 2. This Final Report summarizes the Existing Conditions Analysis, with the full report included in Appendix A, and the findings of the Needs & Prioritization Analysis.

Figure 2: EVIP Development Process



"Timeline of EVIP Development Process with Meetings and Major Documents Highlighted"

"Cars charging at DC Fast Charging Station in Hillsborough County"

EXISTING CONDITIONS

The following section summarizes the key findings of the Existing Conditions analyses, which are documented in full in *Appendix A: Existing Conditions Report*. The Existing Conditions Report documents:

- Details of the unique EV use cases
- Information on the types of EV charging and equipment
- Existing electric vehicle infrastructure in Hillsborough County
- Planning and implementation efforts to date
- Summaries of state and federal EV work
- An evaluation of publicly owned land in Hillsborough County to identify EV-supportive areas

Relevant EV Plans

At the local, regional, state, and national levels, EV infrastructure planning and implementation is front and center as an important part of increasing transportation system resiliency, decreasing transportation emissions, and improving air quality. Many of the Hillsborough TPO's partner agencies are engaged with these efforts, which are described below. Ensuring consistency with these partner agency plans will be a crucial aspect of implementing effective, efficient, and equitable charging infrastructure in Hillsborough County.

- **HART Zero-Emission Fleet Transition Plan (2022):** Hillsborough Area Regional Transit (HART) completed an evaluation of a process to transition to a zero-emission fleet. HART is evaluating a pilot project for battery electric buses and has identified the need for chargers both at the depot and on-route. HART anticipates a preference for fuel cell electric buses due to having longer routes and limited time for recharging.
- **Florida EV Roadmap (2020):** The Florida EV Roadmap was the first Statewide planning effort for EV infrastructure in Florida. The work included a survey of Florida EV owners regarding their experience using EV charging infrastructure.
- **Florida Department of Transportation EV Infrastructure Master Plan (2021)**: The FDOT EV Infrastructure Master Plan built upon the Florida EV Roadmap and developed an overarching plan for EV infrastructure in the State. The Master Plan considered aspects including emergency evacuation, overall infrastructure need, and a gap analysis of existing charging infrastructure.
- **FDOT Electric Vehicle Infrastructure Deployment Plan (2022):** The FDOT EV Infrastructure Deployment Plan was developed to meet the National Electric Vehicle Infrastructure Program (NEVI) requirements and implement this federal funding. The Deployment Plan focuses on installing DCFC charging stations along federally recognized Alternative Fuel Corridors (AFC).
- **Downtown Tampa EV Charging Analysis (2021):** The Downtown Tampa EV Charging Analysis was conducted to make recommendation for how to best expand EV charging in Downtown Tampa. The study includes policy recommendations and actions that can be taken to support an increase in EV adoption. The study suggests that the City of Tampa should install 120 charging ports throughout the city, including 12-24 DCFC charging ports.

EV Use Cases

Over the past few years, EV adoption has grown steadily in Hillsborough County and across the US for a variety of uses. In particular, five use cases are critical to the efficient, effective, and equitable provision of EV charging infrastructure in Hillsborough County:

1. **Urban & Rural Light-Duty Vehicles**: This use case considers the vehicles that individuals use for personal travel.
2. **Disadvantaged Communities**: Disadvantaged communities face additional barriers to adopting EVs and may have unique considerations related to the installation of EV charging infrastructure.
3. **Commercial Delivery (Medium-Duty Freight)**: This use case considers vehicles used to make deliveries or other short distance freight trips.
4. **Transportation Network Companies (TNCs) & Gig Drivers**: TNC Companies (like Lyft and Uber) and other Gig Companies (like Door Dash or Amazon Flex) contract with individuals to use light-duty vehicles to make deliveries or give rides. TNC and Gig drivers travel more miles per day than other drivers.
5. **Transit Fleet:** This use case focuses on public buses.

These use cases form the basis for the EV adoption scenarios, needs analysis, and recommendations discussed in subsequent sections. Other use cases have been explored by other publications including long distance corridor travel, e-micromobility, electric long-haul trucking, electric vertical takeoff and landing (EVTOL), and electric airplanes. These other use cases are not explored in this EVIP.

"Pinellas Suncoast Transit Authority Bus with Charging Equipment"

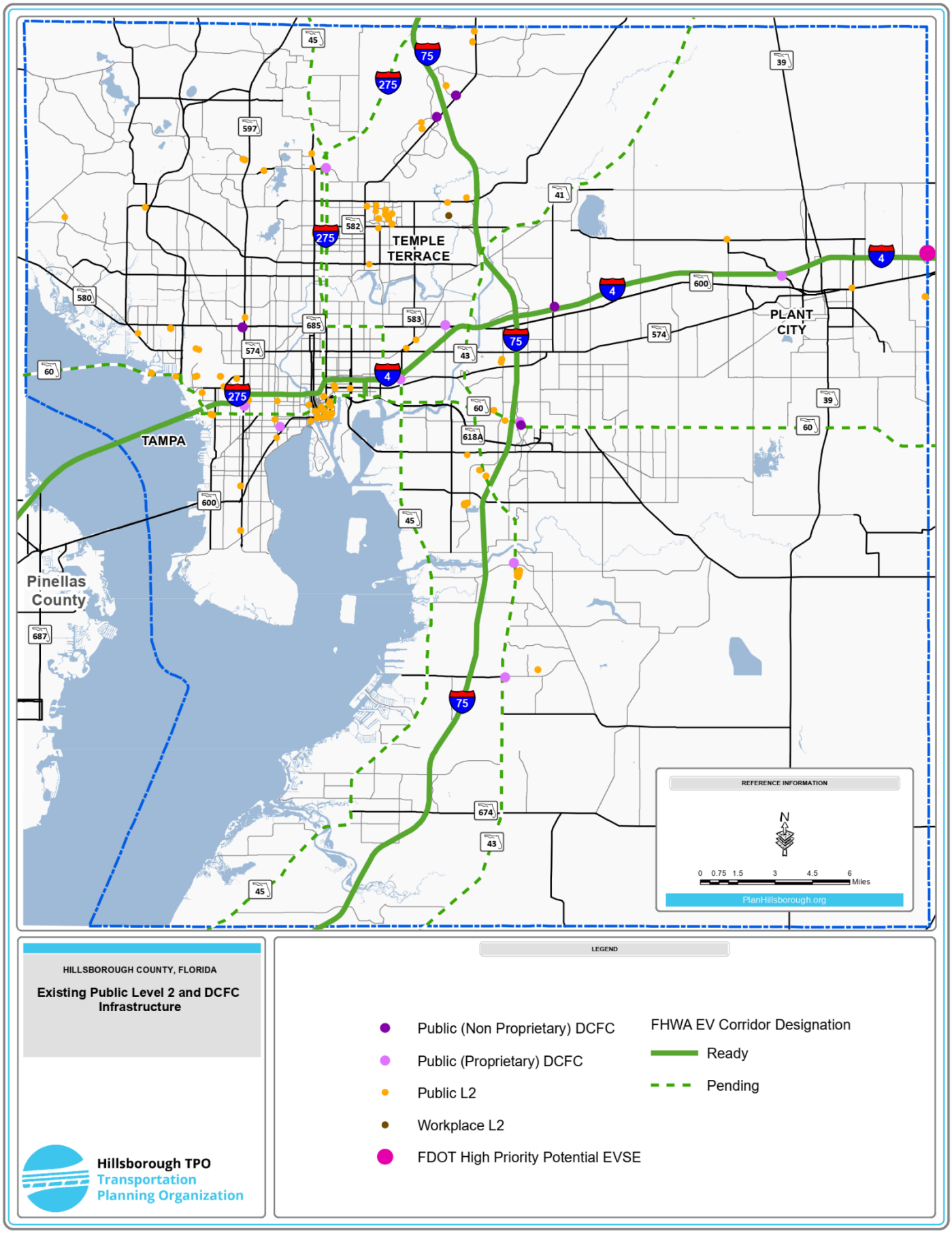
EV Charging Infrastructure & Supportive Land Uses

This section outlines key aspects of the existing EV charging infrastructure in Hillsborough County, as well as providing an overview of the land use analysis performed to understand where EV-supportive lands in Hillsborough County are located.

There are **6,000 EVs** in Hillsborough County and **180 EV charging stations**.

- **EV Adoption**: In 2021, a little over 6,000 EVs were registered in Hillsborough County, 0.6% of the registered light duty vehicles in the County.
- **Existing Charging Infrastructure**: In January 2023, there were 180 EV charging stations in Hillsborough County, 14 of which host DC fast chargers (DCFC), shown in Figure 3. Additionally, FDOT designated I-75 and I-4 as Federal Highway Administration (FHWA) Electric Alternative Fuel Corridors. These corridors are eligible for federal funds to install charging infrastructure. FDOT has identified one site along I-4 at the Polk County border as a high priority potential location for an additional DCFC station.
- **Disadvantaged Communities**: Of the existing and planned EV chargers, 62 (52 Level 2 stations and 9 DCFC stations) are located within either an underserved area or a disadvantaged community identified by the Hillsborough TPO *Equity and Nondiscrimination Plan* or the Joint Office of Energy and Transportation (JOET) Justice 40 definition. Relatively fewer Level 2 chargers are currently located in disadvantaged communities, compared to the distribution of residents in Hillsborough County. Conversely, relatively more DCFC ports are currently located in disadvantaged communities, compared to the distribution of residents in the County.
- **Transit**: HART, the public transit provider in the Hillsborough TPO planning area, currently maintains a fleet of compressed natural gas (CNG) and diesel buses. It also maintains gasoline-powered cutaway vans for its on-demand service. HART is planning a transition towards zero emission vehicles, but is not currently operating battery electric buses.
- **Parking**: Public parking offers an excellent opportunity for EV charging, as both on-street and off-street spaces are located in places already accessed by cars. In the City of Tampa, six garages are equipped with Level 2 chargers, but at present few on-street spaces are equipped with chargers.
- **Land Use Planning**: The Plans and Codes of Tampa and Plant City encourage the development of EV charging spaces. The Comprehensive Plans and Land Development Codes of the County and various cities identify EVs as promoting energy efficiency, air quality, and reduced use of fossil fuels.
- **EV-Supportive Lands**: Installing public EV infrastructure on land that is already publicly owned avoids certain implementation barriers. Of the approximately 300,000 acres of publicly owned parcels in Hillsborough County, many have been identified as potential locations for public EV infrastructure, including existing and future activity centers, Key Economic Spaces, libraries, parks, and interchanges, as well as publicly-owned parcels in underserved areas. To establish sufficient charging infrastructure for EVs and accommodate future EV demand, public-private partnerships may be required to install extra charging stations on private lands.

Figure 3. Distribution of Existing (and Planned) L2 and DCFC Electric Vehicle Charging Infrastructure



STAKEHOLDER ENGAGEMENT

This EVIP was developed in cooperation with an Advisory Committee made up of local agencies. In addition to the Advisory Committee, the TPO collected feedback through stakeholder listening sessions and a public survey. The stakeholders who participated in this planning process represent a wide range of technical expertise and lived experience that were crucial towards the development of the EV adoption scenarios, the needs analysis, and ultimately the implementation recommendations of the EVIP.

Advisory Committee Meetings

Advisory committee meetings were held to review the Existing Conditions Analysis (February 2023) and the Needs and Prioritization Analysis (July 2023). Meeting notes are included in Appendix B. Several takeaways from the Advisory Committee meetings that influenced the development of this EVIP include:

- Exploring opportunities to install semi-public charging infrastructure on school campuses
- Negative externalities should be considered, due to the use of public funds to develop charging infrastructure
- Some local agencies envision using this EVIP to inform upcoming code revisions
- Some local agencies are seeing an increase in multi-unit dwelling development
- Transitioning public fleets to EVs may be an effective policy recommendation
- Consider designing charging stations to accommodate towing vehicles (for example a truck towing a boat)
- When prioritizing sites for installing charging infrastructure, consider the electric distribution system and needed upgrades

Stakeholder Listening Sessions

A series of stakeholder listening sessions were held during the development of the EVIP to educate stakeholders about the EVIP's goals, and to hear about the unique opportunities and challenges that EVs present to each stakeholder group. These sessions were hosted by the Hillsborough TPO and conducted virtually in March and April 2023. Feedback from each session is summarized below. Materials developed for the sessions are available in *Appendix B: Public & Stakeholder Engagement*.

Disadvantaged Communities Session

Hillsborough TPO met with representatives of Community Redevelopment Agencies (CRAs) in Tampa, along with other stakeholders to discuss specific considerations for EV charging infrastructure in disadvantaged communities. Meeting notes are included in Appendix B. The considerations summarized in this section should be especially applied to disadvantaged communities in Hillsborough County when considering the development of EV charging infrastructure for Light Duty Vehicles. Additionally, these considerations are incorporated into the development of Policy Recommendations in this EVIP.

Key takeaways include:

- EVs are not a priority for many residents, and are not perceived as obtainable
- As EVs become more affordable and widely adopted in the future, a lack of investment in charging infrastructure in disadvantaged communities could result in charging deserts and further slow the rate of adoption of EVs in disadvantaged communities
- EV charging on main streets (for example in Ybor City) may promote business and increase visitation

- New developments including the redevelopment of park space can provide an opportunity for installing charging infrastructure
- Benefits should be demonstrated for the community through EV charging, for example directing income from charging back to people in the community
- Most of the growth observed is in multi-unit dwellings
- Some communities are already concerned and seeing impacts of gentrification, communities do not want EV charging infrastructure to result in further gentrification

Commercial Delivery (Medium Duty Freight) Session

Hillsborough TPO contacted numerous stakeholders to seek feedback on the commercial delivery use case, however few stakeholders engaged with the TPO. Considerations for this use case are largely based upon a literature review. However, some important feedback collected from stakeholders who did engage with the TPO include:

When designing facilities for freight vehicles, some special design considerations include:

- Design the flow of the facility to use one-way aisles
- Pull through parking spots. Where EV chargers are used with pull through spots, the charger is typically installed in an aisle with bollards around it.
- Consider pedestrian flow from the parking spots, use crosswalks for the pedestrian path
- Separate light duty vehicles from medium and heavy duty vehicles
- Some amenities that are included at truck parking facilities include: bathrooms, security office, dynamic signs to indicate available spaces, and CCTV coverage.

FDOT is designing a truck parking lot at I-4 and Countyline Road. The intention of these facilities is to serve freight vehicles travelling long distances. Some considerations for the siting of these types of facilities include:

- Identify corridors with heavy freight use
- Identify current parking facilities and areas with insufficient current parking
- Prefer sites that are close to the freight corridor and in a commercial land use
- Sites located outside of the Interstate right-of-way can sell EV charging

HART (Transit) Session

Hillsborough TPO engaged with Hillsborough Area Regional Transit Authority (HART) to discuss HART's ongoing planning for ZEV transition.

HART is planning for a transition to ZEV and considering Hydrogen Fuel Cell and Battery Electric buses.

- HART has prepared a transition plan investigating the use of battery electric buses and Hydrogen fuel cell buses
- HART has been hesitant to transition to battery electric buses due to vehicle range and reliability
- HART currently operates in such a way that any bus can be assigned to any route. Operating this way minimizes the complexity for the maintenance department and minimizes the number of spare buses that must be maintained
- HART currently operates most of the buses 20 or more hours per day. The express route buses typically operate only during the morning and evening peak periods
- HART maintenance typically operates over night, but remains open 24/7

- HART expects buses would need to return to the yard when they hit 20% of battery capacity
- Typically drivers have a layover between 10-30 minutes at the ends of the route
- HART has been in discussion to build a new maintenance facility for the past 10 years. In the design of the new facility, HART intends to be prepared for ZEV technology: Hydrogen facilities or charging infrastructure
- HART is acquiring 4 buses as part of a TECO partnership, these buses have been discussed for using on circulator routes they have also been considering
- HART is coordinating with other agencies and monitoring technology development to understand the ideal mixture of vehicles in the fleet.

FDOT Session

Hillsborough TPO engaged with FDOT to align this EVIP with ongoing work from FDOT. FDOT provided several recommendations that have been incorporated into the Existing Conditions analysis and the Needs Analysis.

- FDOT recommends considering medium duty fleet vehicles in the EVIP. Considerations for medium duty electric vehicles are being discussed in the industry, and are expected to continue to play a role in the EV charging infrastructure needs. The TPO modified the considered use cases to include the commercial delivery use case.
- FDOT recommends conducting a refresh on the gap analysis included in the FDOT EV Masterplan, using similar, but updated datapoints. The TPO considered the criteria used in the FDOT gap analysis when projecting need for EV charging in Hillsborough County and followed a similar approach for the evaluation of EV charging deserts in Hillsborough County.
- FDOT emphasizes the value in including recommendations from the EVIP in the LRTP, to clearly state the vision of the TPO. The TPO intends to use this EVIP to inform the 2050 LRTP.
- FDOT intends to use NEVI funds to complement investment from private companies and incentivize the installation of charging infrastructure in locations where private companies may not be making money currently. Hillsborough TPO can consider a similar approach in the prioritization of locations for charging infrastructure.

Public Survey

A public online survey was conducted between January 18th and March 27th, 2023 to record the perspectives of Hillsborough County residents and visitors regarding EV charging infrastructure. The following section summarizes key findings. The full survey is available in *Appendix B: Public & Stakeholder Engagement*.

The survey recorded 121 responses:

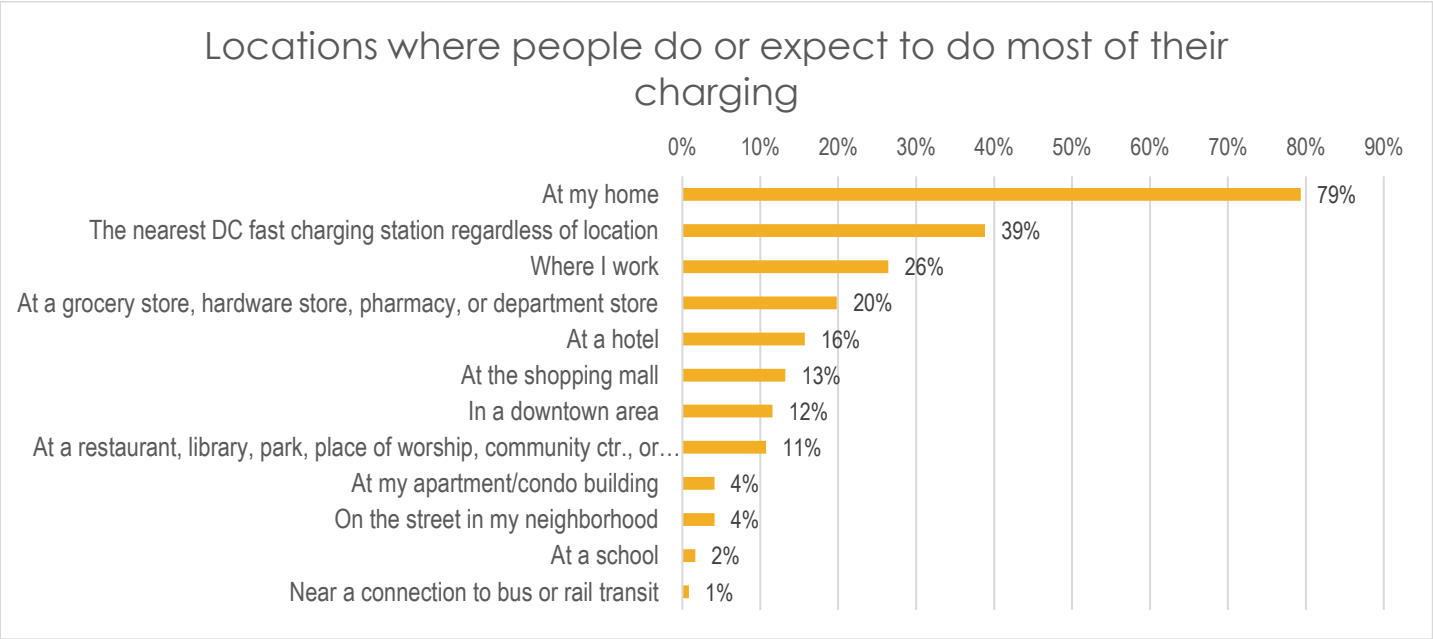
- 64 responses were from EV drivers
- 87 respondents live in Hillsborough County
- 75 respondents work in Hillsborough County

Survey responses are summarized in Figure 4 through 8. Several key findings include:

- About 80% of respondents prefer to charge at home. The nearest DC fast charging station and workplace were the other most preferred charging locations.
- Respondents prioritize amenities including bathrooms and convenience store options (like snacks and coffee) for inclusion at charging stations.
- About 70% of EV drivers do not drive beyond the range of their EV more than once per month.
- The primary obstacle to EV ownership for non-EV drivers is the purchase cost, while concerns about the lack of charging stations during long-distance travel and charging time are also significant concerns.

Respondents (EV drivers and non-EV drivers) chose three preferred charging locations (Figure 4). Around 80% of respondents prefer to charge their EVs at home, which is in line with previous studies. This result highlights the importance of ensuring that there is sufficient infrastructure to support home charging. The nearest DC fast charging station and the workplace were the other most preferred charging locations. Coverage of DCFC charging options across Hillsborough County will help meet this preference. Similarly, supporting workplace charging should be considered. Other types of locations including hotels and shopping areas were identified as preferred locations of charging by different respondents. Providing charging infrastructure at these types of places should be considered, but there is not an overwhelming preference for installing charging around a particular land use.

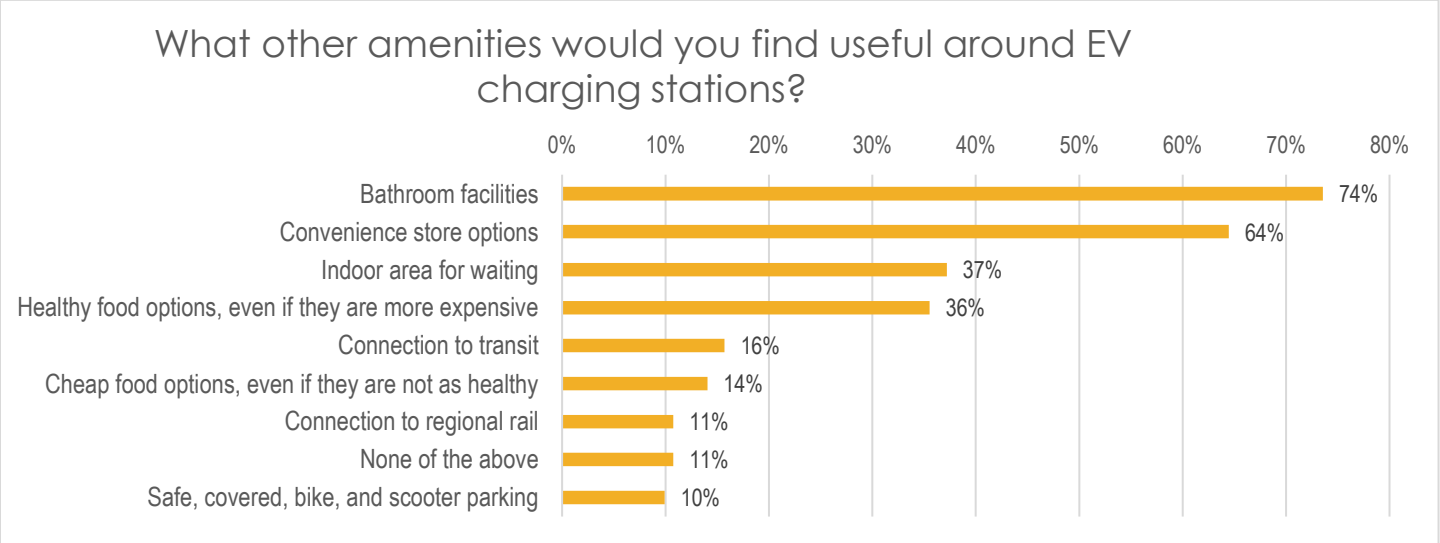
Figure 4. Survey Result - Distribution of (Expected) Charging Locations



**Respondents selected up to 3 locations*

Providing amenities at EV charging stations can enhance the overall charging experience for EV drivers. Respondents find bathroom facilities and convenience store options to be the most useful amenities (Figure 5). Indoor waiting areas and healthy food options are other preferred amenities around EV charging stations.

Figure 5. Survey Result - Useful Amenities around EV Charging Stations



**Respondents could select multiple choices*

About 70% of EV drivers do not drive beyond the range of their EV more than once per month (Figure 6). This suggests that typically charging infrastructure that is near the home, workplace, or other commonly visited location will meet the needs of EV drivers most of the time. Consistent with this assessment, EV driver's most often use public charging infrastructure on long weekend and holiday trips (Figure 7). About 20% of EV drivers use public charging infrastructure for trips around town or regular weekday trips. However, many non-EV owners cite range anxiety or lack of charging stations as barriers to purchasing an EV (Figure 8). This suggests a gap in education between how EVs can be used as part of a normal routine and the charging infrastructure that is available for infrequent trips that are longer than the EV range.

Figure 6. Survey Result - Frequency of EV Drivers Exceeding Driving Range during Trips

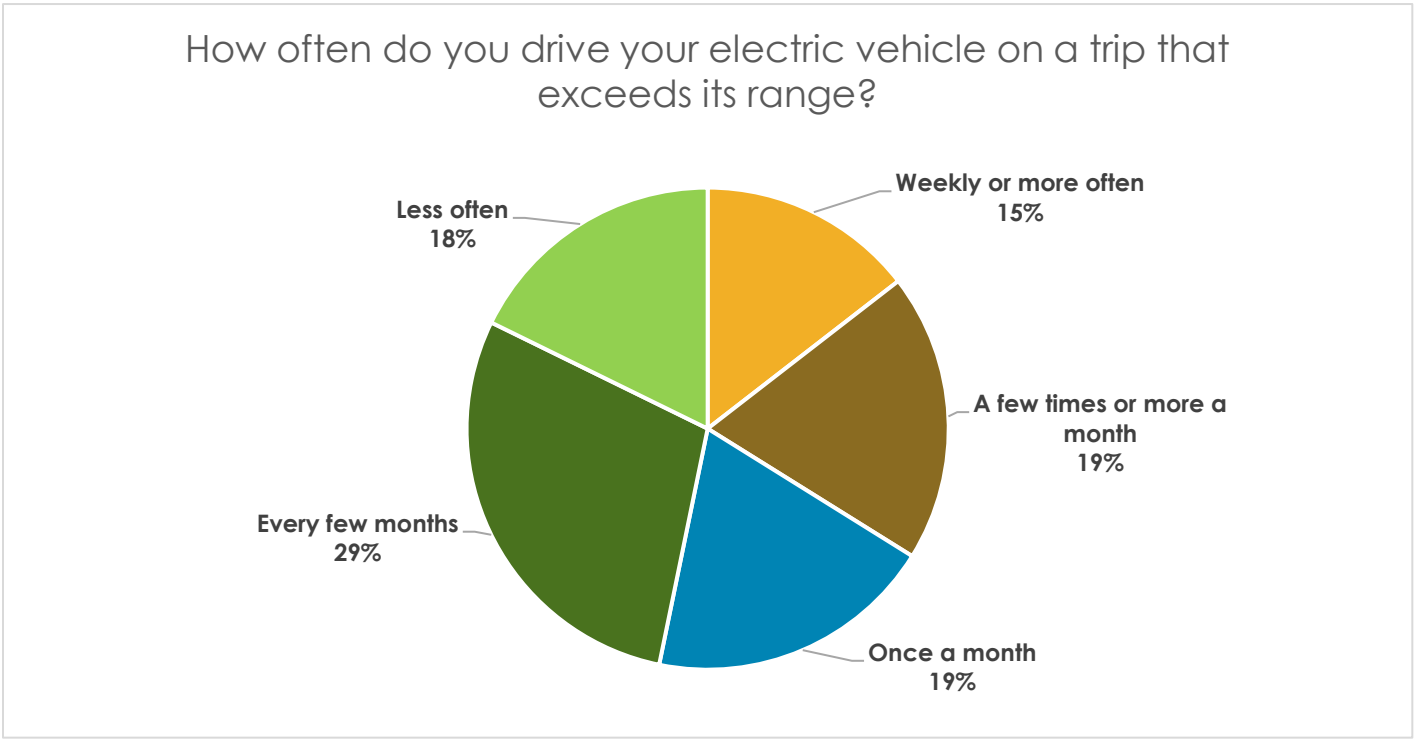
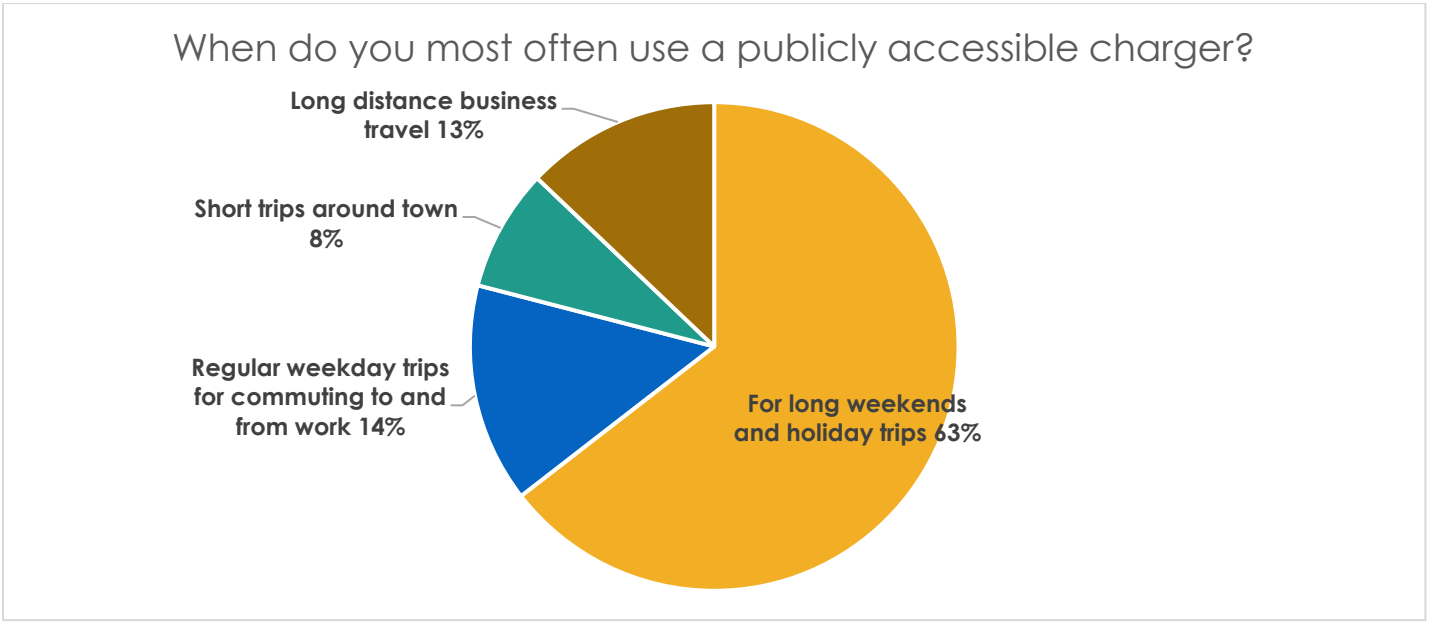
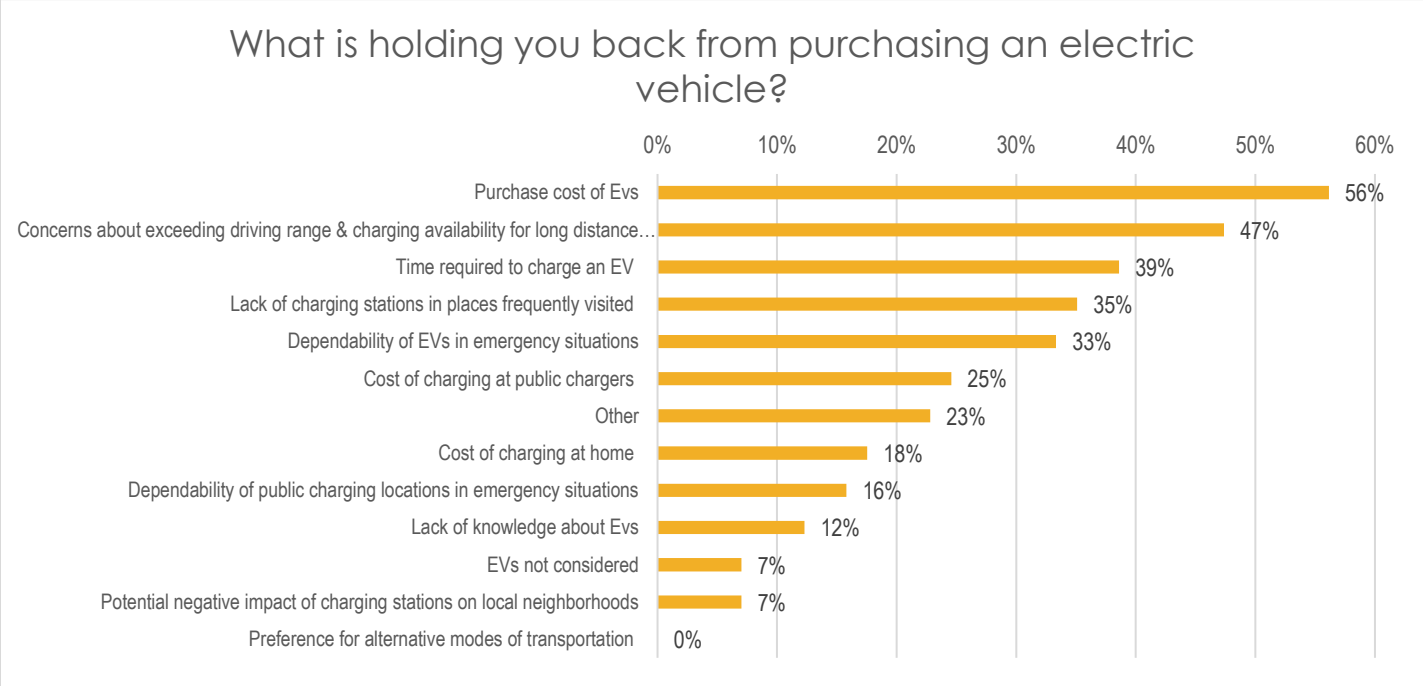


Figure 7. Survey Result - EV Drivers' Usage of Public Chargers



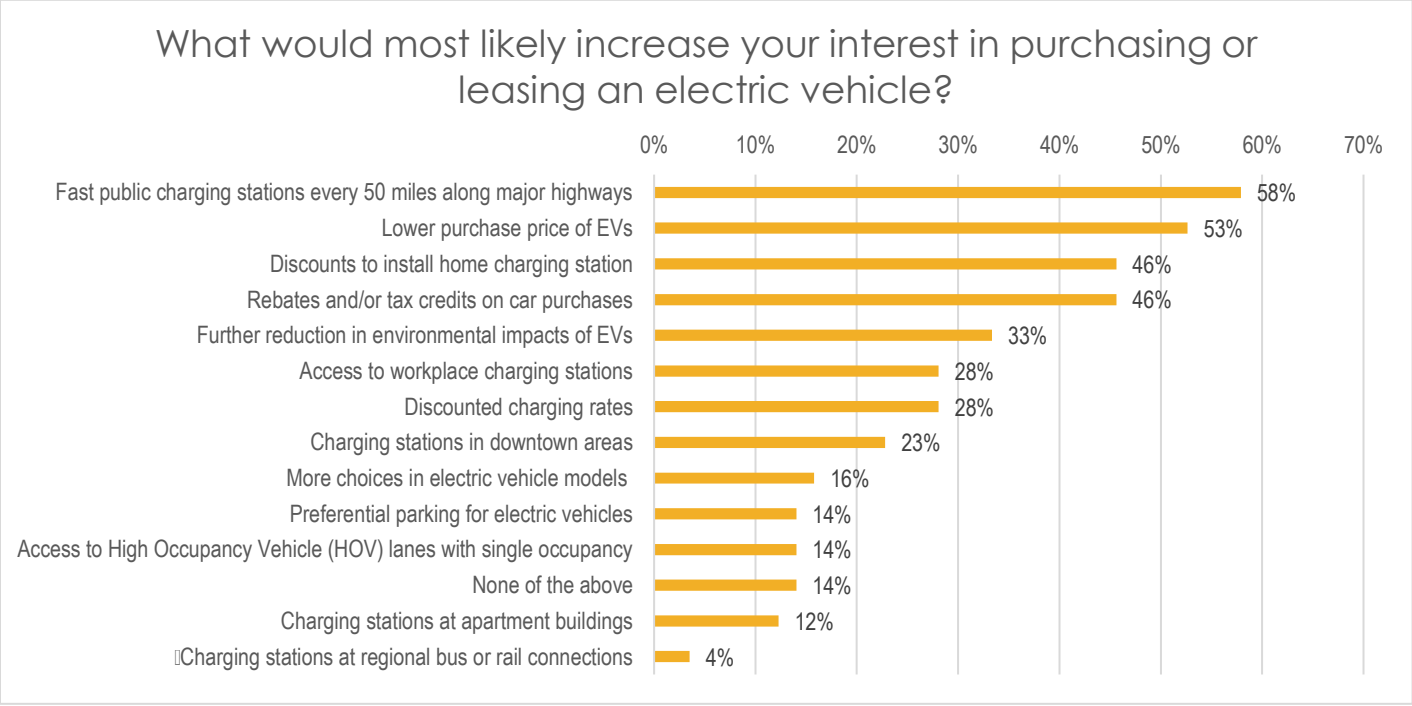
The survey findings for non-EV drivers offer valuable insights into the barriers and motivations for EV adoption (Figure 8 and Figure 9). More than half of non-EV drivers identify purchase cost as a barrier to adopting EVs. Similarly, reducing the upfront costs through incentives such as rebates and tax credits are top ways of increasing interest in EV adoption. Another common barrier to EV adoption is access to charging infrastructure, which this study helps to address. About 30% of respondents are concerned about the dependability of EVs during emergency situations, which is consistent with the findings of other EV plans in Florida, addressing this concern remains an important approach to resolving obstacles and increasing EV adoption.

Figure 8. Survey Result - Barriers to EV Ownership



**Respondents could select multiple choices*

Figure 9. Survey Result - Factors that Could Potentially Increase EV Adoption



**Respondents could select multiple choices*

Respondents were given the option to provide their home and work zip codes. The home zip codes of respondents are shown in Figure 10, with the greatest number of responses coming from people living in the Citrus Park and Greater Carrollwood areas. The work zip codes of respondents are shown in Figure 11, with the greatest number of responses coming from people working in downtown Tampa or the University area. No respondents identified their home or work zip code in the northeast area of Hillsborough County, around Plant City.

Figure 10. Number of Public Survey Responses by Home Zip Code

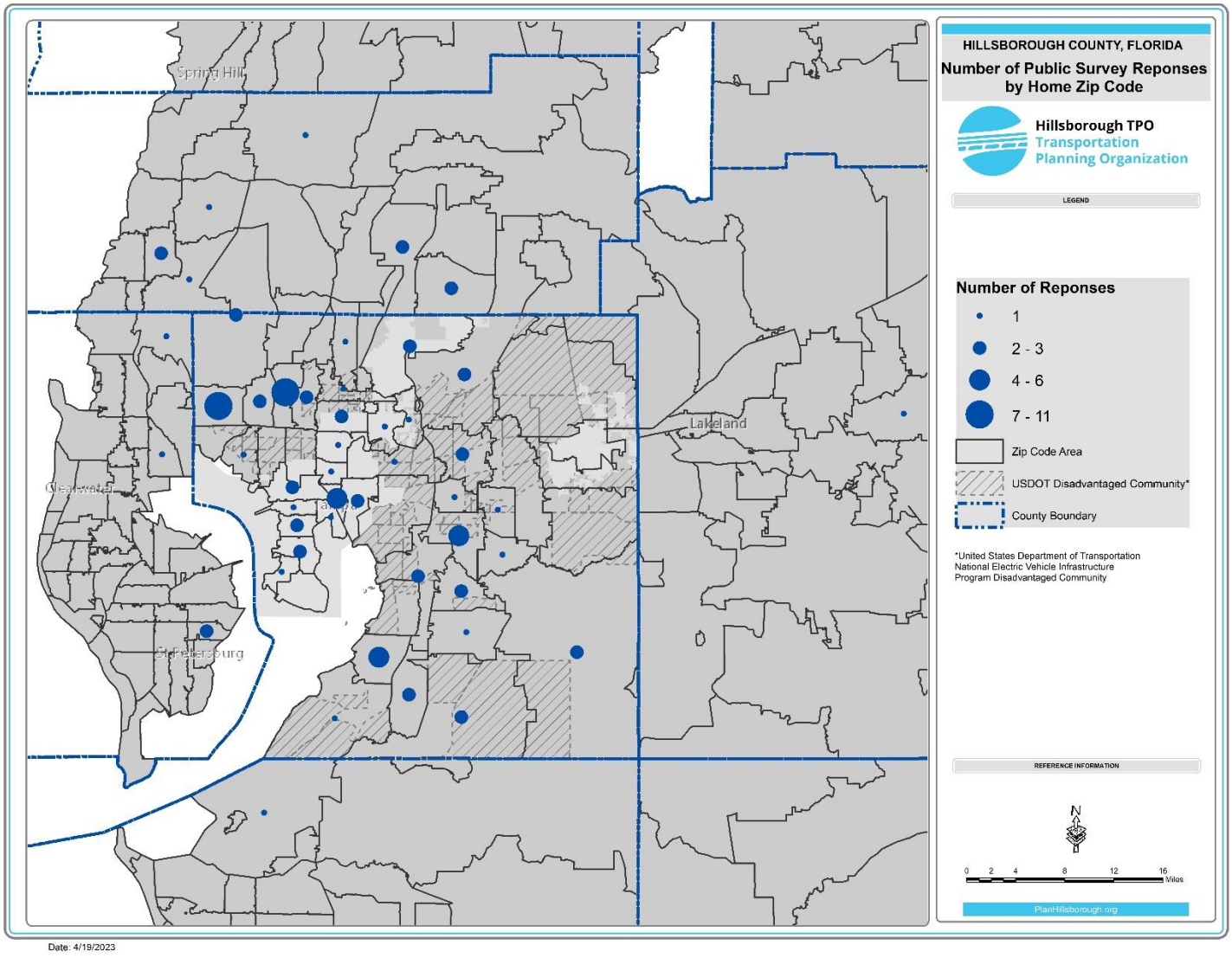
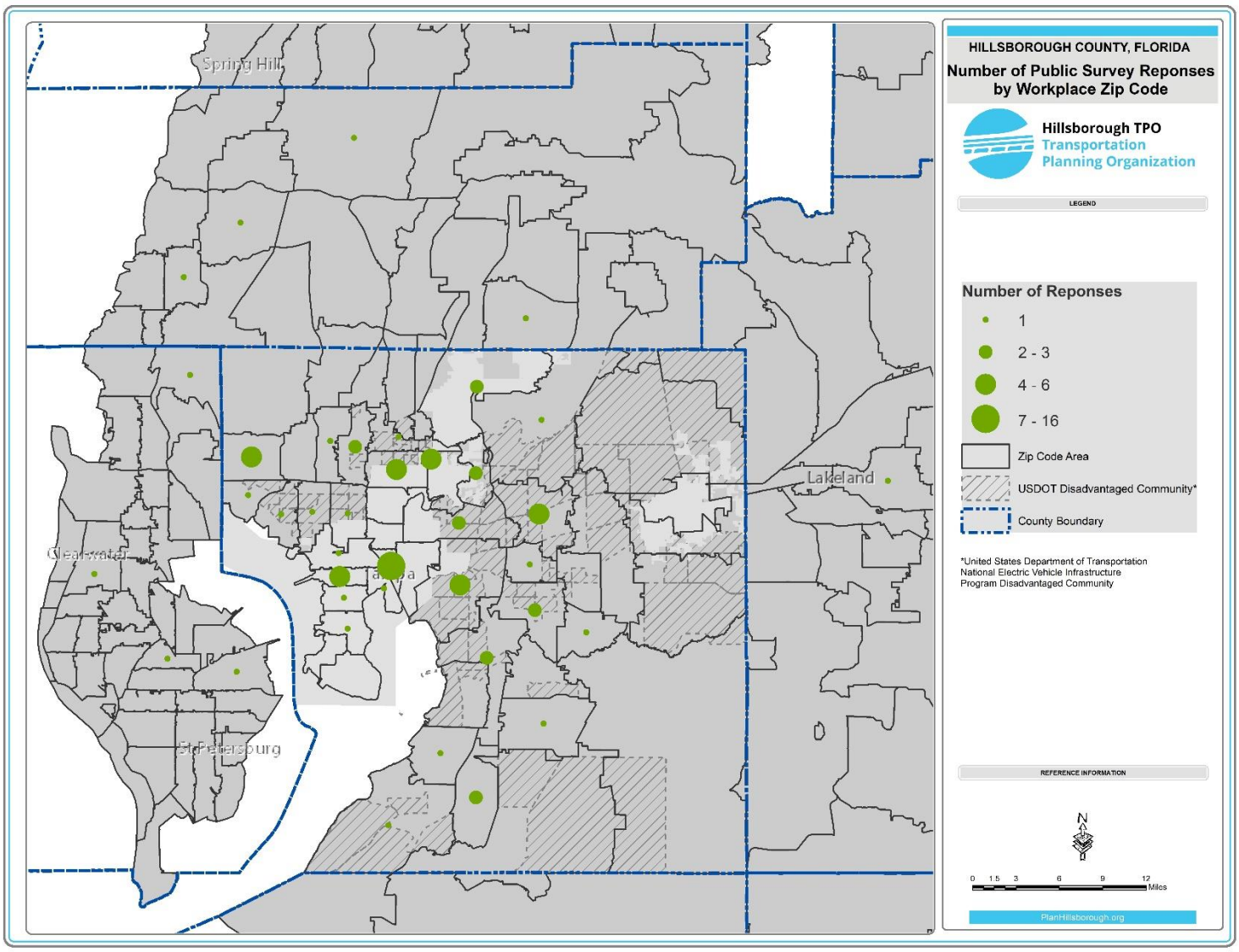


Figure 11. Number of Public Survey Responses by Workplace Zip Code



Respondents were given the option to provide their ethnicity and income level. The ethnic composition of the survey respondents is compared to the population of Hillsborough County in Figure 12. There is a higher proportion of White/Caucasian respondents and a lower proportion of Black or African American and Hispanic respondents compared to the population of Hillsborough County. This trend is even more pronounced among respondents who are EV owners. These findings underscore the importance of addressing equity and affordability issues to overcome the barriers to EV adoption for underrepresented groups.

The income level of survey respondents is compared to the population of Hillsborough County in Figure 13. There is a higher proportion of survey respondents with high incomes compared to the population of Hillsborough County. This trend is seen consistently across the income levels, as the income level increases the proportion of survey responses increases relative to the makeup of Hillsborough County. This trend is more pronounced among respondents who are EV owners. This suggests that income level might influence EV adoption and participation in the survey, indicating the need to address equity and affordability concerns in the transition to EVs.

Figure 12. Ethnic Composition of EV Owners (Who Responded to the Survey), All Respondents, and Hillsborough County Population

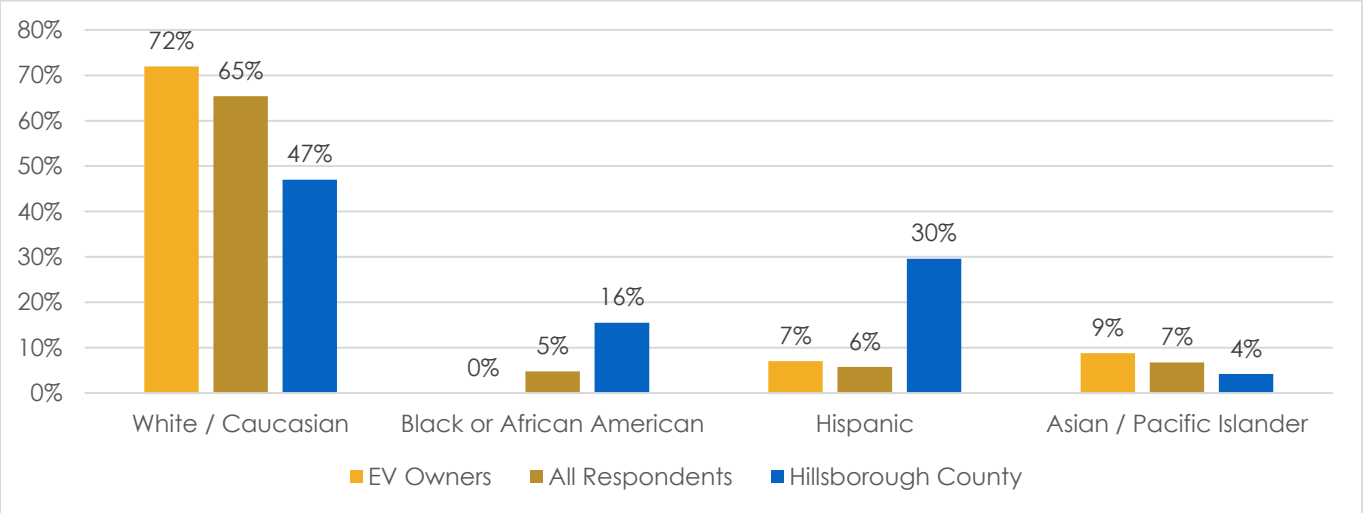
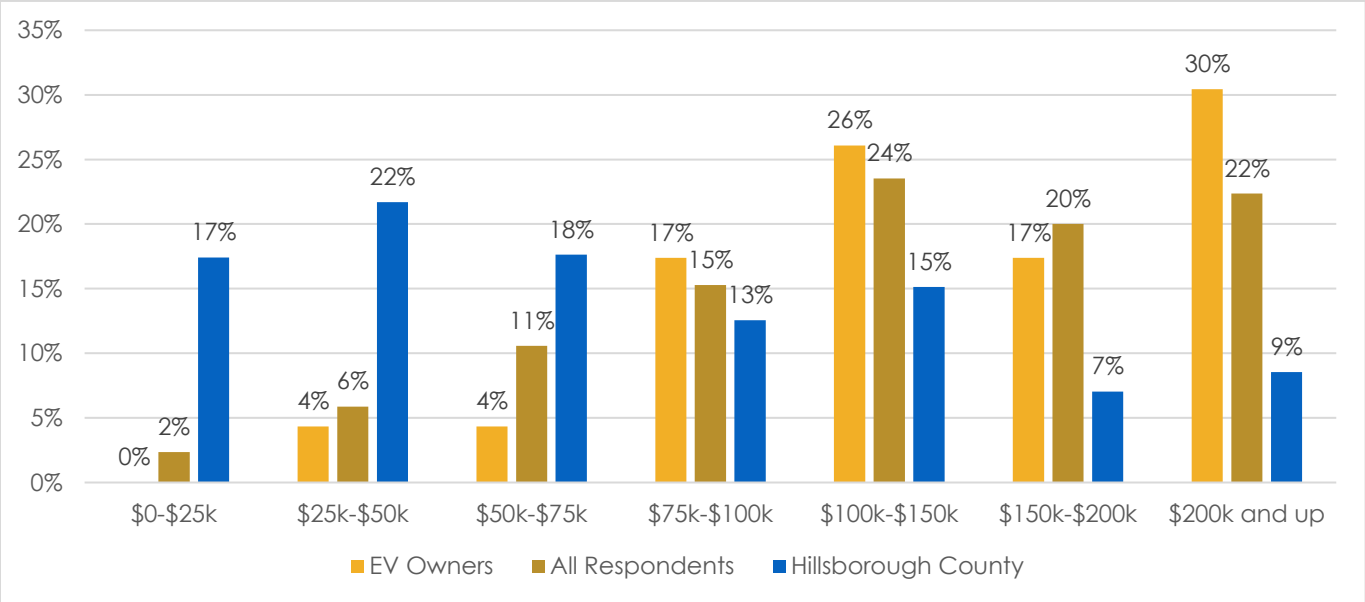


Figure 13. Household Income Profile of EV Owners (Who Responded to the Survey), All Respondents, and Hillsborough County Population



PERFORMANCE MEASUREMENT

Evaluation Measures

Many factors influence the adoption of EVs. Some of these factors are beyond the direct control of Hillsborough TPO and local agencies, for example consumer preferences or product availability. Agencies can choose to measure the direct factors within their control, for example policy adoption, or agencies can measure the outcomes they are seeking, for example EV adoption. In coordination with the Advisory Committee, the Hillsborough TPO has identified the following four categories of measures that consider each of these stages of adoption. The specific statistics used to evaluate these measures are described subsequently.

1/ EV Adoption
2/ Number of Public EV Charging Ports
3/ Public EV Charging Access
4/ Policy Adoption

Equity should be evaluated separately for each measure to ensure that each is advanced equitably throughout Hillsborough County. For example, considering the measure of EV adoption, if EVs are being adopted at lower rates in areas that are defined as disadvantaged, then that measure is not being advanced equitably across the County.

These measures are used to develop the distribution of chargers discussed in the Needs Analysis. Evaluation measures should be periodically reviewed as agency goals change or conditions develop.

EV Adoption

Hillsborough TPO is working towards increased EV adoption by developing this EVIP and providing access to EV charging infrastructure. EV adoption can be measured as **the number of EVs registered in Hillsborough County**. As part of this EVIP, Hillsborough TPO has forecasted the number of EVs expected to be registered in Hillsborough County. This forecast is intended to inform the need for charging infrastructure, but can also be used as a benchmark towards increasing EV adoption. Currently registration data is not available at a more granular resolution than for the whole County. When more granular data is available, EV adoption can be evaluated by community to measure the equitable distribution of adoption.

Number of EV Charging Ports

Access to public charging infrastructure is a barrier to the adoption of EVs for some people. EV adoption can therefore be encouraged through the establishment of sufficient public charging infrastructure. EV charging access can be measured at a high level as **the number of public charging ports in Hillsborough County**. The type of charging port should be considered: workplace Level 2, public Level 2, or DC Fast Charging. The number of charging ports can be compared to the estimated need for charging ports developed in this EVIP.

EV Charging Access

Access to public charging infrastructure can be evaluated from several additional perspectives. For example, are EV charging stations located near to where people want to stop and charge or are there enough charging ports to meet the existing demand of EV owners. An agency should determine what a successful distribution of EV charging looks like before evaluating charging access. In general, different users, for example residents, employees, and visitors, should be considered during the development of these measures to ensure comprehensive access. Hillsborough TPO collaborated with the Advisory Committee and stakeholders on this EVIP to identify **statistics related to access to nearby charging**:

- Is there a nearby charging station?
- Does the charging capacity meet the projected need for charging?
- How much of the time are charging ports in use?
- Are charging ports working?

Charging deserts are defined as areas where there insufficient nearby charging stations. Charging deserts may also be further defined to consider the type of charging available and specific use cases for charging infrastructure. Measuring the **portion of residents or land uses that have one or more nearby charging opportunities** is a simplified measure that can be used to ensure that charging is distributed around the County or local jurisdiction. Example statistics are:

- Portion of all residents who live within 0.5 miles of a DCFC charging opportunity;
- Portion multi-unit dwellings within 0.5 miles of a DCFC charging opportunity;
- Portion multi-unit dwellings within 0.5 miles of a L2 charging opportunity;
- Portion of jobs within 0.5 miles of a L2 charging opportunity;
- Portion of Activity Centers within 0.5 miles of a L2 charging opportunity;
- Portion of Activity Centers within 0.5 miles of a DCFC charging opportunity.

In addition to assessing if there is a nearby EV charger, the capacity of EV charging stations should also be considered. For example, EV charging stations in some areas may need more ports or a higher rate of charging. The needed capacity of EV charging stations is projected in this EVIP for census block groups. These **projections can be used to evaluate if an area has sufficient charging capacity**. For example, if an area is projected to need 50 L2 charging ports in 2035, but only has 30 L2 charging ports in 2035, there is expected to be a gap between the demand for charging and the availability of chargers.

Areas with gaps in the capacity of charging infrastructure may also be identified by **examining charger utilization data.** Areas with a very high utilization may have additional demand for charging infrastructure that is not being met. Users in these areas may find charging stations fully in use when they need to charge their vehicles.

To provide effective access to EV charging a fully operational charging network should be maintained. In addition to installed charging capacity, access can be measured **by assessing the charger up time for chargers**. The federal NEVI program requires an average annual uptime greater than 97 percent for charging stations installed with program funds.

When agencies develop area plans, the evaluation measures presented in this section can be evaluated in greater detail. For example, the location of charging stations within census block groups might be considered.

Considerations discussed in the Prioritization Framework section can be adapted to complete this more granular analysis.

Policy Adoption

Hillsborough TPO and local agencies can adopt policies or institute regulations to promote EV adoption. Policy adoption can be measured on an incremental basis and reflects the actions that are more under the control of the TPO and local agencies. However, it may be difficult to assess the effectiveness of policies until discrete measures such as EV adoption or installation of EV charging stations are measured in the future. Policy adoption can be measured as **whether a local jurisdiction has adopted policies encouraging an aspect of EV adoption**. Policies may cover a wide range of aspects of EV ownership including encouraging the development of EV charging in parking lots, modifying the utility rate structure, adopting EVs in public fleets, or funding other incentives.

How are We Doing Today?

The recommended targets and indicators are assessed for Hillsborough County in 2023. The targets and indicators are assessed for the overall county and the disadvantaged communities (DAC), summarized in Table 1. For this analysis disadvantaged communities are defined as the census block groups that meet at least 4 of the Hillsborough TPO criteria for a disadvantaged community. To assess the equitable distribution of EV charging infrastructure, the targets are compared between the overall County and the DAC. If the overall County meets the targets to a higher degree than the DAC, that indicates that the charging infrastructure may not be equitably distributed.

Table 1: Analysis of Recommended Targets and Indicators

Target	Statistic	2023 County Value	Assessed for Equitable Distribution	
			2023 DAC Value	Note
EV Adoption	Registered EVs	6,364 (0.6% of LDVs in the County)	N/A[†]	-
Number of EV Charging Ports	Public DCFC	17	1 (6% of Public DCFC ports in the County)	Most public, non-proprietary, DCFC stations are located outside of DAC, but 20% of the population resides in DAC
	Proprietary DCFC	76	24 (32% of Proprietary DCFC ports in the County)	
	Public Level 2	360	52 (15% of Public L2 ports in the County)	About 15% of Public L2 charging ports are located in DAC, but 20% of the population resides in DAC
	Workplace Level 2	4	0 (0% of Work L2 ports in the County)	Few workplace L2 chargers are currently in Hillsborough County
EV Charging Desert	% Residents with DCFC <0.5 mi	2%	2%	DAC residents tend to have similar access to DCFC
	% Multi-unit dwelling parcels with DCFC <0.5 mi	Condo: 5% < 10 units: 4% ≥10 units: 4%	Condo: 5% < 10 units: 2% ≥10 units: 1%	MUDs in DAC tend to have lower access to DCFC
	% Multi-unit dwelling parcels with L2 <0.5 mi	Condo: 26% < 10 units: 13% ≥10 units: 23%	Condo: 12% < 10 units: 12% ≥10 units: 10%	MUDs in DAC tend to have lower access to L2
	% Jobs with L2 < 0.5 mi	38%	25%	Jobs in DAC tend to have lower access to L2
	% Activity Center Area with DCFC < 0.5 mi	7%	7%	Activity Centers in DAC tend to have similar access to DCFC
	% Activity Center Area with L2 < 0.5 mi	48%	35%	Activity Centers in DAC tend to have lower access to L2
	Charger Up Time	Not currently reported	Not currently reported	
Policy Adoption		No current policies in local jurisdictions		

[†] EV vehicle registration data is currently not available at a more granular resolution than all of Hillsborough County.
Disadvantaged Community (DAC) – Defined by Hillsborough TPO as Most Underserved Areas

The distribution of current EV infrastructure is assessed according to the recommended targets and indicators. Key findings from the analysis are summarized below for each target:

- **Portion of residents living within 0.5 miles of DCFC**: A small fraction (2%) of the county's total population lives within a half-mile radius of DCFC stations (Figure 14). Neighborhoods along major highways such as I-4 and I-75, designated as EV corridors by the FHWA, tend to have more access.
- **Portion of multi-unit dwellings with access to L2 and DCFC**: A relatively small fraction of multi-unit dwelling parcels in Hillsborough County (5%) are currently within a 0.5-mile radius of fast charging infrastructure. A higher percentage of larger multifamily developments in the county have access to L2 charging options compared to smaller developments. This indicates a need to focus on expanding charging infrastructure in smaller multifamily developments to ensure equitable access for residents. Furthermore, in TPO identified disadvantaged communities, the access percentages for both DCFC and L2 charging are generally slightly lower than the county-wide averages. This highlights the importance of providing equitable access to charging infrastructure in these communities.
- **Portion of jobs within 0.5 miles of L2**: Approximately 39% of jobs in Hillsborough County are within 0.5 miles of L2 chargers (Figure 16). Employment centers, such Temple Terrace, have higher access rates, with over 60% of jobs within 0.5 miles of public L2 chargers.
- **Portion of activity centers within 0.5 miles of DCFC and within 0.5 miles of L2**: Approximately 48% of the total area of activity centers is within a 0.5-mile radium of L2 chargers (Figure 17). Approximately 7% of activity center area is within 0.5 miles of DCFC charging (Figure 18). Several activity centers in downtown Tampa area stand out as having access to both L2 and DCFC chargers. However, a few activity centers in South Tampa, between I-275 and I-75, and east of I-75 lack access to public L2 and DCFC chargers entirely.

Figure 14. Proportion of Residents with DCFC Access at Census Block Level (A 0.5-Mile) Range

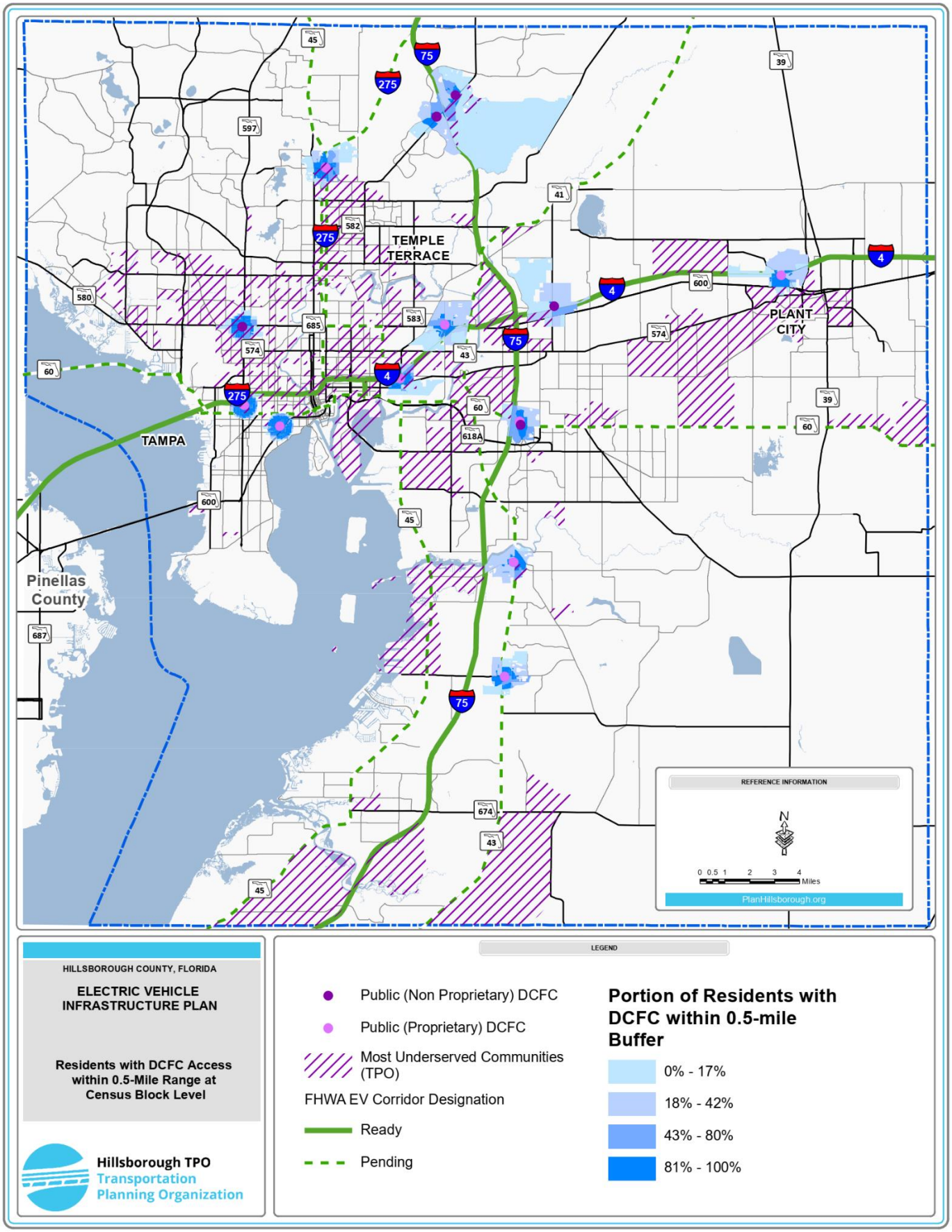


Figure 15. Proportion of Multifamily Developments (10 or More Units) with L2 Charging Access at Census Block Level (A 0.5-Mile) Range

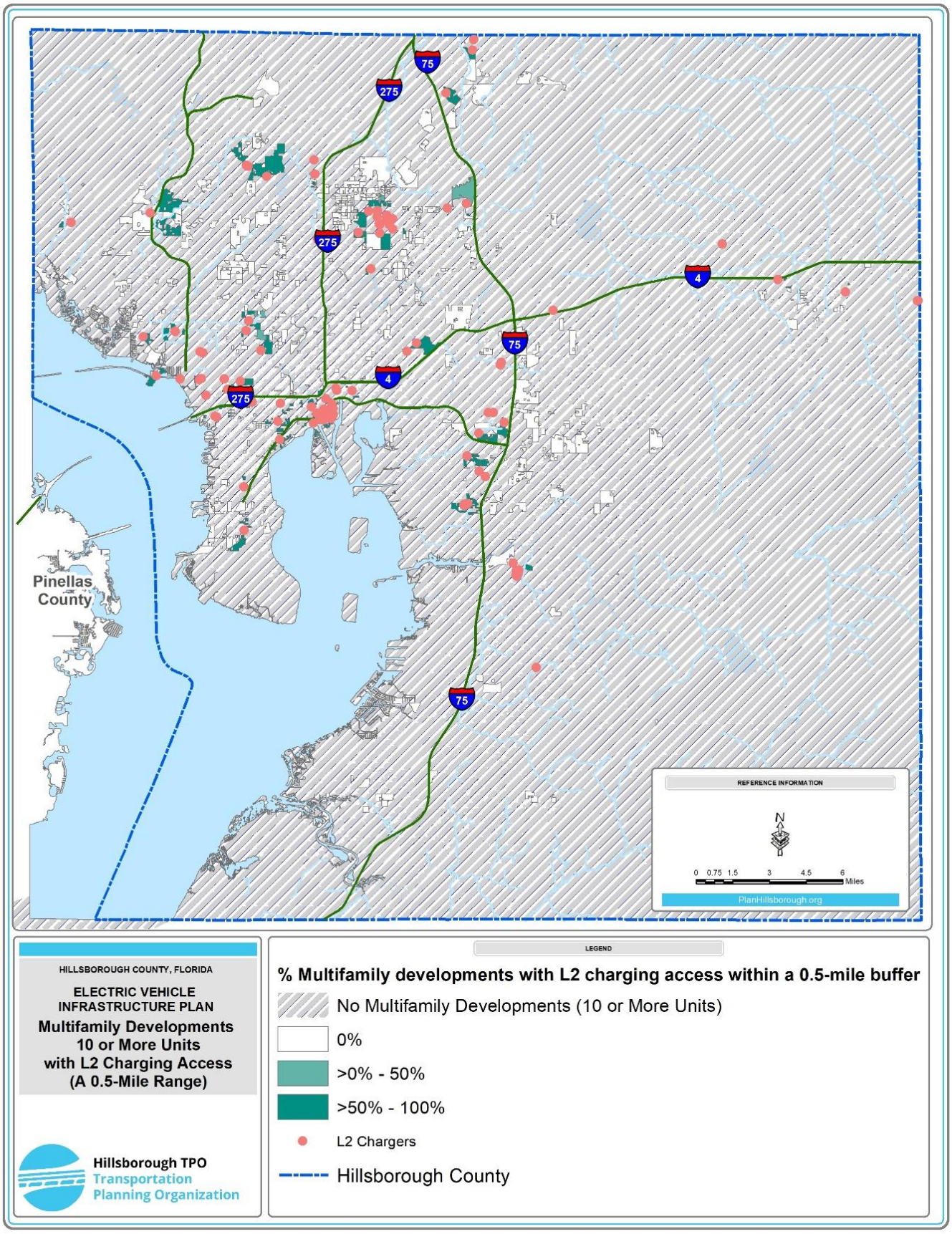


Figure 16. Proportion of Jobs with L2 Charging Access at Census Block Level (A 0.5-Mile) Range

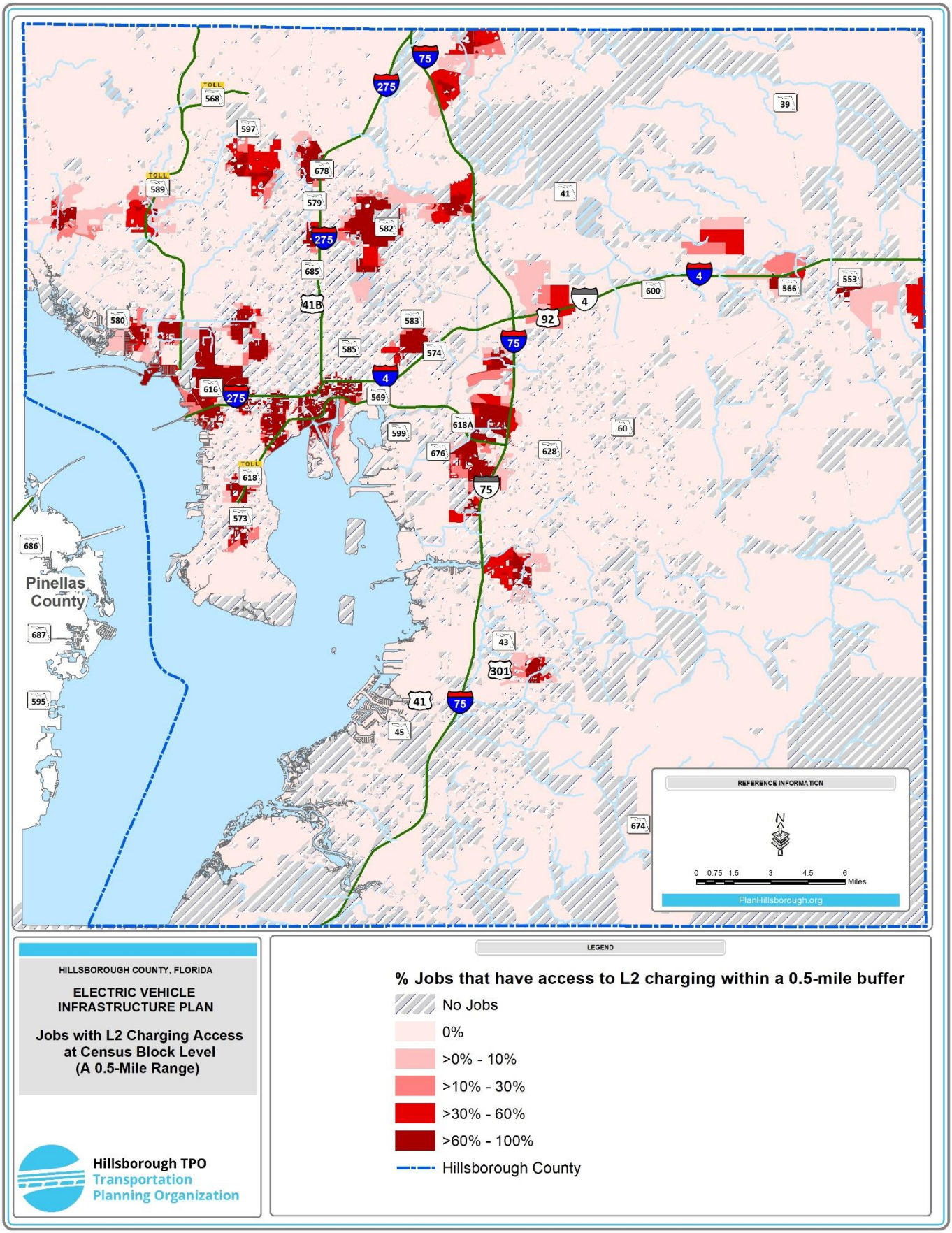


Figure 17. Proportion of Activity Centers with L2 Charging Access at Census Block Level (A 0.5-Mile Range)

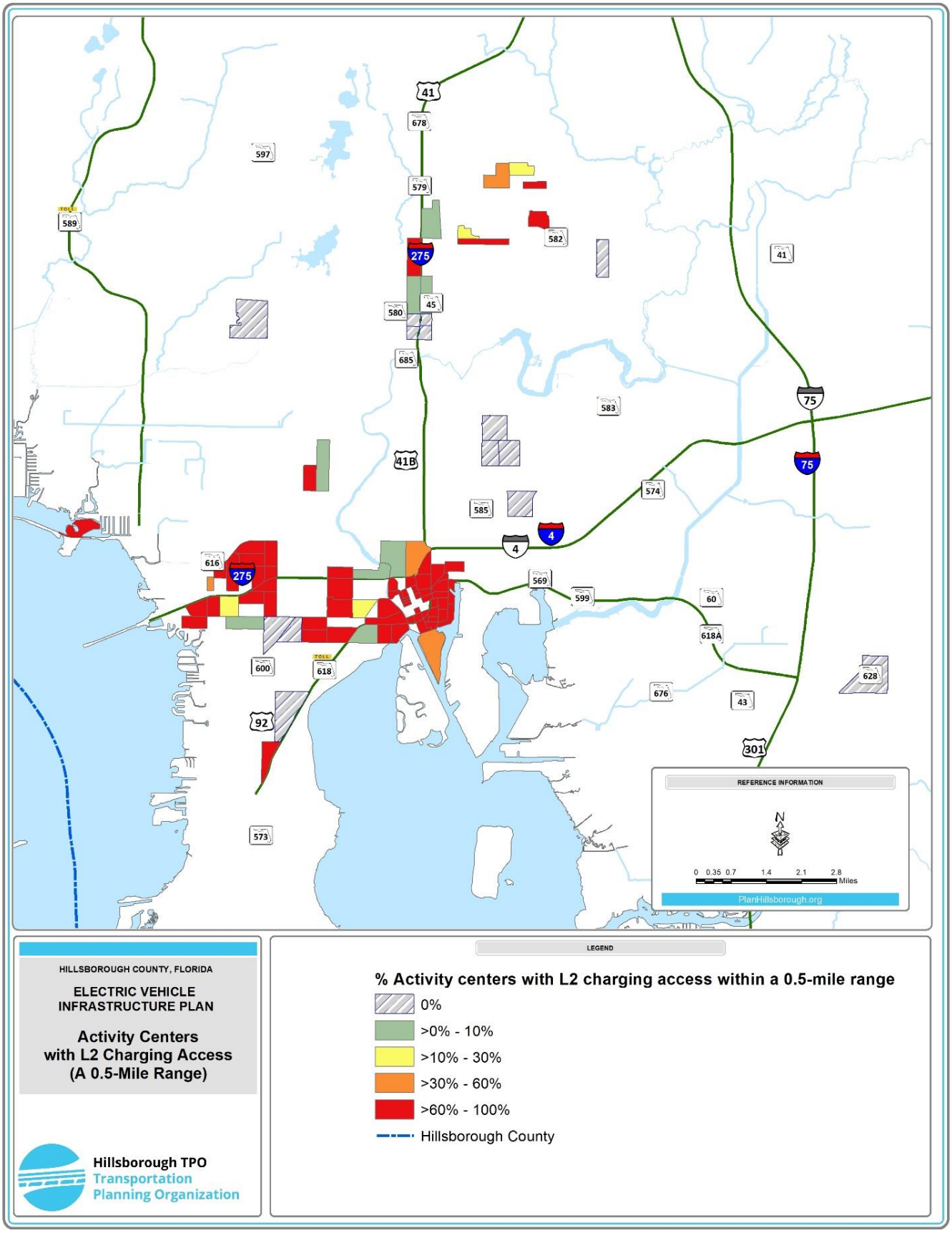
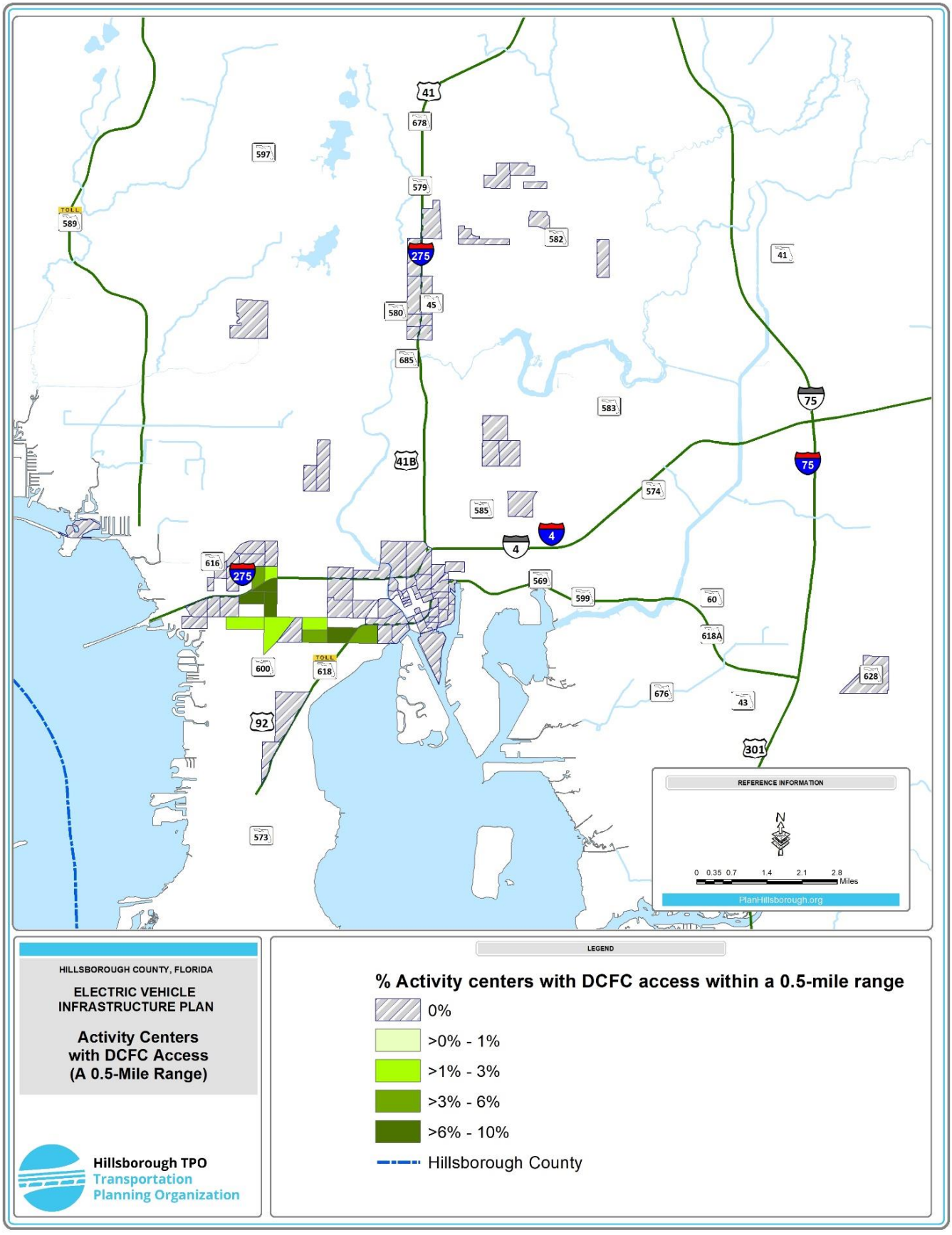


Figure 18. Proportion of Activity Centers with DCFC Access at Census Block Level (A 0.5-Mile Range)



EV ADOPTION SCENARIOS

This section outlines the adoption projections for each of the EV use cases established in the Existing Conditions section. These projections are intended to guide the needs analysis. For some use cases, multiple scenarios are presented, to help identify the range of needs. A summary of the expected adoption of EVs by use cases is included in Table 2. Several use cases do not have a large breadth of available literature or previously conducted planning, so all adoption scenarios are not developed for each use case.

Table 2. EV Adoption Scenarios by EV Use Case

Use Case	Low Need for Charging Infrastructure	Medium Need for Charging Infrastructure	High Need for Charging Infrastructure
Urban & Rural Light-Duty Vehicles and Disadvantaged Communities	2021 – 6,000 EVs (0.5% of all LDVs) 2035 – 90,000 EVs (9% of all LDVs) 2050 – 170,000 EVs (17% of all LDVs)	2021 – 6,000 EVs (0.5% of all LDVs) 2035 – 230,000 EVs (23% of all LDVs) 2050 – 420,000 EVs (42% of all LDVs)	2021 – 6,000 EVs (0.5% of all LDVs) 2035 – 300,000 EVs (30% of all LDVs) 2050 – 690,000 EVs (69% of all LDVs)
Commercial Delivery	2025 – 0.1% EVs 2035 – 0.3% EVs 2050 – 0.7% EVs	Not Estimated	2025 – 0.5% EVs 2035 – 18% EVs 2050 – 60% EVs
TNCs & Gig Drivers[†]	Not Estimated	2035 – 14,000 EVs (6% of EVs in County) 2050 – 35,000 EVs (8% of EVs in County)	Not Estimated
Transit	Maintain 4 BEVs (from pilot) for Support.	Battery Electric Buses for All Local, Fixed Routes with Average Daily Miles of 200 or Lower	Battery Electric Buses for All Local, Fixed Routes

[†] EVs for TNCs & Gig Drivers use case are included in the total number of LDV EVs in Hillsborough County

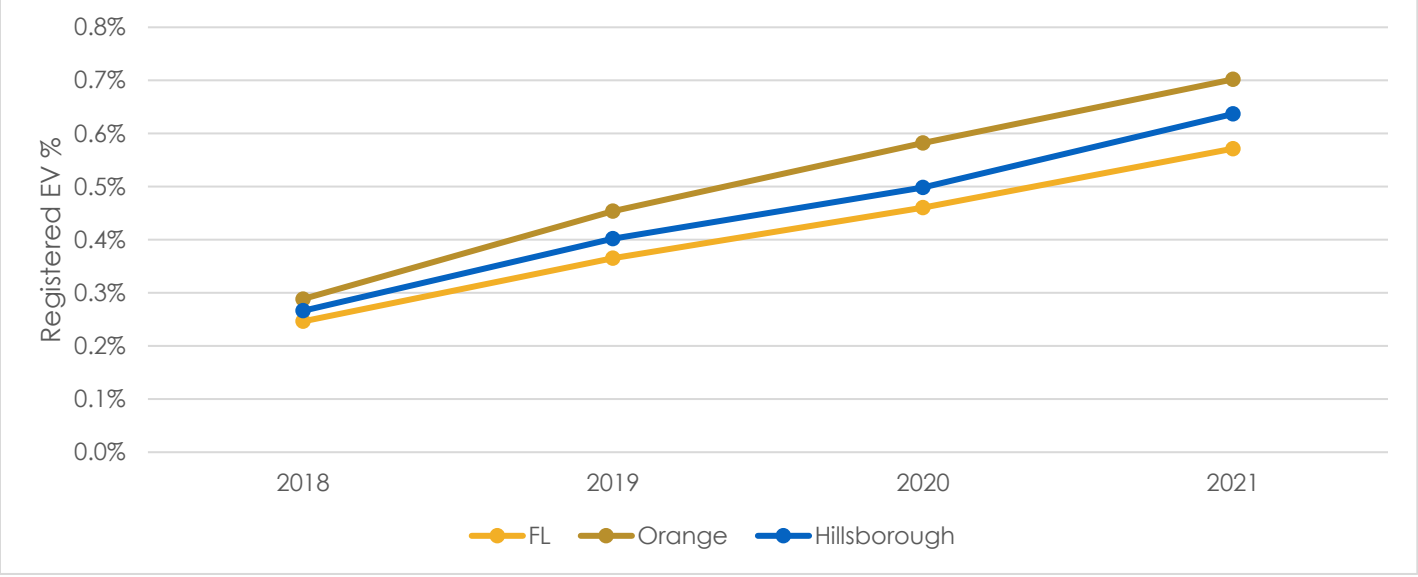
Light Duty Vehicles (Urban & Rural)

To better understand and plan for potential adoption trajectories of light duty EVs in the Hillsborough TPO planning area, the project team developed three EV adoption scenarios by reviewing historical growth trends in Florida, Orange County, and Hillsborough County, and then adapting these agencies' EV adoption scenarios for the Hillsborough planning area. The historical growth and adoption trends of the City of Orlando and Orange County were selected due to their geographical proximity to Hillsborough County, similar composition of urban population, and their local efforts to promote EV adoption in urban areas[1][2].

EV Adoption Historical Trends

Figure 19 shows the percentage of registered EVs for Hillsborough County, Orange County, and the state of Florida. The percentage of registered EVs has grown steadily at the county and state levels. Hillsborough County has tended to have a greater adoption of EVs than the state overall and a lower adoption of EVs than Orange County.

Figure 19. Percentage of Registered EVs of Total Registered Vehicles in Hillsborough County, Orange County, and Florida (2018 – 2021)



Source: Atlas EV Hub; Florida Department of Highway Safety and Motor Vehicles (FLHSMV)

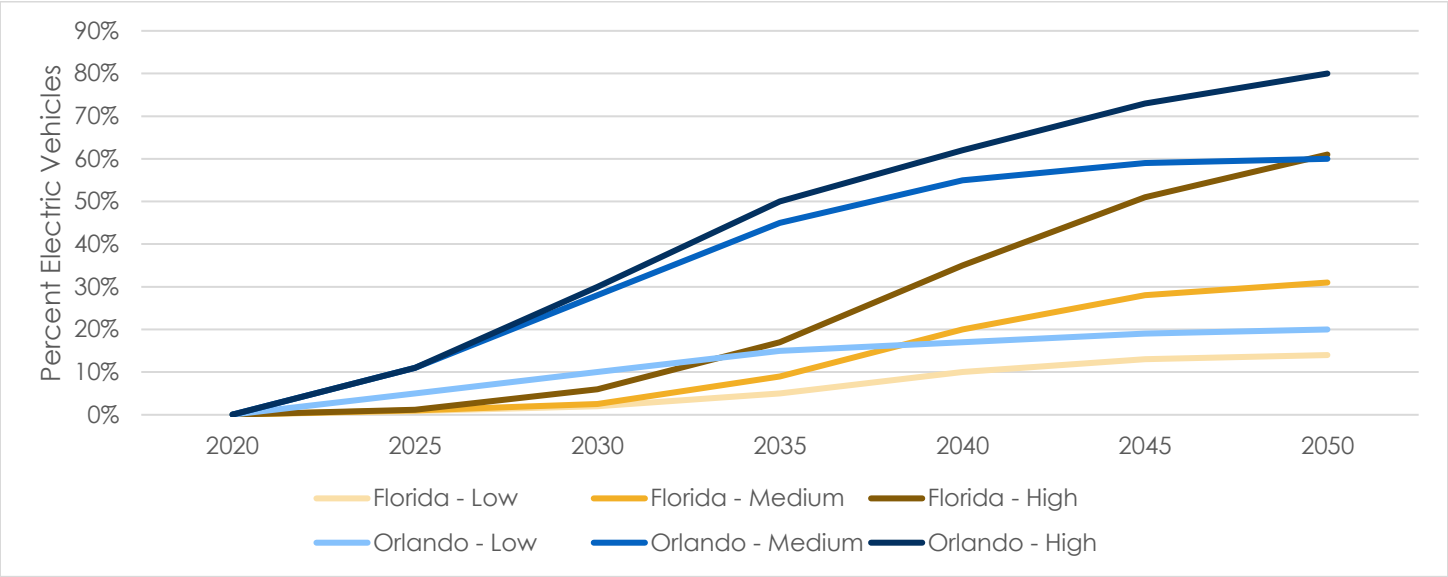
Estimated EV Adoption Scenarios

The projected light duty EV adoption scenarios between 2020 and 2050 by FDOT and the City of Orlando are shown in Figure 20 and Table 3. The EV adoption scenarios projected by Orlando tend to estimate a higher adoption than FDOT projects for the State Additionally, the steady increase in adoption is projected to start to plateau after 2040 for both Orlando and Florida.

[1] Cleanenergy.org. (n.d.). *Orlando City Council Passes EV Make-Ready Code*. Retrieved April 18, 2023, from https://cleanenergy.org/blog/orlando-city-council-passes-ev-make-ready-code/

[2] TECO Tampa Electric. (n.d.). *Electric vehicles*. Retrieved April 18, 2023, from https://www.tampaelectric.com/company/environment/electricvehicles/

Figure 20. Projected Light Duty EV Adoption in Florida and the City of Orlando



Source: Florida Electric Vehicle Master Plan; Orlando Electric Mobility Roadmap

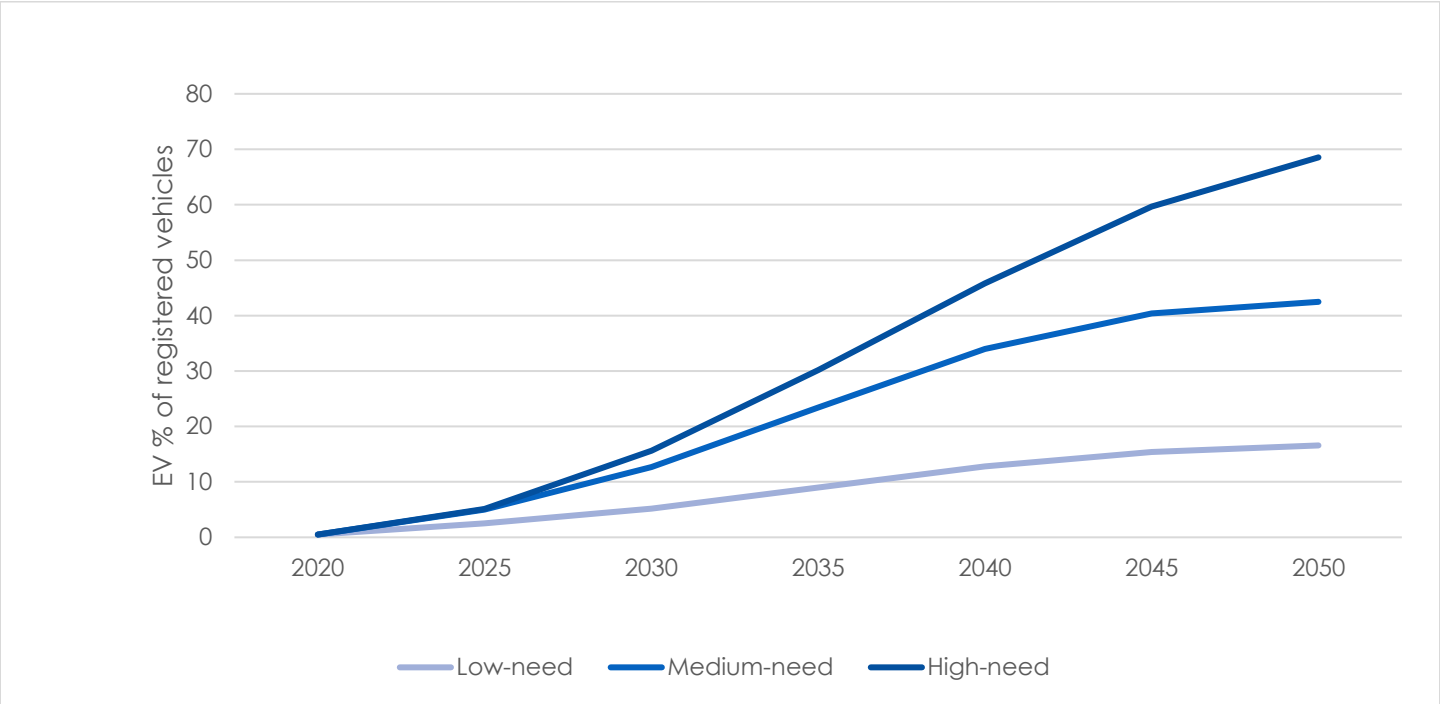
Based on these adoption scenarios and historic trends, EV adoption for Hillsborough County is estimated as being between the projections from Orlando and FDOT. The projections for EV adoption in Hillsborough County, as percent of total registered vehicles, are shown in Table 3 and Figure 21. These EV adoption projections are dynamic and should be periodically evaluated in response to industry developments and policy incentives.

Table 3. Light Duty EV Adoption (EV % of Registered Vehicles) by Scenario in Orlando, Hillsborough, and Florida (2020 – 2050)

	Low Need			Medium Need			High Need		
	Florida	Orlando	Hillsborough County	Florida	Orlando	Hillsborough County	Florida	Orlando	Hillsborough County
2020	0.4%	0.5%	0.5%	0.4%	0.5%	0.5%	0.4%	0.5%	0.5%
2025	1%	5%	3%	1%	11%	5%	1%	11%	5%
2030	2%	10%	5%	3%	28%	13%	6%	30%	16%
2035	5%	15%	9%	9%	45%	23%	17%	50%	30%
2040	10%	17%	13%	20%	55%	34%	35%	62%	46%
2045	13%*	19%	15%	28%*	59%	40%	51%*	73%	60%
2050	14%*	20%	17%	31%*	60%	42%	61%*	80%	69%

*Adoption scenarios in FDOT's EVMP are projected to the year 2040. The starred values are extrapolated.

Figure 21. EV Adoption Scenarios for Hillsborough County



According to vehicle registration data collected by the Florida Department of Highway Safety and Motor Vehicles (FLHSMV), there were 999,409 registered light duty vehicles in Hillsborough County in 2021[3]. Utilizing the adoption scenarios described above, Hillsborough County is projected to have between **89,947 – 299,823 EVs by 2035**, and between **169,900 – 689,592 EVs by 2050**.

EVs Expected in Hillsborough County

2023: 6k

2035: 90k – 300k

2050: 170k – 700k

[3] The estimated population of Hillsborough County in 2021 is 1,478,194. Source: Census Bureau QuickFacts.

Disadvantaged Communities

The recommended EV adoption targets identified by Hillsborough TPO are consistent for communities throughout Hillsborough County. Therefore, the targeted rate of EV adoption in disadvantaged communities is the same as in the County overall.

The Rocky Mountain Institute (RMI) states, "Without targeted policies, the unique challenges in lower-income communities are likely to slow overall EV adoption."[4] Disadvantaged communities may experience lower rates of EV adoption due to several barriers including:

- **High vehicle purchase price**: Although total cost of ownership for EVs may be lower than gas vehicles, the higher initial purchase price of EVs may be a barrier for households without cash for a down payment or who are more likely to buy a used vehicle[4].
- **Access to home charging**: In 2022, 90% of EV owners had a private garage, however for multi-unit dwelling residents home charging might not be available. Multi-unit dwelling residents are more often income constrained making installing charging infrastructure potentially financially difficult.[4]
- **Cost of charging**: Public charging reliance can increase the monetary cost of recharging EVs, compared with at-home charging in a single-family dwelling[5].

> "Without targeted policies, the unique challenges in lower-income communities are likely to slow overall EV adoption."
>
> Rocky Mountain Institute

Considerations for addressing these barriers are included in the subsequent Needs Analysis section.

[4] RMI. (October 2022). *Increasing Equitable EV Access and Charging: A Path Forward for States – Recommendations for US Policymakers and Projected Impacts on Equitable Access to EV Adoption and Charging.*

[5] Dong-Yeon, L., Yang, F., Wilson, A., & Wood, E. (April 2022). *Electric Vehicle Infrastructure – Equity*. National Renewable Energy Laboratory.

Transportation Network Companies & Gig Drivers

EV adoption for TNC & gig drivers is driven by two considerations:

1. Increasing portion of all vehicle miles travelled are done by TNC & gig drivers
2. Increasing portion of TNC & gig driver miles are done in an EV

Increasing portion of all vehicle miles travelled are done by TNC & gig drivers. In 2016, it was estimated that in the United States, ride hail trips comprised about 1% of total annual vehicle miles travelled (VMT)[6]. Similarly, in 2018 TNCs accounted for 1-3% of VMT in six US metro areas[7]. From 2016 to 2019 the number of ride hail trips tripled[8]. Several financial reports expect the ride sharing market to continue to grow in the coming years, by about 15% per year through around 2030[9]. Growth in the TNC & gig driver market could lead to VMT from TNCs tripling by 2030 and increasing even further through 2050.

Increasing portion of TNC & gig driver miles are done in an EV. The major TNC companies, Uber and Lyft, have each announced commitments to transition to electric vehicles. In 2020, Uber announced its goal to be "a zero-emission platform by 2040."[10] In 2020, Lyft announced "its commitment to reach 100% electric vehicles on the Lyft platform by 2030".[11] Due to pressure from leaders in the industry and incentives for drivers from these companies, it is expected that TNC and gig driver adoption of EVs will outpace EV adoption for other passenger cars in the County.

Considering these projected changes in the TNC and gig driver use case, the adoption of EVs is summarized in Table 4. These projections assume that total daily VMT in Hillsborough County grows at about 2% per year through 2050 and that TNC drivers travel about 200 miles per day. The calculation of the portion of EVs in Hillsborough County that are used for TNCs is based upon the medium need scenario under the Light Duty Vehicles use case.

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[6] Hensely, Russel; Padhi, Asutosh; and Salazar, Jeff. (July 17, 2017). *Cracks in the ridesharing market – and how to fill them.* McKinsey Quarterly. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/cracks-in-the-ridesharing-market-and-how-to-fill-them

[7] Fehr and Peers (August 16, 2019). *Estimated TNC Share of VMT in Six US Metropolitan Regions.* https://www.fehrandpeers.com/what-are-tncs-share-of-vmt/

[8] Kersten Heineke, et al. (August 11, 2021). "Shared Mobility Where it Stands and Where its Headed," McKinsey & Company, McKinsey & Company, June 28, 2023, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/shared-mobility-where-it-stands-where-its-headed

[9] Markets and Markets. "Ride Sharing Market by Type (E-hailing, Station-Based, Car Sharing & Rental), Car Sharing (P2P, Corporate), Service (Navigation, Payment, Information), Micro-Mobility (Bicycle, Scooter), Vehicle Type, and Region – Global Forecast to 2026," Markets and Markets, June 28, 2023, https://www.marketsandmarkets.com/Market-Reports/mobility-on-demand-market-198699113.html; Grand View Research. "Ride Hailing Services Market Size, Share & Trends Analysis Report By Offering (E-hailing, Car Sharing, Rental), By Region (North America, Europe, Asia Pacific, Central & South America, Middle East & Africa), And Segment Forecasts, 2022 – 2030," Grand View Research, June 28, 2023, https://www.grandviewresearch.com/industry-analysis/ride-hailing-services-market

[10] Uber. (N.D.). *Your City, Our Promise: Uber Will Be a Zero-Emission Platform by 2040.* https://www.uber.com/us/en/about/sustainability/?uclick_id=52196c9b-1816-4188-a98e-37215a539f66

[11] Lyft. (June 17, 2020). *Leading the Transition to Zero Emissions: Our Commitment to 100% Electric Vehicles by 2030.* https://www.lyft.com/blog/posts/leading-the-transition-to-zero-emissions

Table 4: EV Adoption for TNC & Gig Drivers

	2023	2035	2050
Total Daily VMT in Hillsborough County	39 million	51 million	69 million
Portion of VMT by TNC	1%	5%	10%
TNC Daily VMT in Hillsborough County	390,000	2,700,000	6,900,000
Estimated TNC Drivers	2,000	14,000	35,000
Portion of TNC that are EV	-	100%	100%
TNC EVs	-	14,000	35,000
Total EVs in Hillsborough County	-	230,000	420,000
Portion of EVs in Hillsborough County that are TNCs	-	6%	8%

Other factors that may impact EV adoption for TNC and gig drivers include:

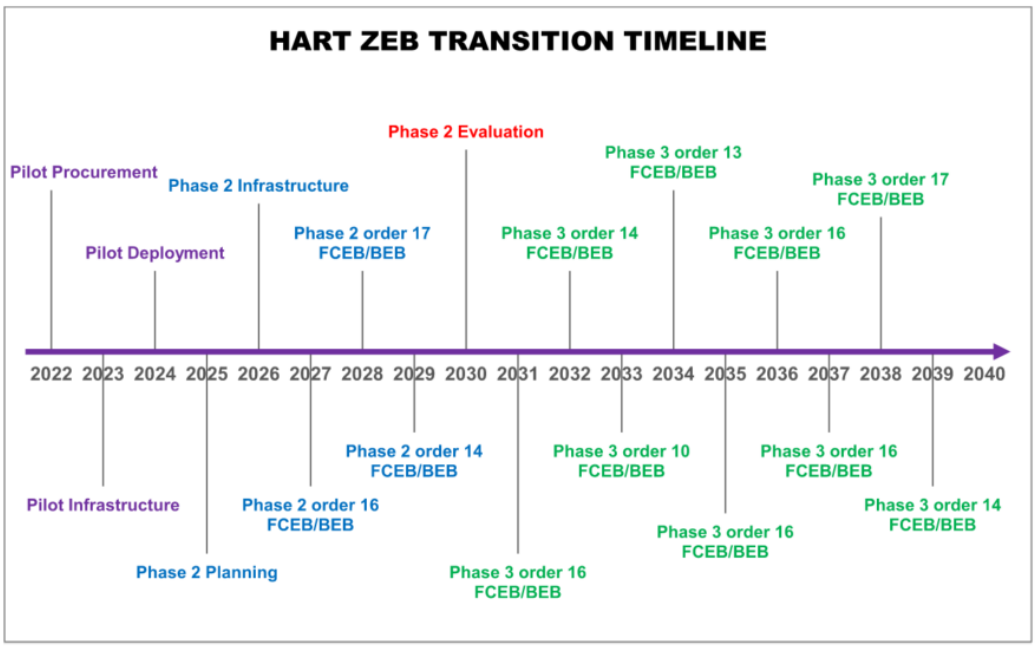
- Development of business models that rent vehicles to gig drivers and provide charging solutions, for example the collaboration between EVgo and Maven
- TNC companies shifting priorities from electrifying fleets
- Adoption of automated vehicles for TNC applications
- Changes in the operating and purchase cost of EVs

Transit (HART)

The Hillsborough Area Regional Transit Authority (HART) is the public transit provider throughout Hillsborough County. In 2021, HART maintained a fleet of 125 forty-foot compressed natural gas (CNG) and diesel buses that operate both fixed route and demand response services. HART offers 34 fixed routes, of which 29 are local, all-day services (the remaining 5 are express routes). The 29 local fixed routes are driven by a fleet of 110 buses that travel approximately 21,500 miles daily, with each bus averaging 205 daily miles.

HART has already initiated planning for transitioning the fleet to zero emission buses. As HART transitions from its low-emissions fleet to its zero-emissions fleet, the agency will pilot Hydrogen Fuel Cell Electric Buses (HFCEB) and Battery Electric Buses (BEB). These pilots will inform the subsequent transition to zero emission buses. The HART Zero Emission Bus (ZEB) Transition Timeline is depicted in Figure 22. **It is HART's goal to transition to a 100% ZEB fleet by 2040**. The scenarios presented in this section are intended to suggest potential outcomes related to adoption of battery electric buses by HART, but the actual transition is dependent on HART's ongoing work.

Figure 22. HART Zero Emission Bus Transition Timeline



Source: HART Zero Emission Fleet Transition Plan (2022)

HART's projected need for EV charging infrastructure based on three scenarios is summarized in Table 5.

Table 5. HART EV Charging Infrastructure Adoption Scenarios

Use Case	Low Need for Charging Infrastructure	Medium Need for Charging Infrastructure	High Need for Charging Infrastructure
Transit	Use pilot BEBs and charging infrastructure to allow BEBs to serve as support vehicles.	Use BEBs for local, fixed routes with average daily miles of 200 or lower	Use BEBs for local, fixed routes

Low Need for Charging Infrastructure

A low adoption of battery electric buses may occur, if HART's pilot program finds that battery electric buses don't currently meet the needs of HART. Under this scenario, the purchased pilot buses and charging stations may remain the sole investment in battery electric buses by HART. Under this scenario, the spare vehicles that HART maintains could be BEVs. Currently, HART maintains a spare ratio of about 15% for its fleet, which equates to about 20 vehicles.[12]

Medium Need for Charging Infrastructure

A medium adoption of battery electric buses may occur, if HART's pilot program finds that battery electric buses can be used for some routes that can be completed using primarily depot charging, with few additional resources for on route charging. Under this scenario, HART may transition some buses to battery electric buses and install depot charging.

[12] Federal Transit Administration. (2022). *Transit Agency Profile: HART 2021*. National Transit Database.

Considering current battery electric bus range of 150-300 miles (from the HART study), local, fixed routes with average daily miles traveled of 200 or lower could be served by BEBs. According to the *Transition Plan,* at present HART operates eleven local, fixed routes that travel on average less than 200 daily miles per bus, including: Routes 1, 14, 19, 24, 25, 31, 33, 42, 44, and 400.

High Need for Charging Infrastructure

A high adoption of battery electric buses may occur, if HART's pilot program finds that battery electric buses can be used for all routes, with investment in on-route charging to accommodate routes that serve a longer distance. On-rote charging will likely happen at bus hubs or other transfer points that could serve multiple routes.

Under this scenario, HART would transition to use BEBs for all local, fixed routes. The high need scenario presents the most challenges for transit fleet electrification, due to the present capabilities of BEB technology, including the rate at which batteries charge (typically 2 – 6 hours for DCFC chargers), the capacity of the battery, and environmental and use considerations such as climate and ridership.

Under this scenario, HART may need to increase the fleet size, so that the buses serving the routes averaging higher than 200 daily miles per bus would have the opportunity to return to a depot or transfer center to recharge, or install on-route charging to allow buses to complete the entire route. If the fleet is expanded to accommodate the routes over 200 miles, it is estimated that an additional 29 BEBs would be needed to allow time for at-depot charging. Crucially, HART must also calculate the overnight dwell time for each bus to determine the length of time that each bus is not in service and can be charged.

Table 6. HART Routes by Daily Mileage & Number of Buses

HART Route	Daily Mileage per Bus	Number of Buses	HART Route	Daily Mileage Per Bus	Number of Buses Needed
1	187	8	31	150	1
5	150	2	32	160	3
6	183	7	33	183	3
7	180	4	34	178	7
8	180	4	36	175	3
9	150	2	37	160	3
10	150	1	38	167	2
12	190	4	39	175	5
14	167	3	42	175	2
15	133	2	44	175	2
16	187	4	45	175	5
17	175	3	46	150	2
19	175	2	48	133	3
24	150	1	275	160	3
25	175	2	360	180	5
30	750	3	400	1,550	8

Commercial Delivery (Medium Duty Freight)

Medium-duty freight vehicles make commercial deliveries between businesses, between businesses and residences, and between residences. Unlike heavy-duty freight trucks, which average over 300 miles per day with about 40,000 lbs. of cargo, these smaller and lighter vehicles typically travel between 60 – 200 miles per day and carry about 2,000 lbs. of cargo.[13,14] In June 2023, about 117,000 heavy trucks were registered in Hillsborough County[15]. Commercial delivery vehicles are expected to transition more quickly to EVs than heavy-duty long-haul trucks.

The *FDOT EV Master Plan* identifies regional market forecasts for medium duty vehicles as an opportunity for collaboration with other agencies in the Southeast. Until local estimates are projected, a few considerations can guide the estimation of the adoption rate of commercial delivery EVs. Medium duty EVs are being adopted as a response to regulations in some jurisdictions and in response to market forces.

Market Forces: Delivery companies believe transitioning to electric vehicles will save money while simultaneously fighting climate change and reducing urban pollution[16]. Delivery companies are beginning to replace gas-powered vehicles with electric or low-emission vehicles. UPS has ordered 10,000 electric delivery vehicles, Amazon is purchasing 100,000 EV vehicles, DHL reports zero-emission vehicles already make up 20% of its fleet with more to be added, and FedEx has pledged to have an all battery-electric delivery fleet by 2040.

Regulations: California adopted the Advanced Clean Trucks (ACT) Rule, which requires an increasing portion of new trucks purchased in the state to be ZEVs beginning in 2025. Several other states have also adopted this Rule. Florida has not adopted the rule, but projections for the adoption of EV medium and heavy duty trucks under the Rule can serve as an upper end of the expected range for adoption of EV commercial delivery trucks in Hillsborough County. The forecasted portion of medium and heavy vehicles that transition to ZEVs in Oregon is summarized in Table 7 under the ACT Rule and without the ACT[17]. These projections serve as boundaries on the expected adoption rate in Hillsborough County.

Table 7: Adoption of ZEV Medium and Heavy Duty Vehicles

Scenario	2025	2030	2035	2040	2045	2050
Baseline (without ACT)	0.1%	0.2%	0.3%	0.5%	0.6%	0.7%
With ACT	0.5%	5%	18%	34%	49%	60%

Other factors that may affect the adoption of EV commercial delivery vehicles include:

- Access to EV charging at the existing depots. Adoption may be limited if the fleet cannot afford the capital cost of installing chargers or if the electric infrastructure cannot support the additional electricity demand.
- Finances for the company to replace existing vehicles with EVs. The ability to replace vehicles may also be impacted by the rate of fleet turnover.

[13] McMaster, Kevin. (February 5, 2019). *Trucker Life: A Day in the Life of a Truck Driver.* Flock Freight. https://www.flockfreight.com/blog/a-day-in-the-life-of-a-truck-driver/#:~:text=Truck%20drivers%20typically%20have%20a,to%20a%20variety%20of%20events.

[14] Gebel, Meria. (December 8, 2020). *I'm a 55-year old Amazon driver. I risk rolled ankles, blown knees, and dog bites daily – but I still enjoy the job.* Insider. https://www.businessinsider.com/amazon-delivery-driver-day-in-the-life-2020-10

[15] Florida Highway Safety and Motor Vehicles, Vehicle and Vessel Reports and Statistics

[16] Domonoske, C. (2021, March 17). From Amazon To FedEx, The Delivery Truck Is Going Electric. NPR. https://www.npr.org/2021/03/17/976152350/from-amazon-tofedex-the-delivery-truck-is-going-electric

[17] Dana Lowell, et al. (2021). "Oregon Clean Trucks Program," M.J. Bradley & Associates.

NEEDS ANALYSIS

This section outlines the charging infrastructure needs that were estimated for each use case, building from the projections of EV adoption discussed in the previous section. The charging needs in 2035 are summarized by use case and adoption scenario in Table 8.

Table 8: Summary of Charging Needs for 2035 Adoption Scenarios by Use Case

2035 Adoption Scenario	Low		Medium		High	
Charging Type	**L2**	**DCFC**	**L2**	**DCFC**	**L2**	**DCFC**
Light Duty Vehicles	1,958	333	4,668	737	6,061	945
TNC*	0	198	0	198	0	198
Transit	0	5	0	21-61	0	61-170
Commercial Delivery*	0	1-13	0	1-13	0	1-13
Rounded Total	**2,000**	**500**	**4,700**	**1,000**	**6,100**	**1,300**

*One adoption scenario is projected

Light Duty Vehicles (Urban & Rural)

The chargers needed to support light duty vehicles are estimated using NREL's EVI-Pro Lite in Hillsborough County. The key inputs are:

- Vehicle Mix: What types of EVs are adopted?
- At Home Charging: How much charging occurs at people's homes?
- EV Adoption: How many EVs are in Hillsborough County?

Vehicle Mix

The vehicle mix is based on the EVs registered in Hillsborough County between 2018 and 2021, summarized in Table 9. The vehicle mix is used consistently for all years and scenarios in this analysis. Plug-in hybrid electric vehicles (PHEVs) are assumed to need partial support from charging infrastructure, this means that drivers may need to use some gasoline on a typical day.

Table 9. Breakdown of EV Types in Hillsborough County

EV Type	EV Mix (%)
Plug-In Hybrids 20-Mile Electric Range	5.8
Plug-In Hybrids 50-Mile Electric Range	4.2
All-Electric Vehicles 100-Mile Electric Range	7.2
All-Electric Vehicles 250-Mile Electric Range	82.8
Total	100

At Home Charging

The EVI-Pro Lite model assumes that if drivers have access to home charging, they will use home charging whenever it is possible. This is in alignment with the US Department of Energy, which reports 80 percent of EV charging to occur at home[18]. According to the 2021 American Community Survey 5-Year Estimate, 28% of the housing units in Hillsborough County are multi-unit dwellings and 40% of the housing units are renter-occupied, shown in Table 10. Multi-unit dwelling households are less likely to have access to dedicated parking with access to an electrical outlet, so therefore may not be able to charge at home. Renting households may not be able to install Level 2 charging infrastructure in their home, and may therefore also be less likely to be able to charge at home. Policies requiring condominiums to accommodate an owner's request to install charging infrastructure[19, 20], EV charging requirements for new developments[21], and other incentives[22] may increase the access to charging infrastructure at home for people living in multi-unit dwellings or rental units.

Some people living in multifamily units or rental units may have access to home charging, for example if they can connect to a nearby outlet and charge their EV using a Level 1 charger. This analysis assumes that 30% of multifamily units and 60% of renter-occupied single detached/attached units have access to this type of home charging. The households in Hillsborough County are categorized by the type of building and owner/renter in Table 10. According to these assumptions, 75% of households are assumed to have access to home charging. This assumption is used consistently for all years and scenarios in this analysis. As more multi-unit dwellings are constructed that include charging infrastructure, the access to home charging may increase.

Table 10: Households by Type and Access to EV Charging at Home

	Households	Access to Home Charging	Households with Access to Home Charging
Single Unit (Owned)	290,401	100%	290,401
Multi Unit (Owned)	14,562	30%	4,369
Other (Owned)	22,443	100%	22,443
Single Unit (Rented)	69,317	60%	41,590
Multi Unit (Rented)	138,309	30%	41,493
Other (Rented)	12,546	60%	7,528
Total	**547,578**	**74%**	**407,823**

[18] Lepre, "EV Charging at Multi-Family Dwellings," 2021.

[19] FCAP. (2021, July 17). Installing Electric Vehicle charging stations in condominiums. Retrieved April 18, 2023, from https://www.fcapgroup.com/flcaj/flcaj-articles/installing-electric-vehicle-charging-stations-in-condominiums/

[20] Biletnikoff, J. L. (2018, September 25). Charging the way: New law opens the door for electric charging stations in condominiums. Becker. Retrieved April 18, 2023, from https://beckerlawyers.com/charging-the-way-new-law-opens-the-door-for-electric-charging-stations-in-condominiums/

[21] Ferrara, J. R. (2023, February 10). Future Portland Apartments now required to include more spaces readied for EV charging. KOIN.com. Retrieved April 18, 2023, from https://www.koin.com/local/multnomah-county/future-portland-apartments-now-required-to-include-more-ev-charging-stations/#:~:text=Oregon%20House%20Bill%202180%2C%20passed,now%20exceeds%20that%20state%20mandate.

[22] Alternative Fuels Data Center: Electric Vehicle Charging for Multifamily Housing. (n.d.). Electric vehicle charging for multifamily housing. Retrieved April 18, 2023, from https://afdc.energy.gov/fuels/electricity_charging_multi.html

Estimated Number of Chargers Needed

The estimated range of Level 2 workplace and public charging ports, as well as DC fast charging ports needed by 2035 and 2050 to support the EV adoption scenarios discussed earlier, are summarized in Table 11.

The EVI-Pro Lite Tool can only analyze the charging needs of up to 10% of the existing light-duty vehicles for Hillsborough County. For the medium- and high-need scenarios, linear regression is used to determine the needed charging ports. This estimation technique is described further in Appendix C.

EV Chargers Needed

2023: 500

2035: 2k – 7k

2050: 4k – 16k

Table 11. Estimated Number of Public Charging Plugs Needed in Hillsborough TPO Planning Area by 2035 and 2050

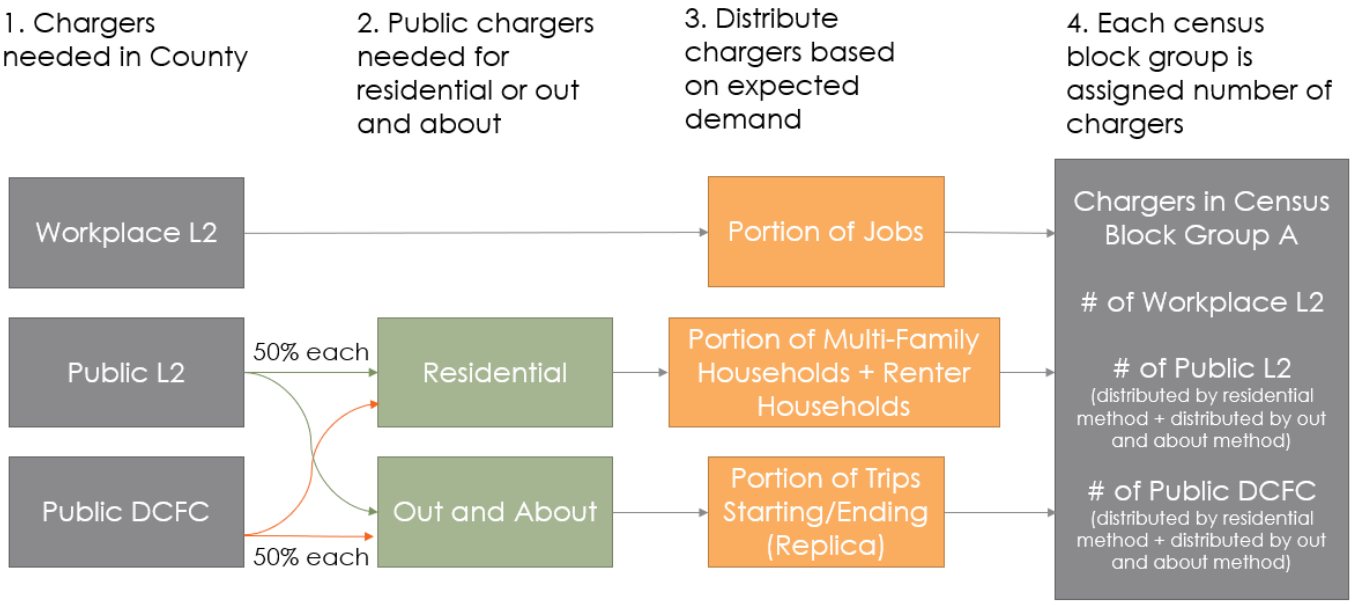
	2035			2050		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**
Number of EVs	89,947	229,864	299,823	169,900	419,752	689,592
Workplace Level 2 Charging Plugs	1,177	2,788	3,621	2,036	5,049	8,263
Public Level 2 Charging Plugs	781	1,880	2,440	1,385	3,399	5,556
Public DC Fast Charging Plugs	333	737	945	559	1,300	2,101
Total	**2,291**	**5,405**	**7,005**	**3,980**	**9,748**	**15,920**

Distribution of Chargers throughout Hillsborough County

The overall need for charging infrastructure for LDV in Hillsborough County is distributed throughout the County by Census Block group. Each type of charger is distributed according to a different methodology. The methodology used to distribute chargers is summarized in Figure 23.

- **Workplace Level 2 Ports**: Distribute chargers based upon the distribution of jobs in Hillsborough County.
- **Public Level 2 Ports**: Distribute half of the needed chargers based upon the distribution of multi-family dwelling units and renting households in the County. Distribute the other half of the needed chargers based upon the distribution of the start/end point of trips in the County.
- **Public DCFC Ports**: Distribute half of the needed chargers based upon the distribution of multi-family dwelling units and renting households in the County. Distribute the other half of the needed chargers based upon the distribution of the start/end point of trips in the County.

Figure 23: Distribution of LDV Chargers by Census Block Group



The distribution of chargers is evaluated in consideration of disadvantaged communities to ensure that the proposed distribution is equitable. Locating charging infrastructure in disadvantaged communities is only part of ensuring that all communities in Hillsborough County have access to charging infrastructure and EVs, but it is a helpful metric at the broad planning level. In general, the distribution of needed chargers in 2035 and 2050 indicates that disadvantaged communities will have equitable access to EV charging. About 20% of the population and 25% of jobs in Hillsborough County are in disadvantaged communities, as defined by the Hillsborough TPOs Most Underserved Areas analysis. About 25% of public charging infrastructure is projected to be needed in disadvantaged communities. The statistics are further detailed in Table 12.

Table 12: Distribution of Charging Infrastructure Considering Disadvantaged Communities

	Hillsborough County	TPO DAC	DAC Portion of County
Population	1,451,358	305,050	21%
Households	338,683	63,059	19%
Jobs	732,948	193,913	26%
Pub DCFC in CBG in 2035	738	189	25.63%
Pub L2 in CBG in 2035	1,880	482	25.63%
Work L2 in CBG in 2035	2,788	738	26.46%
Pub DCFC in CBG in 2050	1,300	333	26%
Pub L2 in CBG in 2050	3,400	872	26%
Work L2 in CBG in 2050	5,049	1,336	26%

The number of chargers projected to be needed in each Census Block Group in Hillsborough County is included in Appendix C. A summary of the needs of some general areas, shown in Figure 24, in Hillsborough County are included in Table 13. These needs are intended as goal posts for the comprehensive need for charging infrastructure in Hillsborough County. The need of one census block group could be potentially fulfilled through the installation of charging infrastructure nearby, but not necessarily within the census block group. This is especially true for DCFC which drivers may be willing to drive further out of the way to use.

Table 13: Summarized Data for Areas in Hillsborough County

Area	DCFC		Public L2		Workplace L2	
	2023	2035	2023	2035	2023	2035
Greater Downtown	0	33	141	84	0	420
Plant City	8	8	2	21	0	29
Sabal Park	0	11	6	27	0	129
Sun City Center Commercial	0	9	0	23	0	22
Temple Terrace	0	26	2	67	4	70
USF & Med Centers	0	19	31	50	0	104

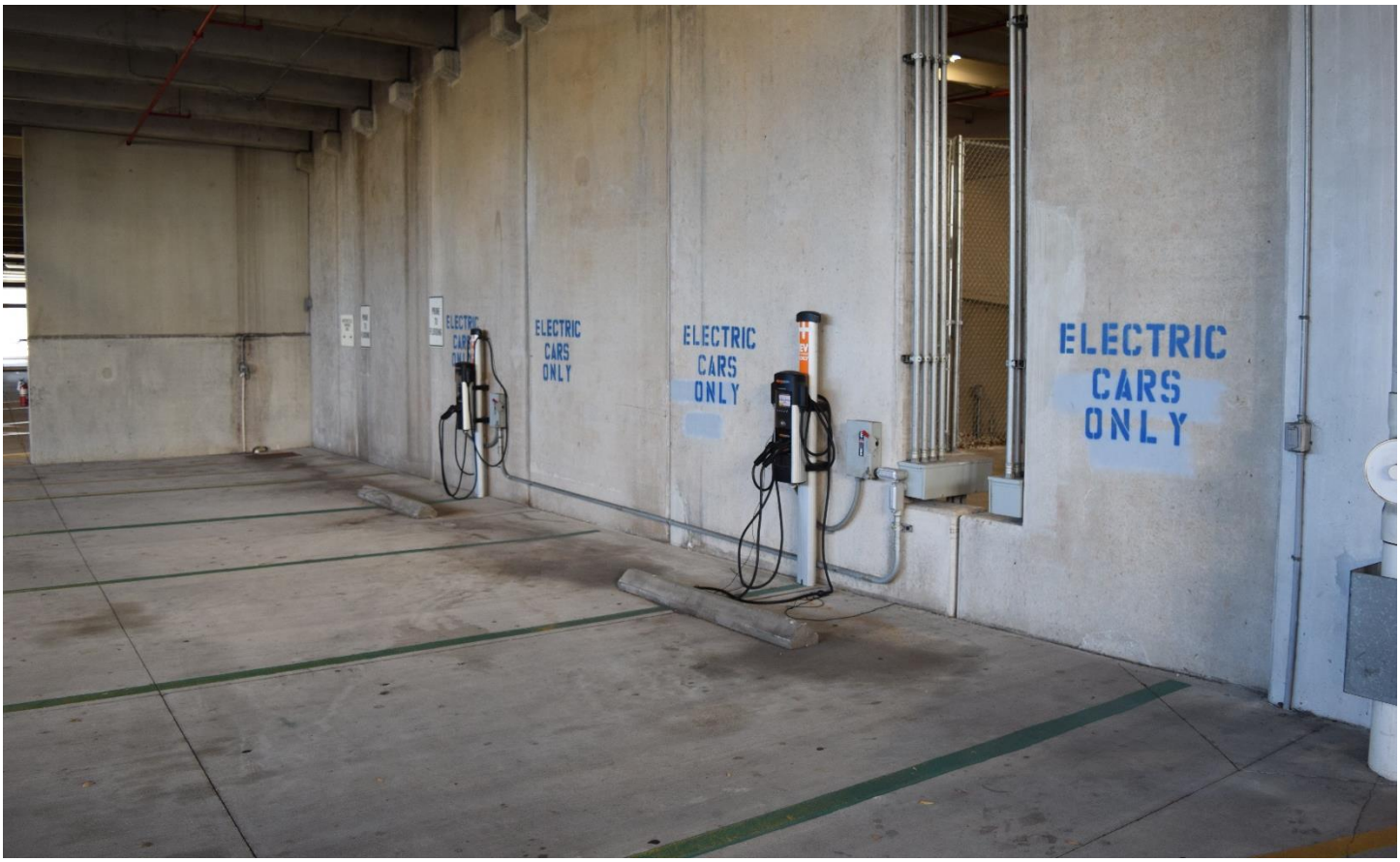
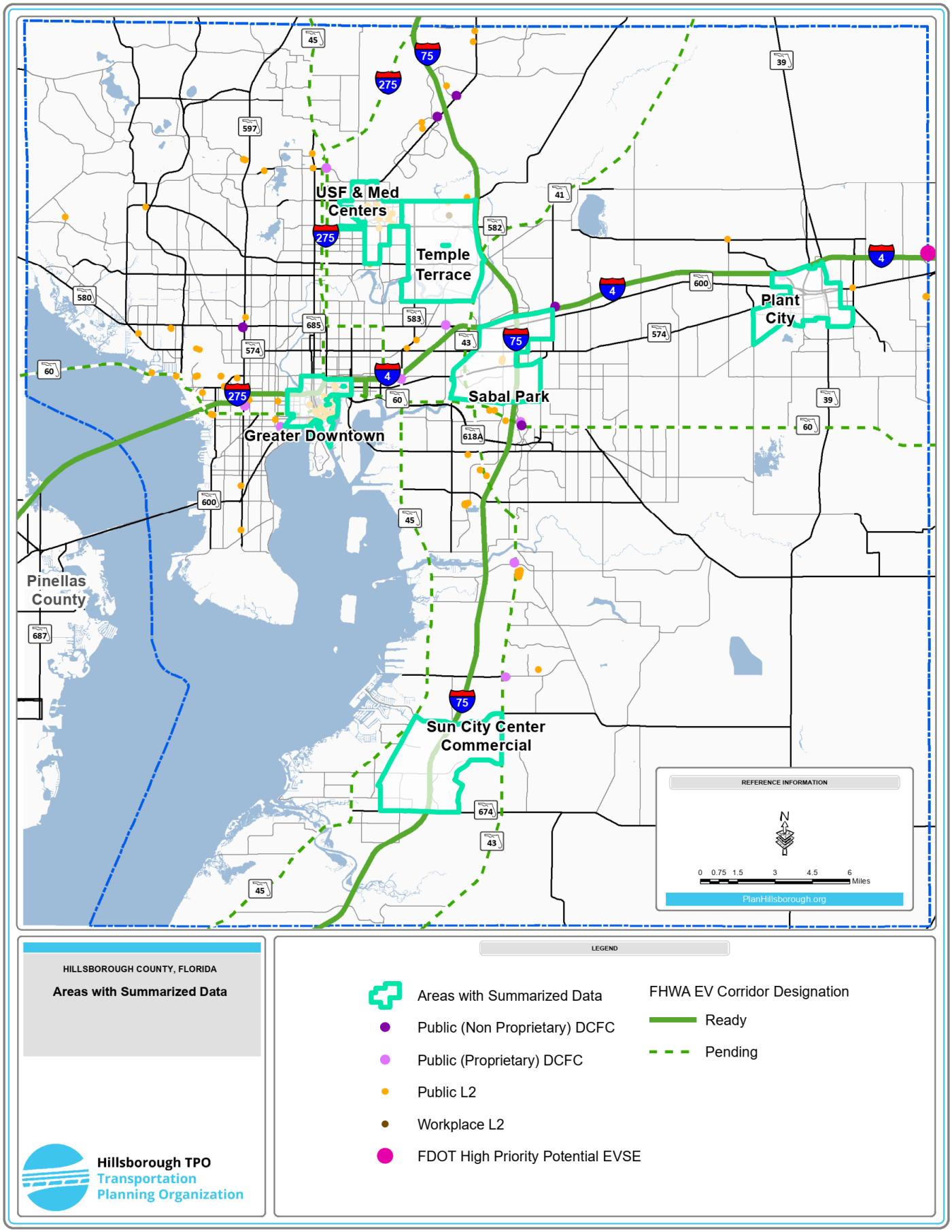
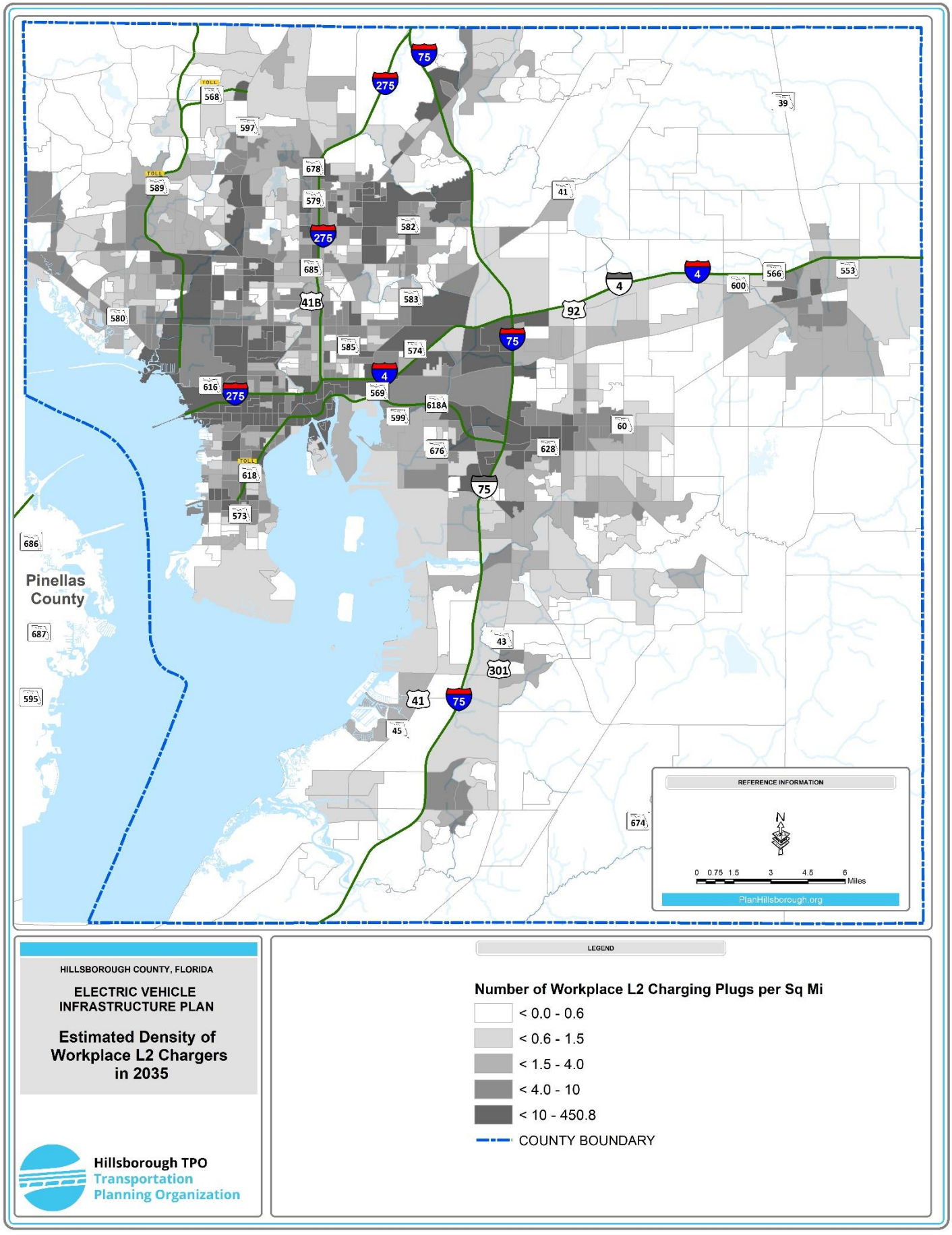


Figure 24: Areas with Summarized Data




HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Workplace L2 Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Workplace L2 Charging Plugs per Sq Mi
< 0.0 - 0.6
< 0.6 - 1.5
< 1.5 - 4.0
< 4.0 - 10
< 10 - 450.8
COUNTY BOUNDARY
REFERENCE INFORMATION
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0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org
Pinellas County
75
275
4
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41B
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301
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597
589
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583
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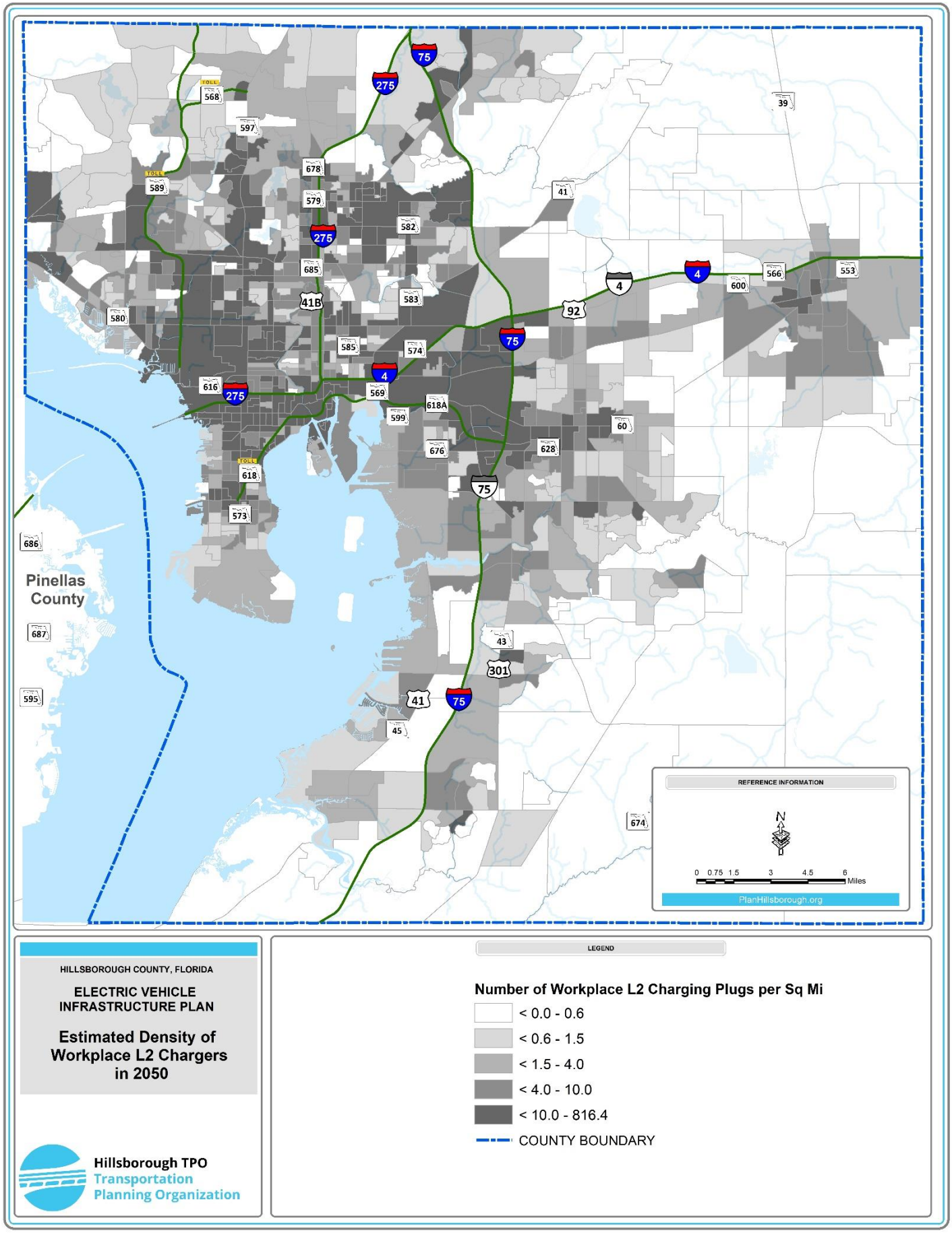
Pinellas County
REFERENCE INFORMATION
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Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Workplace L2 Chargers in 2050
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Workplace L2 Charging Plugs per Sq Mi
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< 4.0 - 10.0
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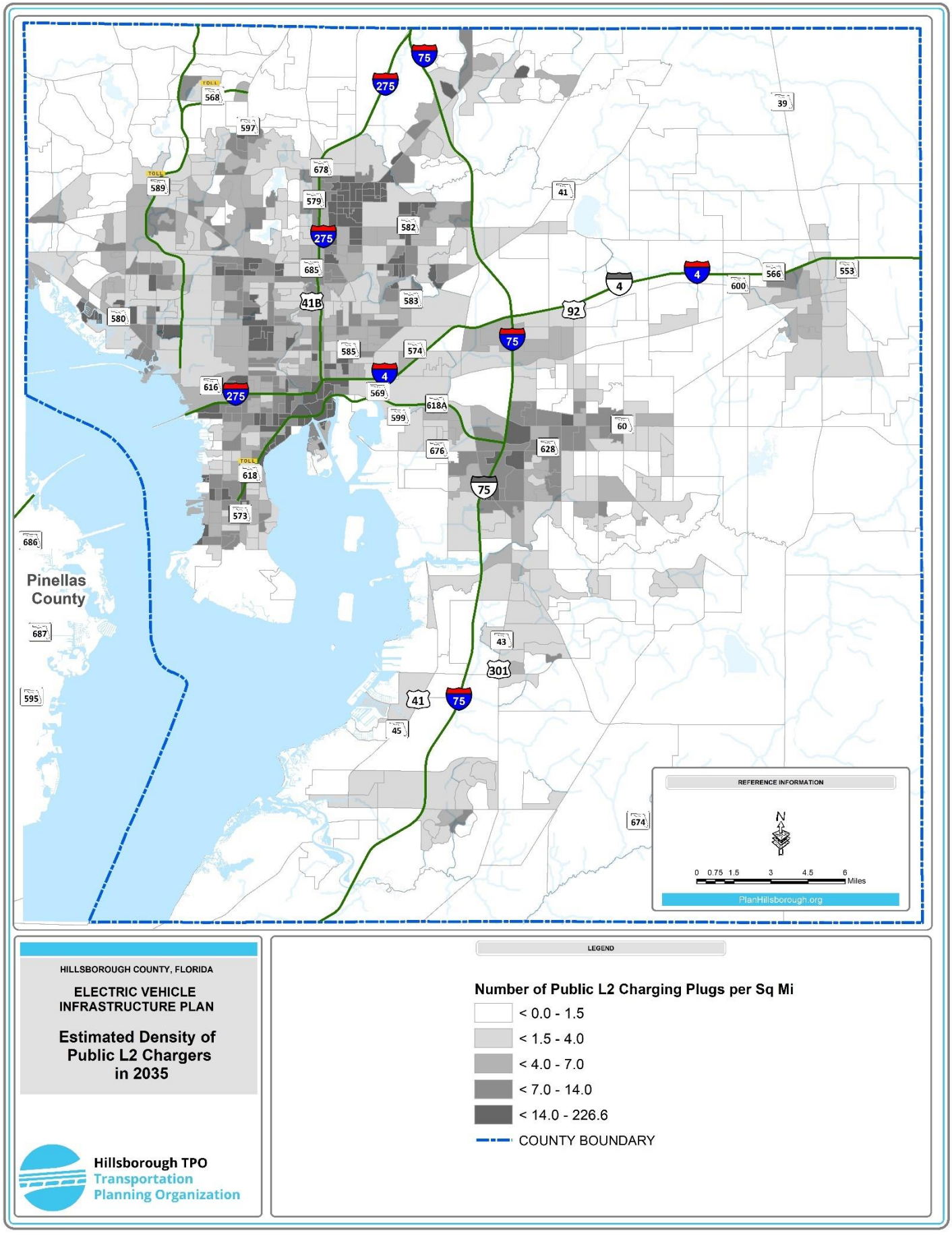
COUNTY BOUNDARY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Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Public L2 Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Public L2 Charging Plugs per Sq Mi
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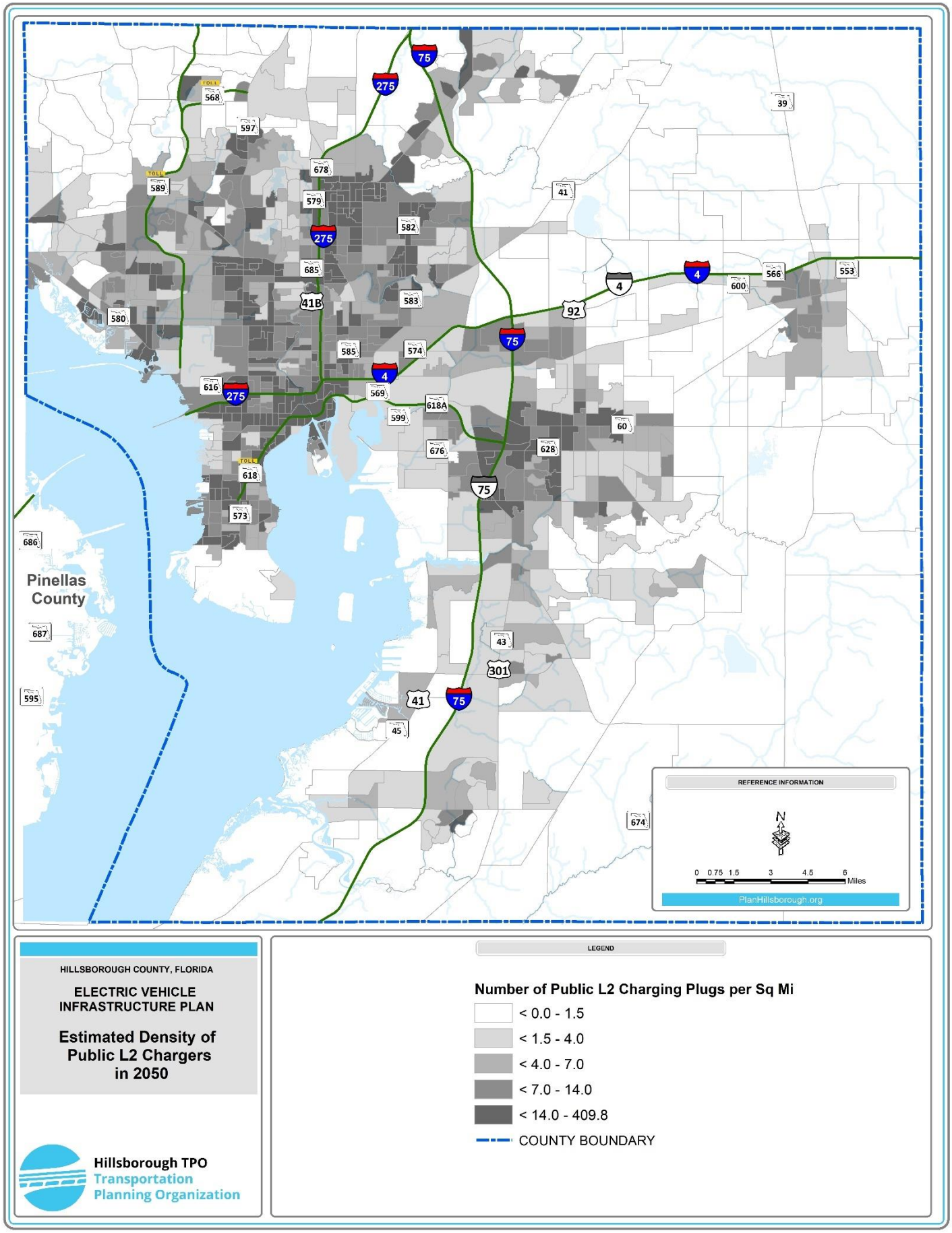
< 4.0 - 7.0
< 7.0 - 14.0
< 14.0 - 226.6
COUNTY BOUNDARY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PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Public L2 Chargers in 2050
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Public L2 Charging Plugs per Sq Mi
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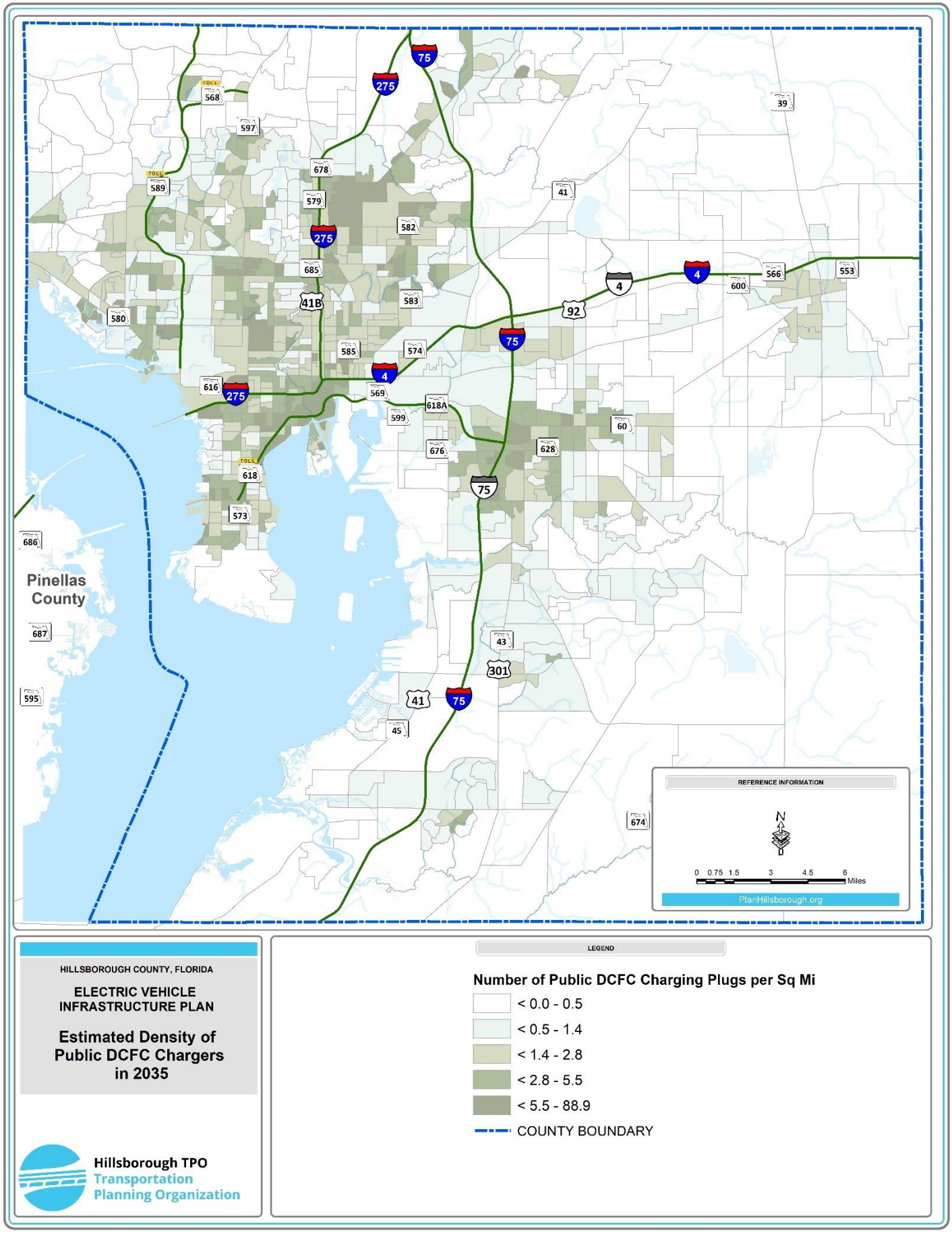
< 14.0 - 409.8
COUNTY BOUNDARY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ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Public DCFC Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Public DCFC Charging Plugs per Sq Mi
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< 0.5 - 1.4
< 1.4 - 2.8
< 2.8 - 5.5
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COUNTY BOUNDARY
REFERENCE INFORMATION
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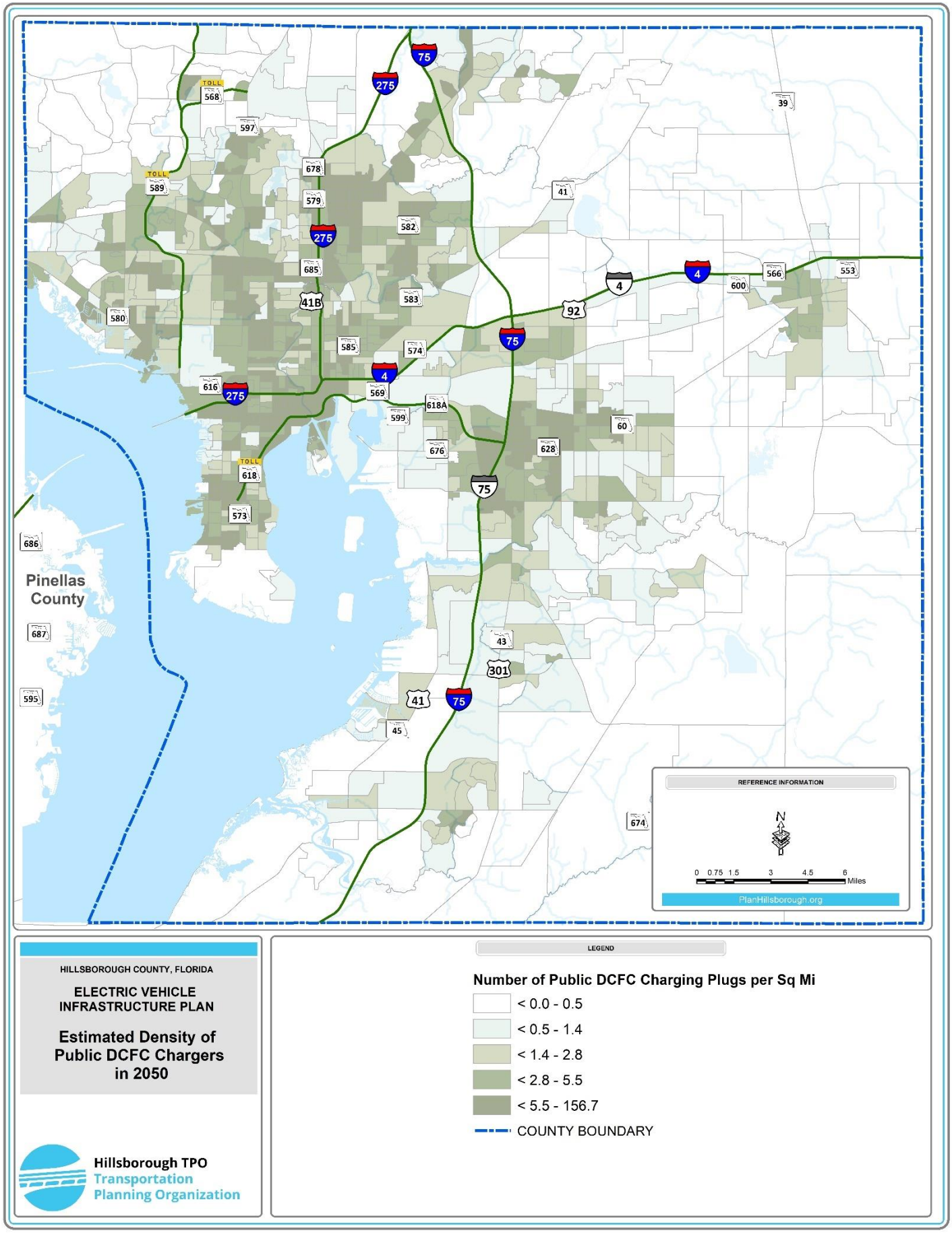
PlanHillsborough.org
Pinellas County


Pinellas County
REFERENCE INFORMATION
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Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Public DCFC Chargers in 2050
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Public DCFC Charging Plugs per Sq Mi
< 0.0 - 0.5
< 0.5 - 1.4
< 1.4 - 2.8
< 2.8 - 5.5
< 5.5 - 156.7
COUNTY BOUNDARY

Disadvantaged Communities

In addition to understanding the distribution of chargers throughout Hillsborough County needed to support the expected adoption of electric vehicles, defined in the previous section, in disadvantaged communities some additional needs should be considered. It is important to install EV infrastructure to support beyond the current EV owners, since adoption is anticipated to become more widespread. Investing in EV infrastructure solely where current EV owners live will not meet the need of all communities in Hillsborough County as adoption becomes more widespread.

Several barriers to adoption of EVs by people in disadvantaged communities have been previously identified. Strategies for addressing these barriers are summarized in Table 14.

Table 14: Barriers and Strategies to EV Adoption in Disadvantaged Communities

Barrier	Strategy
EVs currently have a higher purchase initial purchase price, that is offset by rebates applied after the purchase of the vehicle and reduced operating costs.	- Allow rebates and other incentives to apply at the time of purchase, rather than after[23]. - Target incentives to lower income buyers, such as the California Clean Cars 4 All program. - Over time, EVs are expected to come to price parity with gasoline powered vehicles - Provide assistance to navigating rebate programs
Lack of access to home charging (which reduces the convenience of refueling an EV and also increases the cost to refuel an EV)	- Install convenient charging infrastructure for those without home access, for example in multi-unit dwellings[23] - Affordable charging plans for residents dependent on DCFC, for example those without home charging or TNC drivers[23] - New buildings required to install EV charging[23] - Rebates for installing charging infrastructure at home - In neighborhoods where permanent charging infrastructure is not a feasible option, sponsor the deployment of mobile charging units to increase charging access at community-selected locations
Interest in EVs	- Community specific education and outreach to describe the benefits and costs of EV adoption so residents can make an informed decision - Increase awareness and promote education about EVs through community outreach, informational materials, and "ride-and-drive" demonstration events.

The needs of disadvantaged communities throughout Hillsborough County may be different from one another. Stakeholder engagement during the identification of station locations and design of stations is important.

[23] RMI. (October 2022). *Increasing Equitable EV Access and Charging: A Path Forward for States – Recommendations for US Policymakers and Projected Impacts on Equitable Access to EV Adoption and Charging.*

Additionally, federal funding programs, including NEVI, require at least 40% of the benefits of the investment go to disadvantaged communities defined under Justice 40.

Besides personal adoption of EVs, EVs may offer benefits to community members who do not own an EV, but live in an area with more EVs. For example, air quality may be less impacted by vehicle traffic if more of those vehicles are EVs. Other transportation options, for example greater access to low cost e-micromobility or car sharing may also provide value. Encourage local jurisdictions and partner agencies to update zoning regulations to allow for small, local businesses to provide amenities at charging stations.

To ensure that the needs of disadvantaged communities are met equitably in Hillsborough County, the recommended targets and indicators should be evaluated periodically, with consideration of how those targets are being met in disadvantaged communities and across the County overall. This analysis is summarized previously in Table 1.

Transportation Network Companies & Gig Drivers

The EV charging needs of drivers for transportation network companies (TNCs) and other gig services (such as app-based delivery services), differ from the drivers discussed in the Light Duty Vehicles section.

- Typical light duty passenger vehicle drivers, drive about 35 miles per day, but TNC and gig drivers average between 100 and 300 miles per day.[24]
- TNC and gig drivers must be actively completing trips to earn income, increasing the desire to quickly charge their vehicles[25]. Early adoption of EVs in TNC use cases have tended to use DCFC.
- TNC driver demographics and residence types tend to have less access to overnight charging.

These differences tend to result in a different charging pattern and need from public charging stations. Charging stations that are located at TNC waiting lots, for example at the airport, or other major hubs may be preferred. TNC drivers may be able to minimize non-revenue charging time by using a reservation system at chargers, if available. Ride hail fleets are estimated to need 17.5 DCFC ports per 1,000 vehicles[25]. Considering the EV adoption projections discussed previously, the additional needed DCFC ports in Hillsborough County to support TNCs are summarized in Table 15. Considering the medium need scenario for light duty vehicles, these additions to the number of needed DCFC are significant, requiring an additional 25% DCFC ports in 2035 and 40% in 2050.

As mentioned in the previous section, the adoption of EVs under the TNC use case is dependent on the developing market. If an increasing portion of trips in Hillsborough County shift to TNC, charging infrastructure currently modeled as needed for personal vehicles may not be needed, while additional charging infrastructure may be needed for TNC use cases. Further information on the adoption of EVs by TNCs and the value of installing charging infrastructure in particular locations could be provided by TNCs if they are willing.

Table 15: Charger Need for TNC & Gig Driver

	2035	2050
Estimated EV TNCs	14,000	35,000
Estimated number of DCFC ports to support TNCs	245	613
Estimated number of DCFC ports allocated under LDV to these vehicles	47	117
Additional DCFC ports that should be added to LDV scenario	198	496
Approximate additional percentage for DCFC ports	25%	40%

[24] The Uber Driver's Subreddit. (2021, September 29) *How many miles do you drive per day?* Reddit. https://www.reddit.com/r/uberdrivers/comments/py320p/how_many_miles_do_you_drive_per_day/

[25] Moniot, M., Y. Ge, and E. Wood. *Estimating Fast Charging Infrastructure Requirements to Fully Electrify Ride-Hailing Fleets across the United States.*

Transit (HART)

To support the transition to BEBs, HART may need to install charging infrastructure at the bus depot and along the bus routes at major transfer points, depending on the adoption of BEBs into the transit fleet. Best practices and lessons learned from other transit agencies should be considered when considering how to transition the fleet. Atlas Public Policy provides a summary of best practices in the 2022 publication *Deploying Charging Infrastructure for Electric Transit Buses.* Additional best practices are provided by Oregon DOT in the *Guide to Transit Electrification*[26]. HART's needs should be further considered as part of the transition planning already underway at HART, this assessment is intended to provide a big picture view of what may be needed. The assessment should consider route lengths, daily operating schedules, downtime between service blocks, and operating conditions that might impact energy use. Some agencies have also selected routes that are prominent or further EJ outcomes. Additionally planning should consider the resilience of the system and what to do when things do not go according to plan.

Where to Charge

A fundamental decision HART must make is where BEBs will be charged. Transit agencies can charge BEBs along the route while the BEB is in service, or while the BEB is parked at a depot (usually overnight). Transit agencies may also use a combination of the two. Overall, transit agencies interviewed by Atlas Public Policy suggested using depot charging as much as possible and only including on-route charging where necessary. Some specific considerations include:

- On-route charging tends to use higher powered chargers (350 kW+) which are more expensive to install and may result in higher electricity costs due to demand charges, compared to slower chargers that may be installed in depots (often 60-150 kW).
- On-route charging stations may be more difficult to maintain, because staff must travel to each station, rather than having all the equipment at the depot.
- On-route charging stations may also have increased risk for vandalism, complaints from neighbors, or destroyed equipment from other vehicles crashing into it.
- On-route charging may work well for agencies who cannot install charging infrastructure at depots due to space constraints or electric capacity.
- On-route charging may be more resilient to power outages if the charging infrastructure is spread out across the service area and subsequently the power grid.

Charger Type

Agencies may choose to use several different types of charging infrastructure.

- **Plug-in Chargers**: Similar to typical charging infrastructure for light-duty vehicles, requires connecting a wired plug to a socket on the bus.
    - Plug-in chargers tend to be the simplest solution for smaller deployments of BEBs.
    - Plug-in chargers may use overhead cord reels, or other cord management solutions.
- **Pantograph (overhead) Chargers**: Overhead connections that charge buses parked below.

[26] Oregon Department of Transportation. (N.D.). *Guide to Transit Electrification*. https://www.oregon.gov/odot/RPTD/RPTD%20Document%20Library/Transit-Electrification-Guide.pdf

- Atlas Public Policy found that nearly every agency interviewed with a deployment of more than 10 buses uses pantograph dispensers in depots.
- Pantograph dispensers have a simpler process of starting and ending charging, compared to plug-in dispensers. Pantograph dispensers remove the need to have a cord management system in place.
- Pantograph dispensers are more expensive than plug-in dispensers, require more structural support since they are mounted overhead, and require wireless communication methods which can be less reliable.

/ **Wireless Inductive Chargers**: Large charging pads that are sunk into the ground and transfer electricity to buses parked above.
- Wireless charging is relatively new compared to the other charging methods and is not as commonly available and is not interoperable with all bus manufacturers.
- Wireless charging reduces the risk of buses or other vehicles crashing into equipment, obstructing roadways or sidewalks, or being vandalized as the equipment is mostly below ground.
- Wireless charging allows simple operation, since the driver just has to park on top of it.

Charger Operation

Agencies may choose differing power levels and charging ratios to meet their needs. In general, higher powered chargers are considered to be 350-600 kW and chargers that are 65-150 kW are considered lower powered chargers, for transit vehicles.

/ **Dedicated Charger:** A slower powered charger is available for each BEB.
/ **Manual Shifting:** Some agencies choose to use a fewer number of higher powered chargers, rotating their buses through them. For example, Trimet (Portland, OR) installed 160 kW chargers with the plan to manually cycle 3 buses through each charger per night. This requires staff availability to manually move and plug-in the buses, additionally if one charger is out of service the impacts may be greater. This method can reduce overall equipment costs, utility upgrade costs, and space consumed.
/ **Software-Based Managed Charging:** The charging is managed by software to provide better electricity rates.
/ **Mix of Higher and Lower Powered Chargers:** Some agencies choose to install some fast chargers in combination with slower chargers. For example, CTA considered several combinations. The fast chargers can provide some resilience to the system, for example meeting the needs of buses that come in late or did not charge properly overnight.

The charger operation may also shift over time as the agency becomes more comfortable with operations and increases the adoption of BEBs. For example, Santa Clara VTA plans to start with one charger per bus, and then adopt more buses once they see the reliability of the system.

Other Considerations

HART is including plans for providing charging infrastructure for BEBs or fueling infrastructure for FCEVs in plans for a new depot. Continuing to consider needs for future proofing for the fueling of the bus fleet is critical.

During the stakeholder session, HART noted impacts to the process for servicing buses overnight and current procedures for using buses for any route, without specifically assigning the vehicles. Changing maintenance needs should also be considered.

HART should consider the resilience of the selected system and ensure that operations can continue despite interruptions. This may include considering needs for spare parts or other maintenance procedures.

Charging Infrastructure Need

The needed charging infrastructure to support HARTs adoption of BEBs is dependent on what adoption they follow. A few scenarios are presented in Table 16 to illustrate the variability in infrastructure needs. The infrastructure needs should continue to be developed as part of HARTs planning.

Table 16. Estimated Number of Fleet Charging Plugs Needed for HART 2050

	Low	Medium	High – Increased Fleet	High – On Route Charging
# Total Battery Electric Buses	4	60	~160	~130
# Lower Powered Chargers at Depot (60-150 kW) *	4	20-60	60-160	50-130
# Higher Powered Chargers on Route (350-600 kW)	1	1	1	~40

*If higher powered chargers are used at the depot, the number of lower powered chargers at the depot could be reduced

Low Need for Charging Infrastructure

The HART Transition Plan identifies the need to install chargers at the depot and on-route charging at the main transfer center in downtown Tampa to support 3-4 BEBs. Under the Low Need Scenario, the infrastructure installed as part of the pilot project is expected to be sufficient to meet the needs of the BEBs. The pilot project can consider installing:

- 1 higher powered, pantograph charger along the route
- 3-4 lower powered, plug-in chargers at the depot (equal to the number of BEBs included in the pilot)

The required power levels for the on-route and depot chargers should be based upon the operating characteristics (for example how long the bus is dwelling), the route length, and the specifications of the procured BEBs.

Medium Need for Charging Infrastructure

Under the Medium Need Scenario, buses on local, fixed routes that average under 200 miles per day are expected to transition to BEBs. This is expected to be about 60 BEBs in service.

- 1 higher powered, pantograph charger along the route (installed as part of the pilot)
- 20-60 lower powered chargers at the depot

The required power level and quantity of the additional chargers installed at the depot should be based upon the findings from the pilot study, which should be used to help HART decide how to operate depot charging. For example, does HART prefer to install higher powered chargers that are used by multiple buses each night? Additionally, the pilot study should inform the type of charger installed, for example if pantograph chargers should be deployed, rather than plug-in chargers.

High Need for Charging Infrastructure

Under the High Need Scenario, buses on local, fixed routes are expected to transition to BEBs. About 70 buses are expected to travel more than 200 miles per day. These routes aren't expected to be served without on-route charging or rotating buses in and out of service throughout the day. To meet the needs of these buses serving longer routes:

- HART could increase its fleet to reduce the average daily miles per vehicle, which would allow for at-depot charging for each bus, or
- HART could implement on-route charging at targeted locations for buses to "top off" while in service.

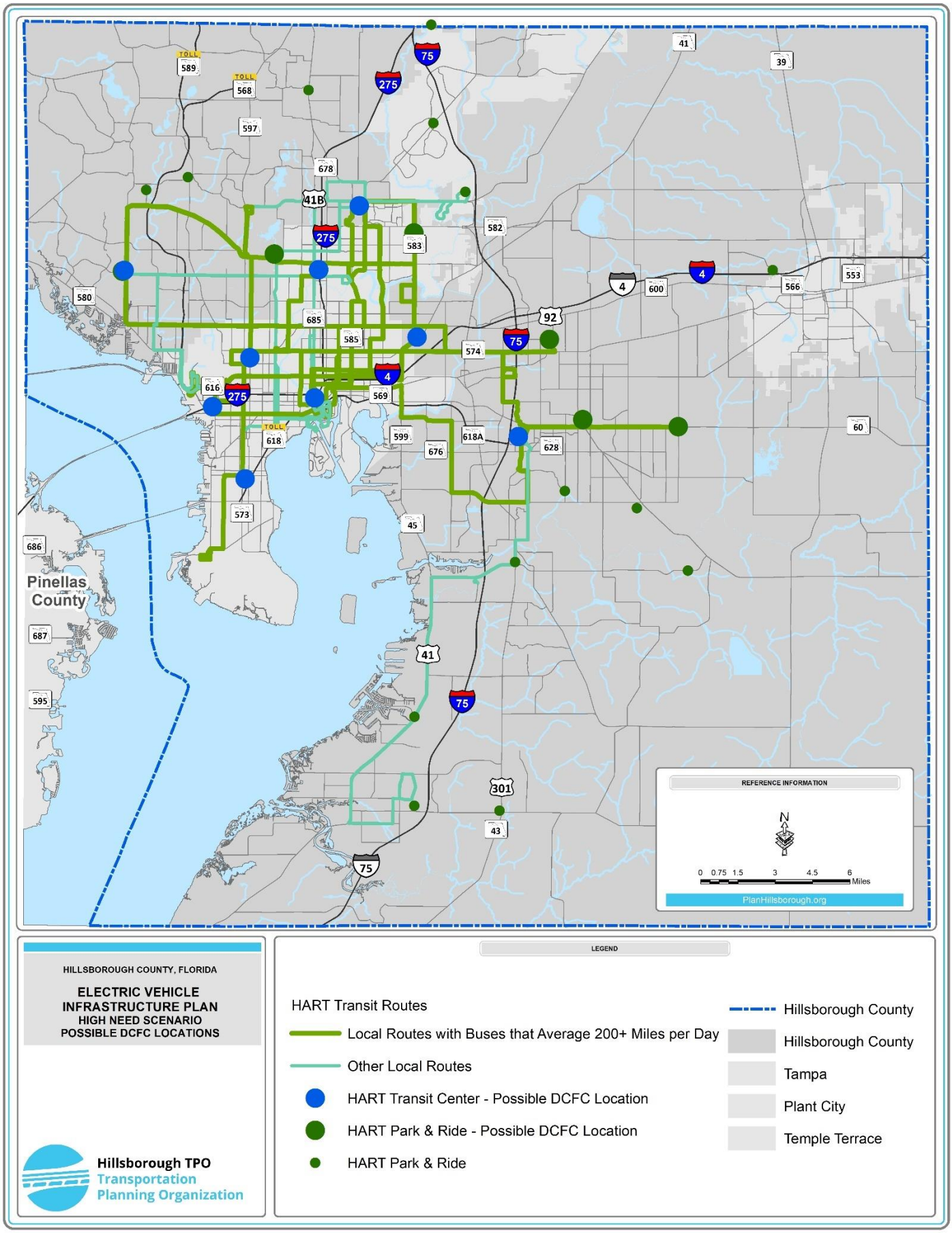
To increase the fleet to the point that all local, fixed route service buses average under 200 miles per day, an additional 29 BEBs would be needed, bringing the fleet to a total of 158 buses.

To implement on-route charging that would support "top ups" in battery range for buses on routes that average over 200 miles per day, HART can identify locations that serve multiple routes and align with schedule stops (for example beginning/ending of route). Figure 25 displays the possible locations for DCFC chargers, located at HART Transit Centers and HART Park & Ride locations along the local, fixed routes with buses that average over 200 daily miles. 21 routes with a total of 69 buses have average daily miles per bus greater than 200 miles. 12 of the routes, with 45 of the buses, travel less than 250 miles on average per day, the remaining routes travel less than 300 miles on average per day. Considering a 350 kW on-route charger, buses could "top up" to cover the route in excess of 200 daily miles in about 20 minutes for routes travelling on average less than 250 miles and in about 40 minutes for routes travelling on average less than 300 miles. Assuming that drivers take a short break at the end of each route, locating on-route charging stations at the end points of each route should provide sufficient capacity for topping up the buses. Assuming that chargers are dedicated for each route, 2 chargers would be required for each route. Therefore about 42 on-route chargers would be needed. Routes may be able to share chargers if they begin or end at the same transit centers and if the route schedules are offset to allow access to the charger for each route.

Whether the fleet size is increased or on-route charging is used, HART will need to install charging infrastructure at the bus depot. Similar to the discussion of medium need for charging infrastructure, the power level and quantity of chargers should be based upon additional planning from HART in cooperation with the findings from the pilot study. In general, it is expected that if lower powered chargers are used HART would need about 1 charger per BEB and if higher powered chargers are used HART would need about 1 charger per 3 BEBs.

The needed chargers for HART operations are expected to be used solely by the HART fleet. HART is responsible for deciding the transition plan for the transit fleet, with the TPO being willing to support as needed.

Figure 25. Possible DCFC Locations to Serve HART Routes with Buses that Average 200+ Miles per Day



Commercial Delivery (Medium Duty Vehicle)

Most of the charging for commercial delivery service is expected to occur at depots. A small portion of commercial delivery charging may occur at public charging infrastructure under use cases including:

- Emergency cases where a vehicle needs a small charge to return to the depot.
- To occasionally extend the range of a vehicle to complete a planned route.
- For fleet vehicles that do not have access to depot charging, for example if the fleet is small, the depot is not located on a site with sufficient electric grid capacity, or if the company chooses to distribute capital expenditure by buying the electric vehicles first and the charging infrastructure after a short period.

Considering these use cases, 5% of the charging demand for medium duty vehicles is assumed to occur at public charging stations. The needed charging infrastructure to support these vehicles is broadly estimated for the whole County, by assuming that 4%[27] of the daily VMT in the County are from medium duty vehicles and that chargers are in use for 30% of the day. It is also assumed that commercial delivery vehicles, due to the business opportunity cost of charging time, will use DCFC chargers.

Considering these assumptions, minimal public charging needs to be dedicated for use by commercial vehicles. Consider accommodating MD vehicles at existing stations. If a greater need for public charging for medium duty vehicles is apparent, it may be appropriate to install charging infrastructure intended for use by medium duty vehicles in areas that are frequented, for example industrial or commercial areas. Daimler Trucks has launched the Electric Island in Portland, intended to serve medium and heavy duty trucks.

Table 17: Charger Need for Commercial Delivery

	2023	2035	2050
MD Daily VMT in Hillsborough County	1.5 million	1.5 million	1.5 million
Portion of MD that are EVs	<1%	<1% - 18%	<1% - 60%
Portion of Charge Need at Public Chargers	5%	5%	5%
150 kW Charger Need	-	1 – 13	1 – 44
Addition to LDV charger need (Med scenario)		+0-2%	+0-3%
Change to Public Charging Estimates	None	Accommodate at some chargers -> add chargers intended for MD at key locations	Accommodate at some chargers -> add chargers intended for MD at key locations

[27] FHWA (July 2022). "2022 FHWA Forecasts of Vehicle Miles Traveled (VMT) Special Tabulations," FHWA, June 28, 2023, https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm#ftn3

To accommodate MD vehicles at public charging stations consider the following during station design:

- Provide charger access behind spaces or otherwise to allow a larger vehicle to park and still reach the charging ports.
- Design flow of the station to allow one-way operation.

In addition to the role that the TPO plays in encouraging the development of public charging infrastructure, to support the electrification of commercial delivery fleets, it may also endeavor to:

- Raise awareness among delivery companies about the benefits of EVs, such as reduced operating costs, lower emissions, and improved public health outcomes, through targeted marketing and education campaigns.
- Provide educational materials about and facilitate partnerships regarding mobile charging solutions, such as battery swapping or on-site generators, to provide access to charging in areas where building permanent charging infrastructure is not feasible.

PRIORITIZATION FRAMEWORK

The charging infrastructure needs can be prioritized according to the framework presented in this section. The prioritization framework is intended to guide agencies in implementing publicly accessible charging infrastructure but may be adapted depending on the application. For example:

- Adapt the framework to align with funding criteria.
- Adapt the framework to align with local priorities.
- Adapt the framework to be applicable for development review.

Light Duty Vehicles and Disadvantaged Communities

The following tenets can guide the prioritization of locations for charging infrastructure intended to serve people charging their personal vehicles. A proposed system is included in Table 18, but may be adapted depending on the application and local agency priorities. This proposed scoring system may also be adapted to further the assessment of the recommended Targets & Indicators, by considering more detailed geographies than Census Block Groups.

Table 18: Prioritization Framework for EV Charging Infrastructure

				
Goal	Close public charging deserts	Install chargers where there is a high expected demand	Ensure that chargers are equitably distributed	Install the right charger type in the right place
High Priority	L2 charging is not available within 2 miles DCFC is not available within 5 miles	Many residents do not have access to home charging & Nearby land uses that attract people and give something to do, for example restaurants, tourist attractions, or public services OR High density of employment	Disadvantaged communities as defined by the TPO or Justice 40 initiative & No existing access to EV charging that meets the community need	Places that have a high turnover or are frequented by a range of people may be prioritized for DCFC Places that people tend to dwell for long periods of time like homes and workplaces may be prioritized for L2
Med Priority	L2 charging is not available within 0.5 miles DCFC is not available within 0.5 miles	Many residents do not have access to home charging OR Nearby land uses that attract people and give something to do, for example restaurants, tourist attractions, or public services	Disadvantaged communities as defined by the TPO or Justice 40 initiative & Low existing access to EV charging that meets the community need	

The goals within the proposed prioritization framework are elaborated upon in the subsequent sections. These goals may be used to develop a prioritization system to identify charging sites in Hillsborough County. In general, the following process may be followed to prioritize sites:

1. Identify eligible activities or specified criteria from the funding source. If sites are prioritized for submission for grant funding, the specific criteria from that grant program should be used in the prioritization. For example, the federal Charging and Fueling Infrastructure Discretionary Grant Program has specific eligible activities and criteria that proposals are evaluated on.
2. Adapt the proposed framework to align with local jurisdiction priorities. For example, review EV plans completed by the local jurisdiction.
3. Evaluate sites based upon criteria aligned with the proposed framework.
    a. Augment the available GIS data to include specific land uses and other criteria identified in the framework.
    b. Establish an agreed upon weighting of criteria. For example, should chargers be emphasized more near activity centers or in charging deserts? Building consensus may be time consuming and require additional stakeholder engagement activities.
    c. Analyze the identified sites or parcels throughout the County using the framework.
4. Further prioritize sites that advance the Evaluation Measures selected by the local jurisdiction or County, for example the measures described previously.
5. Further prioritize sites that may be less likely to be developed by charging infrastructure providers, for example sites in existing multi-family dwellings, or neighborhoods with low current adoption of EVs, but expected demand in the future, or rural areas.
6. Consider the existing electric distribution system and need for potentially costly upgrades to the electric distribution system to provide charging infrastructure at particular sites.
7. Identify, fund, and construct prioritized sites.

Close Public Charging Deserts

Charging stations should be prioritized in areas that are not currently served by charging infrastructure. If charging infrastructure has not been provided due to charging companies not expecting to be profitable, local agencies may consider subsidizing charging infrastructure through grants. This is in alignment with FDOTs approach, note in the stakeholder section. Maps of the charging deserts in Hillsborough County are included subsequently. A few notable gaps in the charging network include:

- DCFC near Plant City
- DCFC in Downtown Tampa
- DCFC near Citrus Park/NW Hillsborough County
- Public L2 charging in Brandon (east of I-75)
- Public L2 charging in Egypt Lake-Leto

Install Chargers Where there is a High Expected Demand

Prioritize areas where there is a high expected demand for charging, considering both current EV use and expected future use. Some characteristics that may indicate a higher expected demand are:

- Households without the ability to install EV charging at home. These may be older neighborhoods, apartments, or housing without dedicated parking
- Activity centers and main street districts where people may already be making trips and spending time
- Employment clusters, especially those with longer distance commuters

/ Industrial and commercial areas near fleet operations
/ Areas with mixed commercial and residential uses that maximize 24-hour usage

Ensure that Chargers are Equitably Distributed

As part of this EVIP, an analysis of the equitable distribution of charging stations was completed. As stations are continued to be installed and prioritized for installation, a similar analysis should be conducted periodically. Agencies may incentivize charging infrastructure installation in areas through funding criteria. In addition to environmental justice implications, such targeted deployment can help to attract new user groups and allows for further diversification of EV owners.

Install the Right Charger in the Right Place

When choosing the type of charger (DCFC or Level 2) to install, consider how long people will need to stay parked at the station to meet their charging needs. Locations where people tend to spend longer, for example workplaces or near their homes, may be more appropriate for installing slower speed chargers, like L2 charging. At stations where people may just top off their battery, L2 charging may also be appropriate. The Bureau of Labor Statistics publishes the amount of time people tend to spend doing various activities including time spent at home, grocery shopping, working, or attending religious services[28]. Data for a select set of activities is summarized in Table 19, the complete tables are included in Appendix D.

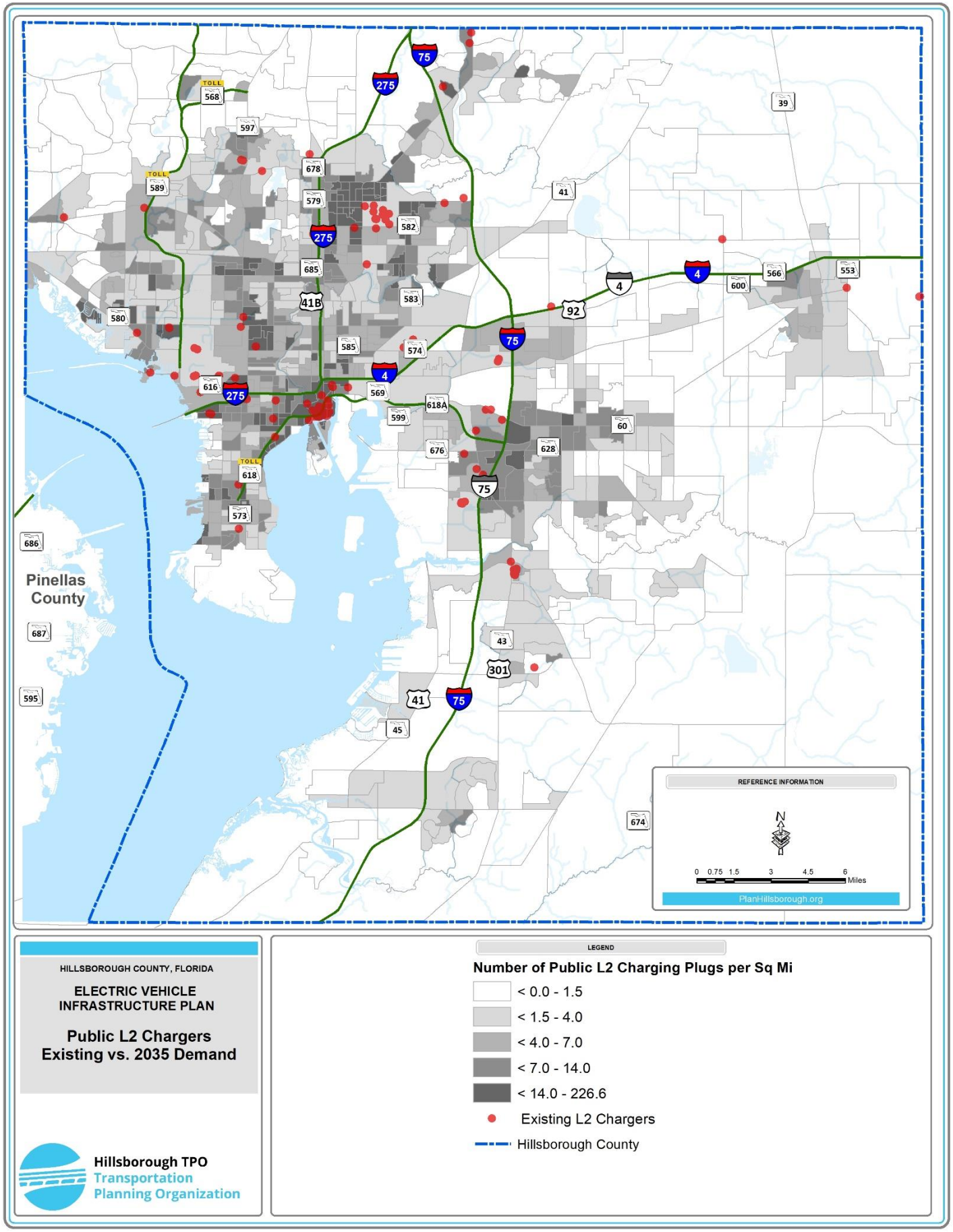
Table 19: Time Spent Doing Different Activities (Bureau of Labor Statistics)

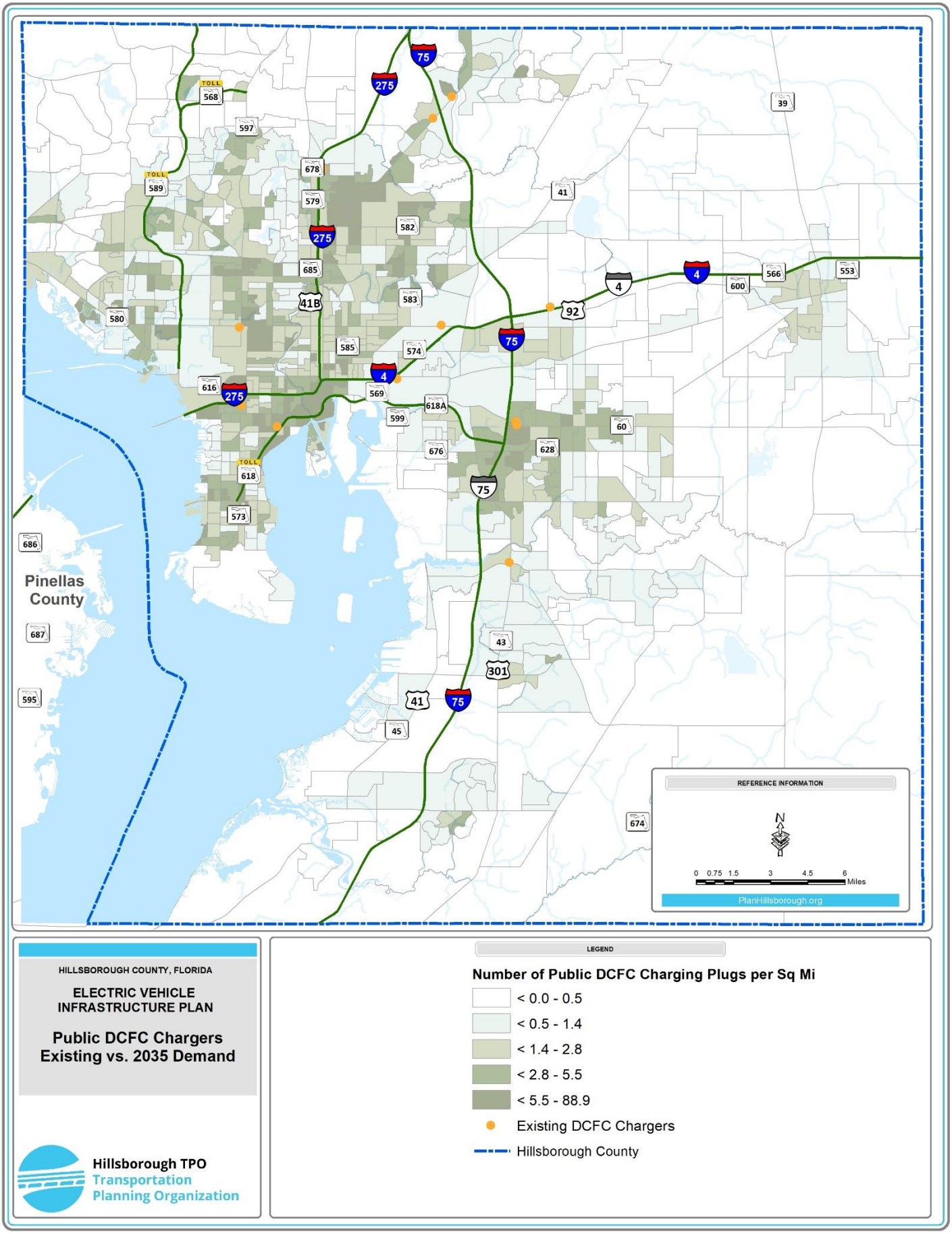
Activity	Average Hours per Day for Persons Who Engage in the Activity	Portion of People Who Engage in the Activity per Day
Grocery Shopping	0.8	13%
Working	7.7	42%
Attending Religious Services	1.9	4%
Participating in Sports	1.4	20%
Medical and Care Services	1.5	4%

Other datapoints that can be used to choose the specific locations for charging infrastructure include:

/ Current EV charging locations
/ Current EV ownership
/ Commuting patterns
/ Major employers and key destinations
/ On-street parking regulations
/ Levels of EV infrastructure demand
/ Demographic analysis, and environmental justice concerns
/ Zoning and building typology
/ High turnover zones (such as retail centers and areas close to highway exits), which particularly support level 2 and level 3 charging

[28] Bureau of Labor Statistics, American Time Use Survey. https://www.bls.gov/tus/tables.htm


Pinellas County
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6
Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Public L2 Chargers
Existing vs. 2035 Demand
Hillsborough TPO
Transportation
Planning Organization
LEGEND
Number of Public L2 Charging Plugs per Sq Mi
< 0.0 - 1.5
< 1.5 - 4.0
< 4.0 - 7.0
< 7.0 - 14.0
< 14.0 - 226.6
Existing L2 Chargers
Hillsborough County


Pinellas County
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6
Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Public DCFC Chargers Existing vs. 2035 Demand
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Public DCFC Charging Plugs per Sq Mi
< 0.0 - 0.5
< 0.5 - 1.4
< 1.4 - 2.8
< 2.8 - 5.5
< 5.5 - 88.9
Existing DCFC Chargers
Hillsborough County

Provide Amenities at Charging Stations

Parking lots with large-scale EV charging stations, as well as charging stations as a principal use, should provide amenities for their users. Such amenities may include, restrooms, recycling bins and trash cans, water fountains, and benches or other seating. Charging stations as a principal use should in particular offer amenities that are typical of gas stations, such as a convenience store, an air pump for filling tires, and windshield cleaning tools.

Transportation Network Companies

Charging stations that are near or at destinations frequented by TNC or gig drivers should be mindful of following some of the guidance described in the Needs Analysis. Some of these locations are known, for example the TNC waiting area at Tampa International Airport, other locations could be identified through collaboration and data sharing from TNC companies.

Transit

Charging stations serving HART are expected to be dedicated to serving transit. Therefore charging stations should be located in alignment with HART planning. The literature review suggests prioritizing charging at depot locations and supplementing with on-route charging. On-route charging may be prioritized at locations that many routes that need on-route charging travel through and have existing dwell times. These locations are likely transfer facilities at the beginning/end of routes.

Commercial Delivery

Continue outreach to companies interested in adopting EVs and prioritize locations where many companies see value in installing chargers to prioritize making sure to accommodate trucks at those public charging stations.

POLICY RECOMMENDATIONS

This section outlines policy recommendations for the Hillsborough TPO and its member agencies that will encourage the development of EV charging infrastructure in a context-appropriate, accessible, resilient, and efficient manner. Policy recommendations are explored in several broad categories:

- **Codes, requirements, and incentives**: Intended to inform local jurisdictions to options for encouraging or requiring the implementation of charging infrastructure.
- **Design considerations for charging stations**: Intended to provide guidance to developers and inform the review of proposed charging stations.
- **Transition public fleets to EVs:** Intended to provide considerations to fleet managers considering transitioning fleets to EVs.

The following best practices have been identified through an analysis of current and proposed regulations in Florida and across the country. As the need for land use policy addressing EV infrastructure is just starting to emerge, recommendations based on only existing codes and regulations are insufficient for creating a comprehensive list of such suggestions. Therefore, several other potential best practices have been identified which are not currently proposed or in place. However, examples of existing land use regulations are provided where available.

Codes, Requirements, and Incentives

There are two primary policy tools for the Hillsborough TPO to ensure developers and property owners provide EV infrastructure: through requirements for installation as part of the development process, and through the provision of incentives. Agencies can adopt requirements for developers to install EV infrastructure as part of the land development code. This is an effective way to ensure that new developments provide an adequate level of EV-readiness.

Incentives for the installation of EV infrastructure can be used to encourage the owners of new and existing developments to retrofit or expand their facilities. These incentives could encourage developers to go beyond the level of EV-readiness that is required as part of the new development. However, for new developments it is recommended to focus primarily on requirements, as incentives may compete with other agency desires, such as the density bonus for affordable housing.

Incentives may include:

- Density bonuses
- Reduction in parking minimums
- Expedited permitting
- Reduced or waived development fees
- Tax abatement, tax credits, grants, loans, or rebates to retrofit facilities with EV infrastructure
- Marketing and promoting businesses that provide EV infrastructure
- Technical assistance and other resources to aid in installing EV infrastructure

Hillsborough County jurisdictions can remove some of the common barriers to permitting that can stall or discourage the provision of EV infrastructure by ensuring that there is a clear permitting process for EV infrastructure. Strategies include allowing EV infrastructure as an accessory use as-of-right, incorporating EV

infrastructure into the parking code, and fast-tracking applications for EV infrastructure in retail parking lots and other desirable locations.

EV Infrastructure Requirements for New Developments

There are a multitude of case studies showing that installing EV infrastructure as part of the initial construction process is much less costly than retrofitting such infrastructure into parking lots that are not EV-capable or EV-ready. The process of retrofitting typically requires pouring new concrete, cutting and patching asphalt, and installing new electric service panels, among other costs. One study from the California Air Resources Board estimated the cost of installing EV charging infrastructure for new commercial buildings to be $1,650 per parking space. The study similarly estimated the cost for retrofitting EV charging infrastructure to be between $3,750 and $6,975 per parking space. Another study, prepared for the City of San Francisco, found the initial cost of installing EV infrastructure in a new parking space to be $920, compared to a retrofit cost of $3,550.[29]

Requirements to install EV infrastructure in new developments (often included in land use codes combined with parking minimums) serve as a useful way for a jurisdiction to further promote EV infrastructure and to ensure that new developments support current and future EV usage. Many municipalities in Florida and across the Southeast already have EV policies in their land use codes that address the different aspects of EV readiness, as displayed in Figure 26. Detailed below are summaries of existing policies, as well as recommendations that have been informed by such policies.

- **EV-Capable**: EV-capable parking spaces require just the infrastructure necessary for the future installation of an EV charging station, such as the conduit, breaker space, and junction box. Capability includes an installed electrical panel capacity with a dedicated branch circuit and a continuous raceway from the panel to the future EV parking spots. Parking spots that are EV-capable allow for the simple installation of a charging station in the future and can save money when compared to retrofitting an existing parking space with EV infrastructure.
- **EV-Ready**: EV-ready parking spaces require both the infrastructure necessary to be deemed EV-capable and a wired outlet. Though the charging unit is still absent, an EV driver can still plug in their portable charger to the outlet to charge their vehicle. EV-ready parking spaces similarly can save money when an EV charging station is installed, compared to retrofitting an existing parking space.
- **EVSE-Installed**: EVSE (Electric Vehicle Supply Equipment) Installed, also referred to as EV-installed, requires all the necessary infrastructure, as well as the EV charging station itself.

Figure 26: Levels of EV Readiness, via Southern Alliance for Clean Energy

[29] "EV-Ready Ordinance Amendments: Research on Costs and Best Practices," American Cities Climate Challenge, June 28,2023, https://www.usdn.org/uploads/cms/documents/ev-ready_ordinance_costs.pdf; https://evchargingpros.com/wp-content/uploads/2017/04/City-of-SF-PEV-Infrastructure-Cost-Effectiveness-Report-2016.pdf

Existing Code Examples

Table 20 provides examples of the different EV readiness measures included in existing codes in cities and counties throughout the US.

Table 20. Existing Code EV Readiness Examples

Location	EV-Capable	EV-Ready	EVSE-Installed
Atlanta, GA		a. All new single-family homes b. 20% of parking spaces in new multi-family & commercial	
Miami-Dade County, FL		20% of parking spaces in new developments	
Orlando, FL	a. 20% of parking spaces in new multi-family and hotel developments b. 10% of parking spaces in new commercial (non-residential) developments		a. 2% of parking spaces in new multi-family and hotel developments – requirement threshold is 50 spaces or more b. 2% of parking spaces in new commercial (non-residential) developments – requirement threshold is 250 spaces or more
Coral Gables, FL	20% of parking spaces in all new development (excluding single family, duplexes, and townhouses) – requirement threshold is 10 or more off-street spaces	15% of parking spaces in all new development (excluding single family, duplexes, and townhouses) – requirement threshold is 10 or more off-street spaces	5% of parking spaces in all new development (excluding single family, duplexes, and townhouses) – requirement threshold is 10 or more off-street spaces
Largo, FL	a. 20% of parking spaces for new multifamily, AHD, lodging, and all other non-residential developments. b. 10% of parking spaces for new industrial developments.	One parking space per dwelling unit for new single-family, duplex, and triplex units.	a. 2% of parking spaces for new industrial, lodging, and multifamily developments. b. About 6% of parking spaces for non-residential developments (the number of spaces is dependent on the required parking spaces).
Leon County, FL			a. One parking space in all new multifamily, commercial, office, institutional, or industrial developments – requirement threshold is 25 or more off-street spaces

Location	**EV-Capable**	**EV-Ready**	**EVSE-Installed**
			b. Two parking spaces in all new multifamily, commercial, office, institutional, or industrial developments – requirement threshold is 50 or more off-street spaces c. 10% of parking spaces in all new multifamily, commercial, office, institutional, or industrial developments – requirement threshold is 100 or more off-street spaces
Charlotte, NC	20% of parking spaces in all new multi-family stacked dwellings, the residential component of mixed-use developments, hotels, and parking lots/structures as a principal use – requirement threshold is 10 or more off-street spaces	10% of parking spaces in all new multi-family stacked dwellings, the residential component of mixed-use developments, hotels, and parking lots/structures as a principal use – requirement threshold is 10 or more off-street spaces	a. One parking space in all new multi-family stacked dwellings, the residential component of mixed-use developments, hotels, and parking lots/structures as a principal use – requirement threshold is 26 – 50 off-street spaces b. 2% of parking spaces in all new multi-family stacked dwellings, the residential component of mixed-use developments, hotels, and parking lots/structures as a principal use – requirement threshold is 51 or more off-street spaces
St. Petersburg, FL	15% of parking spaces in all new residential developments	a. 2% of parking spaces in all new residential developments b. 20% of parking spaces in all new other developments	2% of parking spaces in all new other developments
Boston, MA		75% of parking spaces in all new large-scale developments	25% of parking spaces in all new large-scale developments

Primary Recommendations for Hillsborough TPO

EV charging infrastructure should be included in the parking minimums as established in the land development code. **The percentages of installed infrastructure can differ based on location and the current and future use of EVs in Hillsborough County.** The current estimate (based on the medium-need and high-need adoption curves) is that 40% to 70% of all registered vehicles in Hillsborough County will be EVs by 2050. To accommodate that level of future demand, a high level of EV-readiness needs to be established in new development. For new multi-family and commercial developments, the recommended ranges to establish a strong level of EV-readiness in Hillsborough County are as follows: 25% to 50% of the on-site parking spaces should be EV-capable or EV-ready. Of those, some of the spaces should be EV-ready, but the proportion of EV-ready spaces may be left to local discretion. At least 5% to 15% of the on-site parking spaces should be EVSE-installed. Parking spaces for EVs should be included in the parking minimums, additional parking spaces should not be added to the development in excess of the current practices, to support EVs.

For new multi-family and commercial developments, **5-15%** of parking spaces should have EV charging infrastructure installed.

Using a percentage of installed infrastructure is recommended in part for its code flexibility: percentages are compatible with land use codes that require parking minimums – which Hillsborough County currently has – but also compatible with codes that have no parking minimums, which an increasing number of communities are enacting.

The required percentages should be based on current and projected demand for EV infrastructure, and as EVs continue to increase in popularity, the percentages may need to be raised to reflect increased demand. By ensuring a large percentage of the required parking spaces for multi-family, commercial, and other new developments are EV-ready or EV-capable, the property owner will save money in the long term; if parking spaces are not EV-capable or EV-ready now, they will require costly future retrofitting.

In addition to including EV parking space requirements in the land development code, the contract to install the charging equipment should include requirements related to responsibility of maintenance, response time for repairs, duration for a given repair, and an overall uptime metric. Responsibility of maintenance may be required of the site host, charging network, or installer.

Incentives for EV Infrastructure

Incentives are useful in promoting the creation and expansion of EV infrastructure in existing developments, as well as promoting the installation of EV infrastructure beyond what is required for new developments.

Existing developments created before any requirements have been introduced are often lacking the necessary infrastructure to accommodate current and future EV use. Financial incentives, such as tax abatement, tax credits, grants, rebates, and loans, are the most effective incentive type to encourage property owners to retrofit existing facilities with EV infrastructure and parking.[30]

[30] ICF (March 9, 2018). "Driving to Net Zero," Santa Clara County, https://dtnz.sccgov.org/sites/g/files/exjcpb481/files/Task-1A-EV-Best-Practices-Compendium.pdf

For new developments, offering density bonuses, a reduction in the parking minimum, and expedited permitting and reduced or waived fees can encourage developers to install more than the required level of EV infrastructure.

Agencies may also offer several other incentives that may be implemented without revisions to the existing land development code:

- Agencies can provide marketing or branding opportunities for developments that meet sustainability and energy requirements, including the provision of EV infrastructure.
- Agencies can offer education and technical assistance to help developers understand the benefits of EV infrastructure and how to implement it. By communicating the available incentives, prospective funding sources, and potential costs and benefits, developers will be more likely to embrace the installation of EV infrastructure.

Existing Incentive Examples

Many municipalities across the country already have several types of incentives in place to encourage private developers to install EV infrastructure. These incentives include density bonuses and reduced or waived permitting, which specifically target new developments, and financial incentives such as grants and tax rebates, which specifically target existing developments. Finally, agencies can provide assistance in the form of marketing, education, or technical assistance to businesses and developers who install or are interested in installing EV infrastructure. Relevant examples are detailed below:

- Quincy, WA has begun offering a 10% density bonus for the incorporation of EV chargers, solar, and other green elements within new developments.
- Tacoma, WA temporarily lifted occupancy permit requirements and associated costs for property owners who want to install EV chargers in the public right-of-way near their property.
- SoCalEV offers developers grants of up to $2,500 per EVSE unit for hardware and/or installation costs. Similarly, Charge Ready NY provides grants for developers who install EV infrastructure in their developments.
- Seattle offers rebates for the installation of EV chargers for multi-family market rate and affordable housing properties. Such rebates can cover up to 100% of the cost of level 1 charging stations for market rate developments, 50% of the cost of level 2 charging stations for market rate developments, and up to 100% of the cost of level 2 charging stations for affordable developments.
- Oregon similarly offers rebates of $4,250 to $5,500 for businesses, public entities, tribes, and multi-family complexes to implement level 1 and level 2 EV charging stations.
- The City of Boston compiles a list of eligible grants for developers to assist in the process of funding EV charging infrastructure.
- California-based businesses with EV infrastructure are eligible to be certified on the California Green Business Network. Such businesses are promoted to potential customers in return.
- The City of Boston offers businesses a guide on how to implement workplace EV charging.

Primary Recommendations for Hillsborough TPO

The incentives proposed here are intended to act as a complement to the requirements recommended above. If jurisdictions elect to use incentives instead of requirements, the incentives should be strengthened. **It is important to note that these incentives could compete with other available developer incentives, such as the density bonus offered for the provision of affordable housing** in both the City of Tampa (Land Development Code Section 27-140) and unincorporated Hillsborough County (Comprehensive Plan Housing Policy 1.3.1). Any

incentives offered will need to be structured with careful consideration of how they interact with other incentives that are available.

Agencies can integrate within the land development code several incentives for installation of EV infrastructure as part of new developments, including:

- A density bonus in return for incorporating EV chargers in a new development,
- Permit the installation of EV parking spaces in place of generic parking to meet required minimums, and/or
- Expedited permitting and approvals or reduced or waived fees for new developments with EV infrastructure.

Agencies can also offer financial incentives, in the form of tax credits, tax abatements, grants, loans, and rebates, for developers who implement EV charging infrastructure. These incentives target existing property as a way for residents and businesses to retrofit their facilities with the necessary infrastructure.

Removal of Permitting Barriers

As mass implementation of EV infrastructure is a relatively new phenomenon, most jurisdictions do not have processes in place for permitting EV infrastructure, and may use existing codes, such as electrical permits or gas station regulations, that are not always suited for the needs of EV infrastructure. The resulting "piecemeal" approach and lack of coordination can lead to long wait times for permits.[31] The following best practices are recommended to speed up approval of EV infrastructure projects:

- Include EV charging stations as an accessory use for commercial and residential zones, allowing them to be permitted as-of-right.
    - For example, the City of Lancaster allows EV charging stations within any single family or multi-family residential garage or carport. They are permitted as an accessory use, subject to specific requirements including an accessible and visible location and safe design of pedestals.
- Fast-track applications for adding EV stations in retail parking lots.
- Allow EV stations to count toward required parking, and waive required parking spaces when adding EV infrastructure would result in loss of spaces.
- Restrict EV station spaces to vehicles that are currently charging. This can be done by requiring that vehicles be plugged in and imposing a time limit.
- Parking design guidelines should address physical requirements for EV spaces.
- Provide a publicly available checklist of requirements for obtaining a permit.
- The code should not preclude property owners from voluntarily sharing or renting out EV chargers on their property.

Design Considerations

When designing EV charging stations, there are a number of considerations for ensuring that EV infrastructure is provided in a sustainable and equitable way. These include ADA accessibility, reducing conflict with sensitive areas and other infrastructure such as bike and bus lanes, and prioritizing installation in underserved areas.

[31] Fuels Institute (October 2022). "A Best Practice Guide for EVSE Regulations," Transportation Energy Institute, https://www.transportationenergy.org/research/reports/ev-regulatory-best-practices

These design considerations are also intended to be considered by local agencies when reviewing proposed charging station plans.

The included considerations are intended to serve as a starting point. Local agencies are encouraged to discuss with Hillsborough TPO and other agencies to identify best practices, and share those successes back with the group.

> "The Access Board recommends designing at least two EV charging spaces with accessible mobility features, and providing accessible communication features and operable parts at all EV chargers."
>
> U.S. Access Board, Design Recommendations for Accessible Electric Vehicle Charging

Designing for Accessibility

In July of 2022, the U.S. Access Board released *Design Recommendations for Accessible Electric Vehicle Charging Stations*, a technical assistance document that provides specific guidance for any charging infrastructure constructed with federal funding.[32] However, these guidelines can and should be applied broadly to all EV infrastructure to ensure a design that is universally accessible. In terms of EV charging, there are two aspects of accessibility that must be considered: **accessible mobility features** (the physical access to the charging, including size of the space, access aisles, and physical operability of the charger) and **accessible communication features** (the information communication technology on each charger must provide audio, visual, and haptic/tactile cues for charging connections, payment transactions, and any other user interface interactions). The technical assistance provides recommendations for a variety of scenarios, including new builds and retrofits of parking lots and on-street parking. It also provides guidance on the number of accessible EV charging stations that should be provided for a given site.

The U.S. Access Board is working to issue a rule on the matter, but for the time being recommends that local jurisdictions adopt an approach based on aligning with the 2021 International Building Code requirement of 5%, a minimum number based on Table 208 of the Americans with Disabilities Act[33], a "use last" approach where a higher percentage have accessible mobility features but are not restricted for use only by people with disabilities, or some combination of these methods.

Installing the International Symbol of Accessibility (ISA) signage is not recommended at accessible EV charging spaces, unless required by a state or local code. As of June 2023, there are not state or local codes in Hillsborough County that require ISA signage at accessible EV charging spaces. Rather, a "Use Last" approach should be followed, with signs indicating that a space is accessible and should be used last, installed at accessible EV charging spaces. Examples of proposed signage is included in the U.S. Access Board, *Design Recommendations for Accessible Electric Vehicle Charging Stations.*

Examples of practices followed by other jurisdictions include:

- **Leon County, FL** has instituted a regulation requiring at least one EV charger to be located so it may be used by an ADA accessible space in any lot with EV charging.

[32] United States Accessibility Board. (July 2022). *Design Recommendations for Accessible Electric Vehicle Charging Stations.* https://www.access-board.gov/tad/ev/#:~:text=a%20vehicle%20charging%20space%20at,on%20the%20charger%20and%20connector

[33] United States Accessibility Board. (September 2014). *Guide to the ADA Standards.* https://www.access-board.gov/ada/#ada-208_2

- **California**: The 2016 California Building Code specifies the Minimum Number of EV Charging Stations Required to Comply with Section 11B-812. The California Building Code requires a minimum of 1 spot to be Van Accessible and an increasing number of spots to be Accessible dependent on the total number of EV charging stations.

Designing in Conflicting or Sensitive Areas

When siting charging stations in historical districts and other sensitive zones, EV infrastructure should be installed in a way that ensures compatibility with the surrounding area. For example, avoid locating charging spots near curbside bus lanes or bike lanes, so charging cables do not interfere with the operation of transit or bicycles. Furthermore, charging site selection should avoid sidewalks where bike parking fixtures, benches, streetlamps, signposts, fire hydrants, and curb cuts are present. Lastly, where possible, EV infrastructure in flood prone areas should be located above the ground floor in parking structures.

EV chargers can also be installed in existing parking lots in natural areas, such as parks and preserves. If the installation uses Federal funds, there may be a requirement for an impact assessment under Section 4(f) of the Department of Transportation Act, which protects parks from Federal transportation projects, but impacts are likely to be minimal.

Designing for Multi-Family Housing

In multi-family housing developments, installing Level 1 charging or Level 2 charging may make sense in different circumstances. If residents are currently assigned a parking space, installing Level 1 charging at some parking spaces and allowing residents with EVs to trade spaces to use these spots can be practicable. If parking spaces are shared, installing L2 charging could allow residents to charge their vehicles more quickly, but will also require residents to move their vehicles after charging to provide access to the next person.

Multi-family housing managers have different options for collecting payment from users. If residents currently pay an additional fee for parking spaces, the spaces with EV charging could have an increased monthly rate, with the building manager paying the electricity costs. If a L2 smart plug or a L2 charger with payment interface is installed, the electricity usage could be tracked and charged to the user. In general, providing the charging for free or charging a flat rate will be easier for the multi-family housing manager to track and manage.

Designing for Commercial Vehicles

Public charging stations can be designed to accommodate medium duty commercial vehicles by considering a medium duty vehicle as the design vehicle. This may result in designing the charging station with pull through spots, larger curb radii, larger parking spaces, and longer charging cables. Operations and location of the charging stations may also increase the accessibility for commercial vehicles, for example by including a reservation system or locating the station in industrial or commercial areas the vehicles are currently travelling to. Similarly, the design of charging stations may consider towing vehicles (for example a truck towing a boat) as the design vehicle in some contexts.

Examples of providing public charging for commercial vehicles include the partnership between Daimler Trucks and Portland General Electric on the Electric Island Freight Charging Station, and the NYC Clean Trucks Program.[34,35]

Designing for E-Micromobility

E-micromobility devices, include electric scooters, bikes, and wheelchairs. E-micromobility devices are typically charged using common residential 120V AC outlets and depending on the device battery capacity and charger system, can charge within a 2.5 – 9 hour window.[36] Integrating shared or personal e-micromobility charging infrastructure with electric vehicle charging infrastructure offers an opportunity maximize the efficient use of land while supporting multimodal, low or zero-emissions mobility.[37]

Recommendations for overcoming barriers to e-micromobility adoption are included in Oregon Department of Transportation's (ODOT) Electric Micromobility in Oregon, 2023 report. ODOT recommends installing 120V outlets at charging stations that are prioritized for providing charging for e-micromobility devices. Stations can be prioritized based upon proximity to bicycle facilities, tourist destinations, or areas with high existing e-micromobility use.

Additionally, some recommendations from ODOT extend beyond charging infrastructure to include:

- Ensuring safe and connected transportation infrastructure for micromobility user
- Education for communities
- Data sharing from shared micromobility operations
- Provision of secured and accessible (ground floor or elevator access) parking
- E-bike incentive programs that are based on bike type, bike cost, and household income

E-Micromobility can be accommodated at charging stations by providing 120V outlets and access to a way to secure the e-micromobility device, such as a bicycle rack. Examples of e-micromobility charging infrastructure include:

- In Oregon, e-micromobility chargers have been installed at over 44 EV charging stations along the West Coast Electric Highway.[38]
- In New York City, a partnership between Consolidated Edison, the regional electric utility supplier, and the New York City Housing Authority (NYCHA) was recently announced to pilot the implementation of e-micromobility chargers at four NYCHA housing developments. The chargers will double as secure parking

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[34] Kane, Mark. (April 21, 2021). *Electric Island: See First Charging Site Designed for Big Trucks.* https://insideevs.com/news/502793/electric-island-charging-site-trucks/

[35] New York City Economic Development Council. (April 2019). *NYCEDC Lays Groundwork for Developing Truck-Accessible Electric Charging Stations Throughout City.* https://edc.nyc/press-release/nycedc-lays-groundwork-developing-truck-accessible-electric-charging-stations

[36] United States Department of Transportation. (May 2023). *Electric Micromobility Basics*. https://www.transportation.gov/rural/electric-vehicles/ev-toolkit/electric-micromobility

[37] United States Department of Transportation. (May 2023). *EV Infrastructure Planning for Rural Areas: Planning for Micromobility.* https://www.transportation.gov/rural/electric-vehicles/ev-toolkit/planning-micromobility

[38] Baumhart, Alex. (May 31, 2022). *Electric highway charging stations upgraded to power electric bicycles.* Oregon Capital Chronicle. https://oregoncapitalchronicle.com/briefs/electric-highway-charging-stations-upgraded-to-power-electric-bicycles/

and storage for the e-micromobility devices.[39] This pilot program is part of NYC's larger strategy to support e-micromobility, which will also include piloting public e-micromobility chargers in public right-of-way.[40]

Designing for Physical & Cyber Security

Physical Security

Ensuring the physical safety of EV users, EVs, and EVSE will be a key component for incentivizing the use of public charging infrastructure. Crime Prevention Through Environmental Design (CPTED) is a framework of strategies and design principles that are employed to prevent crime, reduce violence and fear, and improve quality of life.[41] Specifically, CPTED promotes the three interrelated principles of natural surveillance, natural access and territoriality, plus activity support and maintenance to enhance the physical security of build environments, such as transit facilities, fueling stations, and other public places. The American Public Transportation Association (APTA) developed a CPTED Design Considerations Checklist to assist transit providers with the development of safe and secure transit facilities. Many of these principles are applicable to EV charging stations.[42] Additionally, in 2020 the City of Brisbane, Australia developed a model CPTED policy that the Hillsborough County TPO could adapt for the Florida context.[43] The City of Saskatoon, Canada developed four key recommendations to improve selected EVSE sites through a CPTED lens[44], including:

- Highly visible signage that includes maintenance, repair, and enforcement contact information.
- Recognizable EVSE branding for the vehicle spaces and equipment.
- Regularly monitoring of the facility to ensure well-maintained infrastructure.
- Data collection of complaints, damage, criminal incidents, etc. to evaluate site security.

Cyber Security

As the technologies that support EV charging infrastructure continue to progress, the potential consequences of cyberattacks on this infrastructure grows as well. To ensure the safety of energy supply systems and EV users, the deployment of charging infrastructure must include cybersecurity measures.

- Require EVSE to Utilize ISO and EMV Standards for Direct, Secure Payments[45]
- Require EVSE to Utilize ISO 27001 Certification Include Cybersecurity Features by Design Such as Encryption for Data, Servers, and All Communications, and Granular Authorization Processes[46]

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[39] Consolidated Edison, Inc. (March 20, 2023). *Project Will Place Micromobility Chargers At Four NYCHA Developments*. https://www.coned.com/en/about-us/media-center/news/2023/03-20/project-will-place-micromobility-chargers-at-four-nycha-developments

[40] New York City. (2023). *CHARGE SAFE, RIDE SAFE: NYC's Electric Micromobility Action Plan*. https://www.nyc.gov/assets/home/downloads/pdf/office-of-the-mayor/2023/micromobility-action-plan.pdf

[41] International Crime Prevention Through Environmental Design Association. (May 2023). *White Paper on CPTED Methodology*. https://www.cpted.net/resources/Documents/ICA%20Resources/White%20Papers/ICA%20METHODOLOGY%20WHITE%20PAPER.pdf

[42] American Public Transportation Association. (June 2010). *Crime Prevention Through Environmental Design (CPTED) for Transit Facilities*. APTA Standards Development Program Recommended Practice. https://www.apta.com/wp-content/uploads/Standards_Documents/APTA-SS-SIS-RP-007-10.pdf

[43] City of Brisbane. (October 2020). *Crime prevention through environmental design planning scheme policy*. https://cityplandocs.brisbane.qld.gov.au/pdfs/brisbane/1/30Oct2020/SC6-10Crimepreventionthroughenvironmentaldesignplanningschemepolicy_254_30-Oct-2020.pdf

[44] City of Saskatoon. (November 2021). *CPTED Review Report: Electric Vehicle Public Infrastructure Pilot Project. Neighborhood Safety Program*. https://pub-saskatoon.escribemeetings.com/filestream.ashx?DocumentId=161032

[45] Secure Technology Alliance. (February 2021). *Electric Vehicle Charging Open Payment Framework with ISO 15118*. https://www.securetechalliance.org/wp-content/uploads/EV-Charging-Open-Pmt-Framework-WP-FINAL2-Feb-2021.pdf

[46] Sandia National Laboratories. (July 2022). *Cybersecurity for Electric Vehicle Charging Infrastructure*. US Department of Energy Vehicle Technologies Office. https://www.osti.gov/servlets/purl/1877784

/ Implement the Key Findings of the *Cybersecurity Framework Profile for Electric Vehicle Extreme Fast Charging Infrastructure* report currently underway by the National Cybersecurity Center of Excellence[47] and the Key Findings of the *Cybersecurity for Electric Vehicle Grid Integration* research underway by the National Renewable Energy Laboratory[48]

Designing for Active Spaces

Creating a sense of place and community around EV charging stations will be a key method for facilitating EV adoption and integrating EVs into neighborhoods throughout Hillsborough County. To create and activate these spaces around EV charging stations, including the following elements into station design can encourage their use and improve quality of life:

/ **Placemaking**: Landscaping and Green Space, Seating Areas, Waste Receptables, Pedestrian-Scale Lighting, Weather Protection or Shelters, and Nearby Retail/Commercial Opportunities
/ **Branding**: Community Logo, Graphical Signage, and Charger Advertisement or Art Opportunities
/ **Education**: Environmental Message Regarding the Source of the Energy, or a Carbon Offset Tracker to Educate, Inform, and Celebrate EV Users

Transition Public Fleets to EVs

Local jurisdictions and agencies may maintain diverse fleets of vehicles, ranging from light-duty vehicles used for administrative purposes to heavy duty, specialized work vehicles. Public fleets may provide good opportunities to transition to electric vehicles that have lower maintenance and operation costs.

In general, local jurisdictions and agencies may follow this process to transition fleets to EVs:

1/ **Identify vehicles to transition to EVs**: Consider the service life of currently owned vehicles. Consider the daily duty cycles and use requirements for vehicles.
2/ **Identify available EV models**: Identify vehicle models that meet the use requirements for current fleet vehicles. Discuss options with vehicle operators. Document the opportunity for transitioning the fleet vehicle, or the reason for not being able to transition the vehicle to an EV.
3/ **Understand charging needs**: Identify the number, location, and type of EV charging infrastructure needed to support vehicles transitioning to EVs. Assess exiting electrical capacity at vehicle storage locations and determine need for upgrading electric grid infrastructure.
4/ **Select a charging station business model**: Explore options for contracting with an EV Service Provider (EVSP) including whether the local jurisdiction or agency should maintain and operate the charging infrastructure.
5/ **Identify funding opportunities**: Consider opportunities from federal, state, and local funding sources.
6/ **Develop procedures**: Provide training to staff and develop procedures for using and refueling EVs.
7/ **Monitor performance**: Review performance and identify opportunities for improvement.

[47] National Cybersecurity Center of Excellent. (2023). *Cybersecurity Framework Profile for Electric Vehicle Extreme Fast Charging Infrastructure.* National Institute for Standards & Technology. https://www.nccoe.nist.gov/projects/cybersecurity-framework-profile-electric-vehicle-extreme-fast-charging-infrastructure
[48] National Renewable Energy Laboratory. (2023). *Cybersecurity for Electric Vehicle Grid Integration*. US Department of Energy. https://www.nrel.gov/transportation/electric-vehicle-grid-cybersecurity.html

WHAT'S NEXT?

EVs are being adopted in Hillsborough County and are expected to be adopted at even greater rates. As Hillsborough TPO prepares for the future, the findings from this EVIP will be used to inform planning processes such as the 2050 Long Range Transportation Plan. Local agencies may refer to this EVIP as a starting point and framework for further EV charging infrastructure planning work they are interested in pursuing. Local agencies may also use the design considerations and other guidance to inform review of development plans, for example identifying opportunities to encourage developers to include EV charging infrastructure in design plans.

Increasing adoption of EVs offers benefits to the community including reduced pollution along transportation corridors, reduced operating costs for owners, and reduced emissions of greenhouse gases. However, as the Hillsborough TPO and partners invest in EVs some balances to keep in mind include:

- When developing incentives for the installation of EV charging infrastructure, agencies should ensure that the incentives do not compete with existing incentive structures, for example incentives to develop affordable housing.
- Technology is still developing related to EVs and EV charging infrastructure. It is important to continue to develop technology to reduce the price point for EVs, reduce the environmental consequences of battery manufacturing processes. However, it is critical for the Hillsborough TPO and local agencies to monitor technology developments as they plan for how to invest in EV infrastructure. This will ensure that investments are benefiting the community in the future as well as under the present circumstances.
- Hillsborough TPO and local agencies must continue to fund and enhance non-auto modes to achieve climate goals and develop livable communities. As Hillsborough TPO plans for EVs the goal remains to provide transportation options for non-drivers, but if people are driving to provide options to drive an EV.
- EVs tend to offer a lower total operating cost to owners, but if only wealthy communities can afford EVs the benefits may be disparate and cause a further divide in the community related to transportation burden, which tends to be heavier for poorer communities already. Ensuring equitable access to EV adoption and monitoring trends in EV adoption and charging infrastructure location can help reduce the gap between communities related to EV benefits.
- Reduction in greenhouse gas emissions is tied with also ensuring that electricity generation includes renewable and green sources.
- Hurricane evacuations in Hillsborough County can involve drivers needing to travel long distances with potential interruptions to electricity. Ensuring reliable and resilient charging infrastructure is important and being considered by FDOT in their EV planning.

Please contact the Hillsborough TPO to further engage on planning for EV charging infrastructure!

APPENDICES

Appendix A: Existing Conditions Report

HILLSBOROUGH TPO ELECTRIC VEHICLE INFRASTRUCTURE PLAN

Existing Conditions Report

March 2023

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"Car charging in downtown Tampa." Credit: Ryan Casburn, Kittelson & Associates, Inc.

KEY TERMS AND DEFINITIONS

Terms	Definitions
Electric Vehicle (EV)	A vehicle powered by one or more electric motors for propulsion. This plan focuses on BEVs and PHEVs, both of which can be plugged in and recharged from external sources of electricity.
Battery Electric Vehicles (BEVs)	Also known as "all-electric vehicles", BEVs are powered only by electricity battery and are charged by an external power source.
Plug-in Hybrid Electric Vehicles (PHEVs)	PHEVs have an electric battery that operates an electric motor in addition to a gasoline tank that fuels a gasoline motor. The electric battery can be plugged in to recharge and the gas tank can be refilled.
Hybrid Electric Vehicles (HEVs)	HEVs have an electric battery that operates an electric motor AND a gas tank that fuels a gasoline motor. The gas tank can be refilled, but the electric battery cannot be plugged in to charge.
Fuel Cell Electric Vehicles (FCEVs)	FCEVs use hydrogen to power an electric motor.
Vehicle-to-Grid (V2G)	Also known as Vehicle-to-home (V2H) or Vehicle-to-load (V2L), it describes a technology that enables energy to be pushed back to the power grid from the battery of an electric car using bi-directional charging equipment.
Electric Vehicle Supply Equipment (EVSE)	EVSE provides for the transfer of energy between the electric utility power and the EV. EVSE includes EV charge cords, charge stands (residential or public), attachment plugs, vehicle connectors, and protection.
Electric Vehicle Service Provider (EVSP)	Also referred to as EV supply vendors, EVSP delivers end-to-end EV charging, handling charging station installation, operations and maintenance.
Zero-Emission Vehicle (ZEV)	ZEV is a vehicle that does not emit exhaust gas or other harmful pollutants from the onboard source of power during vehicle operation. BEVs, PHEVs, and FCEVs qualify as ZEVs.

PLAN OVERVIEW

Introduction

The popularity of electric vehicles (EVs) has increased significantly in recent years and many are now expressing interest in this new travel option, with special interest in where and how these EVs can be charged. The Hillsborough Transportation Planning Organization (TPO) is developing this Electric Vehicle Infrastructure Plan (Plan) to provide a framework for developing widespread, convenient, and accessible EV charging in Hillsborough County. As EV technology evolves, this Plan is intended to adapt and help the TPO continue to meet the needs of residents, workers, and visitors. The development of this Plan will empower the TPO to access funding opportunities, inform the TPO's long range planning efforts, and provide near term goals and guidance to support communities in accessing EV technology and experiencing the benefits of EVs. This Plan is intended to complement the work of the HART Zero-Emission Fleet Transition Plan (adopted in 2022), FDOT's Electric Vehicle Infrastructure Master Plan (adopted in 2021), and other work by regional and national agencies.

Figure 1: Desired Outcomes of EV Plan

Help Communities Experience Benefits of EVs

Inform Planning

Access Funding Opportunities

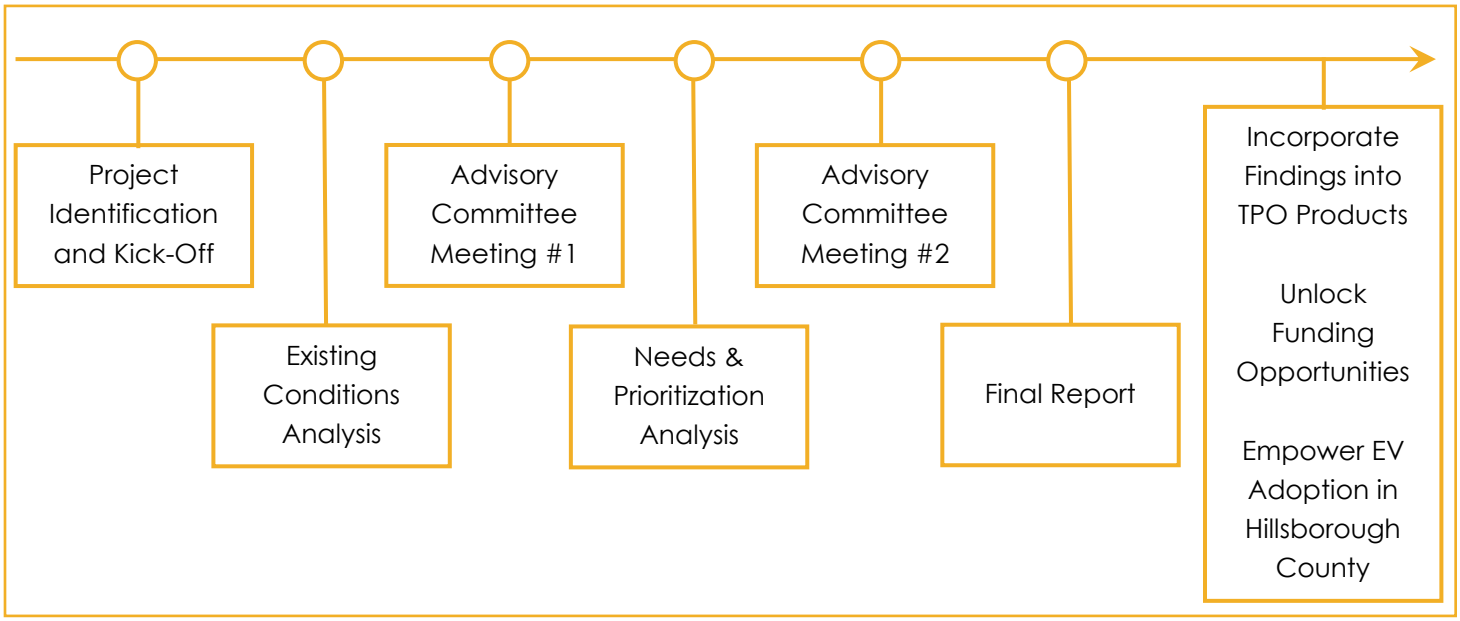
The development of this Plan occurs at a time when EVs are trending and being adopted throughout Hillsborough County, the country, and world. In 2021, there were about 6,000 registered EVs within the County's overall total of 1 million registered vehicles (0.006%). However, various forecasts anticipate EV adoption to range from about 5 - 30% of total vehicles by 2035. Beyond 2035, some agencies envision even greater numbers of private vehicles transitioning to EVs (the City of Orlando sees 80% of light-duty vehicles being EVs in 2050). Hillsborough County must prepare for the increasing presence of EVs.

EVs promise a slew of benefits to owners and the community, but residents and visitors in Hillsborough County also face barriers to adoption. One key barrier is a lack of visible charging infrastructure. People are used to seeing gas stations on the corners of their neighborhood but may not see places where they can recharge their EV. This Plan is intended to evaluate the existing charging infrastructure in Hillsborough County and identify gaps that can be addressed.

Timeline

Hillsborough TPO is developing this Plan with the support of an Advisory Committee made up of local agencies and with the participation of various stakeholders. An overview of the process is shown below.

Figure 2: EV Plan Development Process



"Timeline of Plan Development Process with Meetings and Major Documents Highlighted"

The existing conditions, documented in this report, are intended to provide a baseline understanding of the existing infrastructure and needs in Hillsborough County. The future work in this Plan will build upon the existing conditions to identify next steps to resolving needs.

"Cars charging at DC Fast Charging Station in Hillsborough County"

Fundamentals of Electric Vehicles & Charging Infrastructure

Benefits of Electric Mobility

EVs offer numerous benefits to owners of and to communities where EVs are driven.

Figure 3: Benefits of EV Adoption

Reduced Fuel Costs

EVs can save owners about 60% of fueling costs compared to gasoline vehicles[1].

Reduced Emissions

According to the US Environmental Protection Agency (EPA) in 2020, transportation accounted for 27% of greenhouse gas (GHG) emissions in the US, which commonly include carbon dioxide, methane, and nitrous oxide. Considering the total lifecycle of a vehicle (including manufacturing and driving) GHG emissions for EVs is about half of emissions from gas powered vehicles[2]. Reduced emissions means healthier air, especially along busy corridors or in industrial areas. Additionally, under a proposed rule from the Federal Highway Administration (FHWA) MPOs will need to set declining targets for on-road greenhouse gas emissions. EVs may help achieve these targets. This proposed rule aligns with Executive Orders to reach net-zero targets and tackle the climate crisis[3].

Reduced Maintenance Cost

With fewer moving parts, the maintenance cost of EV is about half as much over the life of the vehicle, saving owners about $4,600 over the life of the vehicle[4].

Backup Power Supply

EVs have the potential to serve as back-up power for personal use when electricity service is disrupted through a technology called "vehicle-to-grid". Using bi-directional charging equipment, EVs can operate as a battery and provide electricity back to the electrical grid on the local level. This could be used in places with frequent power disruptions, during storm-related power outages or other emergencies, or to balance out electricity generation from renewable sources like solar. Some vehicles are already equipped with this technology and larger-scale applications are being piloted[5].

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[1] Harto, C. (2020, October). *Electric Vehicle Ownership Costs: Today's Electric Vehicles Offer Big Savings for Consumers.* Consumer Reports. https://advocacy.consumerreports.org/wp-content/uploads/2020/10/EV-Ownership-Cost-Final-Report-1.pdf (Note: The exact savings are dependent on fluctuations in gas prices, electricity prices, and how much charging is done at home (where charging tends to be cheaper).

[2] International Energy Agency. (2022, October 26). *Comparative life-cycle greenhouse gas emissions of a mid-size BEV and ICE vehicle*. https://www.iea.org/data-and-statistics/charts/comparative-life-cycle-greenhouse-gas-emissions-of-a-mid-size-bev-and-ice-vehicle

[3] FHWA. (2022, July 7). FHWA. *Biden-Harris Administration Takes Step Forward to Combat Climate Change, Announces Proposed Transportation Greenhouse Gas Emission Reduction Framework*. https://highways.dot.gov/newsroom/biden-harris-administration-takes-step-forward-combat-climate-change-announces-proposed

[4] Preston, B. (2020, September 26). *Pay Less for Vehicle Maintenance with an EV.* Consumer Reports. https://www.consumerreports.org/car-repair-maintenance/pay-less-for-vehicle-maintenance-with-an-ev/

[5] Duke Energy. (2022, August 16). *Illuminating possibility: Duke Energy and Ford Motor Company plan to use F-150 Lightning electric trucks to help power the grid.* https://news.duke-energy.com/releases/illuminating-possibility-duke-energy-and-ford-motor-company-plan-to-use-f-150-lightning-electric-trucks-to-help-power-the-grid

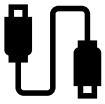
Barriers to Adoption

To encourage EV adoption, barriers that impede the progress toward electrified transportation must be acknowledged and addressed. Such barriers can be related to fundamental policies, access to vehicles and charging infrastructure, public charging experience, and utility support. Figure 4 describes several barriers to EV adoption.

Figure 4. Barriers to EV Adoption

EV Purchase Price

EVs typically have higher up-front purchase prices[1]. However, cost parity between new gasoline vehicles and EVs is anticipated in the mid-2020s[6]. More electric vehicles are becoming available as used vehicles, but in general gasoline powered vehicles remain more prevalent and available at lower prices.



EV Charging Access

EV charging infrastructure is not as visibly common or evenly distributed as gas stations. Charging may be even more challenging for those living in multi-family dwellings who may not have access to home charging. For long-distance trips, EV drivers may need to plan their route and destination with consideration of available charging infrastructure.

Lack of Education

EV technology has been rapidly developing, but education related to EV charging advancements can leave many confused, misinformed, and with a lack of trust. Potential misperceptions surround EV pricing, range, charging infrastructure, maintenance costs, and reliability.

Types of Electric Vehicles

Sometimes the term "electric vehicle" is used to describe several different types of vehicles. The types, features, and performance characteristics of several EVs include:

- **Battery Electric Vehicles (BEVs):** These vehicles operate only on an electric battery and are also known as "all-electric vehicles". BEVs are powered only by electricity and are charged by an external power source. BEVs have a very large battery and can travel between 150 and 400 miles on a single charge[7]. Some popular models of BEVs include Tesla Model 3, Nissan Leaf, and Rivian delivery vans.
- **Plug-in Hybrid Electric Vehicles (PHEVs):** These vehicles have an electric battery that operates an electric motor in addition to a gasoline tank that fuels a gasoline motor. The electric battery can be plugged in to recharge and the gas tank can be refilled. PHEVs consume 14 - 47% less fuel than conventional vehicles when their batteries are fully charged[8]. Using just the battery and electric motor PHEVs can travel between 20 and 40 miles on a single charge[7], but in the absence of electricity, PHEVs can also operate on gasoline. Some popular models of PHEVs include Chevrolet Volt, Chrysler Pacifica, and Ford Fusion Energi.

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[6] City of Orlando (n.d.). *Orlando's 2030 Electric Mobility Roadmap*. Retrieved January 4, 2023, from https://www.orlando.gov/files/sharedassets/public/departments/sustainability/21_exo_emobility-roadmap_020322_pages.pdf.

[7] Alternative Fuels Data Center: Electric Vehicles. (n.d.). *Electric vehicles*. Retrieved January 4, 2023, from https://afdc.energy.gov/vehicles/electric.html.

[8] Charge Together Fleets. (2020, April 17). *Electric vehicles introduction*. Retrieved January 4, 2023, from https://fleets.chargetogether.org/article/introduction/. This is the main source of information, unless otherwise noted.

- **Hybrid Electric Vehicles (HEVs):** These vehicles have an electric battery that operates an electric motor AND a gas tank that fuels a gasoline motor. The gas tank can be refilled, but the electric battery cannot be plugged in to charge. The battery is typically smaller than the battery for PHEVs. Some popular models of HEVs include Toyota Prius and Ford Maverick.
- **Fuel Cell Electric Vehicles (FCEVs):** These vehicles use hydrogen to power an electric motor. They are not very common for use as a personal vehicle, but are gaining traction for commercial uses such as buses and long-haul trucks. Similar to gasoline powered vehicles, FCEVs have a tank that is filled with Hydrogen at a centralized station (similar to a gas station).

These vehicles are currently used in Hillsborough County or may be used in the near future. This Plan considers charging infrastructure for BEVs and PHEVs, which will be referred to as "EVs" in this Plan. The characteristics of these vehicles affect how Hillsborough County can prepare for and develop a supportive charging infrastructure for all residents and visitors.

Charging Infrastructure Overview

Many people are familiar with refueling an internal combustion engine (ICE) vehicle with gasoline, but how does an EV without a gas tank get filled? Recharging an EV is not too different from recharging the battery on a phone, laptop, or any other electronic device. Similar to all of these devices, there is a cable that connects the vehicle to a power source to allow for the movement of electrical current (an EV can even be plugged into a regular wall outlet in a house!).

A few key considerations for EV charging include:

1/ Charging Speeds (Referred to as "Levels")
2/ Types of Connectors
3/ Charging Venues
4/ Ownership Models for Public Charging Stations

These considerations are important for Hillsborough TPO to understand existing conditions of charging infrastructure and the opportunities to develop charging infrastructure that meets the needs of the community.

Levels of Charging Infrastructure

There are different types of chargers that charge EVs at different speeds. EVs can charge at three "levels", each of which carries a different amount of electricity, measured using kilowatt-hours (kWh). Simply stated, the larger the kWh, the faster electricity is refueling the EV. The three levels of charging are described in Table 1.

Level 1 charging equipment can be publicly available, but it is frequently associated with at-home charging using a standard wall outlet. Level 2 charging equipment is found at public charging stations and can also be installed in residential settings. Level 3 charging equipment, also known as DCFC equipment, is typically only available at public charging stations.

Table 1: EV Charging Levels and Associated Energy Needs and Charging Speeds

Charging Level	Alternating Current (AC)	Charging Rate (Kilowatts per hour)	BEV Charging Time (hours)[9]	PHEV Charging Time (hours)[9]	Miles Per Hour of Charge*
Level 1 (L1)	120V	1.9	40-50h	5-6h	3-5
Level 2 (L2)	240V (residential) or 208V (commercial)	19.2	4-10h	1-2h	12-50
Direct Current Fast Charger (DCFC or L3)	NA	50-350	0.4-1.25h	NA	75-300

* When comparing charger types, rather than a vehicle's driving range, it's helpful to consider how much energy is being stored (kW) because the driving range also depends on the vehicles efficiency.

Types of Charging Connectors

As charging equipment has developed, different charging connectors have emerged from different vehicle manufacturers due to a lack of regulatory standards as well as proprietary technologies. The different vehicle ports are shown in Figure 5. This results in needing multiple connectors at charging stations. The types of connectors that are typically available at charging stations are shown in Table 2 by the Level of the charging station.

For L1 and L2 charging, an SAE J1772 EV connector type is the most common connector. Almost all EVs in the United States and Canada can be charged using this type of connector, including Tesla cars with an adapter. Similarly, non-Tesla EVs can connect to Tesla L2 chargers using an adapter.

For L3 charging, three connector types are used: CHAdeMO, SAE Combo CCS, and Tesla Supercharger. Unlike L2 charging, these connectors are not interchangeable. For example, a vehicle with a CHAdeMO port can only use a CHAdeMO connector at an EV charging station[10].

Figure 5: Different Charging Standards Used by Manufacturers

SAE Combo CCS (L1, L2, and DCFC) used by many manufacturers including Ford, GM, and Honda.

Credit: WMrapids from Wikimedia

CHAdeMO (DCFC) and SAE J1772 (L1 and L2) used by Nissan and Mitsubishi

Credit: CleanTechnica

Tesla Supercharger (L1, L2, and DCFC) used by Tesla

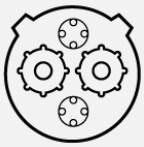
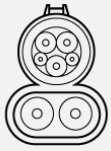
Credit: everythingsticker from Etsy

[9] U.S. Department of Transportation. (n.d.). *Electric vehicle charging speeds*. Retrieved January 4, 2023, from https://www.transportation.gov/rural/ev/toolkit/ev-basics/charging-speeds#:~:text=Level%201,vehicle%20(PHEV)%20from%20empty.

[10] Charge Hub. (n.d.). *Definitive guide on how to charge an electric car*. Retrieved January 4, 2023, from https://chargehub.com/en/electric-car-charging-guide.html.

"DC Fast Charging Station with CCS and CHAdeMO Connectors"

Table 2. Types of Charging Connectors by Charging Level

Charging Level	Station Example	Connector	Wall Plug
L1	 Credit: CleanTechnica	 Port J1772  Tesla HPWC	 Nema 515, Nema 520
L2			 Nema 1450 (RV plug)  Nema 6-50
L3		 CHAdeMO  SAE Combo CCS  Tesla Supercharger	-

Charging Locations

For internal combustion engine (ICE) vehicles that are powered by gasoline, typically gas stations are the only option for refueling. EVs offer the opportunity to refuel at just about any place where electricity is available. Charging locations can be divided into three categories: At-Home Charging, Workplace Charging, and Public Charging. Charging stations in each of these locations have unique considerations. Some of the installation considerations specific to the location of charging infrastructure are included in Table 3. In addition to these considerations, installation of charging infrastructure typically requires cooperation with the local electricity provider, adherence to local zoning codes and parking requirements, and stakeholder participation.

Data from the EV Project and the ChargePoint America project, launched by US Department of Energy, suggests that 98 percent of charging happens at home or at the workplace for those with access to both home and workplace charging[11]. According to the US Department of Energy, more than 80 percent of EV charging is performed at home. An estimated 30% of EV drivers rely on workplace charging for most of their charging. This indicates that workplace charging is important for those without access to home charging or those with longer commutes that cannot be completed on one charge.

Charging cost at workplaces can differ based on the workplace charging program. Typically, public charging costs more than workplace charging or at-home charging.

This Plan is focused on Workplace Charging and Public Charging. However, due to the frequency of use of At-Home Charging, it is also very important to consider when planning for charging stations located in either workplaces or other public locations.

Table 3. Charging Installation Considerations for Different Contexts

Context	Charging Type	EV User Charging Costs	EV Charging Provider Costs Installation Considerations
At-Home Charging	L1 or L2	Vary by seasons, individual plan costs, peak versus off-peak adjustments, and incentives or rebates provided by local electricity providers. (FL residential cost – 12.12 cents/kWh as of Oct. 2021)[12].	• State or utility incentives • Safety-certified equipment • Adequate electrical capacity for vehicle charging • Local requirements • Codes and standards at all levels (e.g. National Electrical Code)

[11] Smart, J. G., & Salisbury, S. D. (2015). *Plugged In: How Americans Charge Their Electric Vehicles*. United States. https://doi.org/10.2172/1369632.

[12] US Energy Information Administration (EIA). (n.d.).Electric Power Monthly. Retrieved January 4, 2023, from https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a.

Context	Charging Type	EV User Charging Costs	EV Charging Provider Costs Installation Considerations
Workplace Charging	L1, L2, or DCFC	Vary by the adoption of a workplace charging program and relevant fee schedule.	• Employee survey for workplace charging • Employers' sustainability portfolio • Management of workplace charging (administration, registration and liability, station sharing, pricing) • Federal, state, and utility incentives
Public Charging	L2 or DCFC	Vary by network and pricing structures. E.g. Electrify America network in FL - 43 cents/kWh (regular rate), 31 cents/kWh (member discounted rate: $4 monthly membership fee)[13].	• Peak demands • Membership programs • Garage locations/paid parking • Nearby amenities • Zoning, codes, and parking ordinances • Charging infrastructure costs and maintenance

Finding EV stations may seem tricky, but there are apps and websites to help identify locations and signage to clarify station location. PlugShare and ChargeHub identify stations and give an opportunity to review stations or leave notes for other EV drivers. These tools and others can also allow EV drivers to see if charging ports are available in real time, or if they are currently occupied. Some sample signage for EV charging are shown in the image below.

How do you navigate to and identify charging stations?

"How do you navigate to and identify charging stations? With Wayfinding Signage and Station Markings"

[13] Electrify America. (n.d.). *Pricing and plans for EV charging*. Retrieved January 4, 2023, from https://www.electrifyamerica.com/pricing/.

At-Home Charging

At-home charging can be accomplished with L1 or L2 equipment. For EV owners interested in faster charging, L2 equipment can be installed, typically by the vehicle manufacturer. Generally, the cost of charging an EV at home is in alignment with typical home energy costs but is subject to the considerations included in **Table 3**. Typically, overnight charging is most cost-effective, as electricity demand usually dips during the nighttime. Increasingly, utility providers are developing special rates to incentivize off-peak charging for EV owners at-home. The image to the right displays a typical at-home EV charging system for L2 equipment.

"Typical At-Home EV Charging"

Workplace Charging

Workplace charging can be provided as an amenity for employees in company parking lots or garages that increases the convenience and affordability of driving electric vehicles. Workplace charging stations can utilize L1, L2, or L3 equipment, depending on the company's needs. Prior to the installation of workplace charging, it is crucial to evaluate the goals and needs of current and potential EV drivers. Design considerations including enforcement of parking and charging fees may be simpler to resolve once a workplace charging program is determined to be right for an organization.

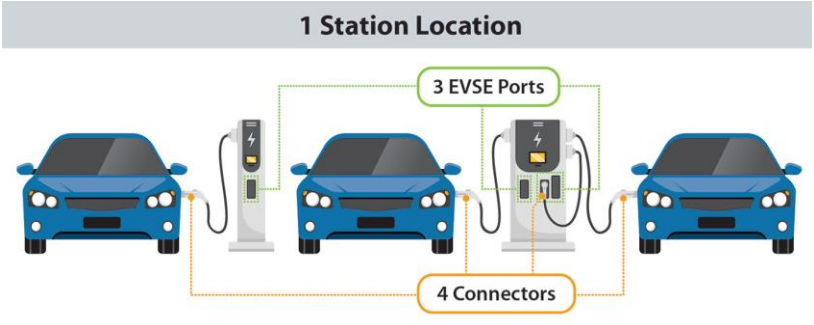
Public Charging

Public charging can be hosted and managed by a variety of agents, described further in the *Charging Infrastructure Ownership Models* section. Fees at some public stations are priced by kilowatt-hour (i.e., kWh, the amount of energy transferred to the EV's battery). For the most part, individual station owners set the charging prices. Thus, charging prices within the same network can vary by location. Public charging at some stations can be free. For instance, free charging is available at some retailers, such as Whole Foods, and many car dealers. However, the distant locations and limited hours of operation at dealership locations inhibit EV drivers from utilizing such perks. In addition, public charging prices can also be subscription-based. Members pay a membership fee and get to enjoy discounted charging rates at stations within the network. The image below features an example of a public charging station.

What is the difference between an EV station and an EVSE port?

Charging Port: A charging port provides power to charge only one vehicle at a time, but it may have multiple connectors. The unit that houses charging ports is sometimes called a charging post, which can have one or more charging ports.

Charging Station: A station location is a site with one or more charging ports at the same address such as a parking garage or a gas station parking lot.



Developing infrastructure to charge electric vehicles. Alternative Fuels Data Center. (n.d.). Retrieved January 19, 2023, from https://afdc.energy.gov/fuels/electricity_infrastructure.html.

"Examples of Public Charging Stations in Hillsborough County – DCFC Station, Parking Garage, and On Street"

Charging Infrastructure Ownership Models

Public and private efforts are both needed to meet the growing demand for EV charging. A variety of ownership models are used for charging deployments, many of which are still in their early stages.

Table 4 summarizes the roles of electric vehicle service providers (EVSPs), also referred to as EV supply vendors, and station hosts, as well as the distribution of revenues in four ownership models: charging as a service, outright purchase, EVSP owned, and hybrid owned. Among the four models, "charging as a service" and "outright purchase" are most common models in today's market.

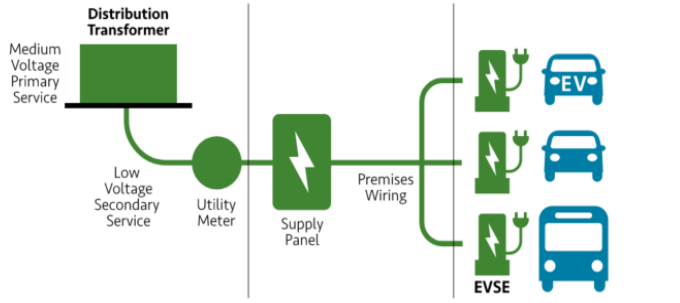
Regarding the costs of stations, an L1 station is approximately $600 per unit; an L2 station is around $2,000 per unit; and the cost of an L3 station is comparatively high, ranging from $50k to $100k. In "charging as a service" and "EVSP-owned" models, the EVSP owns and maintains charging stations and is responsible for the deployment cost. In the "outright-purchase" model, the deployment and maintenance costs are the responsibility of the station host. Rather than having one party responsible for the station cost, all costs and revenues are shared between EVSP and the station host in the "hybrid owned" model.

Figure 6 displays the different roles of providers and station hosts in different contexts.

Table 4. Charging Infrastructure Ownership Models

	Electric Vehicle Service Provider	Station host	Revenue
Charging as a Service	• Deploys the charging station • Owns, maintains, and operates the station • Leases charging equipment to the station host • Provides management services and may include add-ons such as proactive maintenance, monitoring, and driver support services	• Responsible for providing the initial real estate • Enters into a term-based agreement with the EVSP for the use of the land	May be shared between the station host and the EVSP
Outright Purchase	• May be contracted to install the station • Be paid on a subscription basis to maintain and operate the charging station • May switch the maintenance contract after several years due to the increase in maintenance costs	• Owns the charging station equipment • May choose to maintain and operate the equipment themselves	Received by the station host
EVSP Owned	• Owns, operates, maintains, and administers the charging equipment	• May not be involved, if the EVSP owns the land	A portion of the revenue may be shared with the site host
Hybrid Owned	• Costs are shared with the station host • Typically pays costs associated with equipment installation, operation, maintenance, and administration	• Costs are shared with the EVSP • Typically owns the property and pays make-ready costs	Shared between the station host and the EVSP

Figure 6. Roles of Providers and Station Hosts



	UTILITY SERVICE	PREMISES WIRING	EVSE
1. Traditional	Electric Company	Customer	
2. Make Ready	Electric Company		Customer
3. EVSE Only	Electric Company	Customer	Elecric Company
4. Full Ownership	Electric Company		

Potential Partners	Key Roles in EVSE Installations: Electricity Provider	EVSE Operator	EVSE Owner	Site Host
Utility	x	x	x	
Charging Network Provider		x	x	
Property Owner		x	x	x
Tenant		x	x	x

Public agencies should consider some of the following questions when considering capital investments for EV infrastructure. This Existing Conditions report and the subsequent work through this Plan will help agencies answer these questions.

- What use cases for electric vehicles exist in the community? Which use cases should be prioritized when planning for EV charging infrastructure?
- What rate of adoption of EVs is expected under each use case?
- What opportunities does an agency have to influence the rate of adoption? This may be through the adoption or modification of plans or codes.
- How can EVs currently be charged? Are there gaps in the current charging network or unmet needs?
- Considering unmet needs, what type of place should the charging infrastructure be located at (grocery stores, main streets, employment centers, parks, or somewhere else)?
- Considering the type of place and the use case, what level of charging infrastructure should be provided? Is a Level 2 charger or a DCFC more appropriate?
- How can the EV charging station be funded? Is sufficient utilization expected, such that a private company might be able to install, maintain, and operate the station? Should the agency provide an incentive to install a charging station at a particular location?
- Should agencies expect to generate revenue through EV charging? How should the collected funds be used or accounted for?
- How can charging infrastructure and access to benefits from electric vehicles be distributed equitably? How can the equitable distribution of benefits be measured and ensured?
- How can agencies account for or mitigate negative externalities of EV adoption? Negative externalities may include: heavier vehicles posing a greater risk for vulnerable road users, opportunity cost of not investing in other projects due to directing funds towards EV infrastructure, or inducing more driving due to lowering the cost of operating EVs.

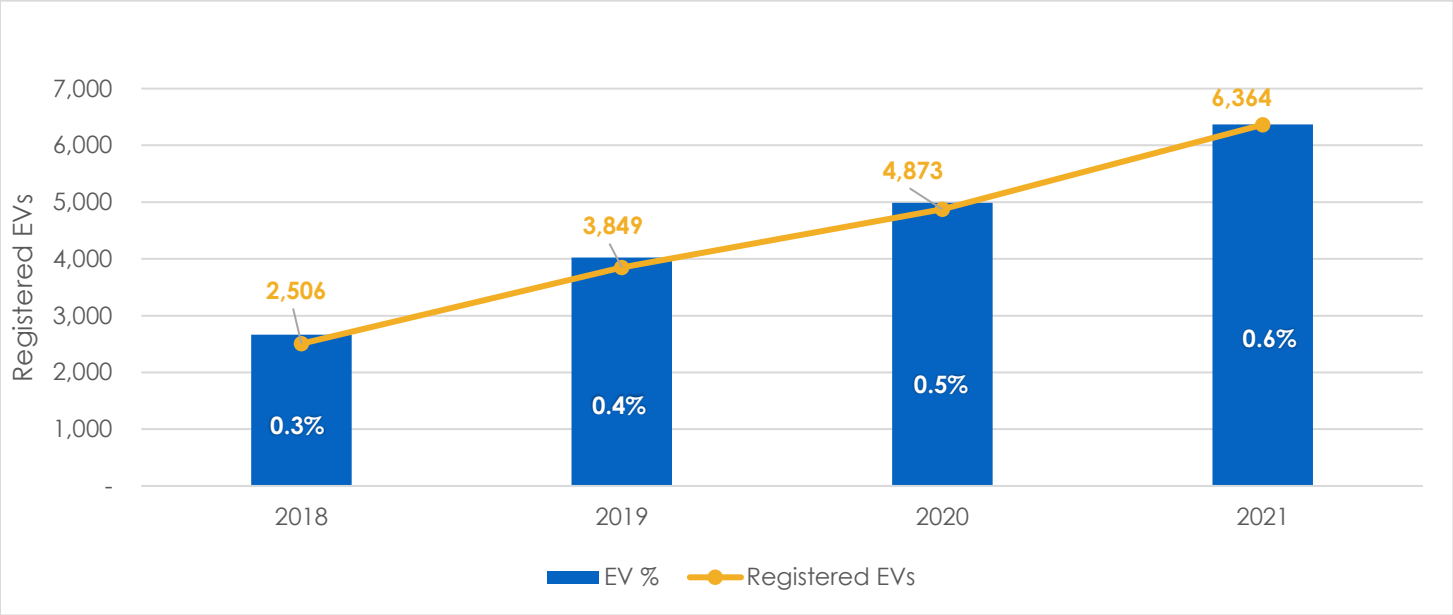
Electric Vehicle Adoption Trends

EVs have been adopted at an increasing rate in the last several years across the nation, but the growth rate of EV adoption in Hillsborough County has been relatively consistent.

Adoption in Hillsborough County

As depicted in Figure 7, there has been a steep rise in the EV registrations in Hillsborough County in recent years. Between 2018 and 2021, this number has grown by 154%, at an annual rate of 51%. Registered EVs, as a proportion of total registered vehicles in Hillsborough County, have increased from 0.3 % in 2018 to 0.6% in 2021. The EV adoption rate in Hillsborough is likely to continue increasing in the near future with the deployment of EV supply equipment and the EV transition of major auto manufactures.

Figure 7. Registered EVsin Hillsborough County, 2018 – 2021 (Data source: Altas EV Hub; Florida Department of Highway Safety and Motor Vehicles (FLHSMV))



Additionally, the Hillsborough TPO's planning area is one of nine major US metro areas where used EVs are selling faster than used conventional vehicles with internal combustion engines[14]. This major shift in the vehicle sales market indicates a growing need for charging that suits a variety of use cases.

Adoption in the United States

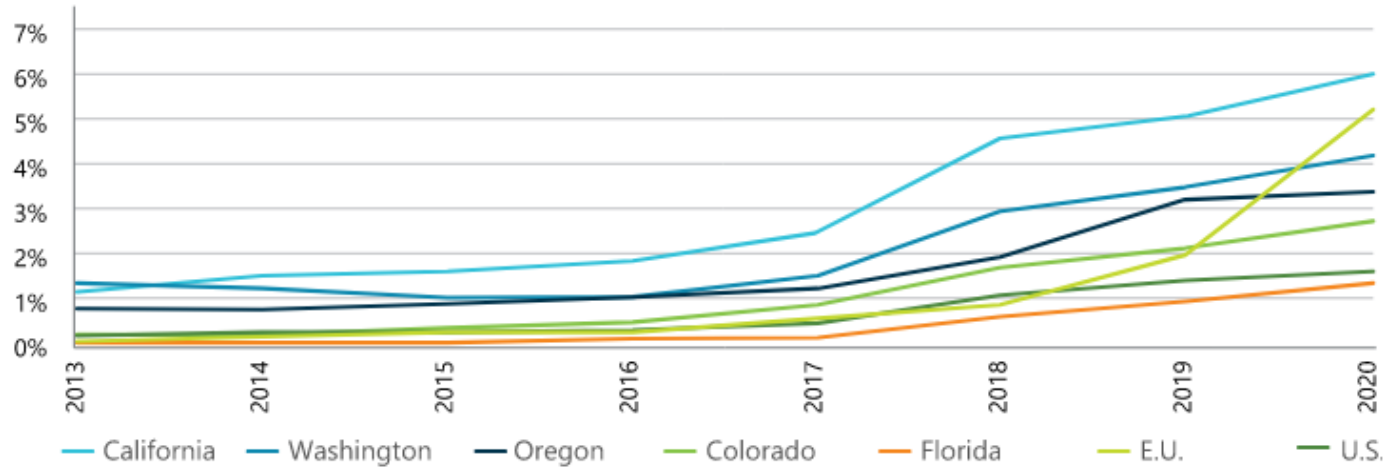
Electric vehicles have steadily gained momentum in the US over the past decade. The number of PHEVs and BEVs sold in the United States has exceeded 2.9 million since 2010[15]. BEVs represent 3.4% of the light-duty vehicles sold in the US, while EVs, in total, account for over 10% of all light-duty vehicles sold (including hybrid

[14] Zukowski, Dan. (July 29, 2022). *EVs are the Fastest-Selling Used Cards in 9 Major Metro Areas*. Smart Cities Dive.

[15] Argonne National Laboratory. (n.d.). *Light Duty Electric Drive Vehicles Monthly Sales Updates*. Retrieved January 4, 2023, from https://www.anl.gov/esia/light-duty-electric-drive-vehicles-monthly-sales-updates.

and PHEVs)[16]. Figure 8 depicts this substantial growth across leading states in the US and in the European Union (EU) between 2013 – 2020, showing steady increases across the board.

Figure 8. Comparison of EV Sales in Various Markets, 2013 - 2020 (Source: FDOT EV Infrastructure Master Plan)



California leads the nation in EV sales largely due to its clean energy policies including the Advanced Clean Cars Program. Between January and September 2022, nearly 18% of new vehicles sold in California were zero-emission vehicles[17]. By 2035, all new passenger cars and trucks sold in CA must be zero-emission or EVs, by State Executive Order. As of August 2022, seventeen states have adopted California's zero-emission vehicle standards or low-emission vehicle standards, including Colorado, Connecticut, Delaware, Maine, Maryland, Massachusetts, Minnesota, New Jersey, Nevada, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and the District of Columbia[18].

Florida has not adopted California's zero-emission vehicle standards or low-emission vehicle standards. However, the Florida Department of Agriculture has established goals for the amount of renewable energy produced in Florida to be at least 40% renewable by 2030, 63% renewable by 2035, 82% renewable by 2040, and 100% renewable by 2050[19].

Additionally, several regional consortiums have emerged to encourage the EV transition, including:

- Multi-State Zero-Emission Vehicle (ZEV) Task Force, established in 2013 to coordinate the deployment of EVs in California, Connecticut, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont.
- In 2020, Colorado, the District of Columbia, Hawaii, Maine, North Carolina, Pennsylvania, and Washington joined the task force to spur the transition for medium and heavy-duty EVs.

[16] US Energy Information Administration (EIA). (n.d.). *Electric vehicles and hybrids surpass 10% of US light-duty vehicle sales*. Homepage Retrieved January 4, 2023, from https://www.eia.gov/todayinenergy/detail.php?id=51218.

[17] California Energy Commission. (n.d.). *New ZEV sales in California*. California Energy Commission. Retrieved January 19, 2023, from https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/new-zev-sales.

[18] Center for Climate and Energy Solutions. (August 2022). *US State Clean Vehicle Policies and Incentives*. https://www.c2es.org/document/us-state-clean-vehicle-policies-and-incentives/#:~:text=As%20of%20August%202022%2C%20fourteen,Vermont%2C%20Virginia%2C%20and%20Washington.

[19] Statewide Renewable Energy Goals, Rule 5O-5.002 (2022). https://www.flrules.org/gateway/RuleNo.asp?id=5O-5.002

- Regional Electrical Vehicle Plan for the West, a consortium created in 2017 and consisting of Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming with the goal of promoting a seamless EV charging network across the region's major corridors.
- Regional Electric Vehicle Midwest Coalition, established in 2021 to accelerate medium and heavy-duty fleet electrification in Illinois, Indiana, Michigan, Minnesota, and Wisconsin.

Adoption Estimates

Federal agencies and interest groups have assessed the expected rate of adoption to help with planning for EVs and to prepare other elements of the market. These adoption estimates vary widely and can inform the forecasting of EV adoption in Hillsborough County. Estimates from a selection of agencies are listed below and visualized in Figure 9:

- **United States:** By 2030, it is projected that half of all new vehicles sold will be ZEV[20], and that 26.4 million EVs will be on US roads[21]. The New York DMV reports about 1.9 Million standard registrations in 2018. Considering the number of standard registered passenger in 2018, the EV goal is about 21% of registered vehicles in 2030.
- **Florida**: In 2035, between 5 - 20% of light-duty vehicles are projected to be EVs[22].
- **City of Orlando**: In 2030, 30% of all light-duty registered vehicles in Orlando are projected to be electric. In 2050, 80% of all light-duty registered vehicles in Orlando are projected to be electric[23].
- **New York**: By 2025, 850,000 ZEVs are forecast to be in New York. By 2035, all new passenger vehicles sold in the state will be ZEVs. The New York DMV reports about 9.5 Million standard registrations in 2018. Considering the number of standard registered passenger in 2018, the ZEV goal is about 9% of registered vehicles in 2025.
- **New York City**: By 2030, 400,000 EVs are forecast to be in New York City[24]. The New York DMV reports about 1.9 Million standard registrations in 2018. Considering the number of standard registered passenger in 2018, the EV goal is about 21% of registered vehicles in 2030.
- **Oregon**: By 2030, 25% of registered light-duty vehicles and 50% of new light-duty vehicles sold are projected to be ZEVs. By 2035, 90% of new light-duty vehicles sold are projected to be ZEVs[25].
- **City of San Francisco:** By 2030, 25% of all private vehicles are EVs. By 2040, 100% of private vehicles are EVs[26].

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[20] U.S. Department of Transportation. (2022, February). *Charging forward: A toolkit for planning and Funding Rural Electric Mobility Infrastructure*. Retrieved January 4, 2023, from https://www.transportation.gov/rural/ev/toolkit

[21] Edison Electric Institute and the Institute for Electric Innovation. (2022, June). *EEI projects 26 million electric vehicles will be on US roads in 2030*. Retrieved January 4, 2023, from https://www.eei.org/News/news/All/eei-projects-26-million-electric-vehicles-will-be-on-us-roads-in-2030.

[22] FDOT. (2021, July). *EV Infrastructure Master Plan (EVMP)*. Retrieved January 4, 2023, from https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/planning/fto/fdotevmp.pdf.

[23] City of Orlando (n.d.). *Orlando's 2030 Electric Mobility Roadmap*. Retrieved January 4, 2023, from https://www.orlando.gov/files/sharedassets/public/departments/sustainability/21_exo_emobility-roadmap_020322_pages.pdf.

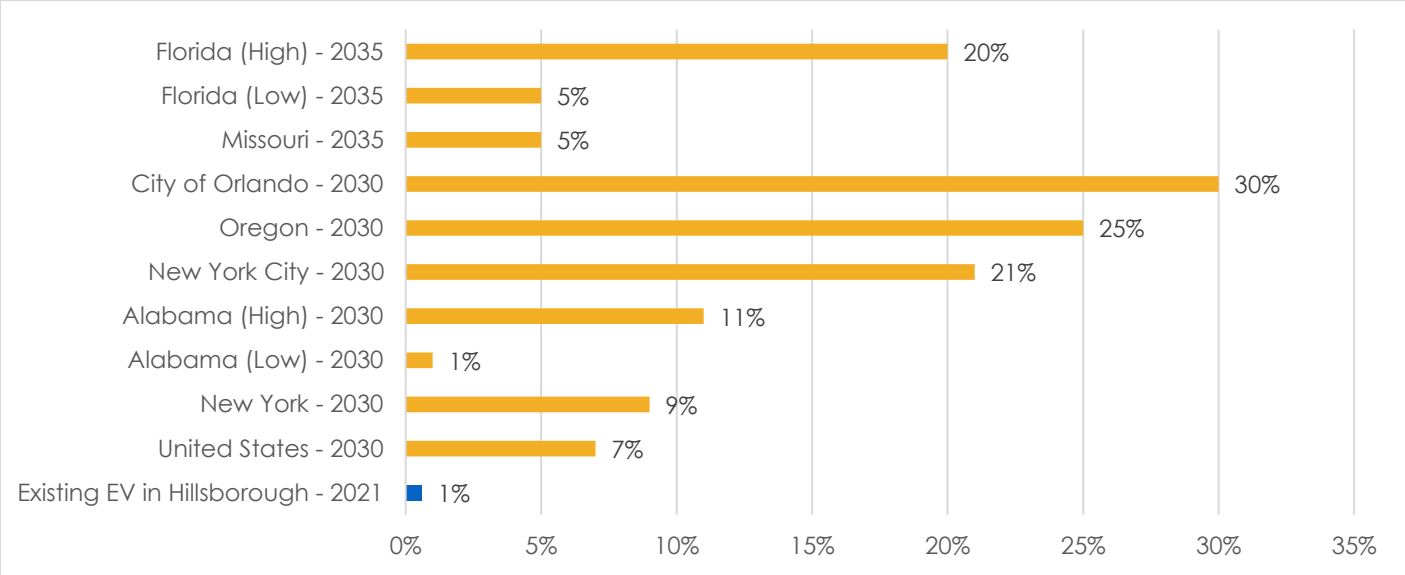
[24] NYC Mayor's Office of Climate and Sustainability, & NYC DOT. (2021, September). *Electrifying New York: An Electric Vehicle Vision Plan for New York City*. Retrieved January 4, 2023, from https://www1.nyc.gov/html/dot/downloads/pdf/electrifying-new-york-report.pdf

[25] Oregon Department of Transportation. (2022, August). *Oregon's Transportation Electrification Infrastructure Needs Analysis (TEINA)*. Retrieved January 4, 2023, from https://www.oregon.gov/odot/Programs/Documents/23021%20T031%20TEINA%20Report%20August%202022.pdf.

[26] Office of the Mayor. (2021, July 20). *San Francisco Adopts New Climate Action Goals*. City and County of San Francisco. https://sfmayor.org/article/san-francisco-adopts-new-climate-action-goals

- **Alabama**: In 2030, between 42,000 and 550,000 light duty vehicles are forecasted to be EVs[27]. The Alabama Department of Revenue reports about 5.1 Million passenger vehicle registrations in 2022. Considering the number of registered passenger vehicles in 2022, the EV goal is between 1 – 11% of registered vehicles in 2030.
- **Missouri**: In 2035, 5% of registered vehicles are forecasted to be EVs[28].

Figure 9. Estimated EV Adoption Rates in Various US Cities and States by Year



*Note: Reported values are for forecasts, goals, and legislative directive for different agencies. Some agencies have set goals of number of vehicles, which have been converted to portion of vehicles using available registration data.

"Charging an Electric Bus. Photo Credit: PSTA"

[27] Holmes, J. (2022, September 23). *Professionals preparing Alabama for surge in electric vehicles*. Alabama Political Reporter. Retrieved January 4, 2023, from https://www.alreporter.com/2022/09/23/professionals-preparing-alabama-for-surge-in-electric-vehicles/

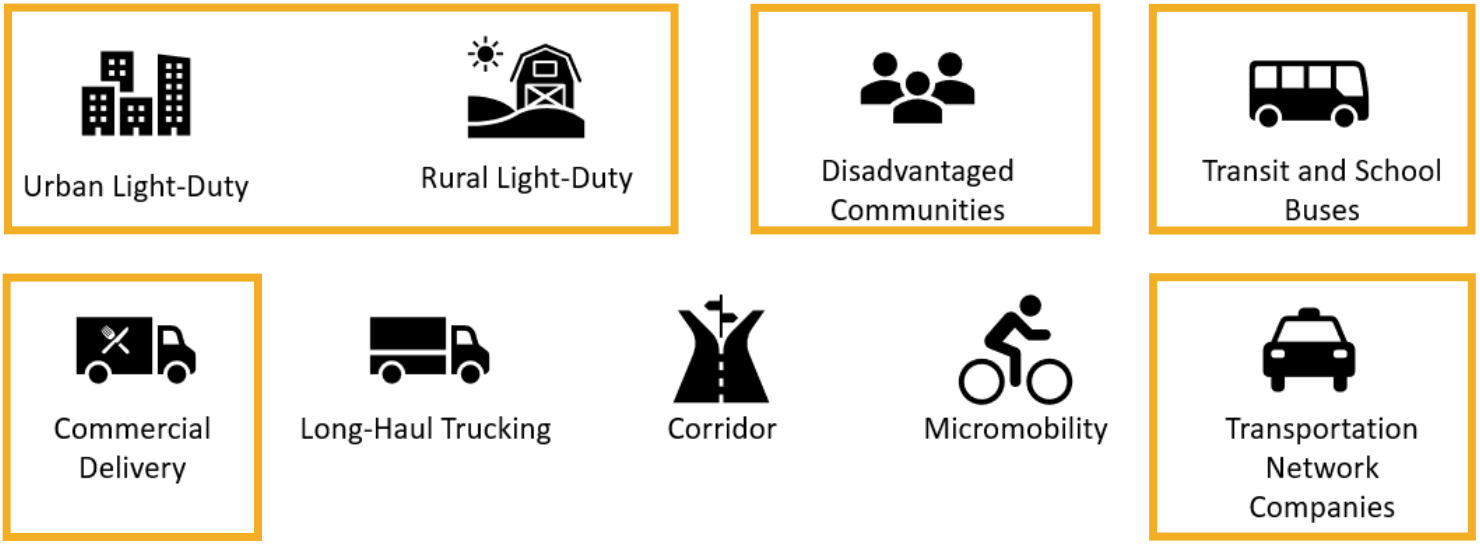
[28] Missouri Department of Transportation. (2022, July). *Missouri Electric Vehicle Infrastructure Deployment Plan*. Retrieved January 4, 2023, from https://www.modot.org/sites/default/files/documents/DRAFT%20FINAL%20MoDOT%20NEVI%20Deployment%20Plan%202022-07-28.pdf.

Electric Vehicle Use Cases

The opportunities and challenges that EVs present are varied in their contexts, applications, and solutions. This section will discuss how different 'use cases' for EVs can be understood, planned for, and supported in the coming years as the electrification of transportation continues to gain momentum. Key takeaways for each use case include charging considerations, such as location, accessibility, and appropriate charging level, as well as supportive policies for each.

Generally, nine use cases for EVs have been identified, and are displayed in Figure 10. These use cases include: Urban Light-Duty, Rural Light-Duty, Disadvantaged Communities, Transit and School Buses, Commercial Delivery, Long-Haul Trucking, Corridor, Micromobility, and Transportation Network Companies (TNC). The FDOT EV Infrastructure Deployment Plan is expected to largely address the Corridor use case by allocating federal funding to high activity corridors in Hillsborough County and throughout Florida.

Figure 10. EV Use Cases



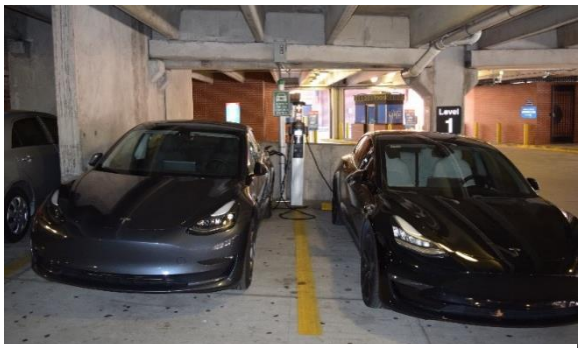
This Plan will discuss the following use cases that are relevant to Hillsborough County. The TPO selected these use cases in consultation with its partner agencies.

- Urban and Rural Light-Duty Vehicles
- Disadvantaged Communities
- Transit Buses
- Transportation Network Companies
- Commercial Delivery

Urban & Rural Light-Duty Vehicles

The Urban & Rural Light-Duty Vehicles use case considers the vehicles that individuals use for personal travel. These vehicles include sedans, SUVs, and pick-up trucks that are rented, leased, or owned.

More than 80% of EV drivers rely on home charging[30], as it tends to be cheaper and more convenient than charging at public stations. However, home charging is not always a viable or easy option, especially for people living in multifamily housing (such as apartments and condos) and for people who are renting their home.



"EVs Charging in a Parking Garage"

Recent research indicates that EV charging as an amenity is increasing in importance for renters[29]. For existing complexes and communities, property managers must analyze current electrical demand to determine existing network electrical loads, and then work with their utility provider to evaluate charging options. In new buildings, the US Department of Energy has recently adopted an International Code Council provision that requires apartment communities to provide EV charging infrastructure for up to 20% of spaces in lots with 25 or more parking spaces. For both retrofits and new builds, the Inflation Reduction Act of 2022 reinstated a tax credit for multifamily dwellings up to 30% of the cost of EV charging infrastructure installation. If at-home charging is unavailable, workplace and public charging is especially important. This Plan will focus on the determination of need for workplace and public charging stations and the identification of the types of places these charging stations should be prioritized.

Thus far in the lifespan of EVs, urban areas have tended to adopt at a higher rate than rural areas, however people living in rural areas can also benefit from EVs, which further underscores the importance of EV charging availability in rural areas. As described in the US Department of Transportation *Charging Forward: A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure*, "In rural parts of the country – home to 20% of Americans and almost 70% of American's road miles – EVs can be an especially attractive alternative to conventional vehicles. Rural residents **drive more** than their urban counterparts, **spend more** on vehicle fuel and maintenance, and often have **fewer alternatives** to driving to meet their transportation needs."

However, the EV transition in rural areas must contend with significant adoption barriers, including upfront vehicle costs, geographic dispersion of EV drivers, utility pricing, upfront infrastructure costs (including electrical service capacity upgrades), and public awareness[30]. To address some of these issues, the USDOT recommends developing public charging stations in rural areas that promote economic development and community place-making to create attractive spaces that support local jobs, with training and employment opportunities for local workers to operate and maintain the charging station. Example locations in rural areas to consider installing charging infrastructure are near community assets like parks, preserves, and main street areas or corners. Additionally, the USDOT recommends designing and building rural charging stations with flexibility at the forefront, by using modular charging equipment to adjust as demand changes.

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[29] Lawrence, Robyn Griggs. (December 13, 2022). *Demand Soars for EV Charging at Apartments.* Smart Cities Dive.

[30] US Department of Transportation. (February 2022). *Charging Forward: A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure.*

Disadvantaged Communities

Historically, many burdens of the transportation system are borne disproportionately by disadvantaged communities. In considering the development of EV technology and the investment of charging infrastructure, it is important to proactively ensure that the same pattern of burden distribution is not continued. Disadvantaged communities are identified two ways in this Plan:

- **Hillsborough TPO Nondiscrimination and Equity Plan**: The TPO identified the most underserved communities by considering a combination of social and demographic characteristics.
- **Justice40**: The Joint Office of Energy and Transportation (JOET) identified Census Tracts throughout the United States as disadvantaged as part of the Justice40 Initiative. The Justice40 Initiative is intended to identify and prioritize projects that benefit communities facing barriers to affordable, equitable, reliable, and safe transportation.

Consideration of disadvantaged communities is needed for several reasons, including:

- Lower-income households are more likely to buy higher-emitting and/or used vehicles because of their lower purchase costs, to hold onto these vehicles longer, and to bear a disproportionate burden of transportation-related air pollution compared with higher-income households[31].
- Transportation-disadvantaged households are more likely to live in multi-family dwellings, which may face increased barriers to accessing EV charging infrastructure.
- Public charging reliance can increase the monetary cost of recharging EVs, compared with at-home charging in a single-family dwelling[32].
- In accordance with the Justice 40 Initiative, 40% of eligible federal programs, including the National Electric Vehicle Infrastructure (NEVI) Program must benefit historically disadvantaged communities to repair and mitigate environmental injustices faced in the past.

To encourage equitable EV charging infrastructure development, the USDOT[33] recommends the following:

- Conduct meaningful community engagement in Disadvantaged Communities and Underserved Areas,
- Dedicate funding towards addressing the issues brought forward by stakeholders,
- Invest in transit electrification and affordable mobility options,
- Partner with local utility providers to identify necessary grid upgrades in equity communities,
- Offer assistance for navigating incentives programs to offset high upfront costs,
- Organize test drives to increase awareness,
- Design EV branding and wayfinding that is regionally consistent, and
- Adjust building codes to abolish parking minimums and require new parking is EV-equipped.

[31] RMI. (October 2022). *Increasing Equitable EV Access and Charging: A Path Forward for States – Recommendations for US Policymakers and Projected Impacts on Equitable Access to EV Adoption and Charging.*

[32] Dong-Yeon, L., Yang, F., Wilson, A., & Wood, E. (April 2022). *Electric Vehicle Infrastructure – Equity.* National Renewable Energy Laboratory.

[33] US Department of Transportation. (2022). *Equity Considerations in EV Infrastructure Planning.* Federal Highway Administration.

Commercial Delivery (Medium-Duty Freight)

The Commercial Delivery use case considers vehicles used to make deliveries or other short distance freight trips. The vehicles used for commercial delivery include box trucks and delivery vans, examples of which are displayed in the images below[34, 35]. These vehicles are typically owned by a company, which may have a fleet of similar vehicles. The vehicles typically return to their "home base" or "depot" at the end of each day.

"Examples of Electric Medium Duty Vehicles"

Delivery companies are beginning to replace gas-powered vehicles with electric or low-emission vehicles. UPS has ordered 10,000 electric delivery vehicles, Amazon is purchasing 100,000 EV vehicles, DHL reports zero-emission vehicles already make up 20% of its fleet with more to be added, and FedEx has pledged to have an all battery-electric delivery fleet by 2040. Delivery companies believe transitioning to electric vehicles will save money while simultaneously fighting climate change and reducing urban pollution[34].

Although medium- and heavy-duty vehicles only make up 5% of vehicles on the road, they produce 33% of the greenhouse gas emissions caused by transportation. They are a major source for air pollution, especially in communities near major freight facilities[36]. Electrifying these vehicles can therefore have an outsized impact on reducing greenhouse gas emissions and reducing air pollution.

Similar to light-duty vehicles, there are two main types of places commercial delivery vehicles charge. Delivery vehicles that use a fixed route and return to a home base each day, often charge at their home base, also called "depot charging". For some vehicles this is sufficient to complete all of the necessary routes. However, some vehicles also require "on-route charging" where they are recharged at least partly during the route or at a destination site, to extend the battery range for the whole route[36]. Depot charging is outside the purview of this EV plan, but on-route charging can be considered when developing public DCFC stations.

Some additional considerations can be made for allowing medium-duty vehicles to use public DCFC stations. These considerations may be more appropriate in areas with high freight activity or along corridors expecting

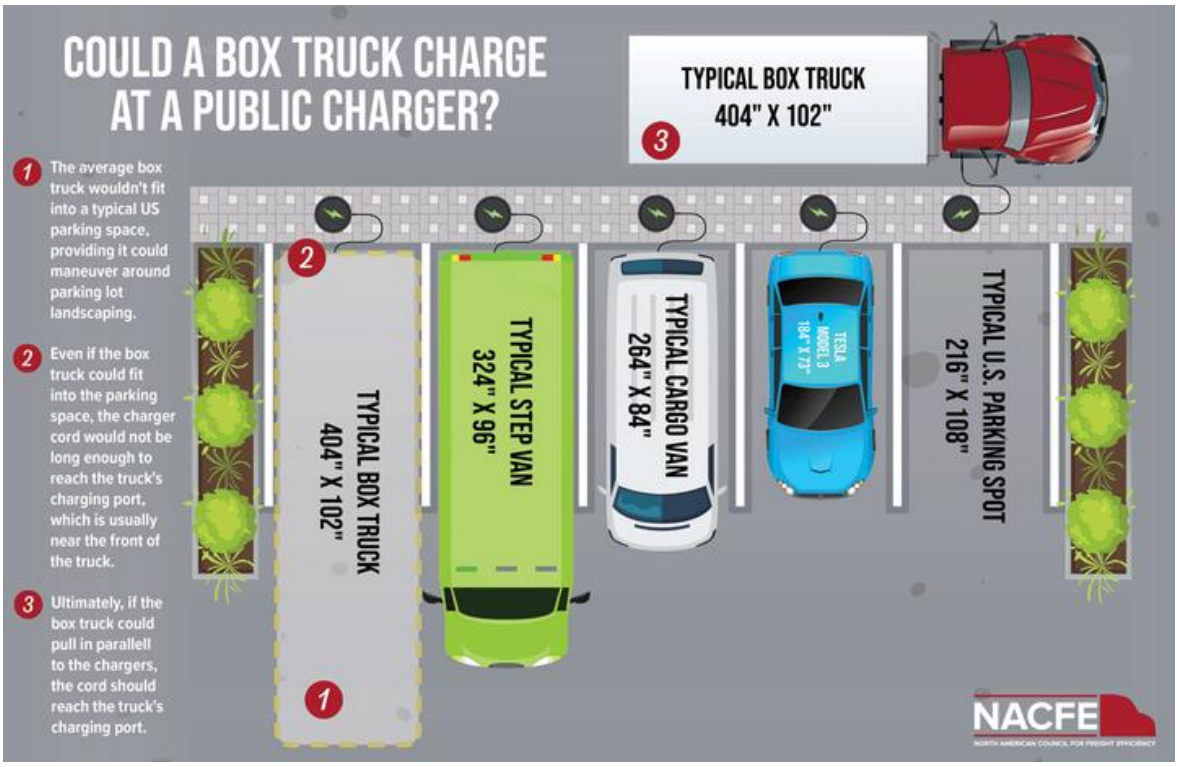
[34] Domonoske, C. (2021, March 17). From Amazon To FedEx, The Delivery Truck Is Going Electric. NPR. https://www.npr.org/2021/03/17/976152350/from-amazon-to-fedex-the-delivery-truck-is-going-electric

[35] Staff (2022, June 28). Benefits and Challenges in Electrifying Medium-Duty Box Trucks. Truckinginfo. https://www.truckinginfo.com/10175806/benefits-and-challenges-in-electrifying-medium-duty-box-trucks

[36] Pournazeri, S. (2022, April 28). Criteria to consider when siting EV charging infrastructure for medium- and heavy-duty vehicles. ICF. Criteria for EV Charging Infrastructure for Medium- and Heavy-Duty Vehicles | ICF.

to see higher freight activity. Figure 11 investigates whether a box truck could charge at a public charging station.

Figure 11. Considerations for Medium Duty Vehicles at Public Chargers[35]



The Tampa Bay Regional Freight Plan identifies some areas in Hillsborough County that have a high freight activity, as shown in Figure 12. Additionally, the City of Tampa has established truck routes in the City shown in Figure 13.

Figure 12. Freight Activity Centers (Inset from Tampa Bay Region Freight Plan)

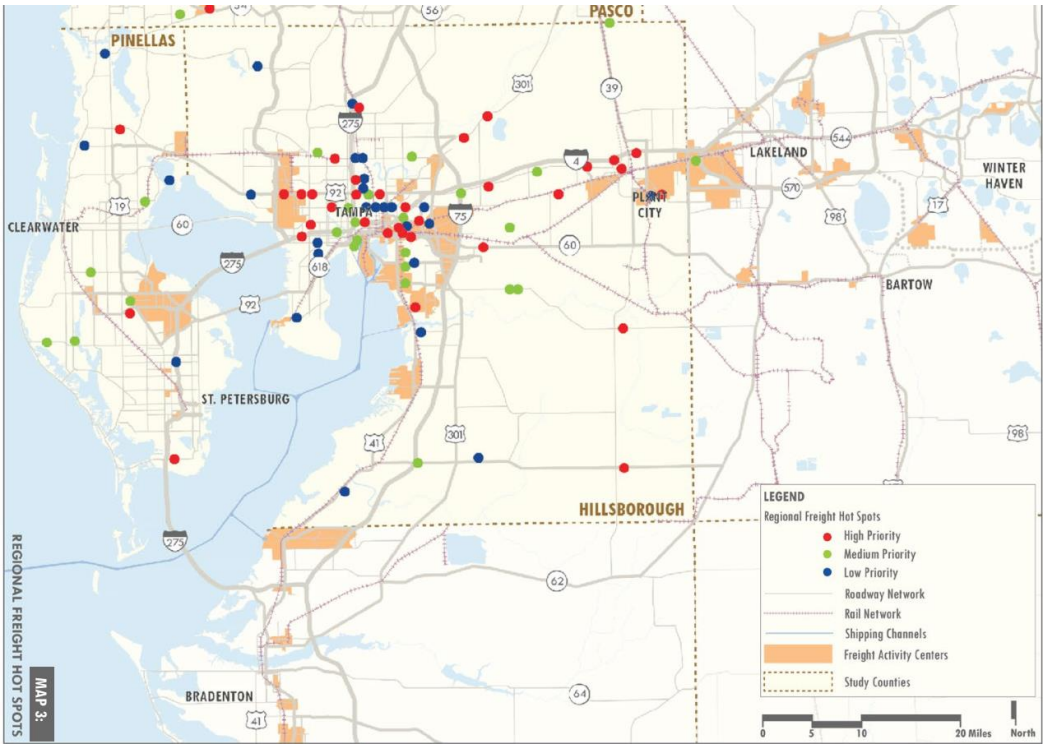
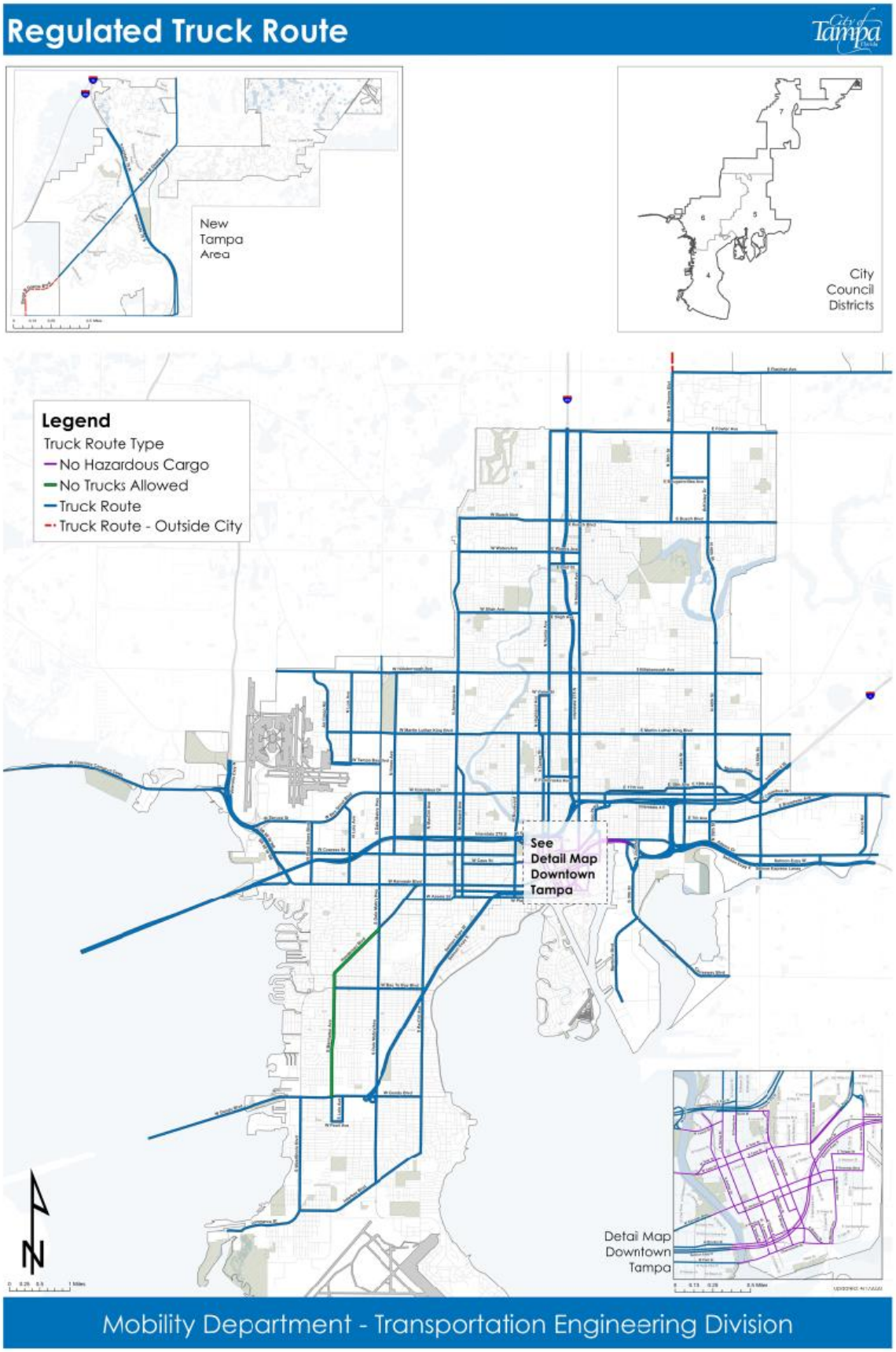


Figure 13. City of Tampa Truck Routes (City of Tampa)



Transportation Network Companies (TNCs)and Gig Drivers

Transportation Network Companies (like Lyft and Uber) and other Gig Companies (like Door Dash or Amazon Flex) contract with individuals to use light-duty vehicles to make deliveries or give rides. The vehicles used for this use case are typically like those used for the Urban & Rural Light-Duty Vehicles use case, but they tend to be driven more miles in a day and may have a greater need for on-route charging. The average driver travels about 35 miles per day compared to TNC drivers who may travel between 100 and 300 miles per day[37].

"Rideshare Loading Zone in a Parking Lot"

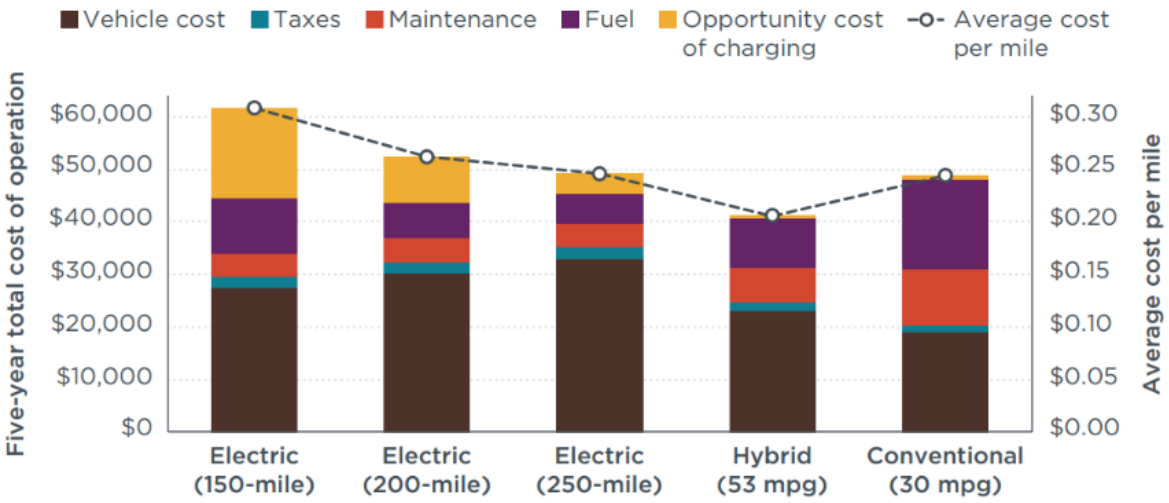
For these drivers, charging overnight while the vehicle is not in use is *not* expected to be sufficient to meet the daily driving requirements. On-route charging can close the gap for TNC drivers. Public fast charging is identified as reducing the opportunity cost for TNC drivers who must pause their workday to refuel their vehicle. As noted by one commenter on the Uber Driver Reddit page, long trips to areas without a DCFC station can result in drivers not being able to charge when they need to. Ensuring broad access to DCFC across the service area could mitigate this concern. To address this challenge, in 2019, a partnership between the City of Los Angeles, the Maven carshare platform, and Evgo fast charging network created the first rideshare-specific EV charging hubs[38].

Although EVs present some additional challenges for TNC and gig drivers, electrifying TNCs can also offer outsized benefits compared to other light-duty vehicles. Due to the longer distance travelled each day, EVs will tend to more quickly reach a breakeven point with the original purchase price. Additionally, in comparing personal vehicles used for rideshare or gig work with personal vehicles used exclusively for personal travel, electrification of rideshare and gig vehicles will have a more substantial impact on GHG emissions. Figure 14 visualizes the total cost of ownership for ridehail vehicles by fuel type.

[37] The Uber Driver's Subreddit. (2021, September 29) *How many miles do you drive per day?* Reddit. https://www.reddit.com/r/uberdrivers/comments/py320p/how_many_miles_do_you_drive_per_day/

[38] EVgo. (April 2019). *EVgo and General Motors' Maven Gig Introduce First in the Nation Public-Rideshare EV Fast Charging Hubs in Los Angeles.* https://www.evgo.com/press-release/evgo-and-general-motors-maven-gig-introduce-first-in-the-nation-public-rideshare-ev-fast-charging-hubs-in-los-angeles/

Figure 14. Total Cost of Ownership (TCO) for Ridehail Vehicles by Fuel Type



This figure presents data on the TCO of different ride-hail vehicles by fuel type excluding existing state and federal vehicle incentives. Without public subsidies, EVs have a higher TCO than conventional ride-hail vehicles.

For both TNC and gig drivers, EVs are coming, and coming fast. In the US, both Uber and Lyft have committed to electrifying their fleets in the coming years. Lyft has publicly committed to "achieve 100% electric vehicles across the Lyft platform by 2030", though not through forcing drivers to purchase EVs[39]. Uber has also publicly committed to phasing out internal combustion engine vehicles from its platform by 2030, with the aim to increase its fleet to 50,000 EVs in North America by the end of 2023[40]. Uber is also pursuing custom-built electric vehicles suitable for its rideshare and delivery services that reduce the purchase price to increase fleet transition[41]. With these ambitious targets in place, there is even more impetus for metro regions like Hillsborough County to facilitate the widely available and accessible installation of charging infrastructure. For the TNC and gig drivers use case, specific considerations related to EVs include:

/ Minimizing wait times and charge times reduces the opportunity cost of charging.
/ Fast charging should be available throughout the service area.

[39] Lyft. (2023). *Lyft Impact: Electric Vehicles.* https://www.lyft.com/impact/electric

[40] CBS. (September 2022). *Uber CEO says that it will phase out gas-powered cars by 2030.* https://www.cbsnews.com/news/uber-ceo-dara-khosrowshahi-electric-vehicles/

[41] Weber, Harri. (January 2023). *In race to electrify, Uber wants EVs that sacrifice top speeds, wheels.* TechCrunch+. https://techcrunch.com/2023/01/19/electrify-uber-ceo-wants-evs-that-sacrifice-top-speeds-wheels/

Transit Fleet

The Transit Fleet use case focuses on public buses. While Hydrogen Fuel Cell Electric Buses are used by some agencies, this report focuses specifically on Battery Electric Buses. Across the United States, many transit agencies have begun exploring the potential to shift their operations from gasoline or diesel-powered fleets to zero emissions vehicles, including electric vehicles. In fact, between 2018 – 2021, the number of electric transit buses on order or operating in the US grew 112%[42]. As of 2022, a typical battery electric bus had a range between 150 and 350 miles. Buses could be charged along the route for a short period like 10 minutes to extend their range. Buses could also be charged in the depot more slowly for a longer period, closer to 8 hours.

"A Portland, Oregon TriMet Battery Electric Bus Charging"

However, before procuring vehicles or electrifying routes can take place, a substantial amount of planning and program design must occur to ensure fiscal responsibility and success. In their review of best practices and lessons learned from deployments across the US, Atlas Public Policy recommends creating an Electrification Transition Plan, which HART, the Hillsborough transit provider, has recently completed. Due to the focus of recent legislation on climate justice and energy efficiency, there has never before been a better time to explore transit fleet electrification. Numerous federal programs are authorized to fund fleet electrification, including vehicle procurement, charging infrastructure, and associated operations and maintenance costs, including:

- Federal Transit Administration (FTA) Low or No Emissions Vehicle Program[43]
- FTA Bus and Bus Facilities Program[44]
- USDOT Rebuilding American Infrastructure with Sustainability and Equity (RAISE)[45]
- Federal Highway Administration (FHWA) Congestion Mitigation and Air Quality Improvement Program[46]
- Environmental Protection Agency (EPA) Diesel Emissions Reduction Program[47]

Additionally, at the state level, the Florida Department of Environmental Protection (FDEP) administers the Electric Transit Bus Grant Program, funded through Volkswagen Settlement Funds. In 2022, FDEP awarded $68 million to thirteen counties for the purchase of 227 electric transit buses[48].

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[42] MacDougal, Pamela. (July 28, 2022). *Four Main Takeaways from America's Top Transit Agencies on Electrifying Buses.* Smart Cities Dive.

[43] Federal Transit Administration. Low or No Emission Vehicle Program – 5339(c). https://www.transit.dot.gov/lowno#:~:text=The%20Low%20or%20No%20Emission,leasing%20of%20required%20supporting%20facilities

[44] Federal Transit Administration. Bus and Bus Facilities Program. https://www.transit.dot.gov/bus-program

[45] United States Department of Transportation. (November 2022). *RAISE Grants*. https://www.transportation.gov/RAISEgrants/about

[46] Federal Highway Administration. (February 2022). *Congestion Mitigation and Air Quality Improvement Program*. https://www.fhwa.dot.gov/bipartisan-infrastructure-law/cmaq.cfm

[47] United States Environmental Protection Agency. (November 2022). *Diesel Emissions Reduction Act Funding*. https://www.epa.gov/dera

[48] Florida Department of Environmental Protection. (November 2022). *DEMP – Volkswagen Settlement and DERA*. https://floridadep.gov/air/air-director/content/demp-volkswagen-settlement-and-dera

Review of Relevant EV Plans

Planning for electric vehicles charging infrastructure is already underway in Florida. The Hillsborough Transit Authority (HART) recently prepared a transition plan for their fleet to move towards zero-emission vehicles. FDOT has prepared two plans, most recently in 2022 to develop EV charging infrastructure primarily along highway corridors throughout Florida and including corridors in Hillsborough County. Planning has also been completed at the national level. Hillsborough TPO seeks to align with the work completed by partner agencies. This section documents the relevant EV plans noted above.

HART Zero-Emission Fleet Transition Plan (2022)

The Hillsborough Transit Authority (HART) Zero-Emission Fleet Transition Plan summarizes the existing service HART provides and a preliminary evaluation of a process to transition to a zero-emission fleet. The long-term fleet management plan is to replace the entire active bus fleet with zero-emission buses at the end of their useful life, contingent on funding availability.

The Transition Plan considers both battery electric buses and hydrogen fuel cell electric buses and their respective infrastructure needs. A preliminary evaluation identified a pilot project for 3-4 battery electric buses that would include chargers at the depot and an on-route charger at the main transfer center in downtown Tampa.

In addition to reviewing the Transition Plan, Hillsborough TPO met with a representative of HART to discuss plans for electrification. HART expects fuel cell electric buses to be more aligned with their needs because more routes are more than 200 miles long with short periods of time for layover at night time. These parameters would make recharging the buses difficult both on route and at the depot.

Florida EV Roadmap (2020)

The Florida EV Roadmap (Roadmap) is the first comprehensive study of EV charging status and needs in Florida, which was completed in 2020. The Roadmap identified recommended sites for charging infrastructure. Two sites were identified directly north of Hillsborough County both of which are near the I-275 interchange with I-75 (Worthington Gardens Area). Several EV charging sites were identified that would serve people evacuating during events such as hurricanes. One solution proposed for these locations is temporary charging installations of DCFC infrastructure. In Hillsborough County, one location was identified near the Hillsborough County I-75 Rest Area (Sun City Area).

The Roadmap identified planning recommendations to address several topics. Including the following:

- Develop State incentives for workplace charging
- Develop a statewide EV educational campaign
- Develop methodologies to track and forecast EV sales and infrastructure requirements

Projected EV sales for Florida were determined using the US Energy Information Administration (EIA) Annual Energy Outlook (AEO). The AEO was used to calculate annual percent growth in PHEVs and BEVs, which was then applied to existing 2019 vehicle registrations in Florida to forecast the EVs in Florida up to 2030. The National Renewable Energy Laboratory (NREL) EVI-Pro Lite tool was used to estimate infrastructure needs based

on projected charging demand. For the needs analysis, 85 % of drivers were assumed to have access to home charging. Infrastructure need was calculated at the county level by scaling the State need down according to the county's 2019 share of EVs and LDVs. The infrastructure need in Hillsborough County is shown in Table 5

Table 5. Hillsborough County Infrastructure Need (EV Roadmap 2020)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Public Level 2 Chargers	14	15	17	22	29	31	32	34	36	38
Workplace Level 2	14	16	20	27	37	39	41	43	46	49
Public DCFC	29	31	36	44	55	58	60	63	66	71

Then, a suitability analysis was completed to identify sites for charging stations at a granularity of 0.25 square mile cells. The intention of the suitability analysis is summed up as, "Charging stations should be in an area that is safe, near commercial activity, accessible to residents in multi-unit dwellings, and efficiently distanced from existing charging locations." The suitability analysis considered the following factors:

- Distance from existing charging stations (35% weight)
- Commercial land use density (15% weight)
- Multi-unit dwelling density (15% weight)
- Registered EVs (15% weight)
- Employment density (10% weight)
- Population density (10% weight)

In 2020, the analysis suggested that at the State level, there were enough DCFC to meet charging demand until 2025 and enough Level 2 chargers to meet charging demand until 2030. However, because the charging infrastructure is not evenly distributed, some areas may require additional charging infrastructure. Hillsborough County was identified as having sufficient DCFC plugs to meet the expected need under the assumptions that formed the basis for these projections.

The Roadmap included a survey of owners of EVs who lived in Florida. A few key findings from the survey included:

- 86% of respondents felt that Florida did not have adequate charging infrastructure.
- 88% of respondents lived in a single-family house. 80% of those living in single-family houses most often charge at home.
- 74% of respondents reported doing 75-100% of their charging at their residence.
- 45% of respondents living in a multi-unit dwelling reported doing less than 25% of their charging at their residence.
- Respondents identified their preference for the location of public charging with the following preferences: 42% along public highways, 37% in shopping and entertainment areas, 10% at work, 7% at multi-unit dwellings, and 4% at government facilities.

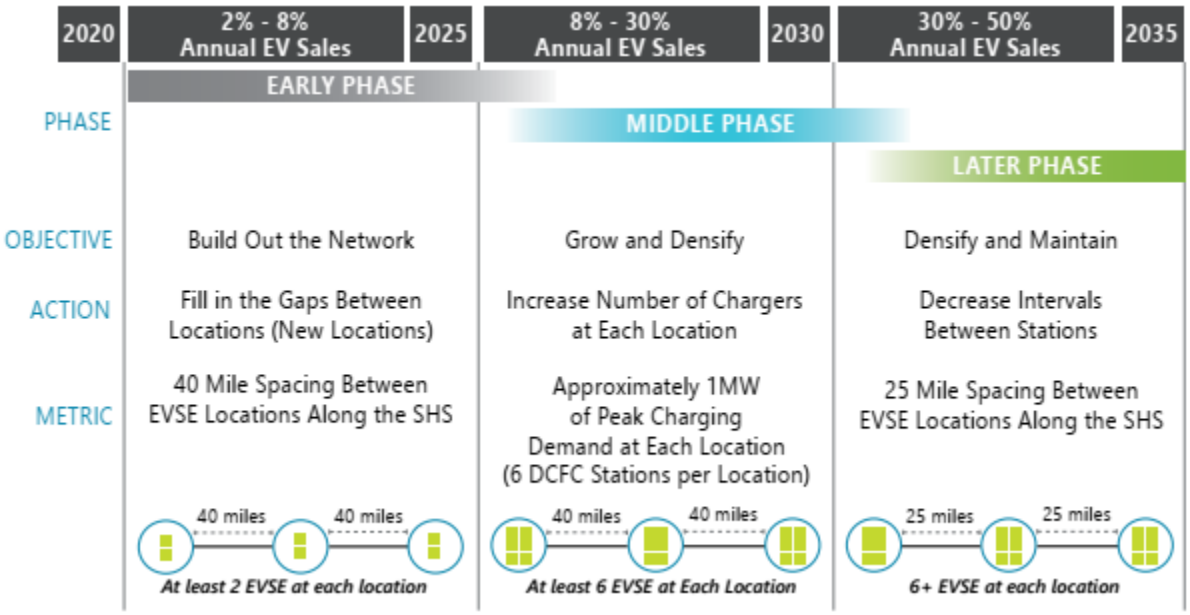
Florida Department of Transportation EV Infrastructure Master Plan (2021)

Florida Department of Transportation (FDOT) developed the Electric Vehicle Infrastructure Master Plan (EVMP) in 2021 to identify needs and opportunities for EV charging station infrastructure along the State Highway System. The EVMP identifies challenges and opportunities for EV charging infrastructure. The objectives of the EVMP are to:

- Support short-range and long-range EV travel as well as emergency evacuation in the state
- Adapt state highway infrastructure consistent with market demand
- Ensure availability of adequate and reliable EV charging stations

The EVMP developed a framework to expand the EV charging infrastructure network along the State Highway System, as shown in Figure 15. In the initial phase of development, the objective is to build out the network. As the network develops, the objective shifts to increasing the density of the network and maintaining the network. By 2035, the plan expects 30-50% of new vehicle sales to be EVs.

Figure 15. FDOT EVMP Plan



The EVMP includes considerations for installation plans, fleet vehicle transitions, utility regulations, and evacuations. The EVMP includes gap analyses for DCFC chargers along the State Highway System and Level 2 charging within urban areas. Recommendations and work completed for the EVMP that may be especially relevant for the Hillsborough EVIP include:

- Gap analysis for DCFC and Level 2 charging stations
- Model building and zoning code language
- EV-ready parking requirements
- Consumer-oriented education and outreach program
- LRTP guidance

FDOT Electric Vehicle Infrastructure Deployment Plan (2022)

In 2022, FDOT developed the Electric Vehicle Infrastructure Deployment Plan (Deployment Plan), Florida's framework for implementing the National Electric Vehicle Infrastructure Program (NEVI). The Deployment Plan focuses on DCFC stations located along federally recognized Alternative Fuel Corridors (AFC). Candidate sites will be determined through ongoing public and partner engagement, with the primary focus being along the Interstate system. The basic requirements that charging infrastructure must meet to qualify for NEVI Program funds includes at least four 150 Kwh DCFC chargers capable of operating simultaneously that are no more than 1 mile driving distance from the designated AFC, spaced no more than 50 miles apart, with a reliability of operations greater than 97%, among other considerations[49].

The NEVI program requires 40% of benefits of investments to go to disadvantaged communities as defined by the JOET Justice40 data.

AFCs in Hillsborough County are shown in Figure 16. FDOT identified gaps in NEVI compliant stations along major interstates in Hillsborough County including I-4, along with other interstates throughout the State. The gaps within Hillsborough County are also shown in Figure 16, and are referred to as "Pending" in the EV Corridor Designation legend. FDOT intends to use NEVI funding to fill these gaps in the 1st year of the NEVI program. NEVI funding can be used to implement stations along other AFCs in subsequent years.

[49] Federal Highway Administration. (February 2022). *National Electric Vehicle Infrastructure Formula Program: Program Guidance*. https://www.fhwa.dot.gov/environment/alternative_fuel_corridors/nominations/90d_nevi_formula_program_guidance.pdf

Figure 16. Alternative Fuel Corridors, Justice40 Disadvantaged Communities, and Existing DCFC Chargers in Florida

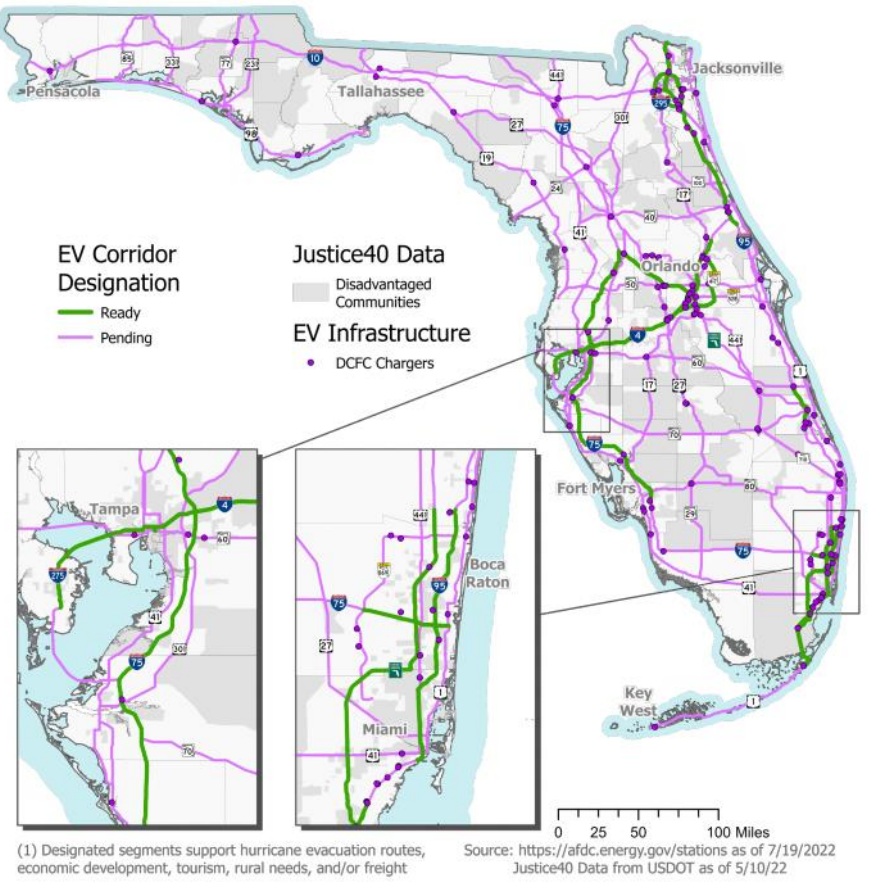


Figure 2: Florida's DCFC Locations within one-mile of an AFC

The Deployment Plan identifies several considerations related to stakeholder needs that should be considered at each identified site including:

- Hurricane evacuation routes and AFC connectors to Interstates
- Utility readiness and alignment with utility expansion plans
- "Smart hub" locations with regional charging nuclei, to fill gaps in high-traffic areas
- Safety considerations and access to amenities and other services

The Deployment Plan identifies other programmatic actions that should be taken in addition to installing charging infrastructure, including:

- Developing a program for mobile charging
- Building a redundant and resilient charging network
- Monitor trends and data to inform planning
- Engage with stakeholders
- Develop the workforce

USDOT Charging Forward – A Toolkit for Planning and Funding Rural Electric Mobility Infrastructure (2022)

This toolkit is intended to help rural communities scope, plan, and fund EV charging infrastructure. Today, the rate of EV adoption in rural areas is about 40% lower than urban areas. As a county with both urban and rural areas, Hillsborough County must consider the needs, barriers, and opportunities for rural charging.

The USDOT guidance identifies common tourist destinations in rural areas as including public lands such as national and State parks, national forests, wildlife refuges, and monuments. Charging stations can also be installed in gateway communities that lead to these destinations. Federal land management agencies can use the General Service Administration's Blanket Purchasing Agreement to acquire EVSE. Coordination with local branches of federal land management agencies will be a critical step in ensuring that many rural recreational areas are served by EV charging infrastructure. Renewable energy sources and off-grid charging are innovative methods for providing sustained EV charging in rural areas and could be combined with communications network coverage to improve the overall connectivity and feasibility of charging infrastructure in rural areas[50]. Many rural areas are also disadvantaged communities, and therefore have special equity considerations for planning and installing charging infrastructure and are also eligible for increased funding through various funding programs.

USDOE National Plug-In Electric Vehicle Infrastructure Analysis (2017)

The United States Department of Energy (USDOE) National Plug-in Electric Vehicle Infrastructure Analysis assesses the quantity of EV charging infrastructure needed in the US. The Analysis considers four specific geographic areas for both public and workplace chargers: Cities (>50,000 population), Towns (2,500 – 50,000 population), Rural Areas, and Interstate Corridors. The Analysis considers a central scenario (that is likely to occur) along with bounding scenarios (that represent the high and low variation that could occur) to understand the sensitivity of the analysis. Several key model variables are delineated for each scenario in Table 6. These key model variables produce useful forecasts for how PHEVs could impact the state of Florida, and the amount of charging infrastructure and capability needed to support them.

Table 6. USDOE National Plug-In Electric Vehicle Infrastructure Analysis Modelling Scenarios & Variables

Variable	Central Scenario	Bounding Scenarios
Light Duty Vehicle EV Total (2030)	15 million (20% linear growth)	• 9 million (10% linear growth) • 21 million (30% linear growth)
Share of EVs in Cities	83% (based on existing Hybrid Electric Vehicles)	• 71% (based on existing LDVs) • 91% (based on existing PHEVs)
Home Charging	88%	82%, 85%, 88%

[50] The Federal Communications Commission projects that all of Hillsborough County will have full LTE data coverage to support cellular connectivity of charging infrastructure, as depicted at: https://fcc.maps.arcgis.com/apps/webappviewer/index.html?id=6c1b2e73d9d749cdb7bc88a0d1bdd25b

The analysis contained several assumptions for modelling purposes, including:

- That the spatial dispersion of BEV adoption will be similar to that of PHEV adoption, using trends from the previous decade.
- That all EVs have a home-dominant charging preference, resulting in 88% of charging occurring at home locations. No distinction is made for multi-unit dwelling residents.
- Level 3 / DCFC charging availability coverage was estimated with a ratio of 56 stations per 1,000 square miles (which equates to stations approximately 3 miles apart).

The Analysis concluded that communities are expected to have significantly larger charging infrastructure requirements than Interstate corridors. The Analysis suggests that organizations planning for charging infrastructure need to be aware of the importance of consumer preferences with respect to electric range and charging behavior. The Analysis suggests that planners focus on providing adequate charging coverage (particularly DCFC) and monitor station utilization over time to increase capacity as the market grows.

FDOT Florida Transportation Plan (2022)

The Florida Transportation Plan (FTP) is the overarching plan guiding Florida's transportation future. The FTP includes strategies and visions related to the adoption of electric vehicles for personal and freight mobility. Several key takeaways from the FTP include:

- By 2030 automobile manufacturers expect upwards of 50% of global vehicles sales will be electric.
- By 2030 medium- and heavy-duty trucks will be cheaper to buy, operate, and maintain as zero emissions vehicles.
- In 2018, 32,000 EVs were sold in Florida making up 2.4% of total vehicle sales.
- In the FTP Visioning section, a key strategy that will be considered is "Leveraging emerging technologies and business practices, such as automated, connected, **electric**, and shared vehicles, to **improve safety**, **mobility**, and **accessibility**."
- To mitigate risks to the transportation system, Florida will update emergency management plans to reflect increasing use of technologies such as electric vehicles.
- To close system gaps, improve connections between modes and systems, and support complete end-to-end trips for people and freight, Florida will expand statewide access to mobility solutions through mobility hubs, micromobility stations, and EV charging stations.
- Develop funding mechanisms other than fuel tax.
- A priority implementation action to transform major corridors and hubs is to expand alternative fuel infrastructure at locations including seaports, intermodal logistics centers, and major trade corridors.
- A priority implementation action to prioritize people and freight mobility is to update zoning, rules, and procedures to accommodate mobility solutions including electric vehicles.

Neighboring Agency EV Readiness

City of Orlando

Orlando Electric Vehicle Readiness Policy (2022)

The City of Orlando implemented an Electric Vehicle Readiness policy, effective January 1, 2022, to provide widespread access to EV charging throughout the city. This policy requires future developments of commercial and multifamily housing in Orlando to be equipped to support EV use. The EV Readiness code requires 2% of parking spaces to be equipped with EV charging stations (in parking lots with at least a certain number of spaces) and 10% or 20% of parking spaces to be built "EV Capable", in commercial/industrial or multifamily

housing uses respectively. "EV Capable" means there is dedicated capacity in the electrical panel and conduit running to future EV charging spaces.

Orlando's 2030 Electric Mobility Roadmap (2021)

The City of Orlando E-Mobility Task Force identified four goals and associated indicators related to the development of EV charging infrastructure, summarized Table 7.

Table 7. Orlando 2030 Electric Mobility Roadmap Goals, Targets, and Indicators

Goal	Targets/Indicators
Provide equitable and affordable access to e-mobility.	/ 100% of Orlando residents live within 10-minute walk of a Level 2 public charging station or 10-minute drive of a DCFC by 2030. / Proportion of e-mobility adoption and use by demographics match city demographics (race, income) by 2030. / 100% of disadvantaged communities are served by electric buses by 2030.
Accelerate EV adoption in multiple transportation sectors	/ 30% of all light-duty registered vehicles in Orlando are electric by 2030, and 80% by 2050. / City and Orlando Utilities Commission (OUC) establish 100% light-duty fleet procurement policy by 2025; perform a medium- and heavy-duty transition analysis by 2025. / 30% of goods deliveries are zero emission by 2030.
Develop a robust charging ecosystem	/ City has 1,400 Level 2 public ports and 250 DCFC public ports by 2030. / City has 200 city-owned Level 2 public ports and 40 DCFC public ports by 2030.
Advance multimodal e-mobility options	/ Transit and school bus fleets are all electric by 2040. / 75% of commute trips are zero emission (walking, biking, electrified transit or shared mobility, EV, or avoided) by 2030.

The Task Force identified a variety of strategies to meet these goals including:

/ Develop ongoing engagement and outreach processes with disadvantaged communities,
/ Advance fleet electrification,
/ Pass EV Readiness land development code,
/ Incentivize new development to include e-mobility access, and
/ Pursue additional charging hubs.

The Roadmap identifies some barriers to EV adoption including:

/ Insufficient access to charging options. Nationwide, 28% of respondents say lack of charging at home prevents them from buying an EV and 48% say lack of public charging stations prevents them.
/ Limited range on vehicles. Nationwide, 2842 of respondents say insufficient vehicle range prevents them from buying an EV.

The Roadmap includes a discussion of EV adoption in Orlando compared to Florida and the United States. The adoption of EVs by zip code was also considered relative to the portion of people of color, type of residence (single unit or multi-unit), and income. Ongoing initiatives are summarized by the partner involved in the program, including the utility company, transit agency, expressway authority, and other agencies.

Under the Roadmap, two adoption scenarios from the National Renewable Energy Laboratory (NREL) were applied to Orlando's estimated baseline condition to estimate the number of personal electric vehicles registered in the city by 2025 and by 2030. These adoption rates are substantially higher than those relied on by FDOT and Florida Department of Agriculture and Consumer Services. The chosen adoption rates would better enable the city to reach its ambitious climate goals. NREL's EVI-Pro Lite online tool was used to estimate the number of Workplace Level 2, Public Level 2, and DCFC ports needed by 2030.

An analysis of public EV charging coverage is included which considered 10-minute walksheds around Level 2 stations and 10-minute drive sheds around DCFC stations.

Pinellas County

Pinellas County has supported EV adoption through acquiring seven battery electric vehicles and three plug-in hybrid electric vehicles for County operations, with plans to transition the whole light-duty vehicle fleet to EVs over the next 10 years.

Pinellas Suncoast Transit Authority

Pinellas Suncoast Transit Authority (PSTA) leads Florida with the largest fleet of hybrid buses and plans to eliminate all diesel buses from its fleet by 2033. Each electric bus saves PSTA about $20,000 a year in diesel fuel costs[51]. As of 2021, PSTA had six battery powered electric buses. The PSTA Board of Directors approved a contract to purchase 60 electric buses by 2027, with 14 buses on order for delivery in 2023[52].

In 2022, PSTA announced an agreement with Duke Energy Sustainable Solutions to install, maintain, and operate electric bus charging infrastructure[52].

Sarasota County

Sarasota County has supported EV adoption through resolutions, installation of charging stations, and education programs. The County also added an EV to its light duty fleet and plans to add an additional 7 EVs. The ChargeUP! Sarasota County program provides rebates (up to $4,000) to certain types of site hosts for the installation of EV charging stations. Eligible locations include tourism attractions, hotels, retail hubs, community centers, government properties with visitors, and major employers (more than 150 employees).

[51] Rank, S. (2021, February 1). PSTA. *PSTA Rolls Out Four New Electric Buses.* https://www.psta.net/about-psta/press-releases/2021/psta-rolls-out-four-new-electric-buses/

[52] Duke Energy. (2022, July 29). Duke Energy. *Pinellas Suncoast Transit Authority Continues to Go Green.* https://news.duke-energy.com/releases/pinellas-suncoast-transit-authority-continues-to-go-green

Hillsborough County Infrastructure Inventory

This section outlines the existing and planned electric vehicle charging infrastructure in Hillsborough County, HART Transit fleet and facilities, and the City of Tampa's vehicular parking inventory. This section also includes an assessment of the access to charging infrastructure for disadvantaged communities and underserved areas in Hillsborough County.

Charging Infrastructure

As of January 2023, there are 180 electric vehicle charging stations in Hillsborough County (both unincorporated county and cities), with over 460 charging ports. Fourteen of the charging stations host Level 3 fast charging[53]. The 180 charging stations belong to nine different charging networks, while a few charging stations are non-networked, which is important for drivers, as charging networks typically set charging cost rates for their networks. Some networks offer subscription plans that allow a user to pay a set rate per month and access discounted charging rates. Table 8 delineates the charging stations by network, charging level, and connector type. All the charging stations are depicted in Figure 17.

Table 8. Publicly Available Electric Vehicle Charging Stations in Hillsborough County

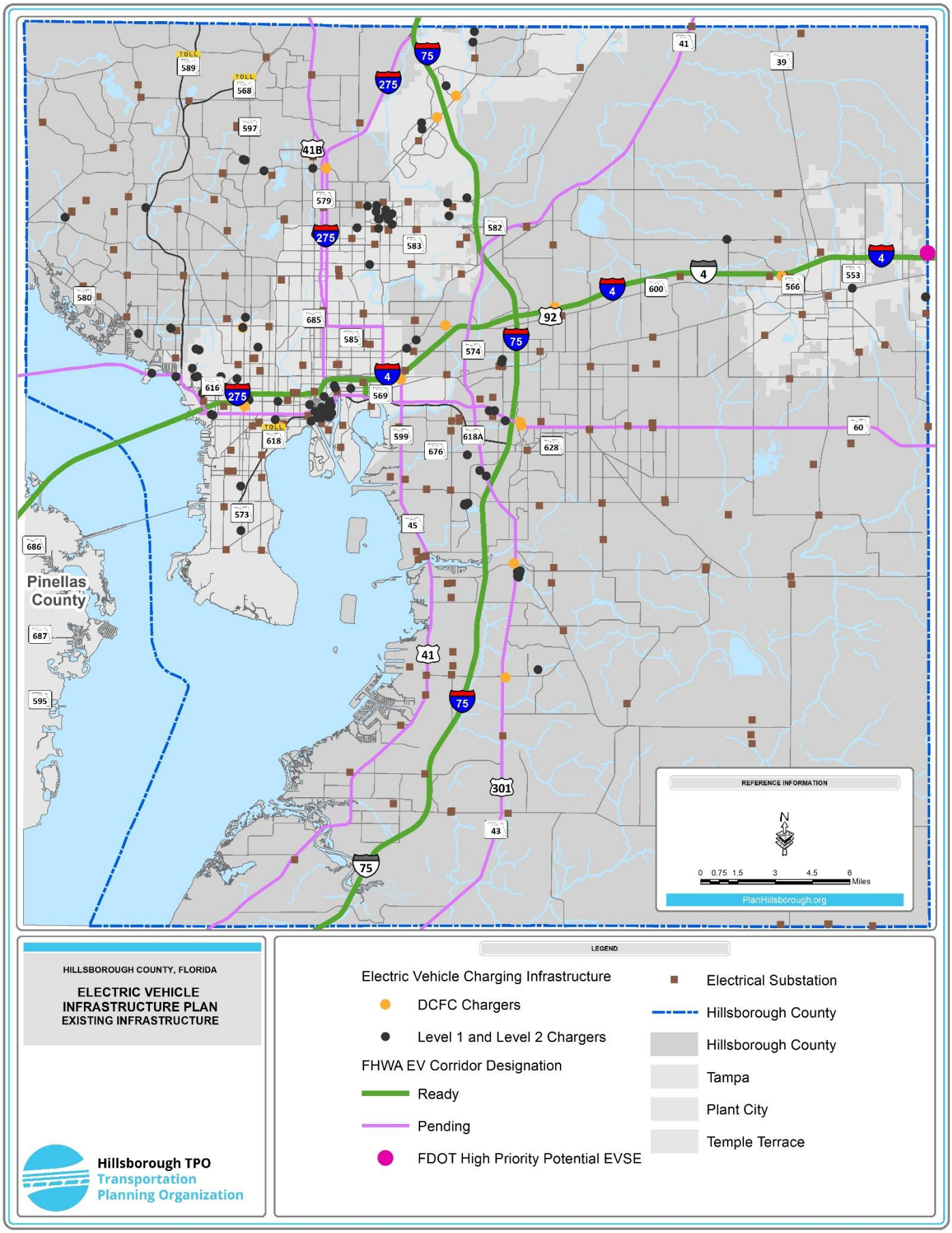
EV Network	Number of Stations	Number of Chargers	Station Levels	Station Connector Types
AMPUP	2	8	Level 2	J1772
Blink	8	12	Level 2	J1772
ChargePoint	99	197	Level 2	J1772
Electrify America	1	8	Level 3	CHADEMO J1772 Combo
eVgo	1	4	Level 3	CHADEMO J1772 Combo
SemaCharge	17	49	Level 2	J1772
Shell Recharge	1	3	Level 2	J1772
Tesla / Tesla Destination	30	57	Level 2 & Level 3	TESLA, J1772
Non-Networked	21	131	Level 1, Level 2, & Level 3	CHADEMO, J1772, CHADEMO J1772 Combo, NEMA515, NEMA520, TESLA

Source: Alternate Fuels Data Center

This figure also displays the designated and pending Federal Highway Administration Electric Vehicle routes in Hillsborough County, which will likely dictate where future fast charging stations are constructed to serve regional travel. As described previously, FDOT recently completed a planning study to determine where electric vehicle charging infrastructure is most needed throughout the state. Figure 17 displays the proposed location of a high priority FDOT EVSE site, along I-4 near Hillsborough County's eastern border.

[53] Florida Department of Environmental Protection. (2023). Diesel Emissions Mitigation Program – Electric Vehicle Charging Infrastructure Phase 1 & Phase 2. https://floridadep.gov/air/air-director/content/demp-volkswagen-settlement-and-dera

Figure 17. Existing and Planned Electric Vehicle Charging Infrastructure



Equitable Access for Disadvantaged Communities

Ensuring equitable access to electric vehicle charging is a critical component of a successful transition to electric mobility in Hillsborough County and across the nation. To support this transition, an interim definition of historically disadvantaged communities ("DACs") has been implemented by the USDOT, in partnership with the USDOE, for the National Electric Vehicle Infrastructure Program (NEVI). This interim, joint working definition of DACs includes combined census tracts from both the DOT and the DOE working definitions, as well as tribal lands and US territories, as consolidated by the Joint Office for Energy and Transportation (JOET) in their Electric Vehicle Charging Justice40 Map[54, 55]. DACs are designated based on six data-driven categories: transportation, health, environment, economic, resilience, and history[56]. In Hillsborough County, 137 Census tracts are designated as DACs.

The Hillsborough TPO, as part of their Nondiscrimination and Equity Plan[57], created an index of the most underserved areas in the County, analyzed at the Census Block group geography, based on demographic and environmental justice measures. These areas are categorized by how many 90th-percentile 'characteristics' are met.

To understand where the existing and planned electric vehicle charging infrastructure is located in relation to identified equity areas, the displayed infrastructure from Figure 17 was combined with the mapped communities to determine the equitable distribution of charging infrastructure. Figure 18 depicts the planned and existing infrastructure overlaid with the equity communities. As depicted below, many of the areas designated as DACs and underserved areas overlap. There are 62 charging stations that are located within either a DAC, an underserved area, or both. Of these, 53 are Level 2 charging stations and 9 are DCFC charging stations.

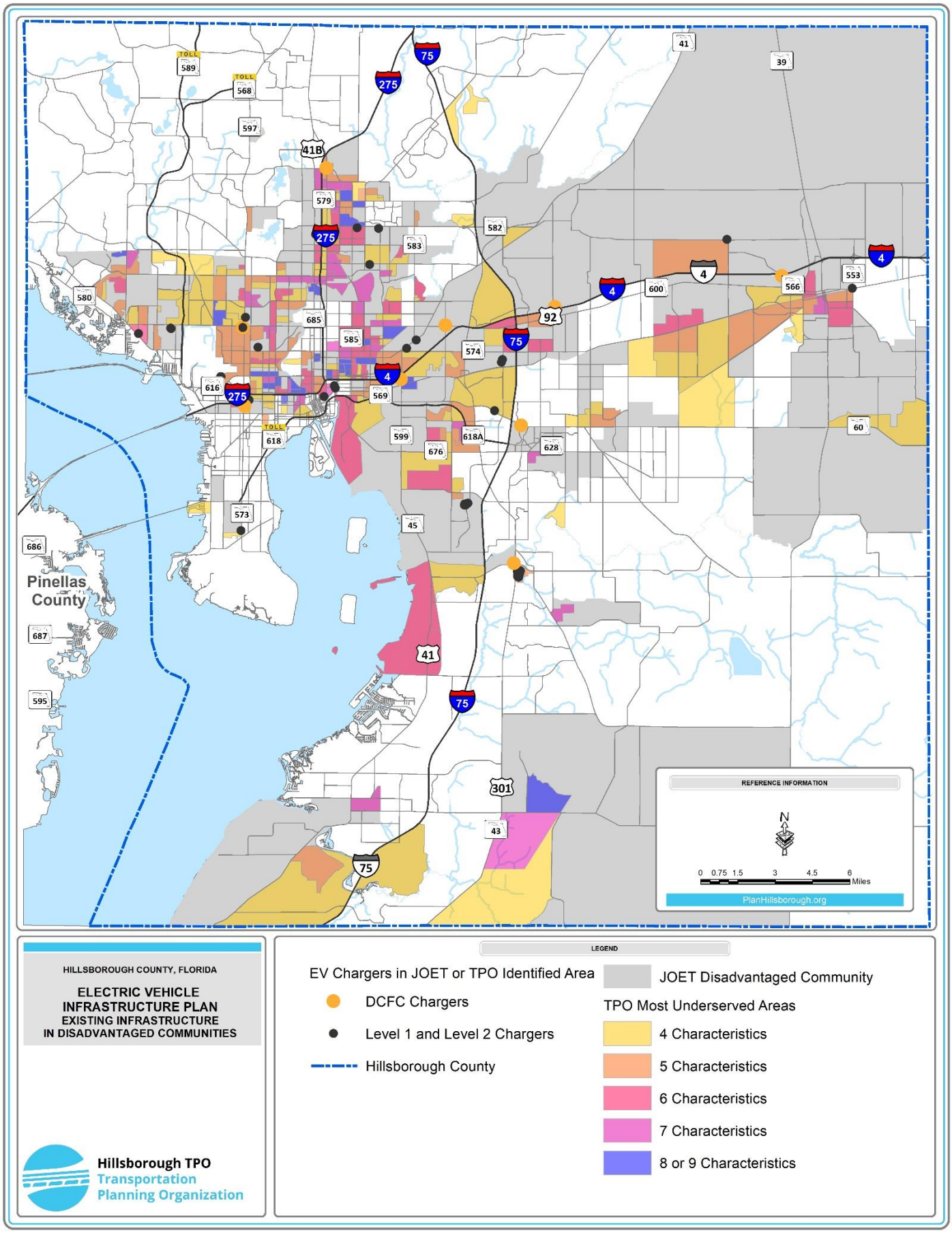
[54] Argonne National Laboratory. (ND). *Electric Vehicle Charging Equity Considerations.* https://www.anl.gov/esia/electric-vehicle-charging-equity-considerations

[55] Joint Office of Energy and Transportation. (May 2022). *Electric Vehicle Charging Justice40 Map*. Electric Vehicle Charging Justice40 Map (arcgis.com)

[56] United States Department of Transportation. (November 2022). *Justice 40 Fact Sheet*. https://www.transportation.gov/sites/dot.gov/files/2022-11/Justice40_Fact_Sheet_v1.2pptx.pdf

[57] Hillsborough Transportation Planning Organization. (August 2021). Plan Hillsborough Nondiscrimination & Equity Plan. https://planhillsborough.org/wp-content/uploads/2021/08/August2021_Nondiscrimination_Equity_Plan.pdf

Figure 18. Existing EV Infrastructure in Equity Communities

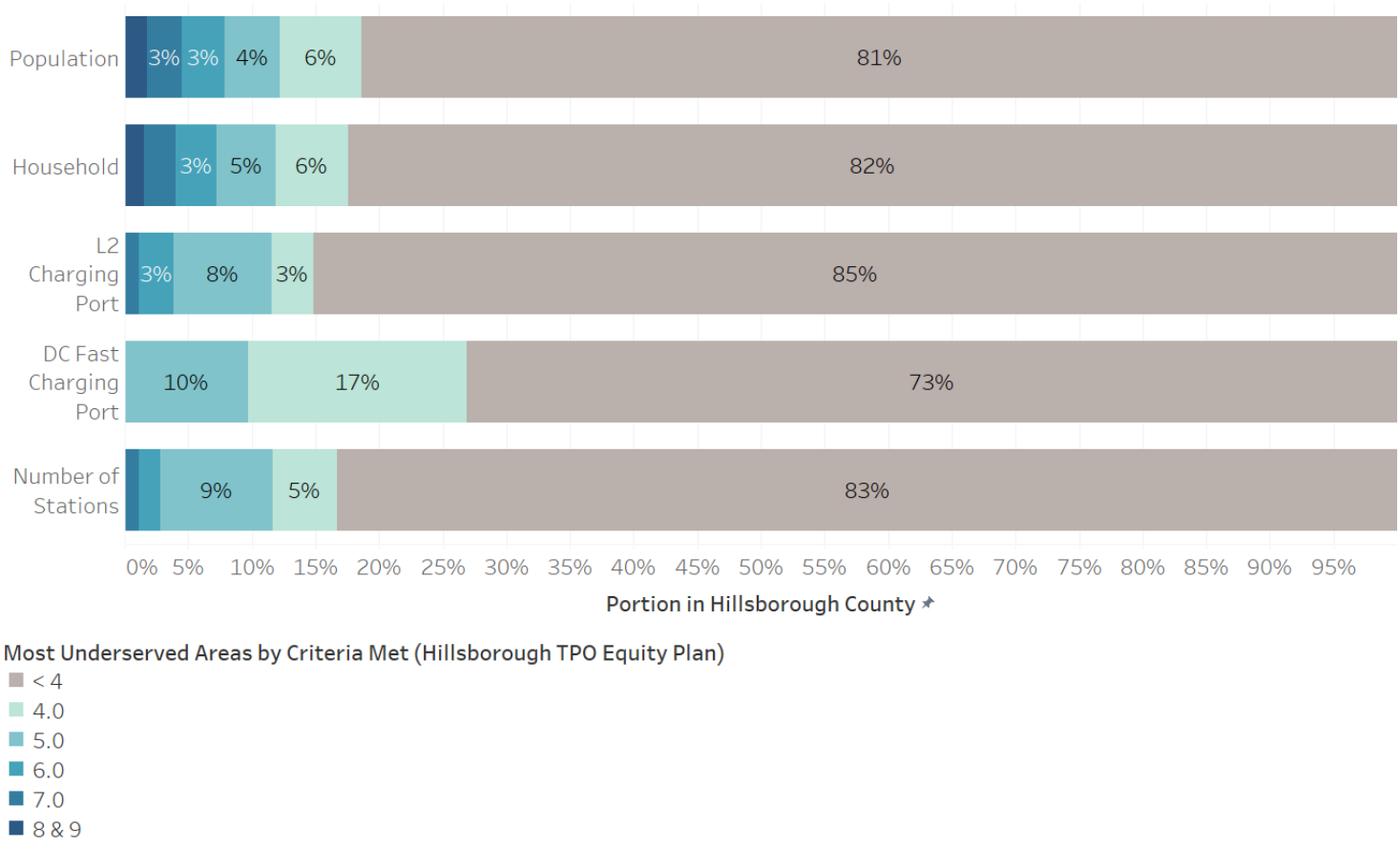


The distribution of charging ports in disadvantaged communities is compared to the distribution of population and households in Hillsborough County in Figure 19 and Figure 20. An equitable distribution of charging stations in Hillsborough County will serve all residents.

In Figure 19 several statistics are shown, considering a categorization of Census Block groups by the number of criteria met for underserved areas in the Hillsborough TPO Equity Plan. For example, considering the population in Hillsborough County, 2% of people live in Census Block groups that meet 8 or 9 of the criteria from the TPO Equity Plan, 3% of people live in areas that meet 7 criteria, 3% of people live in areas that meet 6 criteria, 4% of people live in areas that meet 5 criteria, 6% of people live in areas that meet 4 criteria, and 81% of people live in areas that meet less than 4 criteria. The portion of households, Level 2 charging ports, DCFC ports, and EV charging stations in areas that meet each number of criteria are also shown.

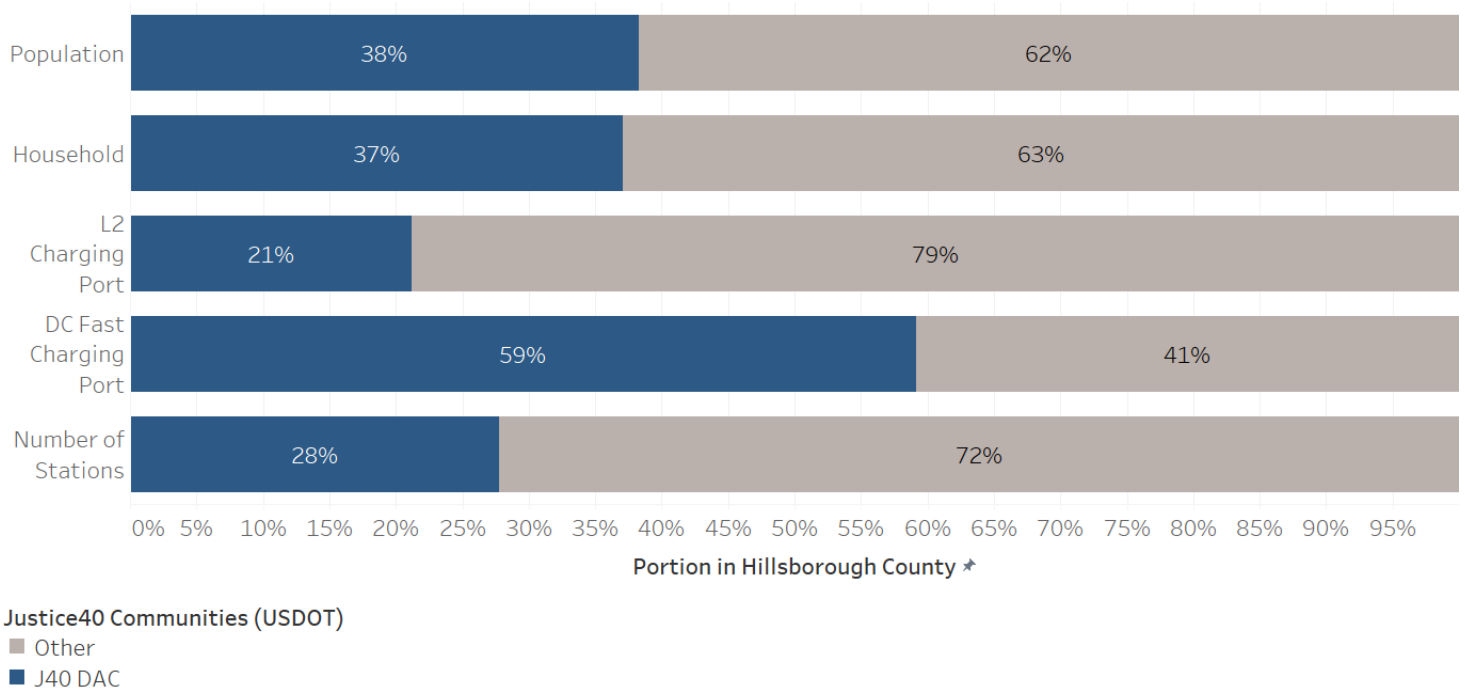
As shown in Figure 19, about 8% of the population in Hillsborough County lives in Census Block groups that meet at least 6 criteria from the Equity Plan. However, only 4% of L2 charging ports, 0% of DCFC ports, and 3% of EV charging stations are located in Census Block groups that meet at least 6 criteria from the Equity Plan. Therefore considering solely the location of charging stations, underserved areas tend to have fewer DC Fast Charging ports, Level 2 Charging Ports, and EV charging stations compared to the portion of the population and households in Hillsborough County who live there. This suggests that at a high-level, people who live in underserved areas tend to have less convenient access to EV charging infrastructure. This analysis only considers the 'home' location for residents and does not consider the convenience of EV charging infrastructure to wherever someone may go regularly. For example, this analysis would not account for charging infrastructure located at someone's workplace.

Figure 19. Distribution of Charging Infrastructure and Population in Hillsborough County (by TPO Equity Plan Metrics)



In Figure 20, several statistics are shown, considering a categorization of Census Tracts as being included in the USDOT Justice40 definition of disadvantaged communities. As shown in Figure 20, about 38% of the population in Hillsborough County lives in Census Tracts defined as disadvantaged communities under the USDOT Justice40 definition. However, only 21% of L2 charging ports and 28% of EV charging stations are located in Census Tracts that are defined as disadvantaged communities. Therefore Census Tracts that meet the USDOT Justice40 criteria tend to have fewer Level 2 charging ports compared to the population and number of households. Dissimilarly, areas that are defined as disadvantaged communities tend to have more DC Fast Charging ports than their relative population and number of households.

Figure 20. Distribution of Charging Infrastructure and Population in Hillsborough County (by USDOT Justice40)



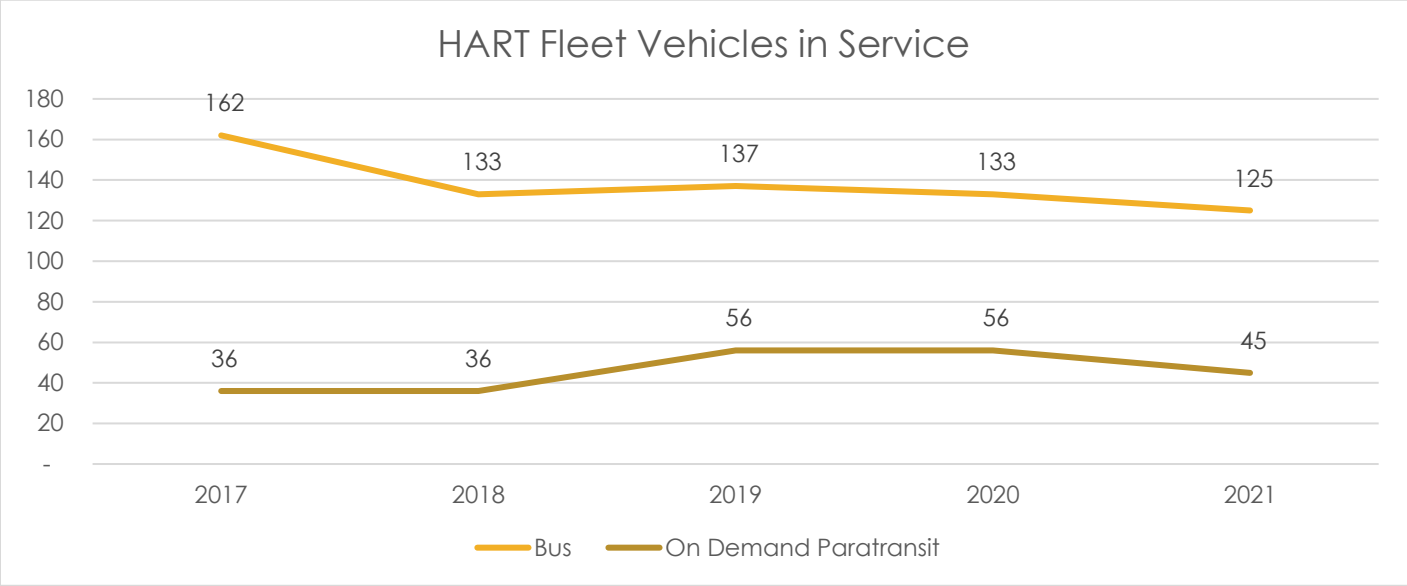
"Electric Bus Charging Station. Photo Credit: PSTA"

HART Fleet & Facilities

Hillsborough Transit Authority (HART) is the public transit provider within the Hillsborough TPO planning area. Currently, HART operates 27 local fixed route, seven limited express routes, one bus rapid transit (BRT) route, and paratransit on-demand service[58]. Across HART's service area, there are over 3,300 bus stops, with nine transit centers and twenty-two Park & Ride facilities. These routes, along with the stops, centers, the HART Maintenance & Operations Facility, are depicted on Figure 22.

To service all these destinations, including the demand-response paratransit locations, HART maintains an annual fleet of, on average, 187 vehicles[59]. Figure 21 displays the trends in fleet size by year and type of vehicle. Currently, HART has a fleet of 132 forty-foot compressed natural gas (CNG) and diesel buses. Fixed route buses travel an average of 205 miles daily, ranging from about 100 to 300 miles daily. HART also operates a demand response van fleet with 83 gasoline-powered 23-foot cutaway vans.

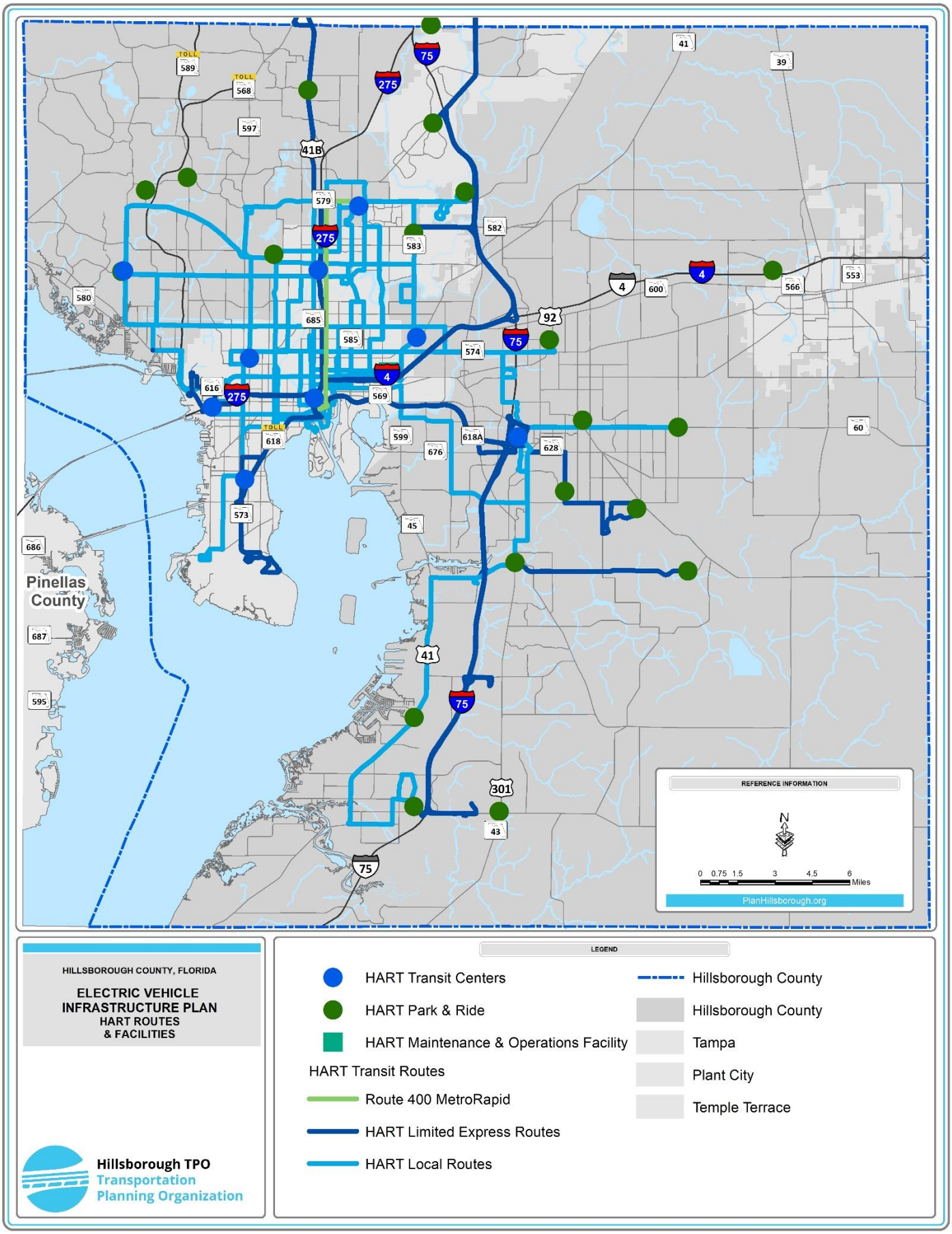
Figure 21. HART Fleet Vehicles in Service (2017 - 2021)



[58] Hillsborough Transit Authority. *HART Takes You There*. http://www.gohart.org/Pages/AboutUS-HART.aspx

[59] National Transit Database. (January 2023). HART Agency Profiles 2017 – 2021. https://www.transit.dot.gov/ntd/transit-agency-profiles/hillsborough-area-regional-transit-authority

Figure 22. HART Services and Facilities



In HART's 2017 *Operations and Maintenance Feasibility Study*, the existing Operations and Maintenance Facility is described as "operating above maximum capacity" for its average fleet size of 200 vehicles. Additional funding is needed for an additional satellite maintenance facility for future fleet expansion[60]. Additionally, this document states that it is "HART's policy to continue purchasing vehicles that are fueled by CNG as the fleet is updated", rather than gasoline or diesel fuels. As such, all scenarios and site selection included in this study consider CNG refueling requirements but exclude the considerations of electric vehicles.

The *HART Transit Development Plan FY2022* (TDP) states that in December 2020, HART was awarded a $4.3 million FTA Bus and Bus Facilities Grant to replace 16 existing diesel buses with new compressed natural gas (CNG) buses[61]. While not a zero emissions fuel, CNG is considered an alternate fuel to gasoline and diesel, with lower greenhouse gas emissions.

However, the following year, HART was awarded a $2.7 million FTA Low or No Emissions Vehicle Grant to purchase four electric buses. As part of the *FY 2027 Hillsborough TPO Transportation Improvement Program* (TIP), HART submitted funding requests for additional electric buses and charging infrastructure but has not yet released a transit electrification plan that outlines specific charging infrastructure needs or planned fleet inventory. The TDP also states that its top priority unfunded project is the replacement of 325 buses and paratransit vans with energy-efficient vehicles – both CNG and EVs. This project needs an estimated $195 million, with an additional $1 million needed for charging infrastructure at all transit centers and $70 million needed for a maintenance facility to service the vehicles.

Understanding the opportunities and deficiencies of the existing HART facilities, especially the Maintenance & Operations Facility will be crucial towards successfully transitioning the HART fleet towards lower emission fuels.

Public Vehicular Parking Facilities

Public vehicular parking is an important asset in the Hillsborough TPO planning area, as the combination of on-street spaces and off-street lots and garages provide necessary facilities that support the economic vibrancy of the region. This section focuses on public vehicular parking in the City of Tampa, as theirs was available for use in this Plan. Many of these parking facilities indicate trip attractors such as schools, places of work, shops, recreation, government services, and more. Existing on and off-street vehicular parking present ideal opportunities for electric vehicle charging retrofits, as they already provide space for vehicles in places that people already park for stretches of time. Figure 23 displays both the on-street and off-street parking facilities in the City of Tampa. It is noteworthy that some public parking garages already have EV charging available, which is further detailed in Table 9. In the City of Tampa, there are over 1,880 on-street parking spaces, none of which currently are EV charging stations. This supply presents an enormous opportunity for providing convenient and accessible EV charging throughout the city.

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[60] Hillsborough Transit Authority. (June 2017). *HART Operations and Maintenance Feasibility Study.* http://www.gohart.org/PlanningDocuments/Final%20HART%20OM.pdf

[61] Hillsborough Transit Authority. (August 2021). *FY2022 – FY2031 Transit Development Plan Annual Update.* http://www.gohart.org/PlanningDocuments/TDFY22-FY31.pdf

Figure 23. Existing Parking Facilities and EV Charging Stations in Tampa

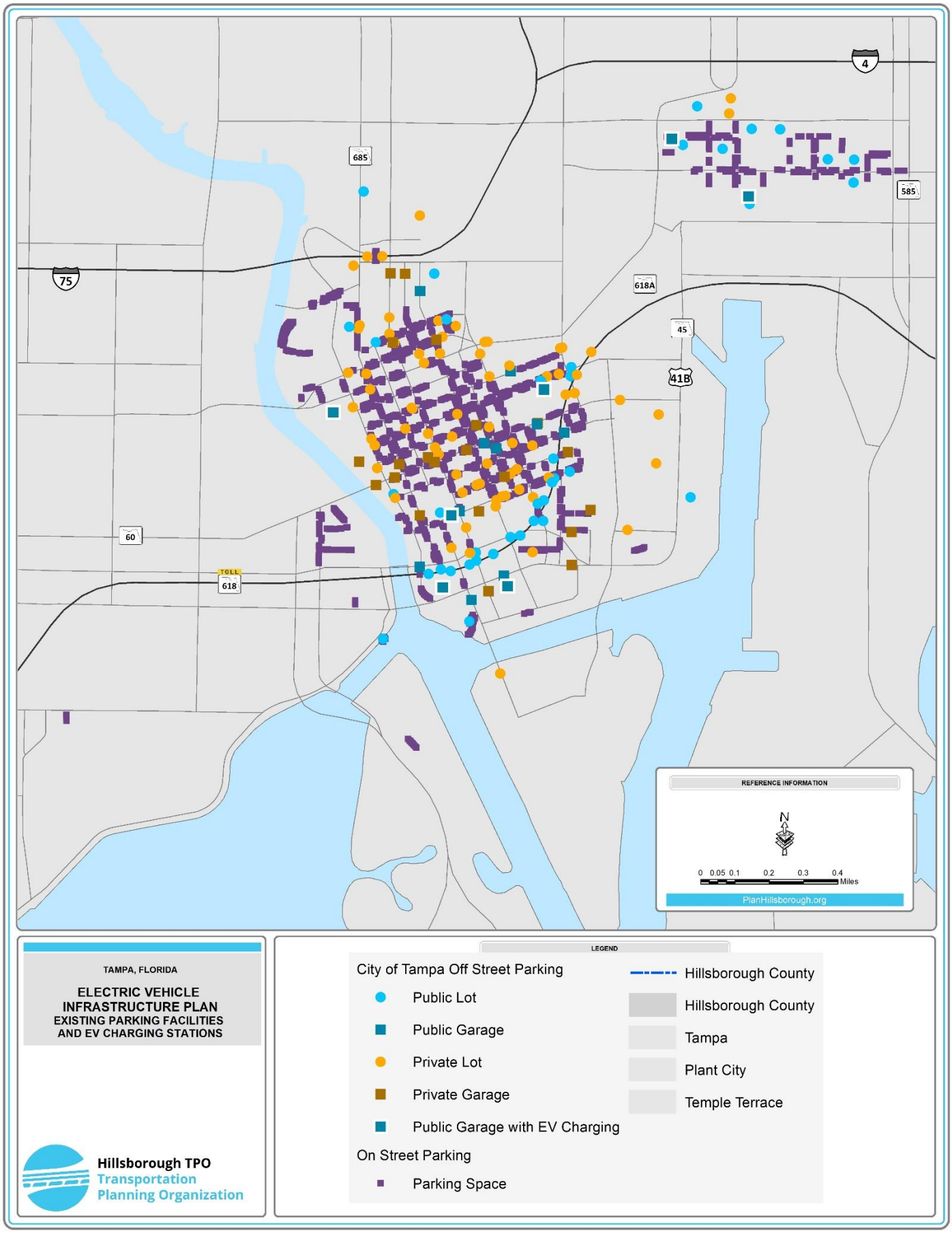


Table 9. Public Parking Garages with EV Chargers in Tampa

Name	Address	Charging Level	Number of Chargers	Connection Types
Twiggs Garage	901 E Twiggs St	Level 2	2	J1772
Palm Fernando Garage	2010 N 13th St	Level 2	2	J1772
Tampa Convention Center Garage	141 E Brorein St	Level 2	2	J1772
Fort Brooke Garage	107 N Franklin St	Level 2	6	J1772
William F Poe Garage	802 N Ashley St	Level 2	4	J1772
Centro Ybor Garage	1500 E 5th Ave	Level 2	2	J1772
Pam Iorio Garage	301 Channelside Dr	Level 2	2	J1772

"Level 2 Charging Equipment in Pierce Street Garage. Photo Credit: Hillsborough TPO"

Local Development & Zoning Regulations

This section documents the current Comprehensive Plan and other land use policies that may impact the implementation of publicly available commercial electric vehicle charging stations. It also reviews guidance from FDOT's *Electric Vehicle Infrastructure Deployment Plan*, published in August 2022. Lastly, it offers collected best practices from other communities. Further information regarding these topics is available in *Appendix B: Additional Information on Local Development & Zoning Regulations*.

Current Plans & Codes

The Comprehensive Plans and Land Development Codes for Unincorporated Hillsborough County, City of Tampa, Plant City, and Temple Terrace present opportunities to better address EV charging to encourage further adoption. The Plans and Codes may be amended to address the inclusion or disallowance of EV charging infrastructure in certain circumstances or land use categories. Key findings are summarized in Table 10.

Table 10. Local Agency Plans & Codes Key Findings

Local Agency	Key Findings
Hillsborough County[62, 63]	/ Policy 6.7.7 of the Comprehensive Plan directly addresses the role that Hillsborough County plays in the electrification of transportation, by stating: "Incentivize the use of electric vehicles through the implementation and expansion of electric vehicle charging stations." / Additional Comprehensive Plan goals and policies address energy efficiency, air quality, and reduced use of fossil fuels, all of which electric vehicles address. / The Hillsborough County Land Development Code does not mention electric vehicles or charging infrastructure at this time.
City of Tampa[64, 65]	/ The Comprehensive Plan does not outrightly address electric vehicles. / Comprehensive Plan goals and policies address energy efficiency, air quality, and reduced use of fossil fuels, all of which electric vehicles address. / In Chapter 15 of Tampa's Land Development Code, the City prohibits all other vehicles except those charging to parking in electric vehicle charging spaces, as per Ord. No. 2011-84, § 6, 7-14-2011 / Other references to electric vehicles similarly address off and on street parking requirements.

[62] Hillsborough County. (September 2022). *Hillsborough County Comprehensive Plan*. https://planhillsborough.org/wp-content/uploads/2021/08/Hillsborough-County-Comprehensive-Plan.pdf

[63] Hillsborough County. (October 2022). *Hillsborough County Land Development Code*. library.municode.com/fl/hillsborough_county/codes/land_development_code

[64] City of Tampa. (November 2022). *City of Tampa 2040 Comprehensive Plan*. planhillsborough.org/wp-content/uploads/2022/10/Adopted-Tampa-2040-Comp-Plan.pdf

[65] City of Tampa. (November 2022). *City of Tampa Land Development Code*. library.municode.com/fl/tampa/codes/code_of_ordinances

Local Agency	Key Findings
Plant City	/ The Comprehensive Plan does not outrightly address EVs. / Goals in the Comprehensive Plan may be affected by the adoption of EVs and increased need for EV charging. / The Land Development Code encourages the development of EV charging spaces. EV charging spaces must be supplied with a working charger and signed to indicate use solely for EV charging. EV charging spaces can be compact spaces.
Temple Terrace	/ The Comprehensive Plan does not outrightly address EVs. / Goals in the Comprehensive Plan may be affected by the adoption of EVs and increased need for EV charging. / The Land Use Development Code does not address EVs or EV charging.

Best Practices

As mentioned in the *Review of Relevant EV Plans* section, the City of Orlando is preparing for electric vehicle readiness through its local policies. In the Orlando Ordinance 2021-47, Section 3G – Electric Vehicle Readiness, the City addresses both quantity and location of EV charging[66]. The ordinance outlines where charging infrastructure will be installed (new developments and substantial remodels), the minimum electrical load capability required, the number of charging spaces required. By clearly outlining how EV charging should be provided within the City limits, Orlando is ensuring that the distribution and capability of its charging network is built out as redevelopment occurs. Further information on the Orlando Ordinance is available in *Appendix B: Additional Information on Local Development & Zoning Regulations*.

Permitting Process

While there is no specific mention of the permitting requirements to install a Level 2 charger in the Hillsborough County Development Services Permitting tool, county staff are familiar with the requirement. Installation of Level 1 charger should not require changes to the electrical system and therefore does not require a permit.

The General Electrical Building Permit applies to all residential installations of a Level 2 charger. This type of permit is used for residential construction, additions, alterations, remodeling and repairs that require electrical work. This permit may be used for projects including electrical service upgrade, generator installation, or replacement of electrical service panels. The residential permit costs $77.

Installing a Level 2 charger at a commercial site, requires a minor site review with an electrical diagram signed in ink by an electrician or engineer. The structure needs to meet design criteria for hurricane force winds. The minor site review process requires a contractor. Electric vehicle charging stations as additions to an existing commercial building are not listed in the permit fee schedule, included as Figure 24, or the Appendix.

[66] City of Orlando. (2021). *Orlando Ordinance 2021-47*. orlando.novusagenda.com/AgendaIntranet/AttachmentViewer.ashx?AttachmentID=107422&ItemID=57297

Figure 24: Hillsborough County's Permit Fee Schedule

Type	Residential Fees	Commercial Fees
New Construction and Additions	See Appendix I	See Appendix I
Alterations and Renovations	See Appendix II	See Appendix II
Electrical (General) For all electrical-related activities not addressed in Appendix I	$77 (maximum one inspection)	$77 (maximum one inspection)
Stand alone- New residential - Electrical	$65	N/A
Multi-Family - Electrical	$77 plus $35 per unit	$77 plus $35 per unit

The installation process for a Level 2 home charging unit is provided by TECO, as summarized below[67]:

1/ **Identify**: Ask your automobile dealer or manufacturer to identify one or more licensed electricians to install charging equipment at your home. You may also contact your own licensed electrician.
2/ **Assess**: Schedule the licensed electrician to perform a home assessment and inspect your electric service. This will help determine the installation location, the amount of work and time required to install and whether your existing electric service can support charging equipment. Most installations will not require a utility upgrade. If a utility upgrade is necessary, your electrician will coordinate with Tampa Electric.
3/ **Permit**: You or your licensed electrician must obtain a permit through the appropriate city or county agency. The process to apply for and receive a permit will vary by jurisdiction. Tampa Electric recommends that you contact your designated permitting office to obtain any specific requirements.
4/ **Install**: Once a permit is secured, the licensed electrician can complete the installation.
5/ **Inspection**: After installation is complete, you or the licensed electrician must contact the permitting office to schedule a final inspection. Charging equipment is typically approved for use as soon as it passes inspection.

"Cars charging in Hillsborough County." Credit: Ryan Casburn, Kittelson & Associates, Inc.

[67] TECO. Charging Options. https://www.tampaelectric.com/company/environment/electricvehicles/chargingoptions/

EV Infrastructure Supportive Lands

A parcel-level analysis was performed to identify appropriate sites for publicly available charging stations, situated on publicly owned lands to reduce barriers to implementation, such as identifying a station host or additional land acquisition. It is important to note that to fully build out the necessary charging infrastructure to support future EV demand, public-private partnerships will likely be necessary to provide additional charging infrastructure on privately held lands. And so, while the evaluated land conditions are public, the analysis does indicate that the same land use context would support EV infrastructure on private land as well. The analysis focuses on current and future activity centers, parks, highway exits, underserved areas, and schools to identify areas to prioritize for EV infrastructure installation. As the Plan development progresses, these locations will be supplemented by results from the public survey. Key findings from the parcel-level analysis include:

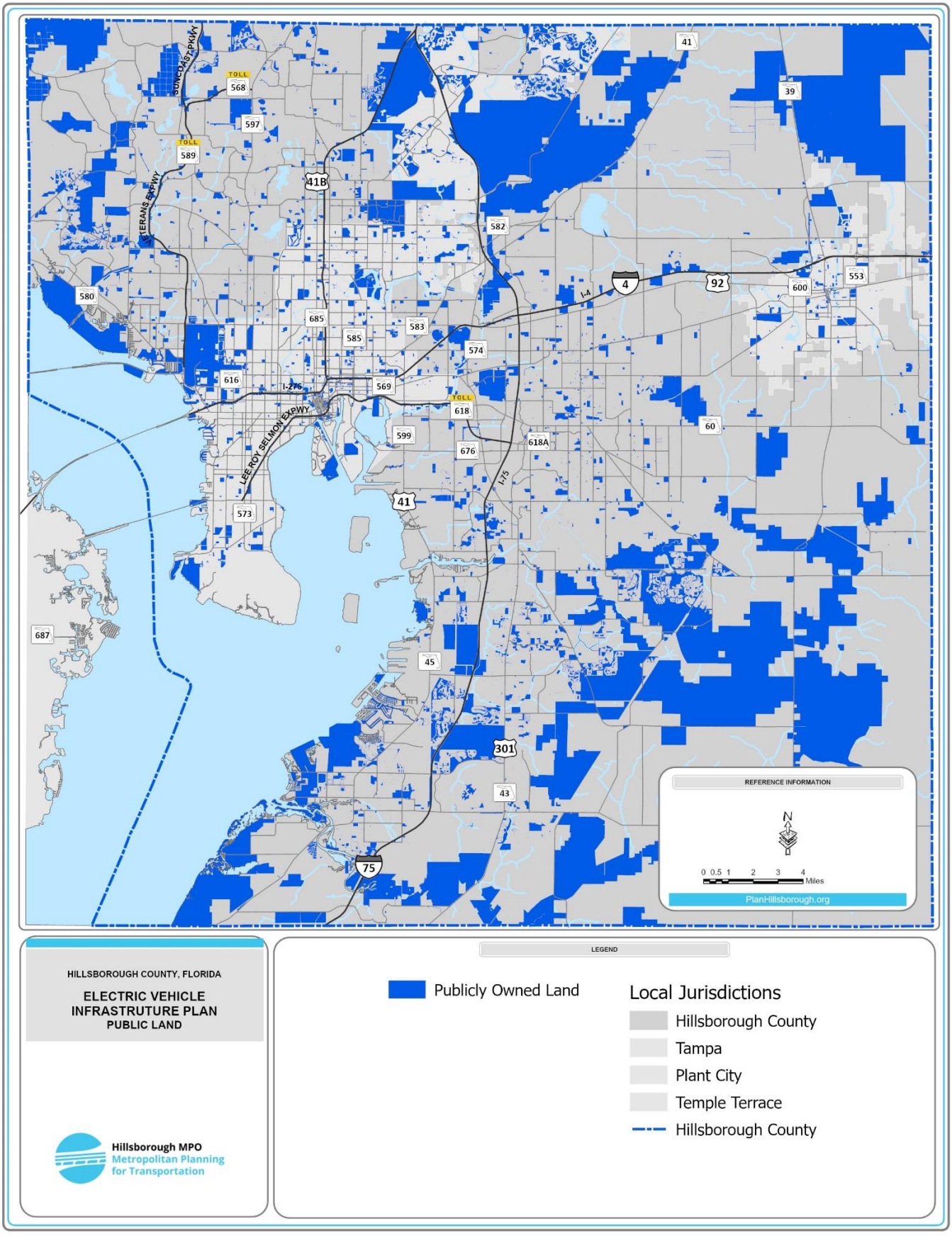
- There are approximately 300,000 acres of publicly owned parcels in Hillsborough County, although much of it is conservation land, wetland, or otherwise unsuitable for charging infrastructure.
- There are about 14,000 acres of publicly owned land in activity centers or Key Economic Spaces, and about 400 acres in both activity centers and Key Economic Spaces. There are about 3,000 acres of publicly owned land in the parcels identified as "Future Activity Centers".
- There are 31 libraries in Hillsborough County, seven of which are in underserved communities.
- There are approximately 10,000 acres of publicly owned land within a half mile of the 74 interchanges in Hillsborough County.
- There are about 11,000 acres of publicly owned land in and adjacent to TPO-identified underserved areas.

Many of these locations could serve as potential places to install EV charging stations. The public parcels identified in this analysis will be used to determine, along with EV demand modelling performed as part of the next step in the Plan, to prioritize locations for EV infrastructure in Hillsborough County.

Existing Land Use and Parcel-Level Analysis

Installing public EV infrastructure on land that is already publicly owned avoids the need for property acquisition. There are approximately 300,000 acres of publicly owned parcels in Hillsborough County, although much of it is conservation land, wetland, or otherwise unsuitable for charging infrastructure. Figure 25 shows publicly owned parcels in Hillsborough County.

Figure 25. Publicly Owned Parcels in Hillsborough County



To identify public land with a high opportunity for successful EV infrastructure development, several factors have been considered:

- Proximity to activity centers with high concentrations of population and employment
- Co-locating with activities (such as parks or libraries) to promote tourism and give users something to do while their vehicle is charging
- Proximity to highway interchanges
- Access for underserved communities

The following sections include maps of publicly owned parcels that meet each of the above criteria. As this analysis has been done at a high level, inclusion on the maps below does not necessarily indicate that the parcel is completely suitable for EV infrastructure. Further evaluation of sites is required before installing charging infrastructure.

Activity Centers

Activity centers are areas with high concentrations of people living, working, and spending time. As there are multiple ways to define activity centers, several types of activity centers have been explored as locations for EV charging infrastructure.

Key Employment Spaces and Current Activity Centers

The Hillsborough TPO identified Key Economic Spaces for the 2045 LRTP, which are defined as "Clusters of at least 5,000 jobs representative of existing employment patterns and areas of future growth potential"[68]. These areas represent high employment densities, but high population densities also indicate opportunities for EV infrastructure. Therefore, another type of activity center has been identified as locations with relatively high density of both population and jobs. They are based on the Hillsborough TPO's Traffic Analysis Zone (TAZ) level population and employment projections for 2025. These activity centers are located around downtown Tampa, Westshore, the University of South Florida (USF), and Brandon. In some cases, they overlap with Key Economic Spaces, indicating areas that may be the most active at all hours.

Figure 26 shows publicly owned parcels within activity centers and Key Economic Spaces. There are about 14,000 acres of publicly owned land in activity centers or Key Economic Spaces, and about 400 acres in both activity centers and Key Economic Spaces.

Future Activity Centers

Future activity centers are those that have been designated as mixed-use and high-density Future Land Uses in the Tampa and Hillsborough County Comprehensive Plans. Figure 27 shows publicly owned parcels within these future activity centers. There are about 3,000 acres of publicly owned land in the parcels shown here.

[68] Hillsborough MPO 2045 Long Range Transportation Plan. https://planhillsborough.org/wp-content/uploads/2017/10/LRTP2045-HMPO-ADA.pdf

Figure 26. Publicly Owned Land Near Activity Centers

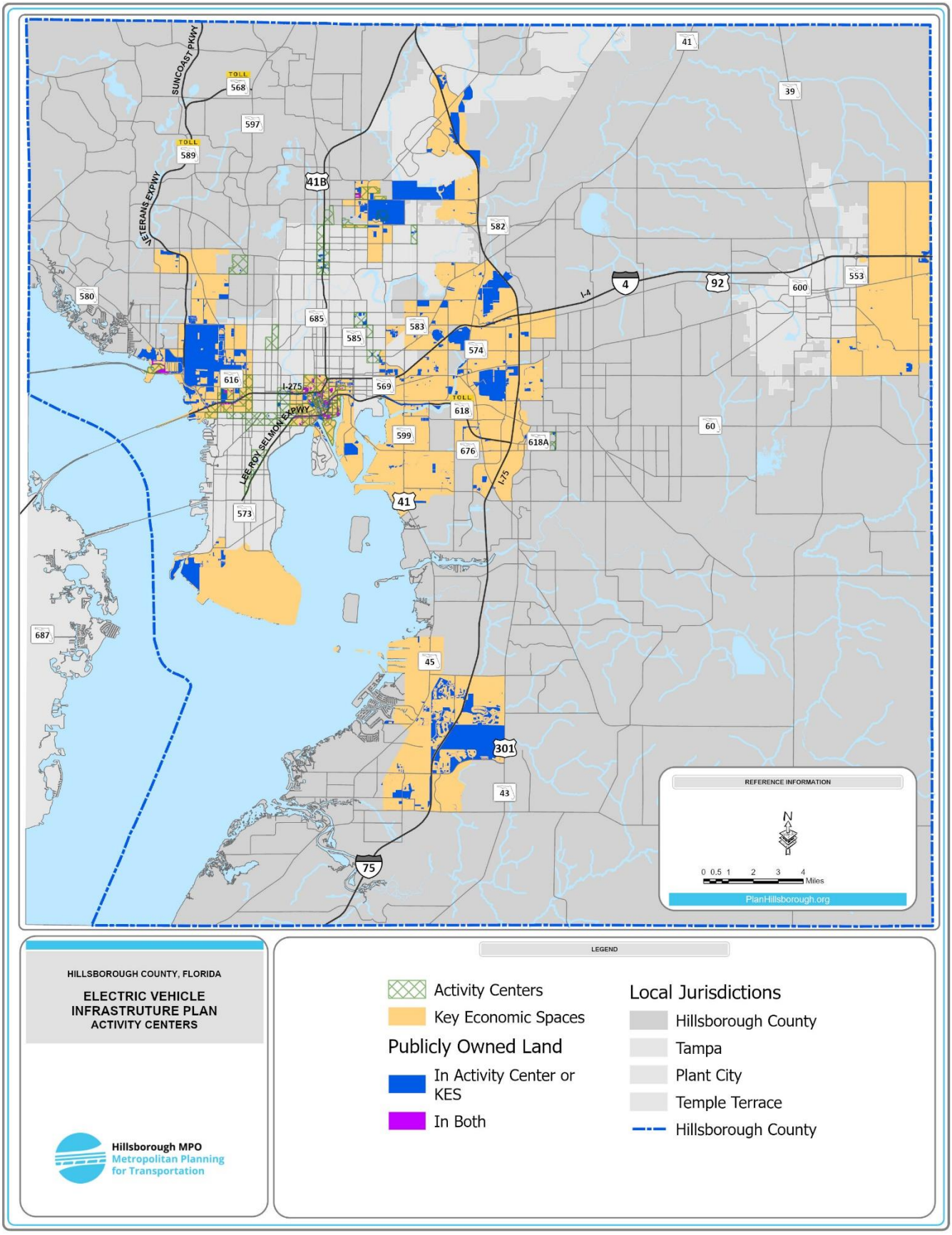
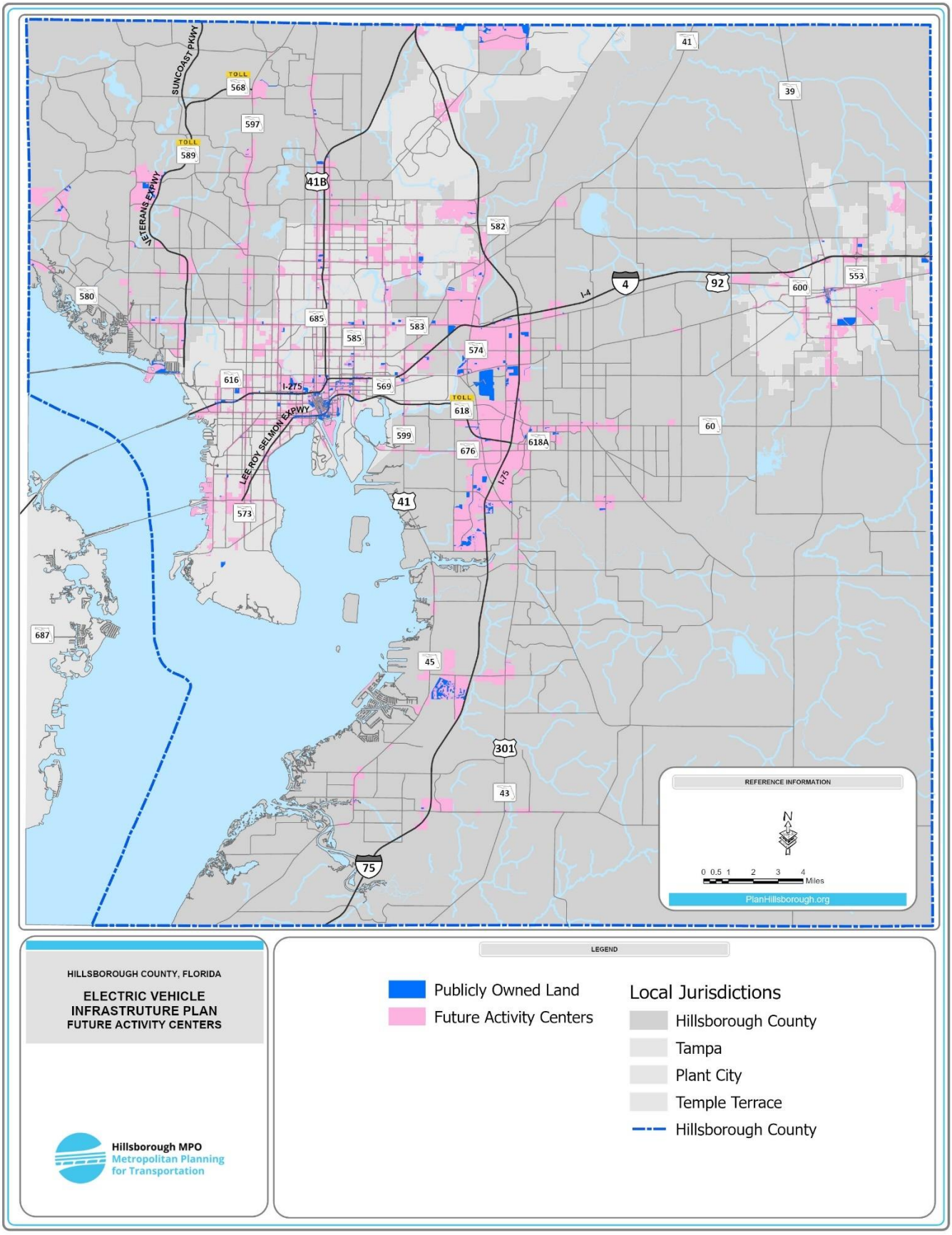


Figure 27. Publicly Owned Land in Future Activity Centers



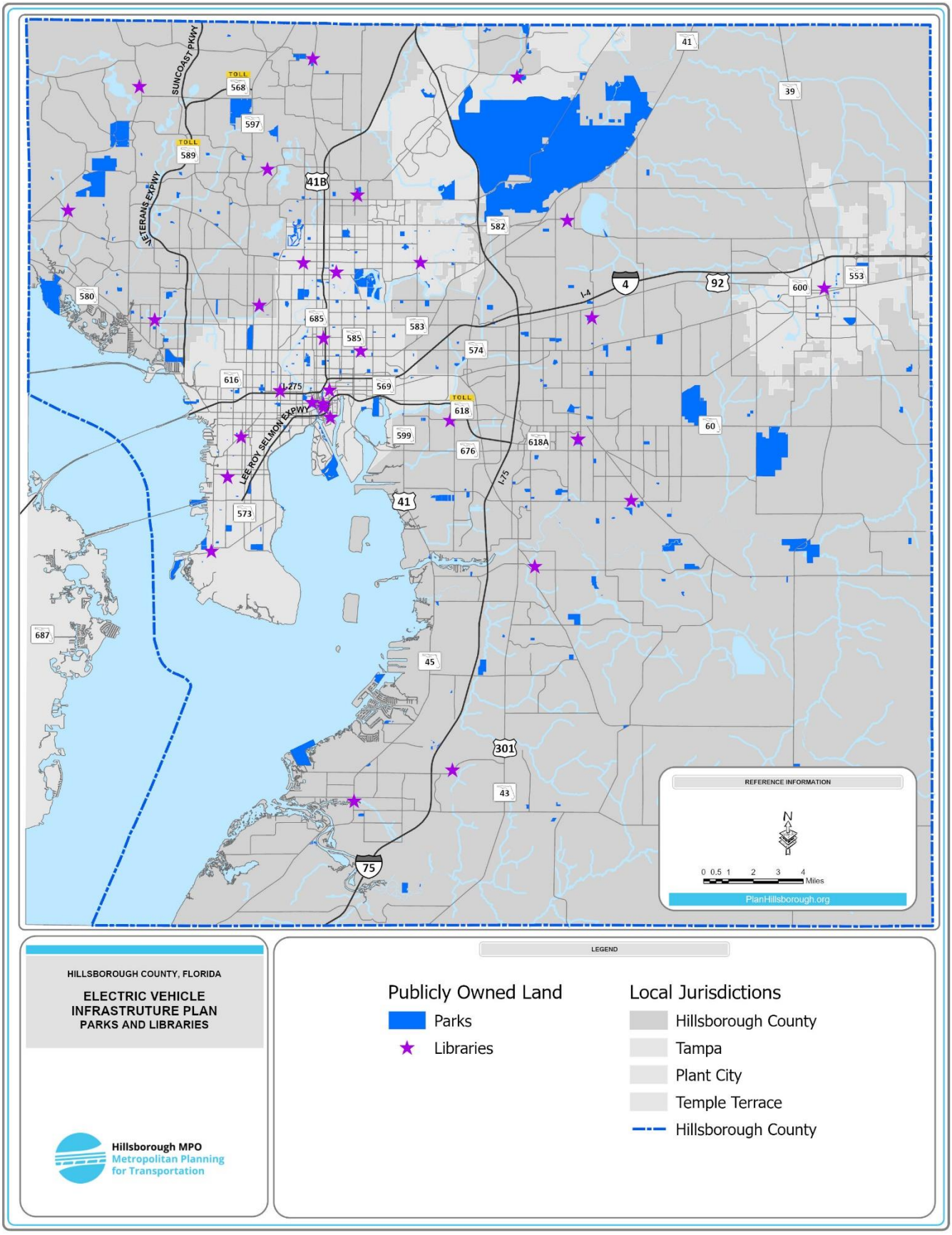
Parks and Libraries

Because charging an electric vehicle takes time, ideal locations for EV infrastructure offer some type of activity for users. Parks and libraries are two types of publicly owned facilities that can provide entertainment for EV users while they take advantage of charging facilities.

There are many parks of various types (neighborhood parks, dog parks, conservation parks, and more) in Hillsborough County, most of which have their own off-street parking. Parks would be excellent places to provide charging infrastructure, as users can enjoy park facilities while they charge. Visitors to Hillsborough County can be directed to parks for charging, increasing tourism to these locations.

There are 31 libraries in Hillsborough County, seven of which are located in underserved communities (see section on underserved areas below). Figure 28 shows the parks and libraries in Hillsborough County.

Figure 28. Park And Library Parcels in Hillsborough County

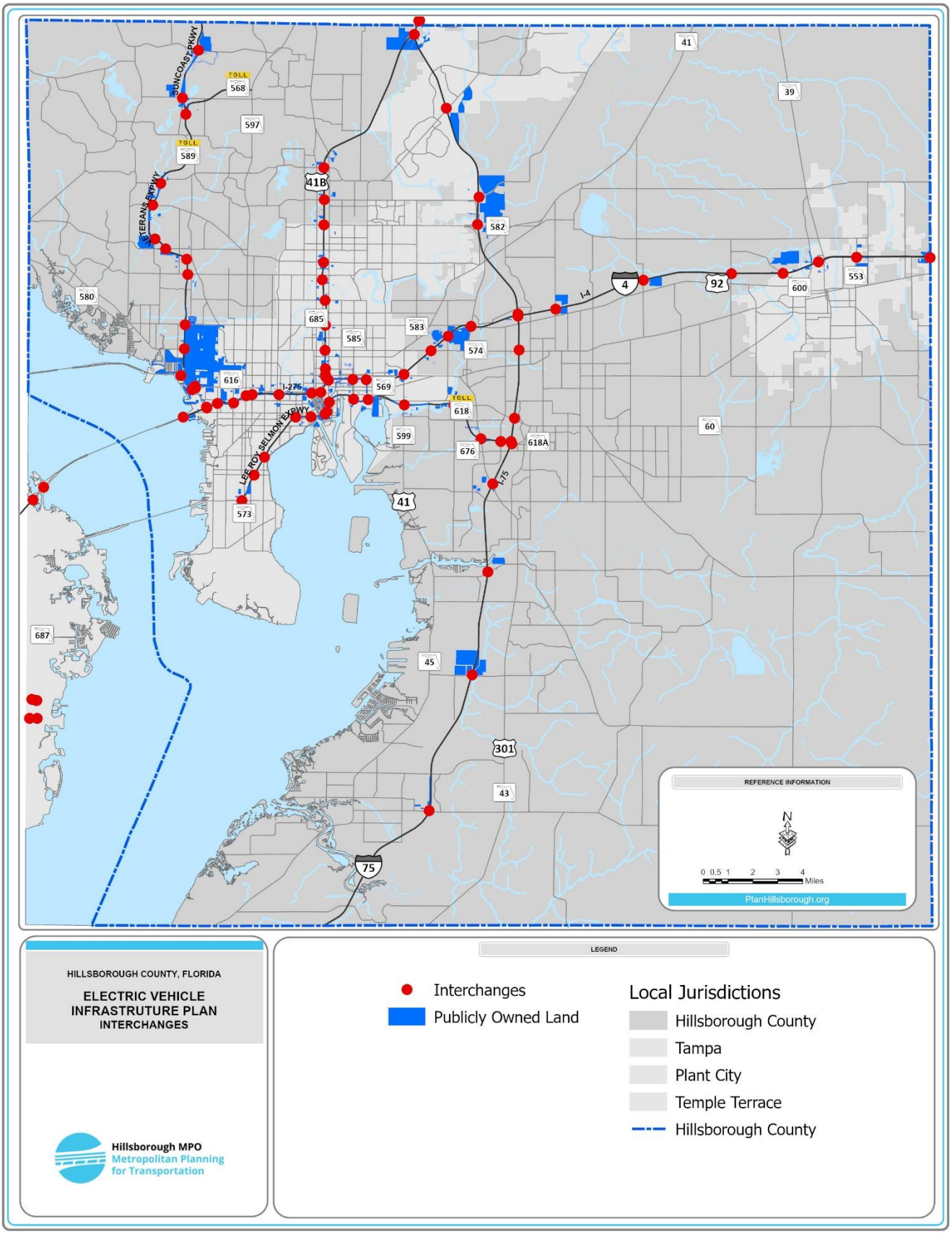


Highway Exits

The NEVI Program allocates funding to states to create a nationwide EV charging network along highway corridors. Interstates 4, 75, and 275 traverse Hillsborough County and have been designated as EV-Corridor Ready or EV-Corridor Pending by the FHWA[69]. Building EV infrastructure along major highways is practical for drivers, and with consideration to other NEVI Program requirements, charging infrastructure in these locations could qualify for formula and grant funding through the NEVI Program. Figure 29 shows the public parcels within ½-mile of highway interchanges, including Veterans Expressway (FL-589) and the Selmon Expressway. There are about 10,000 acres of publicly owned land in the parcels shown below.

[69] https://hepgis.fhwa.dot.gov/fhwagis/ViewMap.aspx?map=Highway+Information%7CElectric+Vehicle+(EV-Round+1,2,3,4+and+5)

Figure 29. Publicly Owned Land Near Highway Interchanges



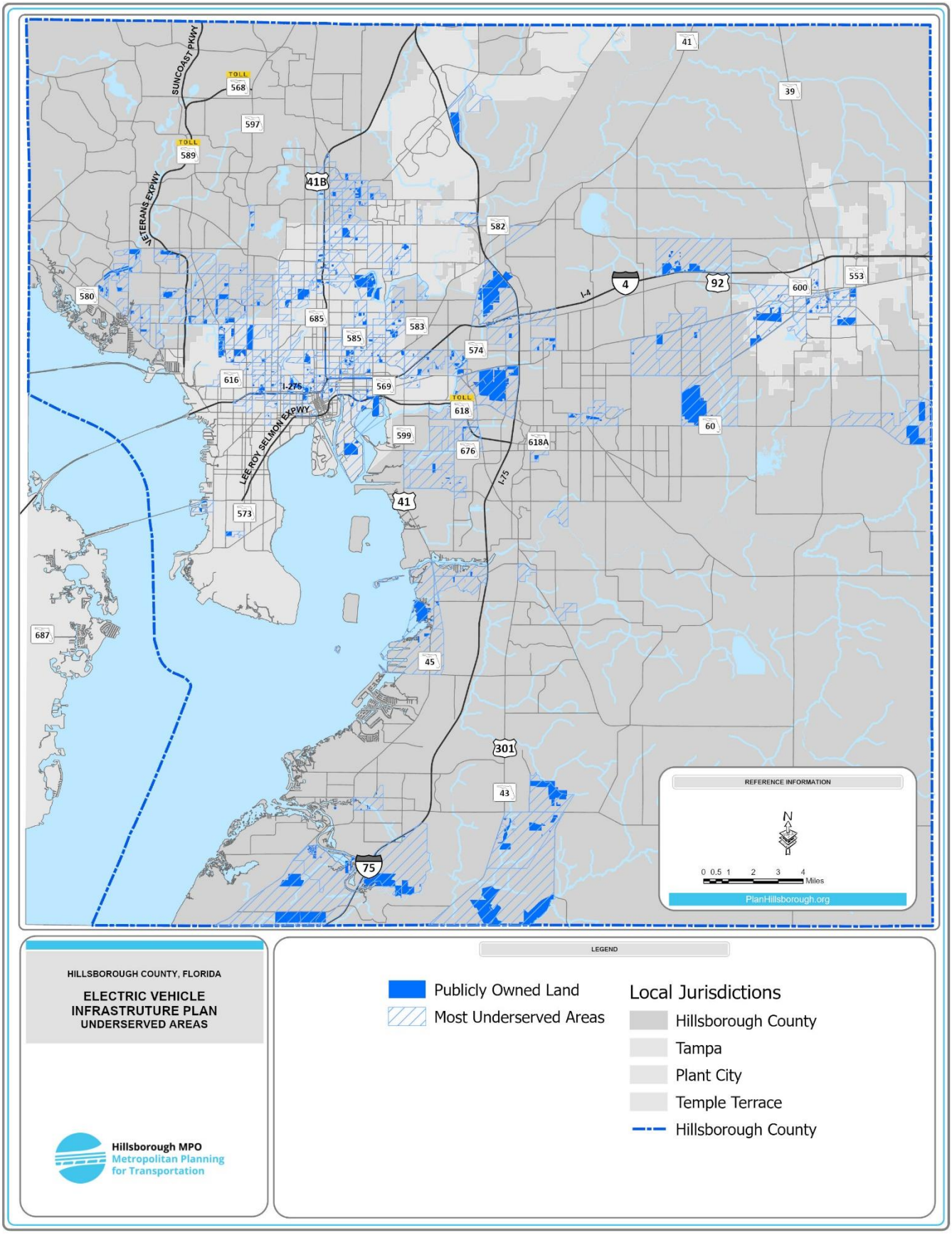
Underserved Areas

Underserved areas (Figure 30) are identified in the TPO's Nondiscrimination and Equity Plan as those with high concentrations (in the 80th percentile) of four or more of the following characteristics:

- Racial minority
- Ethnic minority
- Limited English proficiency
- Older adults
- Youth
- Low-income
- People with disabilities
- People without a high school diploma
- Zero vehicle households
- Female head of household

There are about 11,000 acres of publicly owned land in and adjacent to these underserved areas.

Figure 30. Publicly Owned Land in Underserved Areas



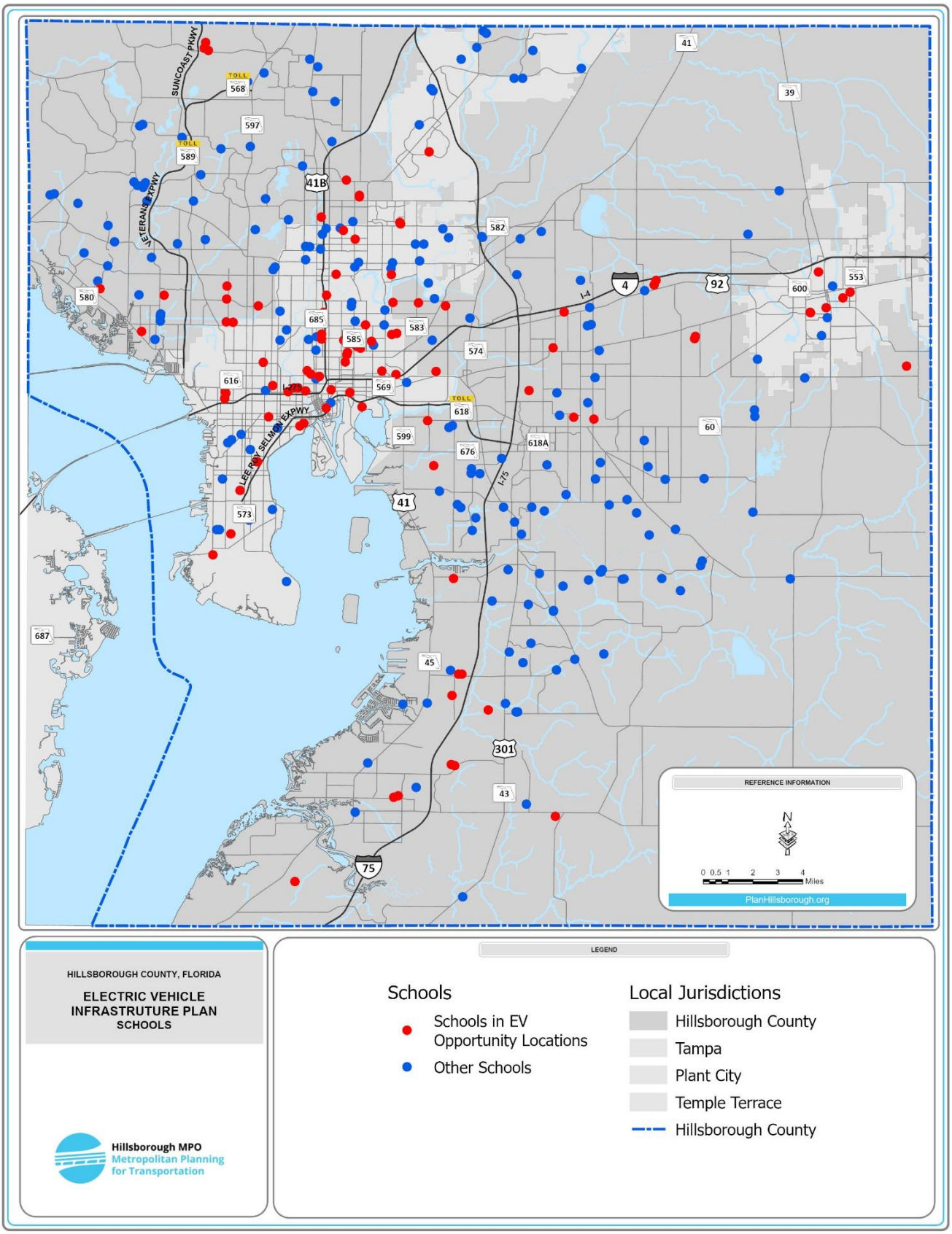
Schools

Many of the publicly owned parcels that meet multiple criteria above (near activity centers, highway interchanges, and/or underserved areas) are schools.

Providing charging stations on school property would be beneficial for staff and students who can charge their vehicles during the school day. Stations could potentially be made publicly available when school is not in session, such as on weekends and during the summer. There may even be an opportunity to use these stations for school fundraising.

There are about 290 public elementary, middle, and high schools in Hillsborough County on about 5,000 acres of land. Figure 31 shows the locations of these schools throughout the county. Schools symbolized in red are in one of the above identified EV opportunity areas – near an Activity Center, near a highway interchange, or within or adjacent to an underserved community.

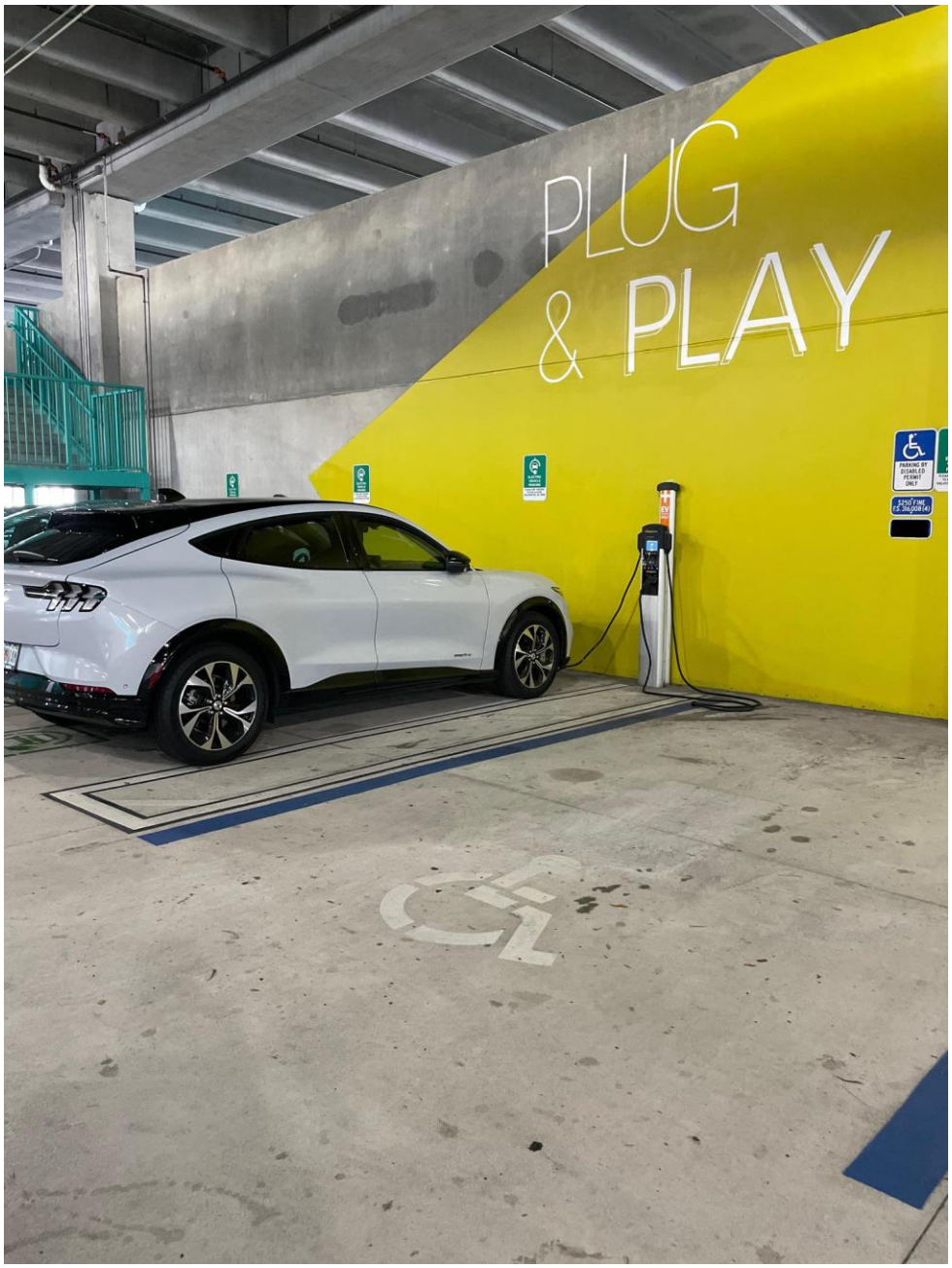
Figure 31. Public Schools in Hillsborough County



Next Steps

The Hillsborough TPO will build upon the existing conditions analysis by completing a needs analysis to identify charging needs and develop a framework for prioritizing the location of charging infrastructure. Additionally, the Hillsborough TPO will provide recommendations for the adoption of local zoning regulations and guidelines. The Hillsborough TPO intends to incorporate findings from this analysis including adoption rates, targets for EV infrastructure, and priorities into other TPO products including the Long Range Transportation Plan (LRTP).

Throughout the needs analysis and recommendation portion of the Plan, the Hillsborough TPO will engage with stakeholders through the Advisory Committee and focused listening sessions related to the identified use cases.



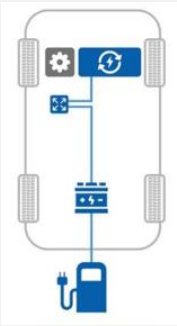
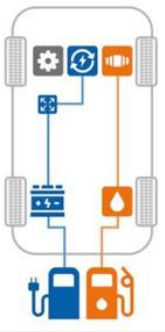
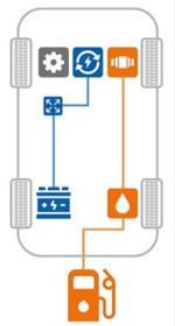
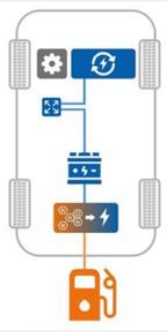
"Vehicle charging in Hillsborough County." Credit: PlugShare.

APPENDICES

Appendix A: Additional Information on Electric Vehicles

The components of different types of electric vehicles power the engine in different manners[70]. Table 11 illustrates how the power sources of different types of EVs connect with the drivetrain and engine of the vehicle.

Table 11. Power Systems by EV Type

Battery Electric Vehicles (BEVs)	Plug-In Hybrid Electric Vehicles (PHEVs)	Hybrid Electric Vehicles (HEVs)	Fuel Cell Electric Vehicles (FCEVs)
			

[70] Miller, T. (2021). *The different types of electric and hybrid vehicles*. National Motorists Association. Retrieved January 4, 2023, from https://ww2.motorists.org/blog/different-types-of-electric-and-hybrid-vehicles/.

Appendix B: Additional Information on Local Development & Zoning Regulations

Current Plans & Policies

Related mentions are recorded below. This content could be tailored in the future to guide the implementation of electric vehicle infrastructure in a way and in locations that is most beneficial to the county's residents and visitors.

Hillsborough County Comprehensive Plan

The Hillsborough County Comprehensive Plan was last updated in September 2022[71]. The Comprehensive Plan mentions the following items that are related to electric vehicles and their charging infrastructure:

/ Mobility Goal 6: Build a smart system that utilizes technology and strategies to improve safety, efficiency and reliability for all modes of transportation and to meet the needs of all users.
- Objective 6.7: Monitor and support emerging technologies and strategies that improve safety, sustainability, efficiency, and access for all modes of travel on existing and planned transportation facilities, as appropriate for the context.
    i. Policy 6.7.7: Incentivize the use of electric vehicles through the implementation and expansion of electric vehicle charging stations.

/ Environmental and Sustainability Goal 1: Ensure sufficient, reliable, and clean energy is available to meet the future needs of Hillsborough County residents, businesses, and government.
- Objective 1.1: Actively participate in EPA's Energy Star for Buildings program, which promotes energy conservation in major public and private structures and facilities.
    i. Policy 1.1.1: Engage in and promote practices that result in energy conservation and efficiency.
    ii. Policy 1.1.2: Continue to offer energy conservation and efficiency information to enable residents, businesses, and County employees to reduce electrical loads and demands on the electrical utility system.
    iii. Policy 1.1.4: Promote energy efficient and sustainable development practices.

/ Environmental and Sustainability Goal 3: Support the preservation, conservation, restoration, and management of natural resources while maintaining or enhancing environmental quality.
- Objective 3.1: Comply with all national and state ambient air quality standards.
    i. Policy 3.1.1: Collaborate with the EPC to promote energy conservation measures and alternative energy sources to reduce the demand for electricity and to minimize power plant emissions from the burning of fossil fuels.

Hillsborough County Land Development Code

The Hillsborough County Land Development Code was last updated in October 2022, and at the time did not mention electric vehicles or charging infrastructure.

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[71]

Tampa 2040 Comprehensive Plan

The City of Tampa 2040 Comprehensive Plan, which was adopted in November 2022, contains the following references related to electric vehicles and charging infrastructure:

/ Environmental Goal 3: Have sufficient, reliable, and resource-efficient energy available to meet the future needs of City of Tampa residents, businesses, and government.
- Objective 3.1: Engage in and promote practices that result in energy conservation and efficiency.
  i. Policy 3.1.1: Offer energy conservation and efficiency information to enable residents, businesses, and City employees to reduce electrical loads and demands on the electrical utility system.
- Objective 3.2: Encourage energy and resource efficient green building and sustainable development practices.
  i. Policy 3.2.1: Encourage builders and developers to exceed the minimum requirements for energy efficiency of the Florida Building Code by sharing information on available training, tools, or literature on resource efficient development
  ii. Policy 3.2.4: When planning to construct City-owned buildings or facilities, build to satisfy, at a minimum, the most current United States Green Building Council "Leadership in Energy and Environmental Design" (LEED) Silver Standard program or meet similar standards.
- Objective 3.3: Support the development of, and engage in the use of, alternative energy and fuels in order to achieve energy supplies that are proven to do no harm to other sectors of the world economy, population or environment, and are secure, resource efficient and sustainable.
  i. Policy 3.3.2: Diversify its fuel supply and reduce its use of fossil fuels by using alternative energy technologies that are proven to do no harm in other sectors of the world economy, population or environment, and are secure, resource efficient and sustainable.
  ii. Policy 3.3.4: Investigate on-site electrical generation using micro-turbines, fuel cells, combined heat and power, renewable, or other technology for City facilities.
  iii. Policy 3.3.6: Pursue the incorporation of alternative energy technology and energy saving specifications within its construction bidding documents, for example, on-site generation using micro-turbines, fuel cells, combined heat and power, photovoltaic power or other appropriate technology.

City of Tampa Land Development Code

The City of Tampa Land Development Code was last updated in November 2022, and contains the following references to electric vehicles and charging infrastructure:

/ Chapter 15: Parking; Article II: regulations, permits, penalties
- Sec 15-56. No person shall park any vehicle in any parking space located in any city owned or operated parking garage or parking lot which is clearly marked as being reserved for the use of an electric vehicle charging station located within said parking garage or lot, unless such vehicle is actually using the electric vehicle charging station. (Ord. No. 2011-84, § 6, 7-14-2011)

/ Chapter 27: Zoning and Land Development; Article III: establishment of zoning districts and district regulations
- Sec 27-184. Official schedule of permitted principal, accessory, and special uses; required off-street parking ratios by use; parking space equivalencies by transportation use (Table 184-B) specific to CBD. (*Does not address parking ratios for charging stations, but does include an 8:1 ratio for "Car-share, ride-hail, or similar type of shared vehicle/neighborhood electric vehicle (low-speed vehicle) vehicle stall.")*
- *Sec 27-185. General parking design standards by transportation mode addresses "neighborhood electric vehicle (low-speed vehicle)" (may mean golf cart)*

Imagine 2040: Plant City Comprehensive Plan

The Plant City Comprehensive Plan was adopted in 2016 and last amended January 25, 2023. The Plant City Comprehensive Plan does not specifically address EV adoption or charging infrastructure. However, Plant City does have goals that may be achieved or are impacted by the adoption of EVs and increased need for EV charging.

/ Environmental Goal 1: Preserve, conserve, restore, and appropriately manage the natural resources of importance to the citizens of the city of plant city, in order to maintain or enhance environmental quality for present and future generations.
    - Objective 1.1: Cooperate as appropriate to maintain compliance with federal and state air quality standards in part by implementing the following policies and practices.
        i. Policy 1.1.1: Actively promote, through conditions in development orders, signs, media promotions and other techniques, the use of ride-sharing, carpooling, safer bicycle routes, improved traffic signal timing and other techniques for reducing vehicle emissions in the City.
/ Environmental Goal 2: Have sufficient and reliable energy available to meet the future needs of residents, businesses and government, and development practices shall be resource efficient.
    - Objective 2.1: Engage in and promote practices that result in energy conservation and efficiency.
    - Objective 2.2: Encourage energy efficient and sustainable development practices.
    - Objective 2.3: Support the development of and consider use of alternative energy/fuel in order to achieve energy supplies that are secure, sustainable and not harmful to the environment.

Plant City Development Code

The Plant City Land Development Code was last updated in January 2023. The Plant City Land Development Code encourages the inclusion of EV charging spaces, with the following guidance and requirements:

Subpart B, Chapter 102, Article VII, Division 11, Sec. 102-1413 – Standards for off-street parking areas:

/ Electric Vehicle Charging Spaces (EVCS) are encouraged and must be supplied with a working charging unit.
/ [Electric Vehicle Charging Spaces] can be compact spaces and shall be no smaller than eight feet wide and eighteen feet long (8' × 18').
    - Note: Except as provided in subsections (a)(5), (10), (11) (12) and (14) herein, each off-street parking space shall consist of a minimum net area of 200 square feet and shall have a minimum width of 10 feet and a minimum length of 20 feet.
/ [Electric Vehicle Charging Spaces] shall be clearly and prominently marked with paint or signs to advise that the charging station spaces are reserved for electric vehicle charging use only.

Imagine 2040: Temple Terrace Comprehensive Plan

The Temple Terrace Comprehensive Plan was adopted in 2016 and last amended January 20, 2023. The Temple Terrace Comprehensive Plan does not specifically address EV adoption or charging infrastructure. However, Temple Terrace goal of having sufficient and reliable energy available to meet future needs is impacted by the adoption of EVs and increased need for EV charging.

/ Environmental Goal 3: Have sufficient and reliable energy available to meet the future needs of residents, businesses and government, and development practices shall be resource efficient.
    - Objective 3.1: Engage in and promote practices that result in energy conservation and efficiency.
    - Objective 3.2: Encourage energy efficient and sustainable development practices.
    - Objective 3.3: Support the development of and consider use of alternative energy/fuel in order to achieve energy supplies that are secure, sustainable and not harmful to the environment.

Temple Terrace Development Code

The Temple Terrace Land Development Code was last updated in January 2023. The Temple Terrace Land Development Code does not include any references specific to EVs or charging infrastructure.

Best Practices

City of Orlando

/ Sec 61.360 - Purpose of EV Parking Requirements. The requirements of this Part are intended to provide electric vehicle charging abilities distributed throughout the City to serve public mobility needs, prepare for emerging electric vehicle technologies, improve air quality, and achieve City sustainability goals, including climate change mitigation.
/ Sec 61.361 – Applicability. The requirements of this Part shall apply to new development or substantial enlargement of structures. Only the new parking spaces added as part of a substantial enlargement are subject to the requirements of this Part.
/ Sec 61.362 - General Requirements. (a) Electric vehicle parking spaces shall meet all performance standards of Ch. 61 Part 3. (b) EV Readiness requirements are categorized in two levels as follows:
    - EV Capable: These parking spaces prepare for future EVSE installation by providing dedicated electrical capacity in the service panel (40amp breaker for every two EV Capable two spaces) and conduit to the EV Capable space. These spaces do not require wiring to the space or a receptacle.
    - EVSE Installed: These parking spaces are reserved for EVs and provide drivers the opportunity to charge their electric vehicle using EV charging stations rated at a minimum of 32amp 7.2 kW. These spaces should be installed per the requirements of the National Electrical Code (NFPA 70) as adopted and amended by the State of Florida.
/ Sec 61.363 - Number of Spaces Required. The parking requirements of this Part are intended to provide minimum standards and do not count towards maximum parking requirements. The EV parking requirements are based on a percentage of the minimum required parking spaces of Part 3 of this Chapter.

Sec 61.364 – Location.

TYPE	EV Capable**	EVSE Installed (threshold)**
Certified Affordable Multi-family Housing	20%	N/A
Multifamily, Hotel, all parking structures	20%	2% (requirement begins at 50 spaces)
Commercial (non-residential)* (office, retail, and public, recreational & institutional uses)	10%	2% (requirement begins at 250 spaces)
Industrial (employee parking only)	10%	2% (requirement begins at 250 spaces)

*Commercial projects for fuel retailers in which *automotive services* is the primary use are excluded from requirements contained in this Part.
**All partial space requirements are rounded down.

Appendix B: Public & Stakeholder Engagement

Advisory Committee Meetings

KITTELSON & ASSOCIATES
225 E ROBINSON STREET, SUITE 355
ORLANDO, FL 32801
P 407.540.0555 F 407.540.0550

Advisory Committee #1 Meeting Notes

Date:	February 8, 2023	Project #: 24840.002
To:	Connor MacDonald Planner I Plan Hillsborough Transportation Planning Organization Email: macdonaldc@plancom.org Phone: 813.946.5334	
From:	Poppy Yang, Rachel Grosso, Chris Bame, and Aditya Inamdar – Kittelson & Associates, Inc.	
Project:	Electric Vehicle Infrastructure Plan	
Subject:	Advisory Committee #1 Meeting Notes	

MEETING DATE:

February 3, 2023

MEETING LOCATION:

In-Person:
Manatee Room
18th floor of County Center
601 E Kennedy Blvd, Tampa, FL 33602

Virtual:
Microsoft Teams

MEETING ATTENDEES:

- Connor MacDonald (Plan Hillsborough) – In Person
- Davida Franklin (Plan Hillsborough) – In Person
- Allison Yeh (Plan Hillsborough)
- Lizzie Ehrreich (Plan Hillsborough)
- Brynn Dauphinais (Plan Hillsborough)
- Johnny Wong (Plan Hillsborough)
- Meagan Winchester (Hillsborough County)
- Troy Salisbury (Hillsborough County)
- Michael Brown (Florida Department of Transportation)
- Brian McCarthy (Temple Terrace)
- Robyn Baker (Plant City)
- Eric Caplan (Tampa International Airport)
- Kenneth Hernandez (Tampa Electric)
- James Beekman (School District of Hillsborough County)
- Aditya Inamdar (Kittelson & Associates)
- Chris Bame (Kittelson & Associates)
- Rachel Grosso (Kittelson & Associates)
- Poppy Yang (Kittelson & Associates)

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The following document summarizes the first Advisory Committee (AC) Meeting for the Electric Vehicle Infrastructure Plan between Hillsborough Plan (the TPO), partner agencies and organizations in Hillsborough County, and Kittelson & Associates, Inc. (KAI). The purpose of this meeting was to inform the TAC of the key findings of the Existing Conditions Report, as well as to solicit feedback to inform the next phase of the project.

NOTES

Welcome and Introductions:

- Introductions of project team and meeting attendees.
- Description of project schedule, desired outcomes, and context.
- KAI has drafted an Existing Conditions Report, and requests feedback from the AC in the coming weeks.
- Are there any important documents that should be included in this Plan that are not currently?
    - Several relevant efforts were discussed that the School District of Hillsborough County has undertaken:
        - Applied for an FDEP school bus grant but was unsuccessful. The School District is applying again.
        - Investigating installing chargers at schools and will soon be documenting these efforts. The chargers will likely be placed in semi-publicly accessible locations for events, such as high school sporting events. However, school campuses are required to be locked for other portions of the day.
        - Applying for a grant to electrify Drivers Education vehicles.

Fundamentals of EVs:

- Overview of the benefits of and barriers to electric vehicle adoption, description of the types of EVs, charging infrastructure, and ownership models currently available, and details about current adoption trends.
- What levels of charging are most relevant to this planning effort?
    - The charging level needed is dependent on context and goals. For most cases, L2 is probably sufficient. L3 is relevant for arterial or highway settings.
        - Cost benefit analysis is a significant factor in determining between L2 and L3.
    - Charging is increasing in importance for evacuation and resiliency planning, especially before returning service following natural disasters. Critical locations, such as hospitals, should have faster charging capabilities.
    - The airport prioritizes a quality charging experience, and so L2 is available in staff and ridehail lots. Long-term and economy parking lots need or will be provided with L1, due to longer dwell times. L3 is likely needed at other locations around the airport. The level of charging is also dependent on whether the airport plans to require the user to pay for charging.
    - Tampa Electric is preparing for the majority of charging to take place at home, but to spur the transition, visible, accessible, and efficient charging is needed. Places with longer dwell times can suffice with L1 or L2, but for L3 charging, the kwh (capability) must be aligned with vehicle capabilities and infrastructure, which presents an evolving challenge. Additionally, fleet electrification has its own opportunities and challenges, but could potentially be solved by "charging hubs" that have a variety of levels and kwh capabilities.
- Is there any information on how chargers fare in extreme weather, such as storms and heat?

  - Charging stations need to comply with building codes, so they would be resilient to weather such as high winds. Temperature impacts the rate of charging, but Florida's climate would not typically pose an issue, as cold weather is a more difficult issue.
- Will hurricane evacuation routes be considered for fast charging infrastructure? Will rest stops be considered?
  - If evacuation routes and rest stops have significant overlap with alternative fuel corridors (AFCs, designated by the Federal Highway Administration), then the Plan will consider these locations as opportunities for National Electric Vehicle Infrastructure (NEVI) program funding.

Use Cases:

- Overview of the five identified use cases that are most relevant to Hillsborough County.
- Was EVTOL (electric vertical takeoff and landing) considered in the use cases?
  - EVTOL was not originally included but can be acknowledged.
  - EVTOL craft would have even higher charging needs than the EVs under discussion as part of the five use cases.
- Which use case is the most promising in terms of initial deployment?
  - Urban/rural light-duty vehicles and TNC/gig driver use may deploy first, given the incentive programs and public sentiment, in addition to increasing awareness of charging infrastructure. Freight and transit are tackling specific issues with each of the technologies the industry deploys. This Plan will focus on prioritizing locations that can serve as many use cases as possible.
  - It will be important to consider negative externalities for all use cases, but especially transit because those costs are incurred using public funds.
- Are micromobility connections available with EV charging infrastructure for cars?
  - Some chargers can have a standard outlet for micromobility devices to use. The Oregon DOT recently released a report on the topic.
- Do the EVs used for freight and transit use cases require less maintenance than internal combustion engine vehicles, as is known with urban/rural light-duty vehicles?
  - So far that has held true.

Existing Conditions:

- Overview of the existing infrastructure in Hillsborough County, as well as assessment of current land use planning.
- Are any land use agencies considering EV charging at multi-dwelling units?
  - Plant City is using this group as an educational opportunity to influence upcoming code revisions. Additionally, multi-unit dwelling applications are increasing, and so this is a relevant topic.

Goals and Indicators:

- In the coming weeks, the AC members will provide their thoughts on how to best measure success through the Plan.

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Advisory Committee #1 Meeting Notes

Date:	July 11, 2023	Project #: 24840.002
To:	Connor MacDonald Planner I Plan Hillsborough Transportation Planning Organization Email: macdonaldc@plancom.org Phone: 813.946.5334	
From:	Chris Bame and Aditya Inamdar – Kittelson & Associates, Inc.	
Project:	Electric Vehicle Infrastructure Plan	
Subject:	Advisory Committee #2 Meeting Notes	

MEETING DATE:

July 11, 2023

MEETING LOCATION:

Microsoft Teams

MEETING ATTENDEES:

- Connor MacDonald (Plan Hillsborough)
- Allison Yeh (Plan Hillsborough)
- Lizzie Ehrreich (Plan Hillsborough)
- Brynn Dauphinais (Plan Hillsborough)
- Meagan Winchester (Hillsborough County)
- Troy Salisbury (Hillsborough County)
- Robert Stine (Hillsborough County)
- Michael Brown (Florida Department of Transportation)
- Austin Britt (City of Tampa)
- Brian McCarthy (Temple Terrace)
- Kenneth Hernandez (Tampa Electric)
- Daryl Leslie (Tampa Electric)
- Nigel (School District of Hillsborough County)
- Juston Lafler (HART)
- Aditya Inamdar (Kittelson & Associates)
- Chris Bame (Kittelson & Associates)

The following document summarizes the second Advisory Committee (AC) Meeting for the Electric Vehicle Infrastructure Plan between Hillsborough Plan (the TPO), partner agencies and organizations in Hillsborough County, and Kittelson & Associates, Inc. (KAI). The purpose of this meeting was to inform the TAC of the key findings of the Needs Analysis, as well as to solicit feedback on the project outcomes.

NOTES

Welcome and Introductions:

- Introductions of project team and meeting attendees.
- KAI has drafted a Final Needs Analysis Report, and requests feedback from the AC in the coming weeks.

Refresh on Plan Background

- Hillsborough Electric Vehicle Infrastructure Plan (EVIP) is intended to communicate benefits of EVs, inform future planning efforts, and help access funding opportunities.
- Benefits of EV adoption include reduced operating costs and reduced emissions.
- Barriers to EV adoption include EV purchase price and access to charging infrastructure.
- Use cases include personal vehicles, transit vehicles, commercial delivery vehicles, and transportation network company (TNC) vehicles.
- Evaluation of the success in EV planning and adoption can include measures like:
    - EV adoption
    - Number of public EV charging ports
    - Access to public EV charging
    - Policy adoption
- Austin comments that the EV adoption is a good measure, and would like to also consider individuals who live outside of Hillsborough County, but visit or commute into the County.

EV Adoption Scenarios:

- The projection of EV adoption for light duty personal vehicles considers the adoption rates from City of Orlando and Florida DOT. A low, medium, and high adoption scenario are projected. In 2050, the scenarios are significantly different (20-70% EV adoption), however the range is narrower in the interim years. Re-evaluation of EV adoption trends should be considered periodically.
- Disadvantaged communities are projected to have the same rate of EV adoption as the rest of the County. However, disadvantaged communities may face additional barriers. The evaluation measures should be assessed in terms of the overall County and also in terms of disadvantaged communities to make sure they are advanced equitably.
- TNCs are projected to adopt EVs at a greater rate than personal vehicles due to commitments from TNC companies to adopt EVs.
- HART is conducting planning to transition to zero emission buses. Several scenarios of adoption battery electric buses are considered, but HART is also considering using fuel-cell electric vehicles. Under a low adoption of battery electric buses, only the buses acquired for the pilot project are used by HART. Under medium adoption, buses that can charge up at the depot and then drive around on the route all day are transited to battery electric buses. Under high adoption, all buses are transitioned to battery electric buses.
- Adoption of EVs for commercial delivery are driven by market forces and regulations requiring adoption of EVs (although these regulations are not currently in place in Florida).

EV Charging Needs:

- Charging need for personal light duty vehicles is calculated using EVI-Pro Lite tool. Charging need is divided into DC Fast Charging ports, Public L2 ports, and Workplace L2 ports. Chargers are distributed throughout the County considering the distribution of jobs, multi-family households, renter households, and the location of trip start/end points.

- A table is shown aggregating the number of chargers for several areas in Hillsborough County. Maps are shown showing the density of chargers for Hillsborough County.
- Austin: Do the number of chargers shown in the table (Slide 19) indicate the additional need for chargers or the total chargers needed? The numbers show the total chargers needed, however for L2 charging the Public and Workplace charging may be considered together (especially for downtown Tampa where employees may be parking in public parking garages).
- Disadvantaged communities may face additional barriers to EV adoption. Several strategies for addressing EV initial purchase price, limited access to home charging, and lack of interest in EVs are discussed.
- Allison: Consider the digital divide that might prevent access to EV charging or resources EV owners uses.
- The number of chargers to support TNCs are estimated using a ratio of 18 DCFC ports to 1,000 TNC EVs. TNCs will tend to need more DCFC charging due to driving many more vehicles per day and the opportunity cost of charging.
- Allison: Are there opportunities to use inductive charging rather than plug in charging to minimize opportunity cost? This is a developing technology, but right now it is not expected to be an effective solution.
- The number of chargers needed to support transit EVs depends on the adoption scenario. On route chargers tend to be higher powered and more costly to install. Completing most charging at depots is expected to be most effective.
- Public charging for commercial delivery vehicles is expected to support vehicles that need a little range extension in an emergency situation or to enable some businesses to adopt EVs that might otherwise not be able to charge vehicles at a depot location. This need should be accommodated at public charging stations, but may not need to have dedicated charging stations developed.
- Charging sites should be prioritized based upon funding program priorities. Additional criteria may be developed to differentiate between sites including criteria related to closing public charging deserts, high expected demand, and equitable distribution of charging stations. Prioritization may also include consideration of what sites may be installed by private providers, rather than subsidized with public funding.
- Some land uses are more attractive for EV charging stations, including places people are already visiting, places that have something to do while charging, and places people tend to spend at least a half hour.
- Austin: Tampa has found that installing charging infrastructure in some places incurs additional costs, if the electric distribution system is not in place. This is a good consideration to keep in mind when prioritizing sites for funding.

Policy and Design:

- Currently local agencies don't have many defined policies to encourage EV adoption
- Recommend requiring EV charging installation for new developments. Typically EV ready codes from other jurisdictions require 2-20% of parking spaces to have EV charging installed, which is typically dependent on land use. 5-15% of parking spaces in new developments in Hillsborough County are recommended to have EV charging installed.
- Austin: This will increase costs for developers, may need to consider using incentives to balance out the costs, for example allowing the developer to install fewer parking spaces.
- Brian: Increasing EV adoption may impact funding sources from gas taxes, this impact to revenue should be considered. It could be helpful to develop language for replacing this revenue with a sort of tax on charging.
- Incentives for installing EV charging should be added to codes.

- EV charging stations should be designed for accessibility. A 'Use Last' approach is recommended where a subset of charging spaces have accessible mobility features. The Access Board recommends designing at least 2 EV charging spaces with accessible mobility features.
- Kenneth: The ADA guidance is helpful and will provide some clarity to developers. It is important to consider if guidance or installation of charging creates any liability concerns.
- EV charging stations should be designed to accommodate micromobility and commercial vehicles.
- Kenneth: Consider designing stations to accommodate towing vehicles (for example a truck towing a boat).
- Several considerations for the design of EV charging stations in multi-family stations include whether the spaces should be reserved or rotating, whether L2 or L1 charging should be used, and what payment structure to use.

Next Steps:

- When developing EV charging infrastructure and policies it is important to keep balances in mind, including being aware of developing technologies and how that might impact recommendations.
- The EVIP will be used to inform the LRTP, pursue grants for community charging, adopt policies, and review development proposals.
- Austin: Going forward interested in looking at charging for micromobility.
- Brian: Temple Terrace is converting city vehicles to EVs, consider adding transition to public fleet EVs in the policy recommendations.

Stakeholder Listening Sessions

Disadvantaged Communities

Discussion questions at this session included:

- What are the perceptions of or opinions on electric vehicles in your community?
- What are the top two challenges impacting your community when it comes to electric vehicles in the Hillsborough / Tampa area?
    - Financial accessibility of EV ownership (upfront purchase cost and/or maintenance/repair costs)
    - Geographic coverage of EV charging ("range anxiety")
    - Design or context of existing EV chargers
    - Lack of at-home charging
    - Accessibility of EV charging for people with disabilities
    - Gentrification around EV charging infrastructure
    - Access to EV-related training and employment opportunities
    - Others?
- Where would you located public fast chargers to support electric vehicles in your community FOR your community?
- What amenities would improve public chargers to appeal to people in your community?
- What are the ideal benefits that your community would like to receive from EV charging?
    - Increased traffic at local businesses
    - Job opportunities for owning, operating, and maintaining charging infrastructure
    - Improved air quality
    - Reduced noise pollution
    - Others?
- What is the best way to communicate with people in your community? Do you think that additional information, opportunities to test drive, or other events/services would be interesting to people in your community?

Commercial Delivery (Medium-Duty Freight)

Discussion questions at this session included:

- We'd like to understand your current fleet. Could you describe your current fleet's:
    - Composition in terms of make, model, year, Class, and fuel type?
    - Daily geographic service area?
    - Fueling locations: at a depot, on the road, or both?
- We'd like to know more about your fleet's potential transition to electric vehicles:
    - Does your company have plans to transition to electric vehicles?
    - Would your fleet use public fast chargers if they were available near to delivery routes?
- What are the top two challenges impacting fleet electrification for freight vehicles in the Hillsborough County / Tampa area?
    - Lack of Fast Charging along Key Freight Corridors
    - Workforce Training
    - Lack of Economic Incentives
    - Cost of Electrical Upgrades for Charging Demand
    - Difficulty Forming Partnerships with Key Stakeholders (Government, Utilities, etc.)
    - Lack of Awareness of the Potential Benefits
    - Others?

/ Where would you locate public fast chargers to support freight movement?
/ What amenities would improve charging stations to appeal to freight drivers?

Transit (HART)

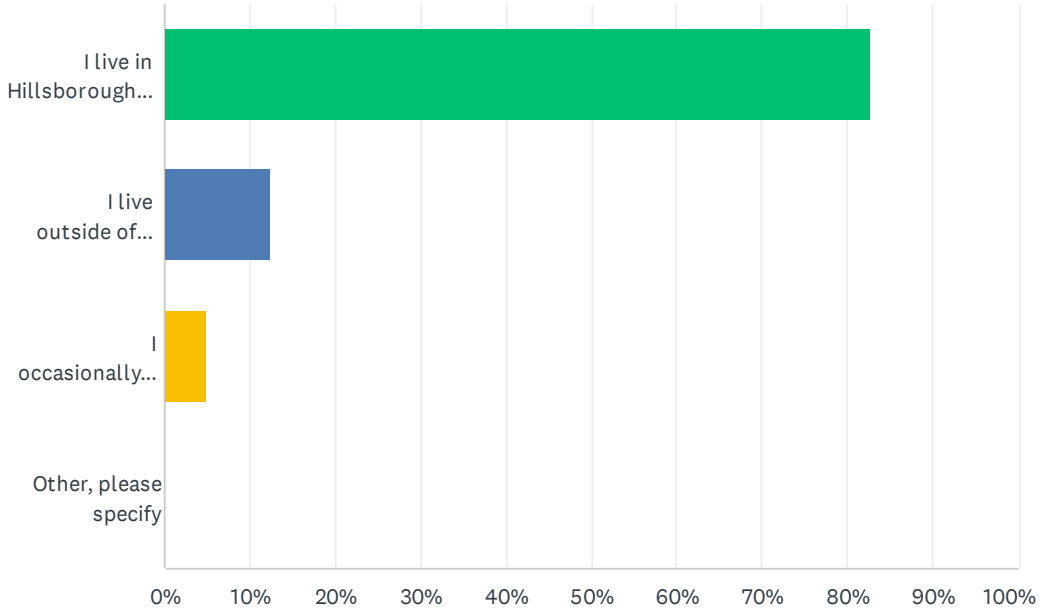
Discussion questions at this session included:

/ Inventory of Existing Fleet
    - How many vehicles are in the operating fleet? What are the make and model of these vehicles? What is the fleet's spare ratio?
    - What are the capacities/capabilities that are needed by the agency? For example, number of seats, fuel capacity/distance range, and accessibility.
    - What is the lifecycle for existing vehicles? (i.e. how often must new vehicles be purchased?) (Also known as the fleet replacement rate)
    - How old are existing vehicles? When would the agency be phasing out old vehicles and purchasing new ones?
/ Existing Operating Conditions
    - How many miles does a vehicle typically travel in a day: <100 mi, 100-200 mi, 200-300 mi, 300+ mi?
    - How often do vehicles leave service? How long do vehicles break before resuming service?
    - How many hours is a vehicle in service?
    - How many vehicles are assigned to each route?
    - Are vehicles assigned to a particular route, or interchangeable?
/ Inventory of Fleet Facilities
    - Are there major stop-over locations that serve multiple routes (for example transit centers)?
    - Where are buses stored during off-service times?
    - Do any of the routes have other stop-over locations?
    - What is the capacity of storage facilities? How many buses are stored at each currently?
    - Where is maintenance completed?
/ Maintenance Procedures
    - Does the agency have in-house maintenance personnel?
    - How are maintenance personnel trained?
    - How often are new/replacement parts required with maintenance?
/ Operating Costs
    - How much diesel/fuel does the agency currently use?
    - How is the budget divided: staff driver pay, administrative pay, maintenance pay, capital costs, maintenance materials, fuel costs?
/ Planned Investments
    - Does the agency have any existing plans to invest in electric buses?
    - Has the agency completed any study of charging needs and/or capacities at existing storage facilities?

Public Survey

Q1 Tell us a little about yourself.

Answered: 121 Skipped: 0

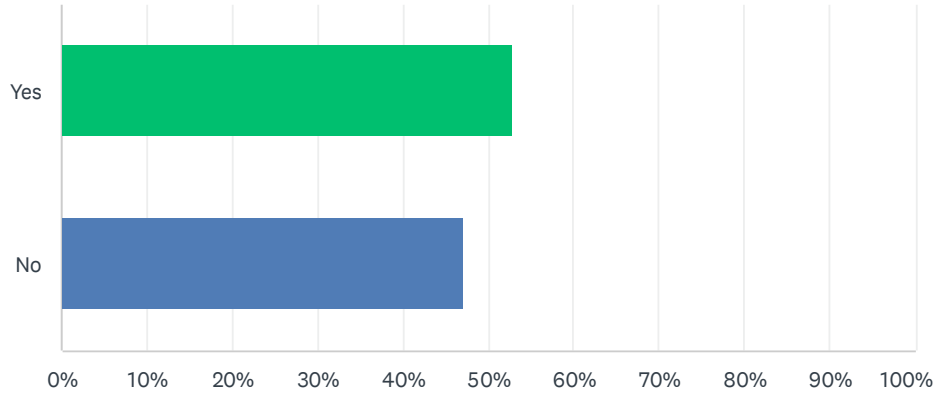


ANSWER CHOICES	RESPONSES	
I live in Hillsborough County	82.64%	100
I live outside of Hillsborough County but travel within Hillsborough County on a regular basis	12.40%	15
I occasionally visit Hillsborough County	4.96%	6
Other, please specify	0.00%	0
TOTAL		121

#	OTHER, PLEASE SPECIFY	DATE
	There are no responses.	

Q2 Do you currently drive a battery electric vehicle or a plug-in hybrid electric vehicle?

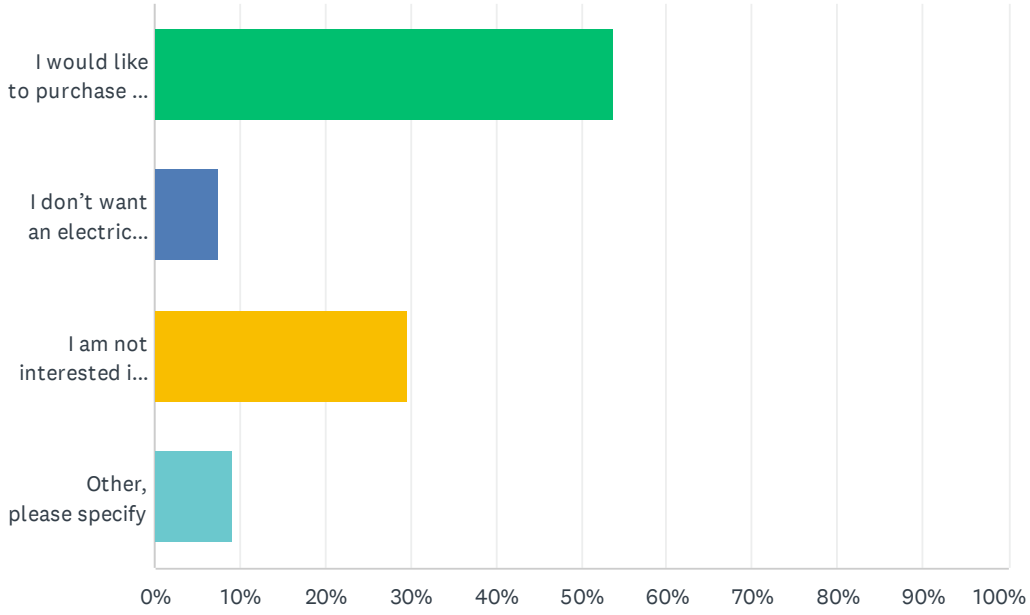
Answered: 121 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	52.89%	64
No	47.11%	57
TOTAL		121

Q3 Tell us a little about yourself.

Answered: 54 Skipped: 67

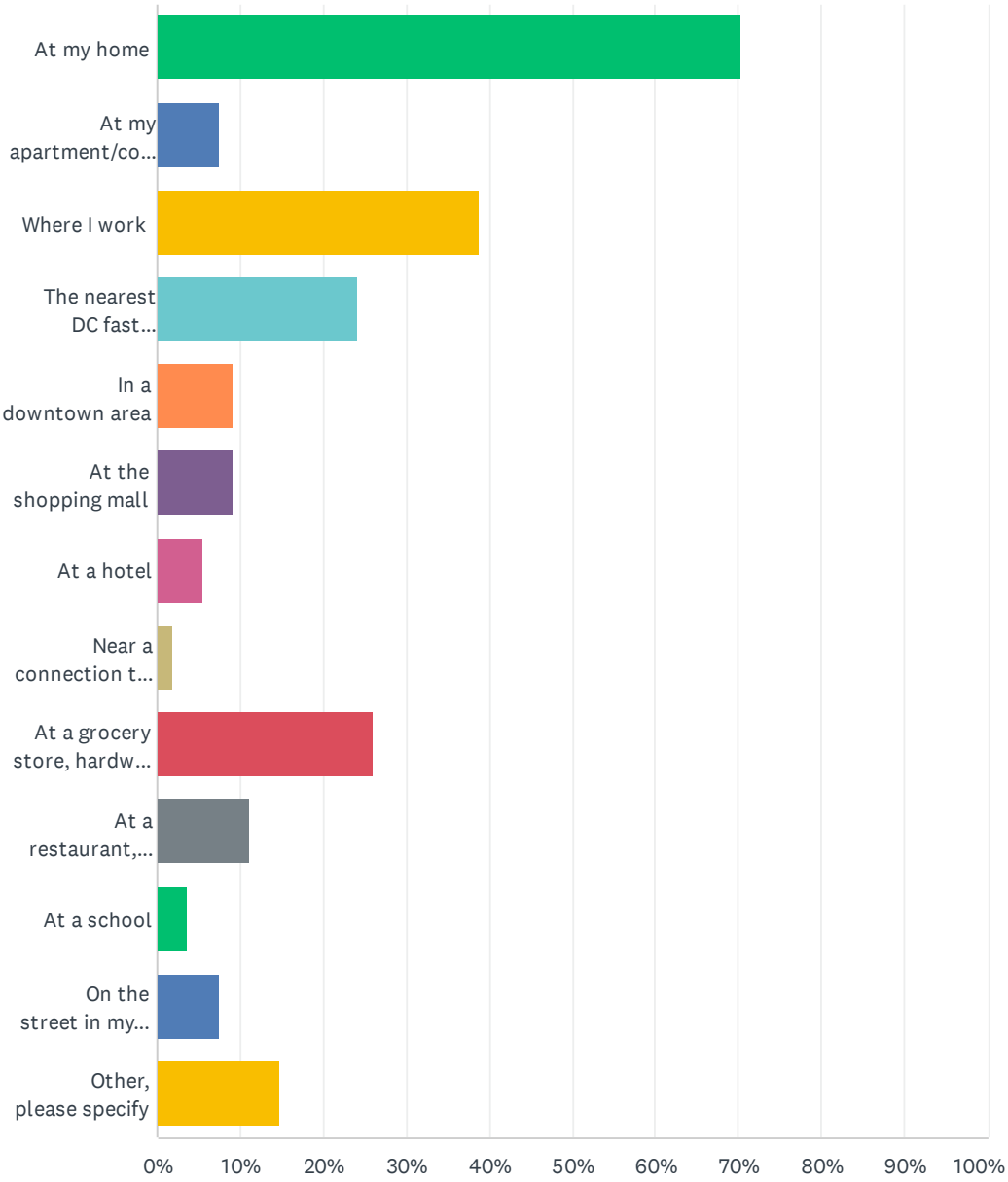


ANSWER CHOICES	RESPONSES	
I would like to purchase an electric vehicle in the future	53.70%	29
I don't want an electric vehicle but understand the benefits and support electric vehicle use	7.41%	4
I am not interested in electric vehicles	29.63%	16
Other, please specify	9.26%	5
TOTAL		54

#	OTHER, PLEASE SPECIFY	DATE
1	I would like an EV but I am not sold that the benefits outweigh the toll they bring on the environment in the mining of the metals for the batteries and the disposal of batteries. Also, natural gas and coal are still the primary ways of producing electricity.	3/20/2023 1:16 PM
2	I am currently waiting for delivery of my electric vehicle	3/7/2023 10:40 AM
3	I have had an electric vehicle in the past for many years. Charging stations can be a concern and why I went hybrid this time.	3/2/2023 11:07 AM
4	I don't think electric vehicle tech is developed enough for me to purchase for personal use.	2/22/2023 7:41 AM
5	I would like a hybrid	1/30/2023 11:59 AM

Q4 If you had an electric vehicle, where do you think you would most often charge your vehicle? Please choose 3.

Answered: 54 Skipped: 67

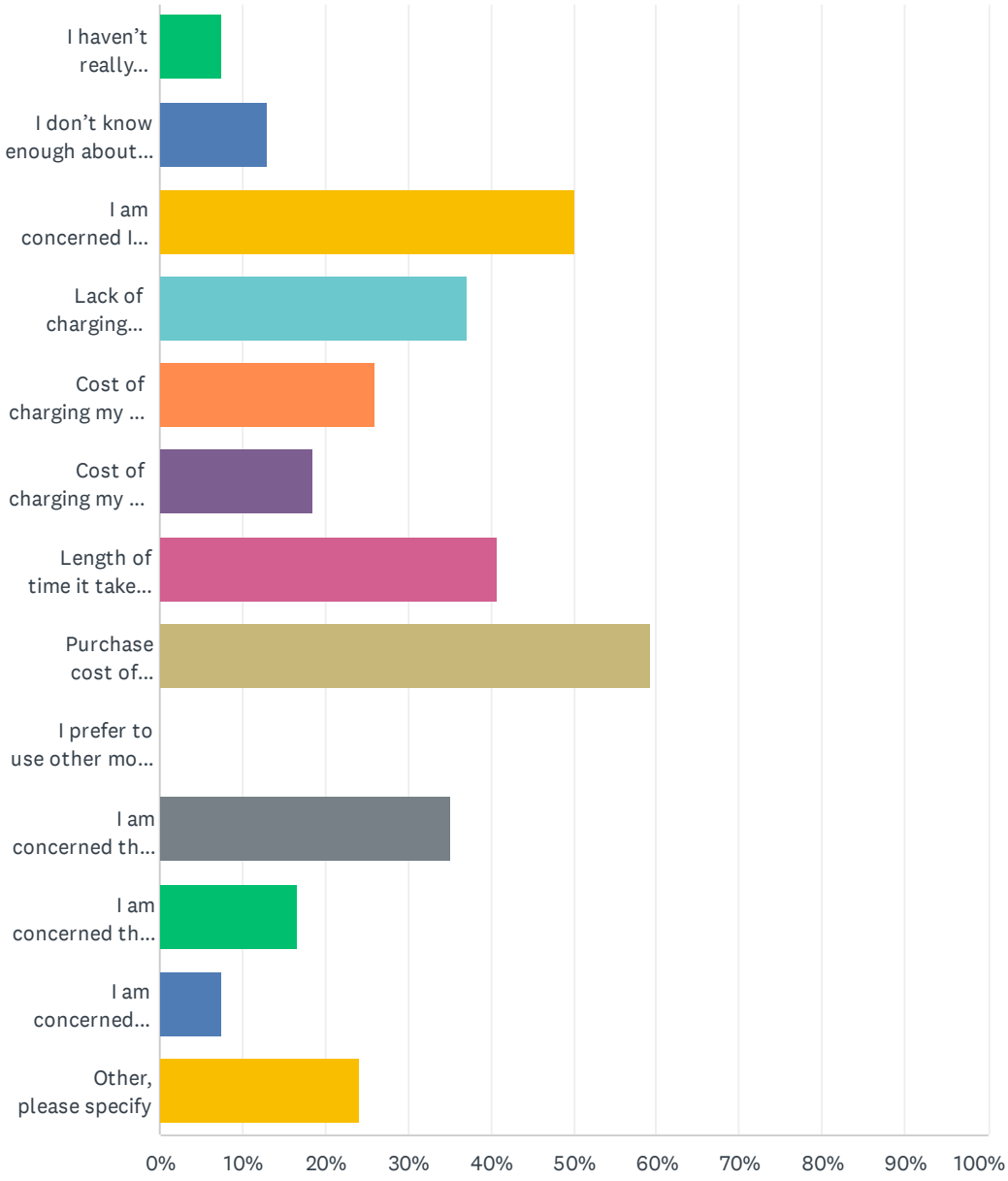


ANSWER CHOICES	RESPONSES	
At my home	70.37%	38
At my apartment/condo building	7.41%	4
Where I work	38.89%	21
The nearest DC fast charging station regardless of charging station location	24.07%	13
In a downtown area	9.26%	5
At the shopping mall	9.26%	5
At a hotel	5.56%	3
Near a connection to bus or rail transit	1.85%	1
At a grocery store, hardware store, pharmacy, or department store	25.93%	14
At a restaurant, library, park, place of worship, community center, or bank	11.11%	6
At a school	3.70%	2
On the street in my neighborhood	7.41%	4
Other, please specify	14.81%	8
Total Respondents: 54		

#	OTHER, PLEASE SPECIFY	DATE
1	never will own one	3/27/2023 7:32 PM
2	Parking lots for Amalie Arena	3/26/2023 6:18 PM
3	Private Marina	3/21/2023 3:08 PM
4	Dont know, thats why i dont want one	3/21/2023 6:42 AM
5	I would push it off a cliff	2/23/2023 6:03 AM
6	University	2/22/2023 7:41 AM
7	I wouldn’t buy one in the first place	2/18/2023 3:43 PM
8	I don’t know.	2/18/2023 5:36 AM

Q5 What is holding you back from purchasing an electric vehicle? Please check all that apply.

Answered: 54 Skipped: 67

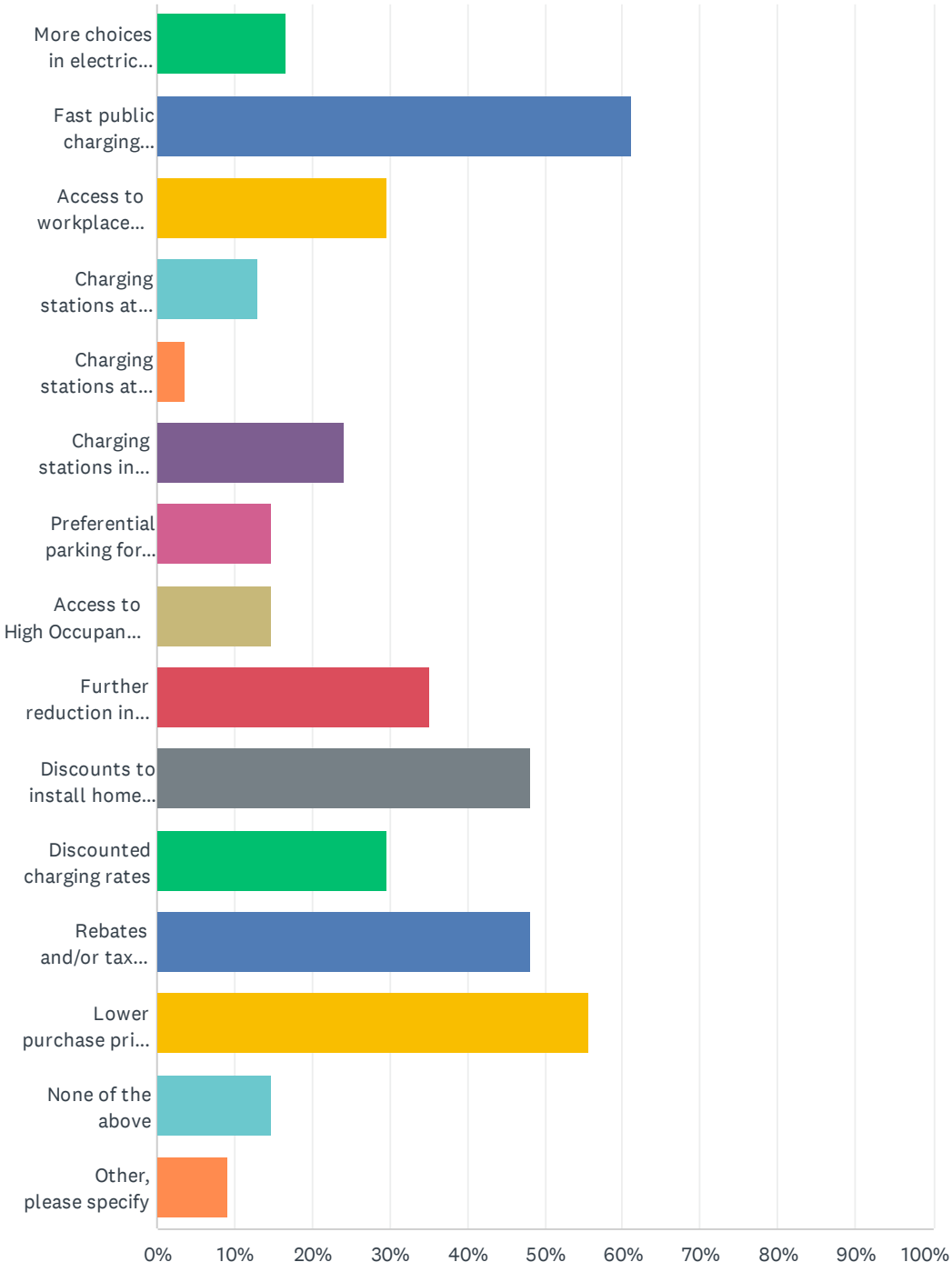


ANSWER CHOICES	RESPONSES	
I haven’t really considered buying an EV	7.41%	4
I don’t know enough about electric vehicles yet	12.96%	7
I am concerned I won’t be able to get where I need to go, and when I do travel long distances I am concerned there won’t be charging stations where I need them	50.00%	27
Lack of charging stations in places I regularly go	37.04%	20
Cost of charging my car at public chargers	25.93%	14
Cost of charging my car at home	18.52%	10
Length of time it takes to charge a vehicle	40.74%	22
Purchase cost of electric vehicle	59.26%	32
I prefer to use other modes of travel than automobile	0.00%	0
I am concerned that an electric vehicle will not be dependable to evacuate me in an extreme weather event or other emergency	35.19%	19
I am concerned that public charging locations could be destroyed or compromised in an extreme weather event or other emergency	16.67%	9
I am concerned electric vehicle chargers will negatively impact local neighborhoods.	7.41%	4
Other, please specify	24.07%	13
Total Respondents: 54		

#	OTHER, PLEASE SPECIFY	DATE
1	Lack of driving range between charges.	3/30/2023 12:50 PM
2	gasoline forever	3/27/2023 7:32 PM
3	Have 2 year old hybrid, not ready to buy. Next car will be EV though.	3/25/2023 5:00 AM
4	I believe other technology will replace electric vehicles	3/25/2023 2:38 AM
5	no good way to dispose of old batterys	3/21/2023 6:42 AM
6	We dont know how to recycle batteries	3/20/2023 4:43 PM
7	I am not sold that the benefits outweigh the toll they bring on the environment in the mining of the metals for the batteries and the disposal of batteries. Also, natural gas and coal are still the primary ways of producing electricity.	3/20/2023 1:16 PM
8	I am concerned about the long-term impacts on the environment when the life of the EVs have to be absorbed by the planet... much like the Prius batteries.	3/17/2023 4:02 PM
9	None	3/7/2023 10:40 AM
10	Lithium mines.. mic drop!	2/23/2023 6:03 AM
11	I don't have solar at home, so I'd be switching from gas to coal or natural gas powered car. I feel public transit, biking, and carpooling are more sustainable alternatives.	2/22/2023 7:41 AM
12	Inefficienct and has no lesserenvironmental impact than internal combustion cars do	2/18/2023 3:43 PM
13	Burning of fossil fuels to make electricity	2/18/2023 11:29 AM

Q6 What would most likely increase your interest in purchasing or leasing an electric vehicle? Please check all that apply.

Answered: 54 Skipped: 67

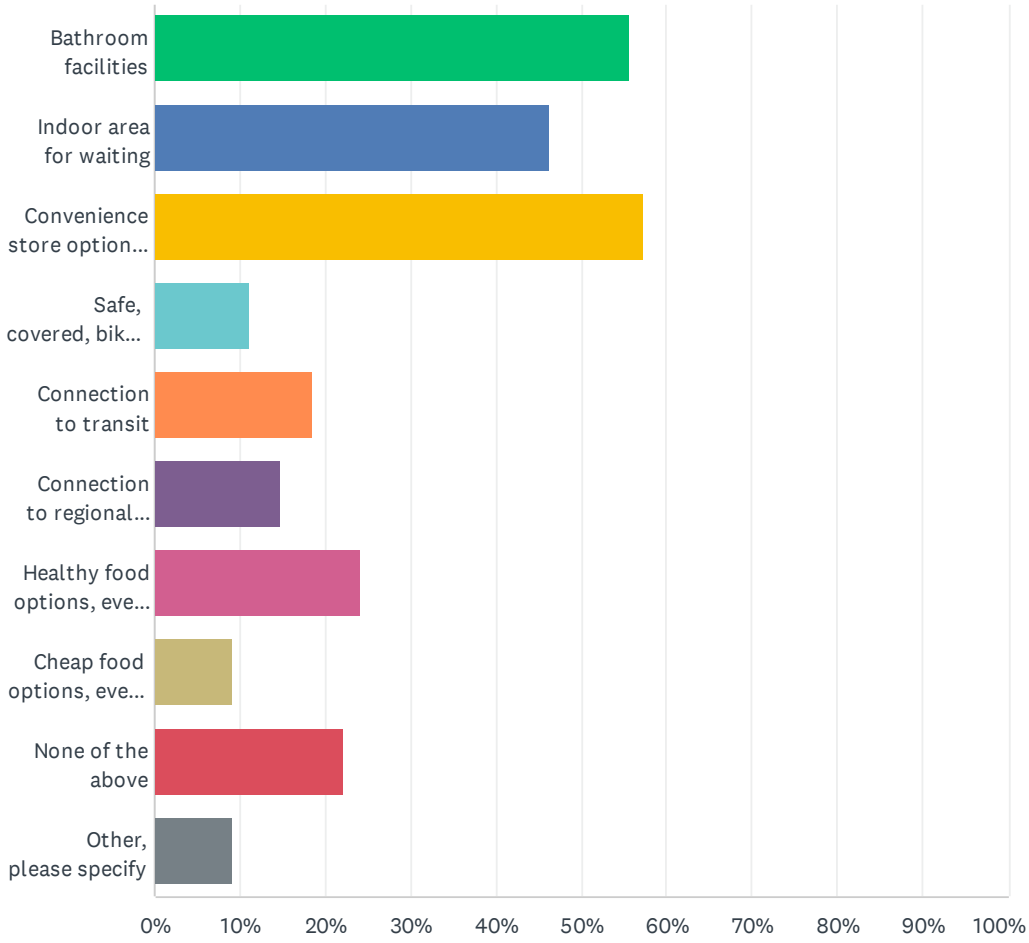


ANSWER CHOICES	RESPONSES	
More choices in electric vehicle models i.e., trucks, bigger SUVs, etc.	16.67%	9
Fast public charging stations every 50 miles along major highways	61.11%	33
Access to workplace charging stations	29.63%	16
Charging stations at apartment buildings	12.96%	7
Charging stations at regional bus or rail connections	3.70%	2
Charging stations in downtown areas	24.07%	13
Preferential parking for electric vehicles	14.81%	8
Access to High Occupancy Vehicle (HOV) lanes with only the driver in the vehicle	14.81%	8
Further reduction in environmental impacts of EVs	35.19%	19
Discounts to install home charging station	48.15%	26
Discounted charging rates	29.63%	16
Rebates and/or tax credits on car purchases	48.15%	26
Lower purchase price of electric vehicles	55.56%	30
None of the above	14.81%	8
Other, please specify	9.26%	5
Total Respondents: 54		

#	OTHER, PLEASE SPECIFY	DATE
1	Improvements in the safety and capacity of battery packs.	3/30/2023 12:50 PM
2	Electric is not a good alternative. There are other's out there that should be used.	3/21/2023 6:42 AM
3	We know how to reuse old batteries to avoid polluting our landfills	3/20/2023 4:43 PM
4	Honestly, I'd rather see incentives and discounts given to transit, not another type of driving that favors driving alone. Incentives should be driven to bus and rail and things less costly and crowded than roads.	3/17/2023 4:02 PM
5	Nationwide ev charging network	2/18/2023 11:29 AM

Q7 What other amenities would you find useful around EV charging stations? Please check all that apply.

Answered: 54 Skipped: 67

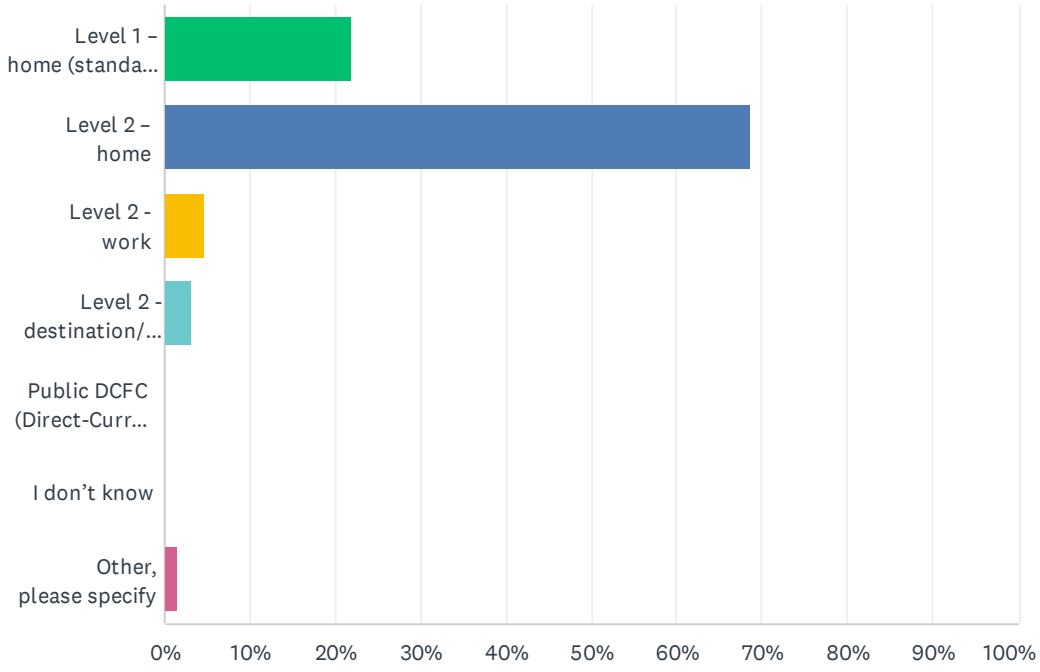


ANSWER CHOICES	RESPONSES	
Bathroom facilities	55.56%	30
Indoor area for waiting	46.30%	25
Convenience store options like coffee, snacks, and prepared meals	57.41%	31
Safe, covered, bike, and scooter parking	11.11%	6
Connection to transit	18.52%	10
Connection to regional rail	14.81%	8
Healthy food options, even if they are more expensive	24.07%	13
Cheap food options, even if they are not as healthy	9.26%	5
None of the above	22.22%	12
Other, please specify	9.26%	5
Total Respondents: 54		

#	OTHER, PLEASE SPECIFY	DATE
1	,	3/25/2023 3:49 AM
2	Again, I clicked off a bunch of things, but TRANSIT should be this good, comfortable, and convenient to use, not overpriced vehicles that will still harm the environment in the end. Electric vehicles make more sense to me for non personal uses. Local fleet vehicles and even bus systems, not personal cars.	3/17/2023 4:02 PM
3	safe green trail with cameras. a loop which takes about 15-20 minutes	2/21/2023 7:12 PM
4	It's 20 minutes , bring a book. Do full charge at home	2/18/2023 9:00 AM
5	I don’t know.	2/18/2023 5:36 AM

Q8 Where do you most often charge your electric vehicle for daily short trip use:

Answered: 64 Skipped: 57

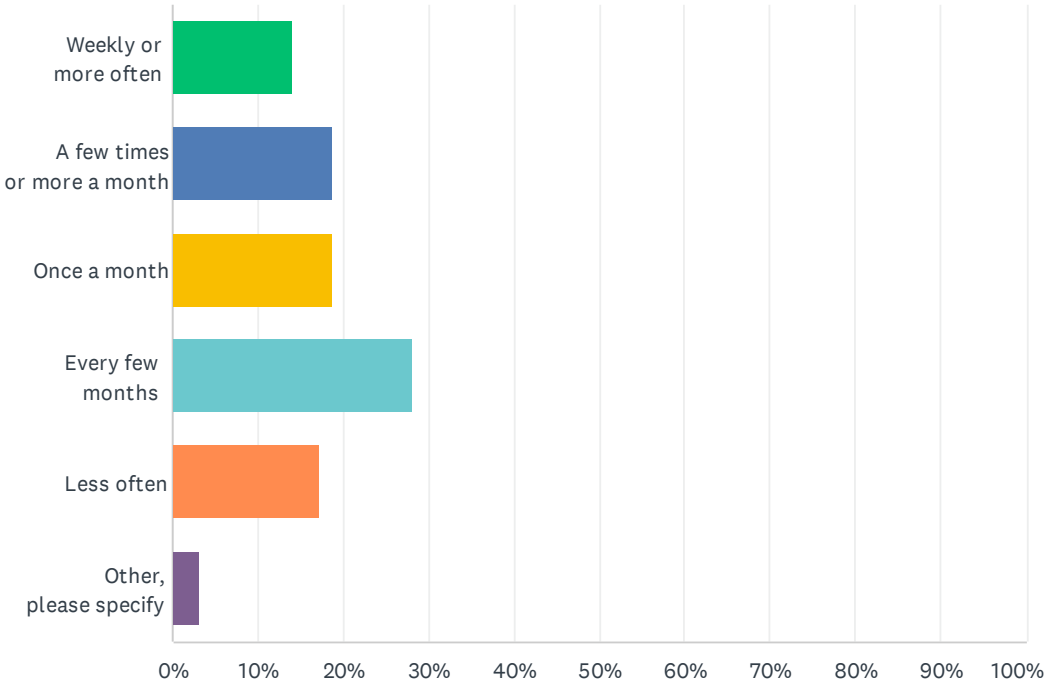


ANSWER CHOICES	RESPONSES	
Level 1 – home (standard wall outlet)	21.88%	14
Level 2 – home	68.75%	44
Level 2 - work	4.69%	3
Level 2 - destination/community	3.13%	2
Public DCFC (Direct-Current Fast Charging)	0.00%	0
I don't know	0.00%	0
Other, please specify	1.56%	1
TOTAL		64

#	OTHER, PLEASE SPECIFY	DATE
1	Level 2 - home: Apartment Community Use	3/7/2023 9:49 AM

Q9 How often do you drive your electric vehicle on a trip that exceeds its range?

Answered: 64 Skipped: 57

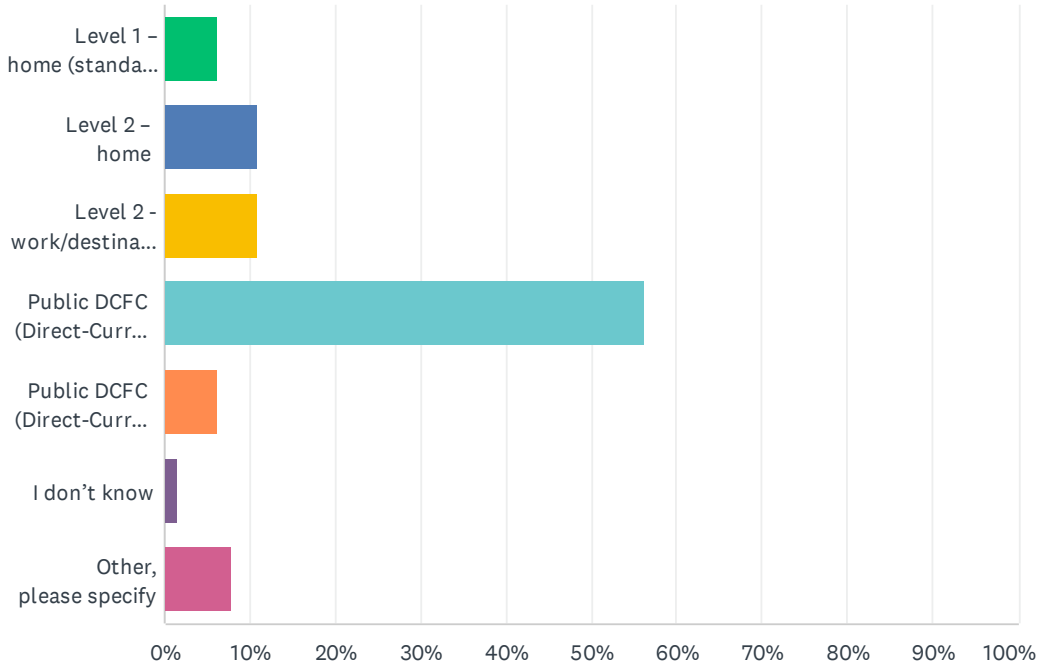


ANSWER CHOICES	RESPONSES	
Weekly or more often	14.06%	9
A few times or more a month	18.75%	12
Once a month	18.75%	12
Every few months	28.13%	18
Less often	17.19%	11
Other, please specify	3.13%	2
TOTAL		64

#	OTHER, PLEASE SPECIFY	DATE
1	Never drive exceeding range, plan ahead.	3/24/2023 7:47 PM
2	Only once in 3 years	2/19/2023 12:40 PM

Q10 What type of electric vehicle charger do you most commonly use when you are traveling longer distances?

Answered: 64 Skipped: 57

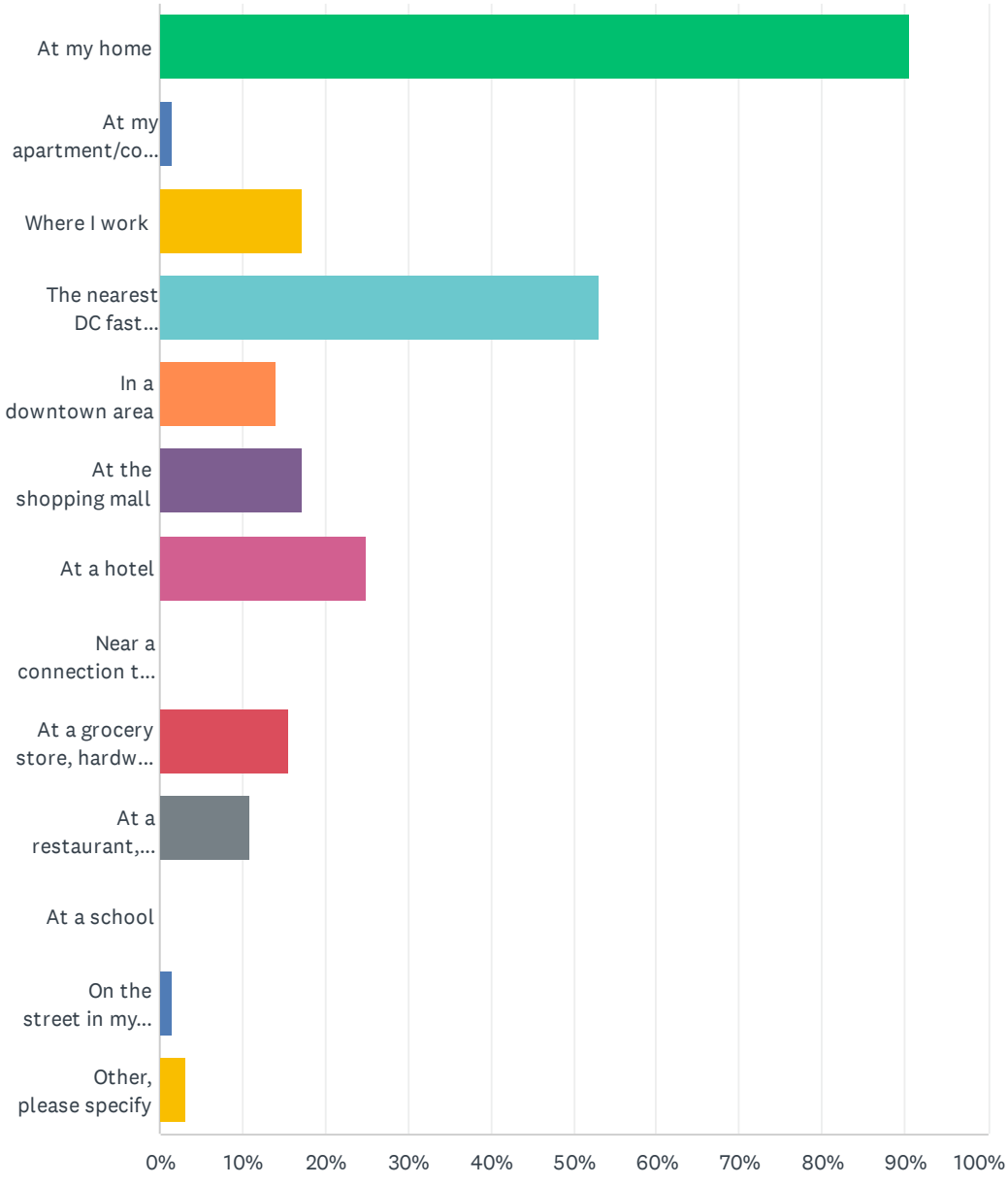


ANSWER CHOICES	RESPONSES	
Level 1 – home (standard wall outlet)	6.25%	4
Level 2 – home	10.94%	7
Level 2 - work/destination/community	10.94%	7
Public DCFC (Direct-Current Fast Charging) near highway	56.25%	36
Public DCFC (Direct-Current Fast Charging) at destination	6.25%	4
I don't know	1.56%	1
Other, please specify	7.81%	5
TOTAL		64

#	OTHER, PLEASE SPECIFY	DATE
1	Tesla Supercharger	3/29/2023 11:30 PM
2	Tesla Supercharger	3/25/2023 6:11 AM
3	Tesla Supercharger	3/7/2023 6:41 AM
4	Tesla supercharger	3/6/2023 7:16 AM
5	Tesla Supercharger	3/4/2023 6:34 PM

Q11 Where are the most common places you charge? Please choose 3.

Answered: 64 Skipped: 57

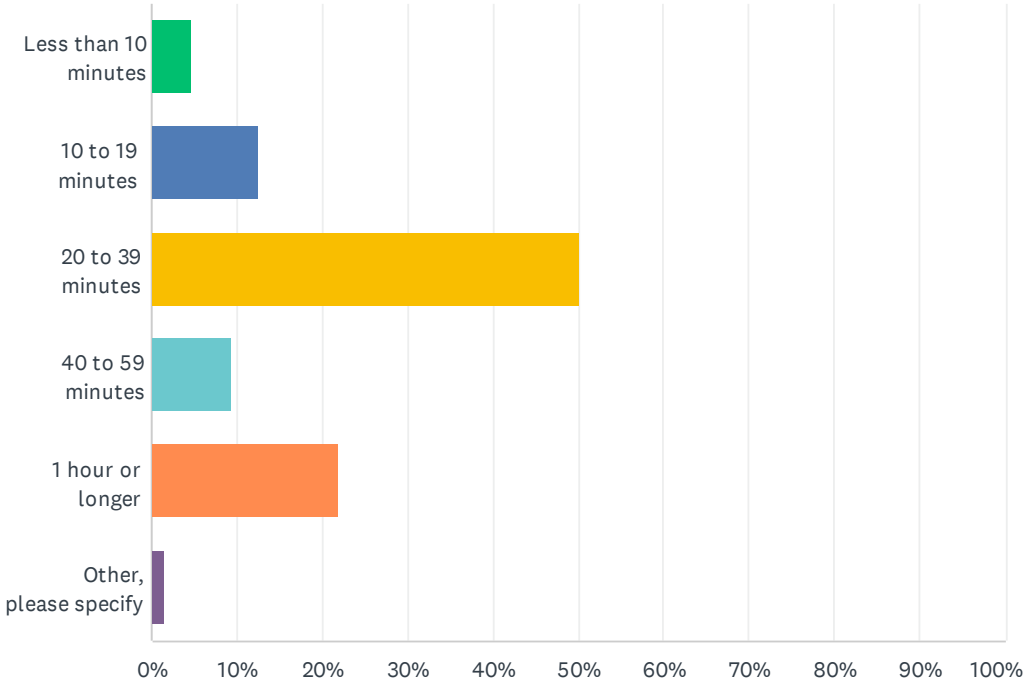


ANSWER CHOICES	RESPONSES	
At my home	90.63%	58
At my apartment/condo building	1.56%	1
Where I work	17.19%	11
The nearest DC fast charging station regardless of charging station location	53.13%	34
In a downtown area	14.06%	9
At the shopping mall	17.19%	11
At a hotel	25.00%	16
Near a connection to bus or rail transit	0.00%	0
At a grocery store, hardware store, pharmacy, or department store	15.63%	10
At a restaurant, library, park, place of worship, community center, or bank	10.94%	7
At a school	0.00%	0
On the street in my neighborhood	1.56%	1
Other, please specify	3.13%	2
Total Respondents: 64		

#	OTHER, PLEASE SPECIFY	DATE
1	Dc charge near my trip / hwy	3/28/2023 3:14 AM
2	Tesla supercharger at Wawa on Dale Mabry Hwy	3/4/2023 6:34 PM

Q12 When using a public charger, how long do you typically charge?

Answered: 64 Skipped: 57

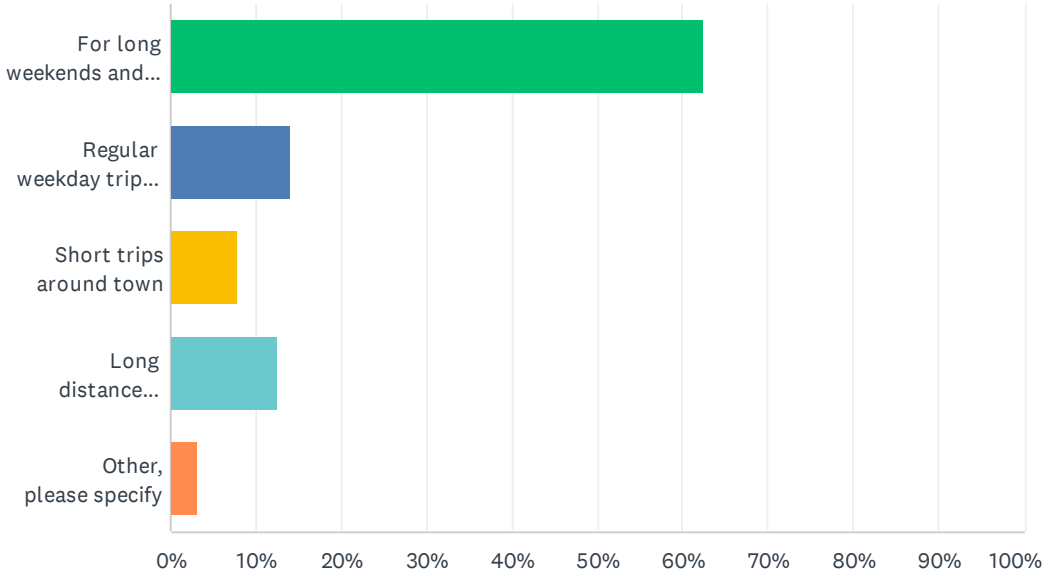


ANSWER CHOICES	RESPONSES	
Less than 10 minutes	4.69%	3
10 to 19 minutes	12.50%	8
20 to 39 minutes	50.00%	32
40 to 59 minutes	9.38%	6
1 hour or longer	21.88%	14
Other, please specify	1.56%	1
TOTAL		64

#	OTHER, PLEASE SPECIFY	DATE
1	DCFC: 20-30 minutes. Hotel L2: Overnight.	3/3/2023 6:21 AM

Q13 When do you most often use a publicly accessible charger?

Answered: 64 Skipped: 57

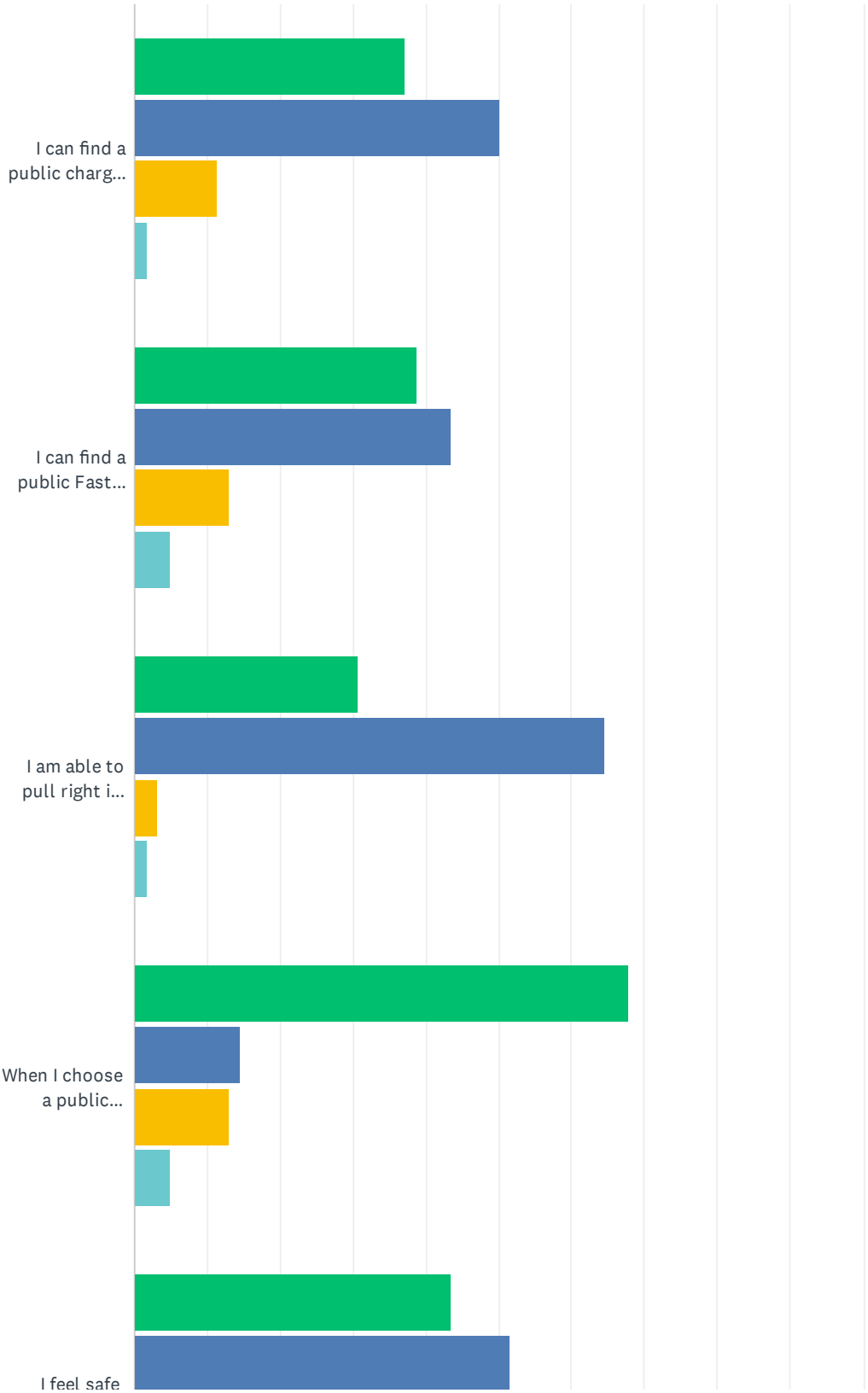


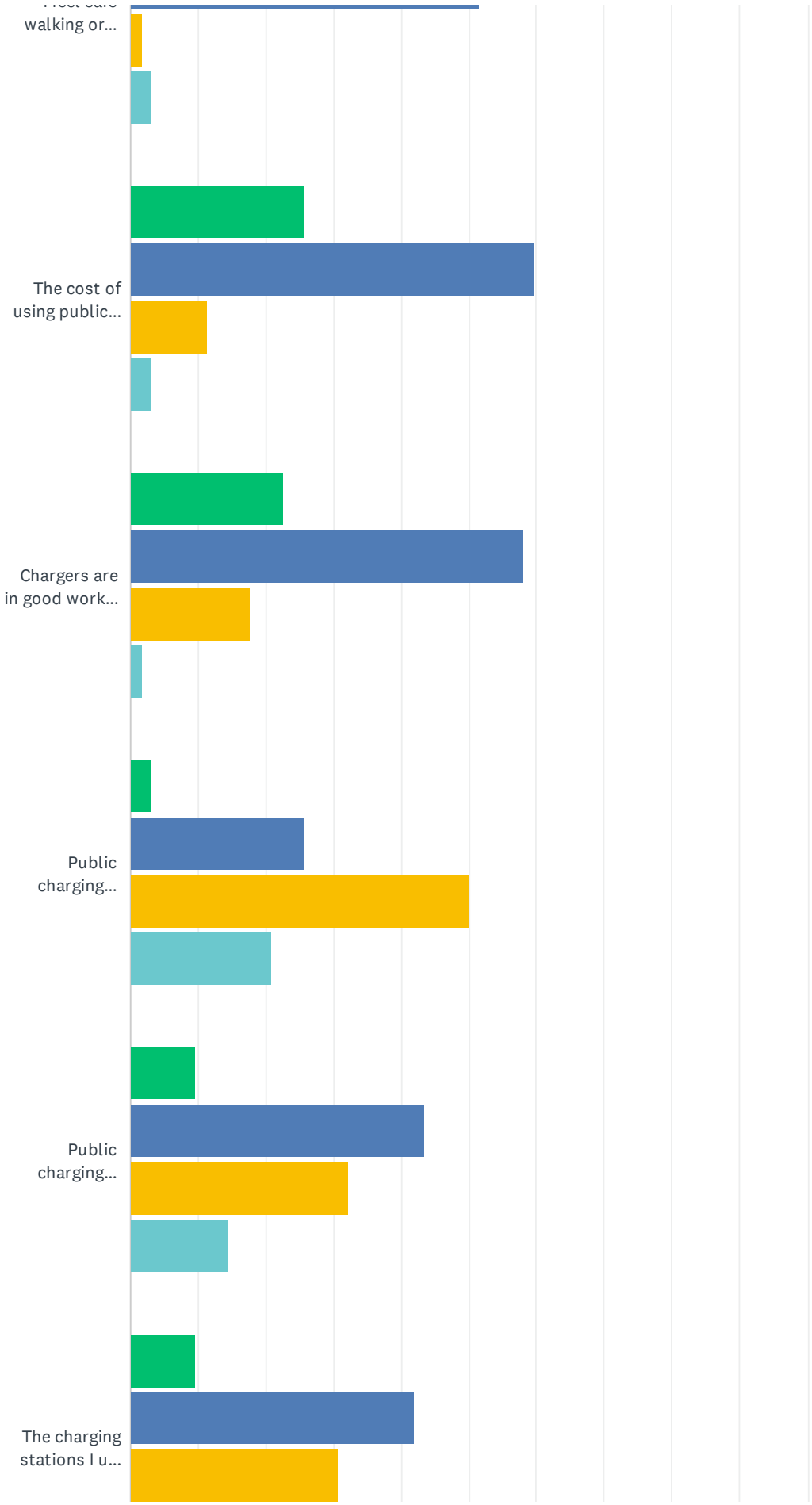
ANSWER CHOICES	RESPONSES	
For long weekends and holiday trips	62.50%	40
Regular weekday trips for commuting to and from work	14.06%	9
Short trips around town	7.81%	5
Long distance business travel	12.50%	8
Other, please specify	3.13%	2
TOTAL		64

#	OTHER, PLEASE SPECIFY	DATE
1	Leisure trips on weekends/ weekdays	3/28/2023 3:14 AM
2	on a long trip…once in 3 years	2/19/2023 12:40 PM

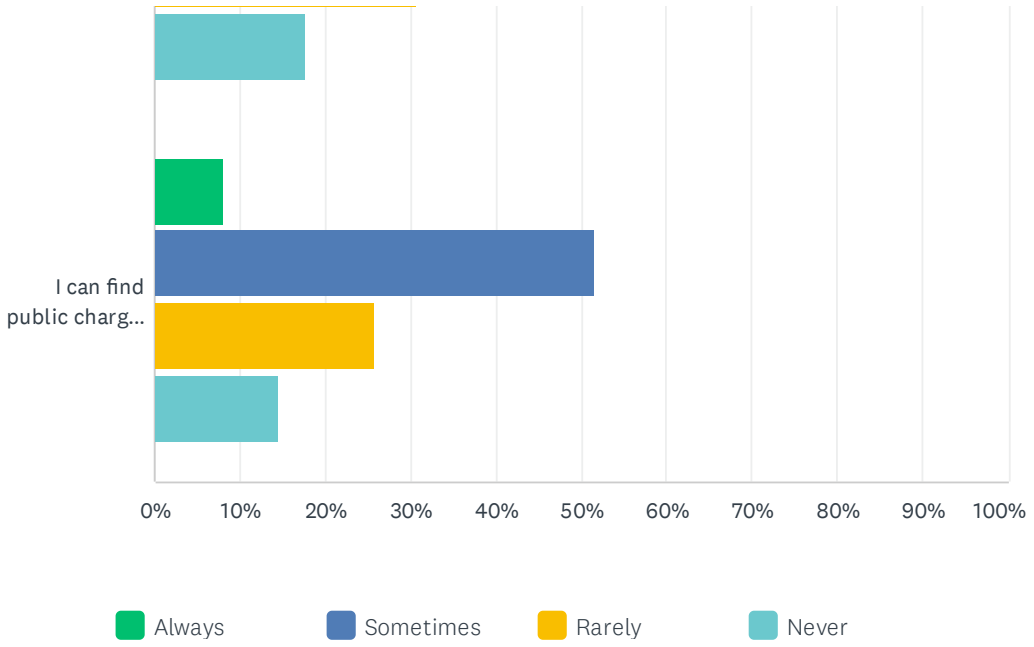
Q14 Tell us about your electric vehicle charging experiences using public chargers.

Answered: 62 Skipped: 59




walking or...
The cost of using public...
Chargers are in good work...
Public charging...
Public charging...
The charging stations I u...

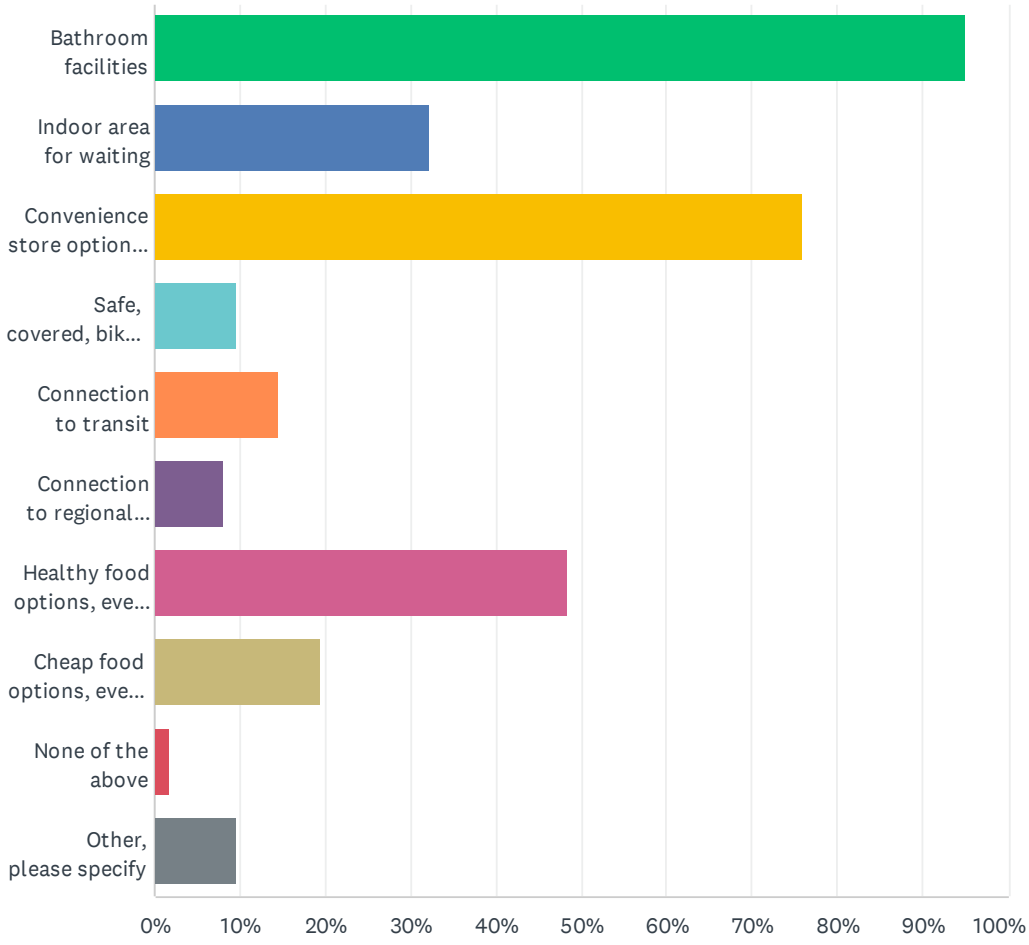
Electric Vehicle Charging Survey



	ALWAYS	SOMETIMES	RARELY	NEVER	TOTAL
I can find a public charger on my travel routes.	37.10% 23	50.00% 31	11.29% 7	1.61% 1	62
I can find a public Fast Charger on my travel routes.	38.71% 24	43.55% 27	12.90% 8	4.84% 3	62
I am able to pull right in and plug my vehicle in without waiting.	30.65% 19	64.52% 40	3.23% 2	1.61% 1	62
When I choose a public charging station to use, personal safety is a consideration.	67.74% 42	14.52% 9	12.90% 8	4.84% 3	62
I feel safe walking or biking near the public charging stations I use.	43.55% 27	51.61% 32	1.61% 1	3.23% 2	62
The cost of using public charging stations is reasonable.	25.81% 16	59.68% 37	11.29% 7	3.23% 2	62
Chargers are in good working condition.	22.58% 14	58.06% 36	17.74% 11	1.61% 1	62
Public charging stations have shelter from the weather.	3.23% 2	25.81% 16	50.00% 31	20.97% 13	62
Public charging stations have restrooms available for use.	9.68% 6	43.55% 27	32.26% 20	14.52% 9	62
The charging stations I use are near transit connections.	9.68% 6	41.94% 26	30.65% 19	17.74% 11	62
I can find public charging in downtown locations.	8.06% 5	51.61% 32	25.81% 16	14.52% 9	62

Q15 What other amenities would you find useful around EV charging stations? Please check all that apply.

Answered: 62 Skipped: 59

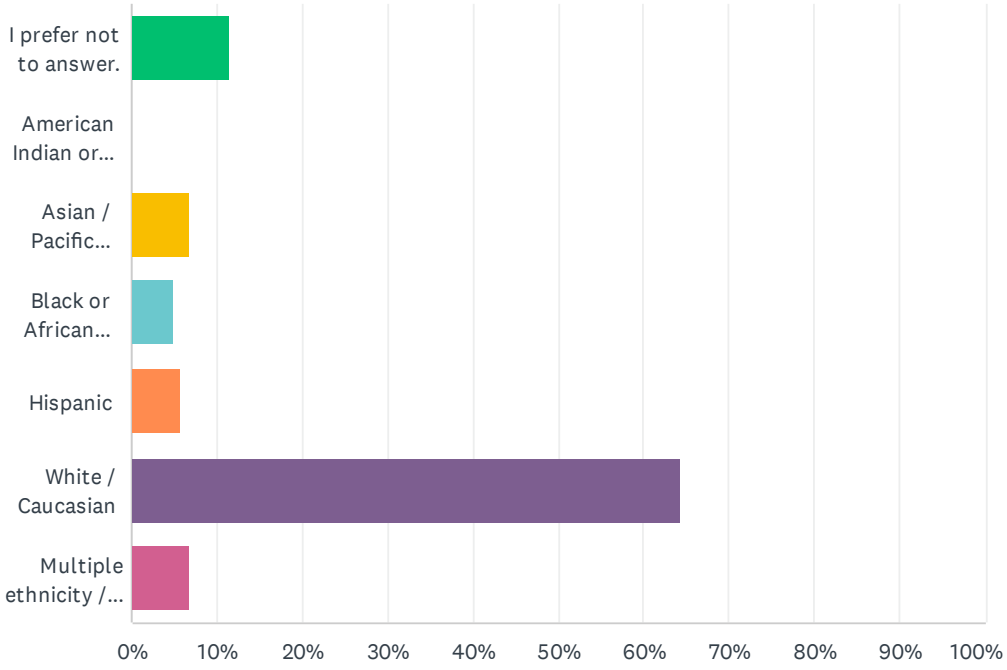


ANSWER CHOICES	RESPONSES	
Bathroom facilities	95.16%	59
Indoor area for waiting	32.26%	20
Convenience store options like coffee, snacks, and prepared meals	75.81%	47
Safe, covered, bike, and scooter parking	9.68%	6
Connection to transit	14.52%	9
Connection to regional rail	8.06%	5
Healthy food options, even if they are more expensive	48.39%	30
Cheap food options, even if they are not as healthy	19.35%	12
None of the above	1.61%	1
Other, please specify	9.68%	6
Total Respondents: 62		

#	OTHER, PLEASE SPECIFY	DATE
1	Something available 24/7	3/28/2023 9:37 AM
2	Fast food and sit-down restaurants.	3/3/2023 6:23 AM
3	Shopping, parks with shade and benches, and wifi	3/2/2023 4:23 PM
4	garbage cans	3/2/2023 1:38 PM
5	Chargers at shopping/grocery locations are helpful. Ex. Butler Town Center - Gainesville - TESA Supercharger location or Chargers at Wawa	3/2/2023 9:14 AM
6	Located at a place of business I frequent or could be my destination, so I don't feel like I'm wasting time (Target, Costco, Kohls, grocery stores, movie theaters, sports arenas) - will utilize existing services (bathrooms/food/shopping/entertainment). This works for Level 2 & 3. Prioritizing businesses closest to highways will help tourism and attractions, but lower income and apartment residents without chargers require more options where they normally shop.	2/18/2023 6:13 AM

Q17 Which race/ethnicity best describes you? (optional)

Answered: 104 Skipped: 17

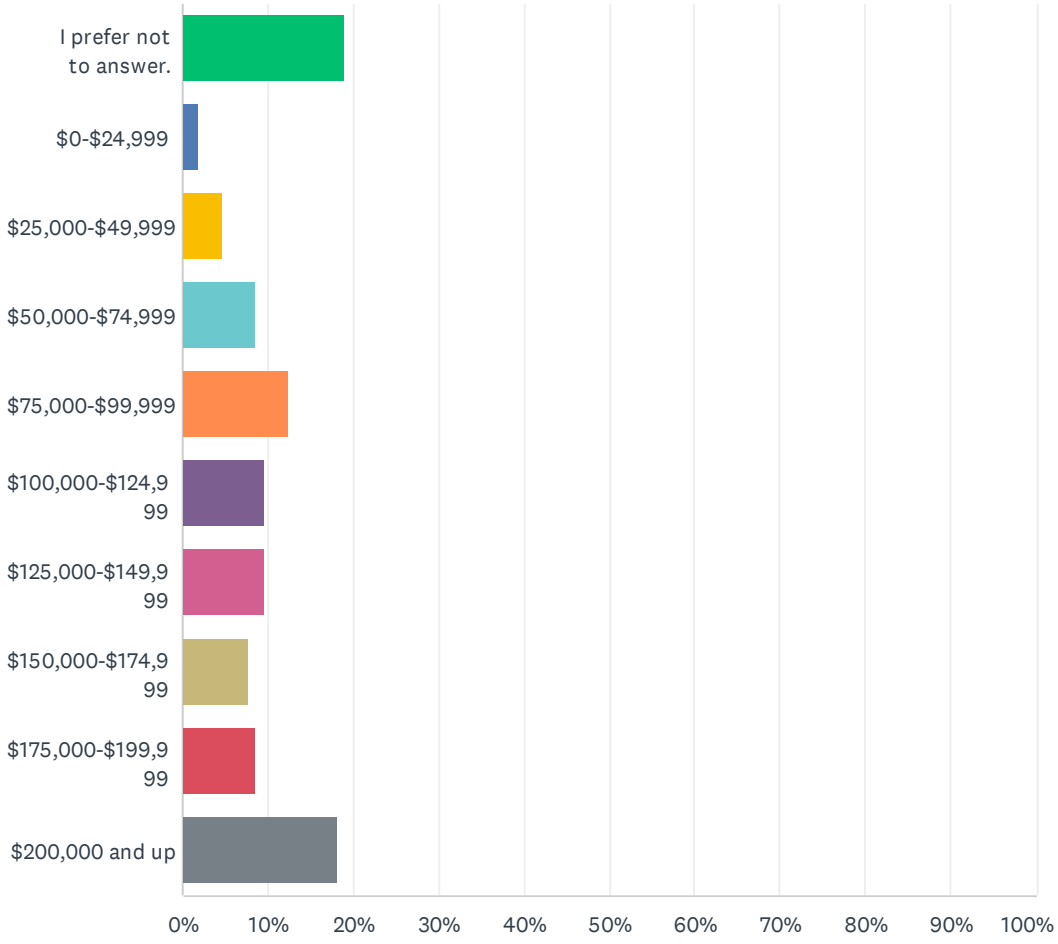


ANSWER CHOICES	RESPONSES	
I prefer not to answer.	11.54%	12
American Indian or Alaskan Native	0.00%	0
Asian / Pacific Islander	6.73%	7
Black or African American	4.81%	5
Hispanic	5.77%	6
White / Caucasian	64.42%	67
Multiple ethnicity / Other (please specify)	6.73%	7
TOTAL		104

#	MULTIPLE ETHNICITY / OTHER (PLEASE SPECIFY)	DATE
1	irish	3/27/2023 7:33 PM
2	All of them	3/1/2023 6:23 PM
3	White Hispanic	2/22/2023 7:42 AM
4	Many ethnicities	2/18/2023 11:30 AM
5	Eufro American	2/18/2023 5:38 AM
6	White and Asian	2/16/2023 2:44 PM
7	Black Hispanic	1/30/2023 11:59 AM

Q18 What is your approximate annual household income?

Answered: 105 Skipped: 16



ANSWER CHOICES	RESPONSES	
I prefer not to answer.	19.05%	20
$0-$24,999	1.90%	2
$25,000-$49,999	4.76%	5
$50,000-$74,999	8.57%	9
$75,000-$99,999	12.38%	13
$100,000-$124,999	9.52%	10
$125,000-$149,999	9.52%	10
$150,000-$174,999	7.62%	8
$175,000-$199,999	8.57%	9
$200,000 and up	18.10%	19
TOTAL		105

Appendix C: Estimating Charging Need in Hillsborough County

As mentioned in the Needs Analysis, the EVI-Pro Lite tool is limited to analyze the charging needs for up to 10% of the current light duty vehicles in an analysis area. To project charging need for the medium- and high-adoption scenarios for light duty vehicles, data form the EVI-Pro Lite tool was extrapolated. Data points within the limit of EVI-Pro Lite tool were collected, as shown in Table 21, using the same assumptions described in the Needs Analysis section. The Pearson Correlation Coefficients suggest strong positive linear relationships between the number of light-duty vehicles and the numbers of workplace/public charging plugs, with all values over 0.99. Therefore, linear regression was used to extrapolate the number of charging plugs needed to support the projected number of light-duty vehicles. Three models (Workplace Level 2 Charging Plug Model, Public Level 2 Charging Plug Model, and Public DC Fast Charging Plug Model) were developed. Model results are summarized in Table 21.

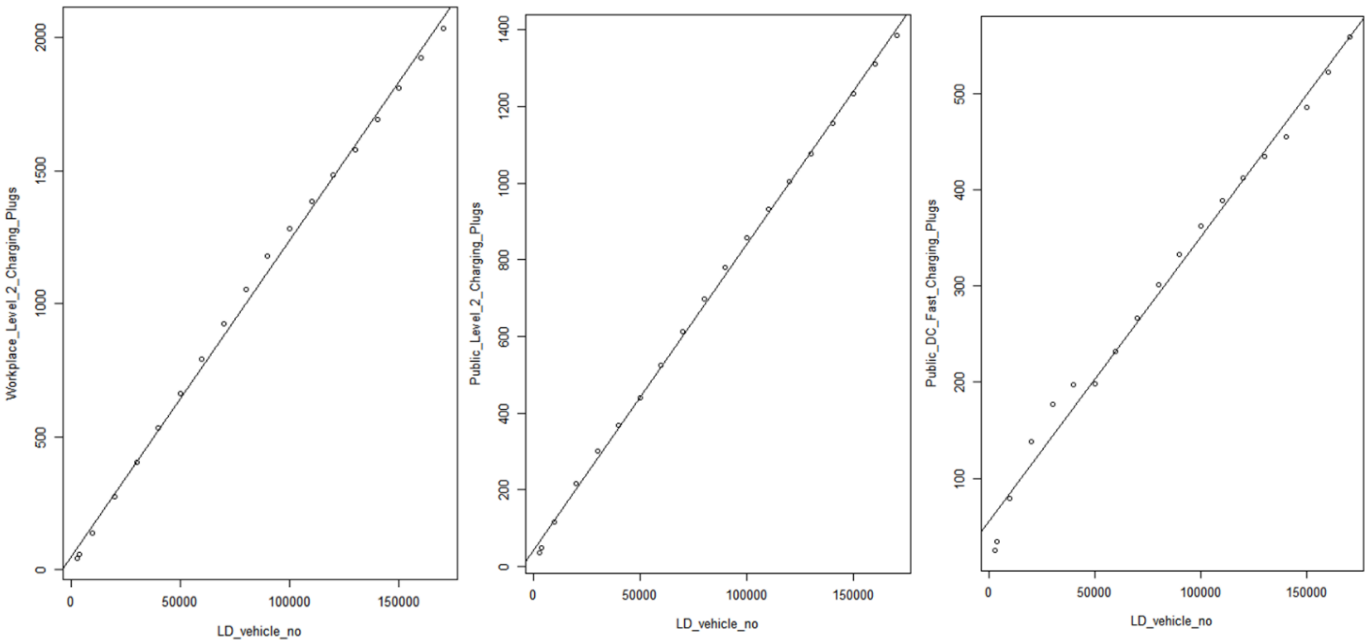
Table 21. Data Points Retrieved from EVI-Pro Lite Tool

Light-Duty vehicle	*Workplace Level 2 Charging Plug*	*Public Level 2 Charging Plug*	*Public DC Fast Charging Plug*
3,000	42	36	25
4,000	56	48	34
10,000	138	116	79
20,000	273	216	138
30,000	405	300	177
40,000	533	369	197
50,000	662	440	198
60,000	793	526	232
70,000	924	613	267
80,000	1,054	698	301
90,000	1,178	781	333
100,000	1,284	858	363
110,000	1,385	933	389
120,000	1,482	1,005	413
130,000	1,577	1,077	435
140,000	1,693	1,155	455
150,000	1,809	1,233	486
160,000	1,923	1,309	523
170,000	2,037	1,386	560

Table 22. Charging Plug Regression Models

	Workplace Level 2 Charging Plug Model				Public Level 2 Charging Plug Model				Public DC Fast Charging Plug Model			
	Estimate	*Std. Error*	*P value*		*Estimate*	*Std. Error*	*P value*		*Estimate*	*Std. Error*	*P value*	
(Intercept)	49.840	14.330	0.003	**	42.660	6.309	0.000	***	54.990	7.667	0.000	***
Light-Duty vehicle	0.012	0.000	0.000	***	0.008	0.000	0.000	***	0.003	0.000	0.000	***
Multiple R-squared	0.997				0.999				0.988			
Adjusted R-squared	0.997				0.999				0.987			

Figure 27. Regression Plots (Left: Workplace Level 2 Charging Plug Model; Middle: Public Level 2 Charging Plug Model; Right: Public DC Fast Charging Plug Model)

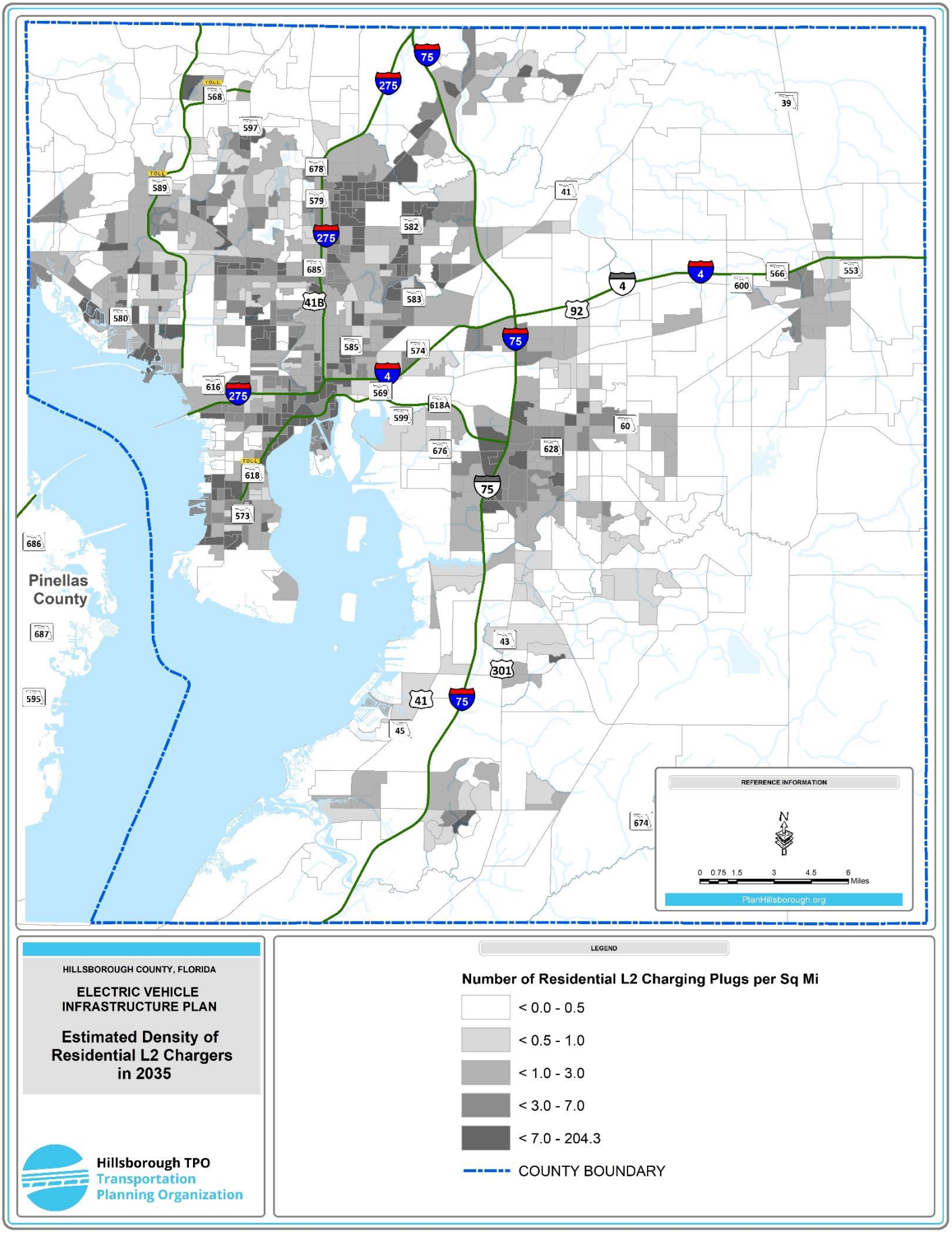


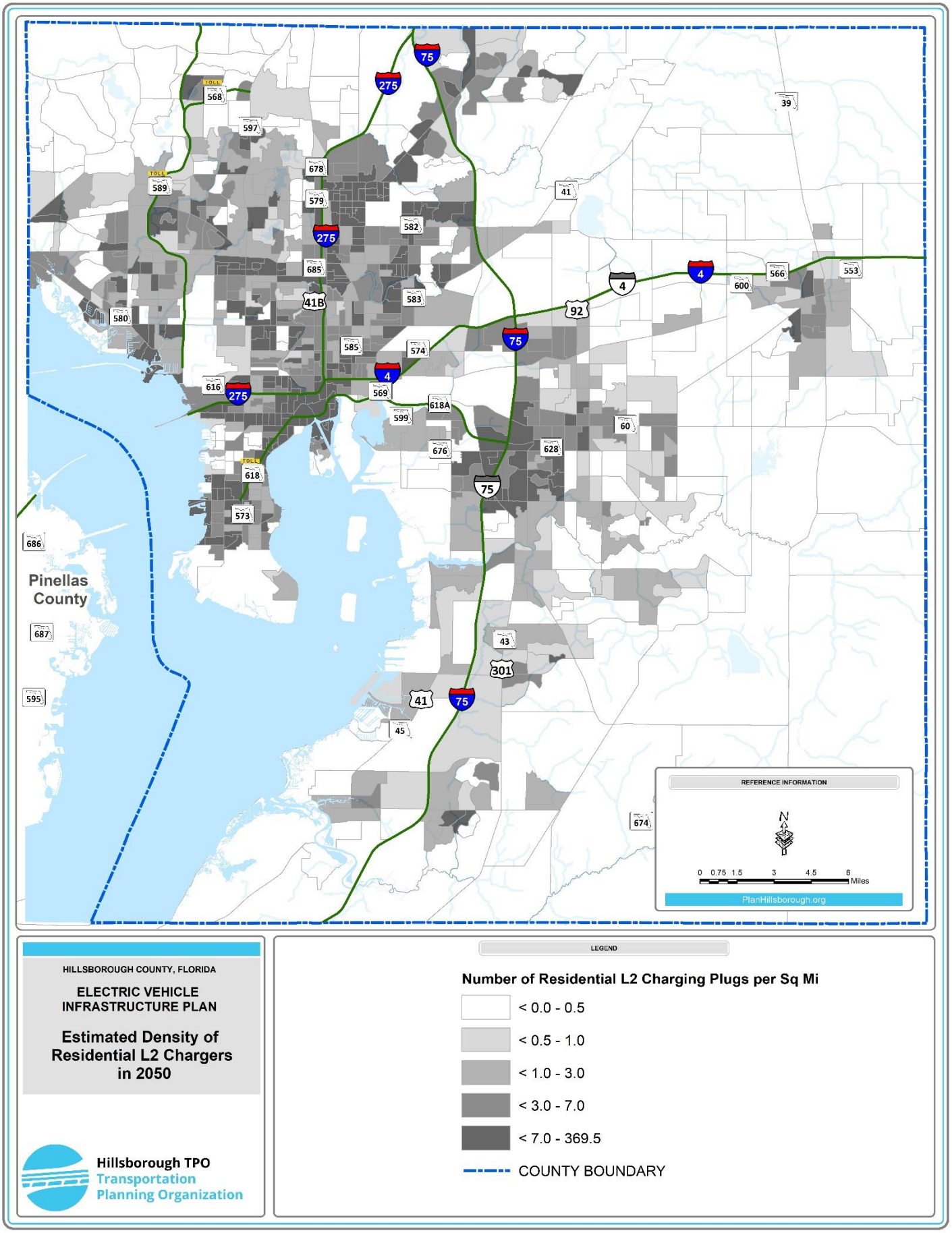
The number of Light-Duty vehicles significantly predicted the numbers of workplace/public L2 DCFC plugs. More than 98% of the variability observed in the number of charging plugs is explained by the regression models. The regression models, suggested in Table 22, were then used to make predictions of the number of charging plugs beyond the limits of the EVI-Pro Lite tool.

The linear regression equations suggest that the following ratios of EV charging ports per EV in Hillsborough County are needed.

- Public DCFC: 3 plugs per 1,000 EVs
- Public Level 2: 8 plugs per 1,000 EVs
- Workplace Level 2: 12 plugs per 1,000 EVs

Charging infrastructure is distributed to Census Block Groups throughout Hillsborough County according to the methods described in the Needs Analysis. The total number of charging ports projected for Hillsborough County under each adoption scenario are distributed similarly. The distribution of charging ports is shown on the subsequent maps and is also recorded tabularly.


HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Residential L2 Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Residential L2 Charging Plugs per Sq Mi
< 0.0 - 0.5
< 0.5 - 1.0
< 1.0 - 3.0
< 3.0 - 7.0
< 7.0 - 204.3
COUNTY BOUNDARY
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6
Miles
PlanHillsborough.org
Pinellas County
75
275
4
41
41B
92
301
568
597
589
678
579
582
685
583
580
585
574
569
616
618A
599
676
628
618
573
686
687
595
43
45
674
39
553
566
600
60


HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Residential L2 Chargers in 2050
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Residential L2 Charging Plugs per Sq Mi
< 0.0 - 0.5
< 0.5 - 1.0
< 1.0 - 3.0
< 3.0 - 7.0
< 7.0 - 369.5
COUNTY BOUNDARY
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6
Miles
PlanHillsborough.org
Pinellas County
75
275
4
41
41B
92
301
39
43
45
568
597
589
678
579
582
685
583
580
585
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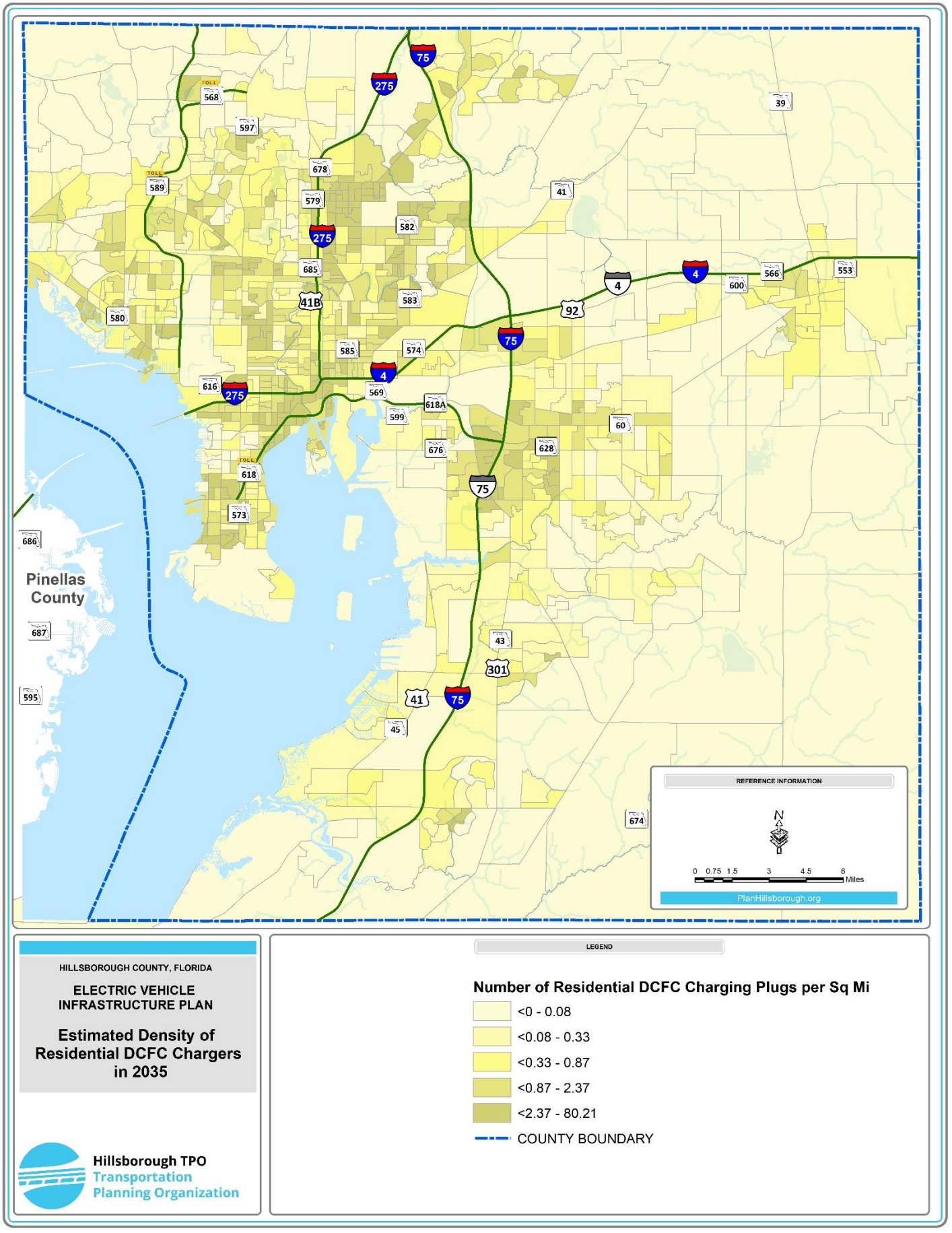
569
616
618A
599
676
628
618
573
686
687
595
674
566
553
600
60


HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Residential DCFC Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Residential DCFC Charging Plugs per Sq Mi
<0 - 0.08
<0.08 - 0.33
<0.33 - 0.87
<0.87 - 2.37
<2.37 - 80.21
COUNTY BOUNDARY
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6
Miles
PlanHillsborough.org
Pinellas County
75
275
4
41B
92
41
301
39
41
43
45
60
553
566
600
568
597
589
678
579
582
685
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585
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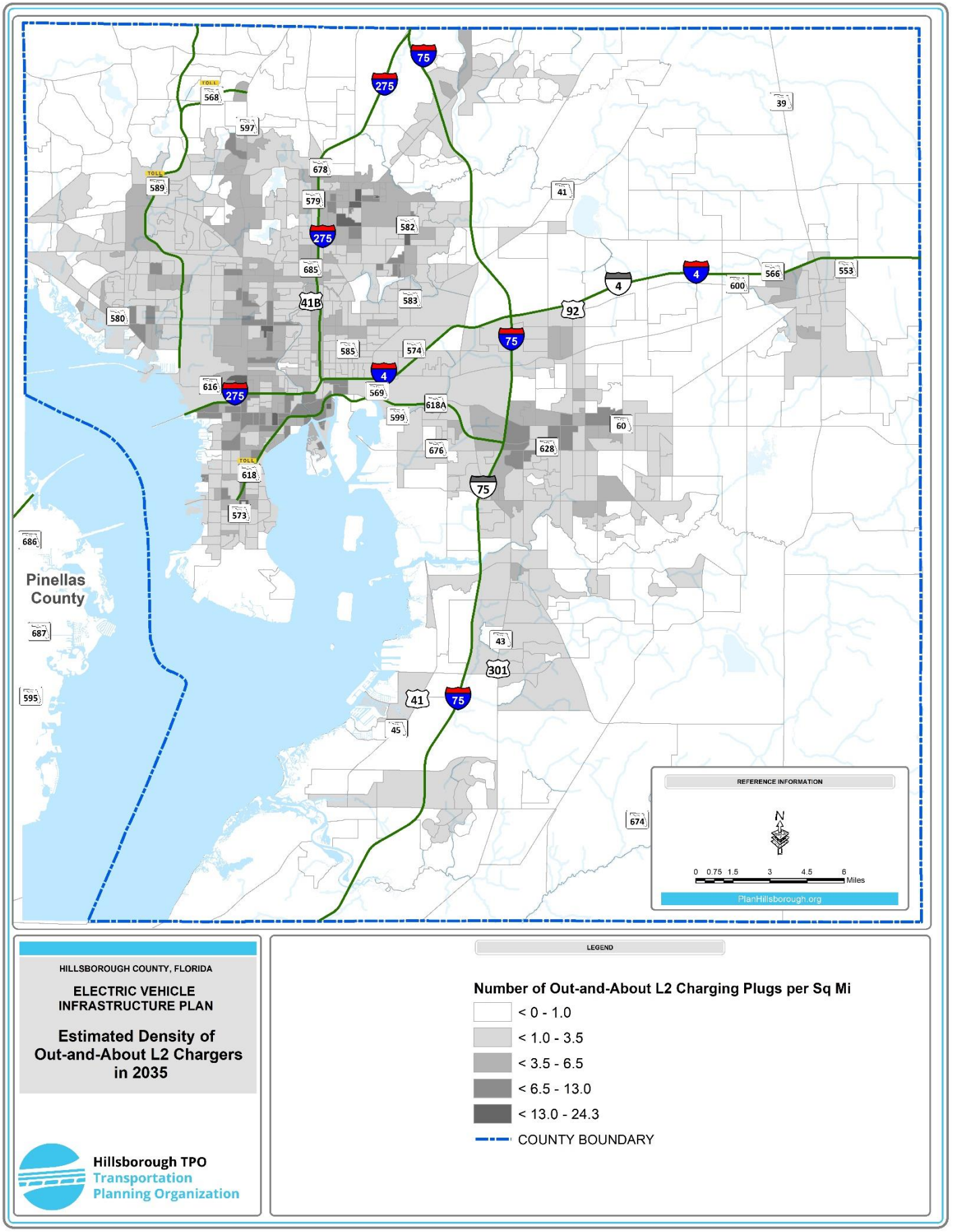
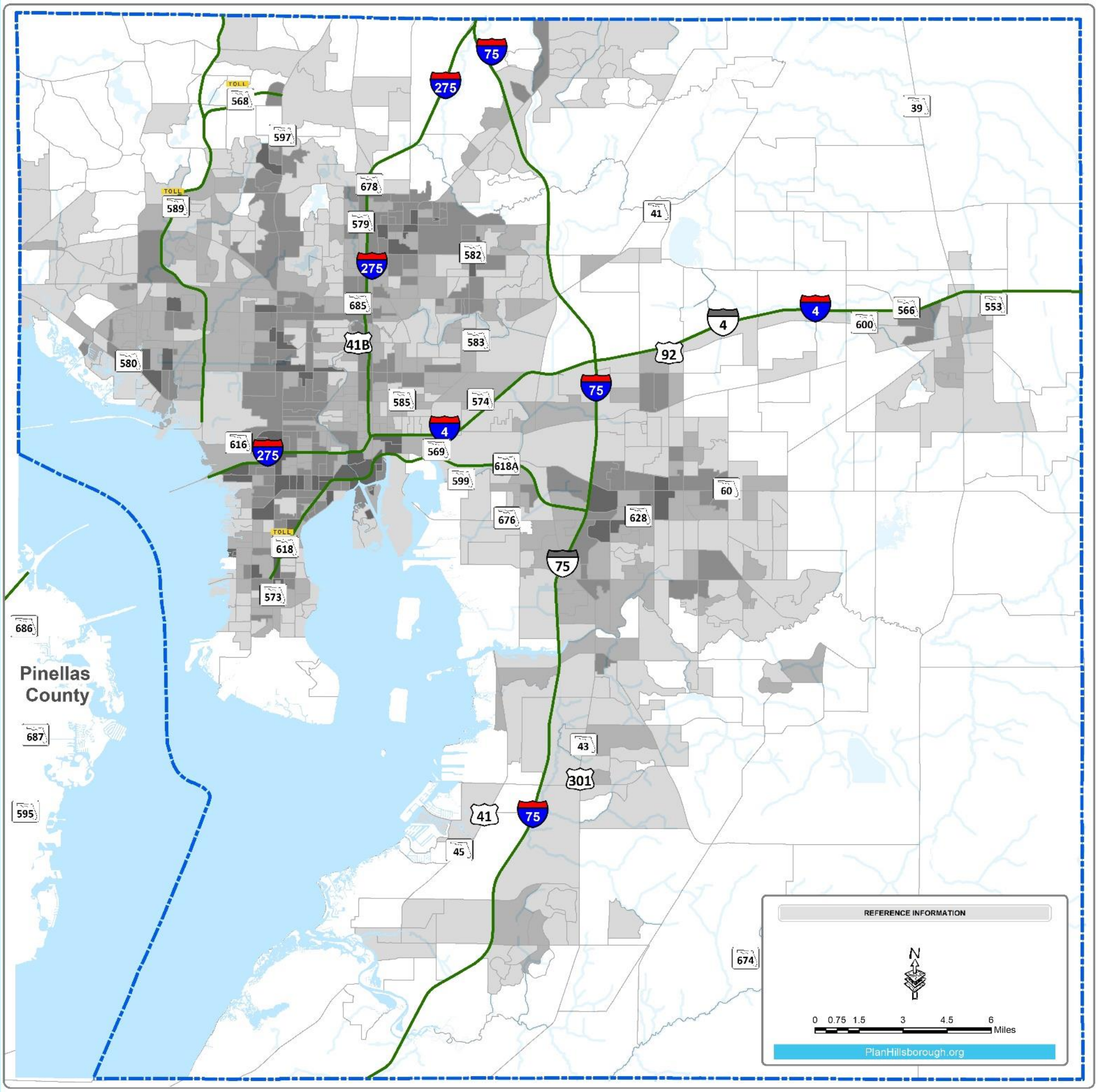
676
628
618
573
686
687
595
674


Pinellas County
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6
Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Out-and-About L2 Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Out-and-About L2 Charging Plugs per Sq Mi
< 0 - 1.0
< 1.0 - 3.5
< 3.5 - 6.5
< 6.5 - 13.0
< 13.0 - 24.3
COUNTY BOUNDARY



HILLSBOROUGH COUNTY, FLORIDA

ELECTRIC VEHICLE INFRASTRUCTURE PLAN

Estimated Density of Out-and-About L2 Chargers in 2050

Hillsborough TPO
Transportation Planning Organization

LEGEND

Number of Out-and-About L2 Charging Plugs per Sq Mi

- < 0.0 - 1.0
- < 1.0 - 3.5
- < 3.5 - 6.5
- < 6.5 - 13.0
- < 13.0 - 43.9
- COUNTY BOUNDARY

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570128002	0.501	1241	317	14				6066	0.119	460	0.063	1.8	3.3	0.7	1.3	1.7	3.2
120570045002	0.127	525	123	26				3097	0.061	396	0.054	1.1	2.0	0.4	0.8	1.5	2.7
120570018001	0.191	497	124	0				2785	0.054	186	0.025	0.8	1.4	0.3	0.5	0.7	1.3
120570116052	0.172	1679	376	0				1971	0.039	27	0.004	0.5	0.9	0.2	0.4	0.1	0.2
120570114081	0.197	560	189	0				788	0.015	18	0.002	0.4	0.7	0.1	0.2	0.1	0.1
120570112045	0.395	1362	349	0				4333	0.085	467	0.064	0.8	1.5	0.3	0.6	1.8	3.2
120570114131	0.815	2366	531	25				5162	0.101	557	0.076	2.5	4.5	1.0	1.7	2.1	3.8
120570123011	0.849	2032	581	2				3125	0.061	114	0.016	0.9	1.7	0.4	0.6	0.4	0.8
120570033002	0.126	1024	308	38				1181	0.023	7	0.001	1.8	3.2	0.7	1.2	0.0	0.0
120570122075	0.254	1447	310	18				2745	0.054	60	0.008	0.9	1.7	0.4	0.6	0.2	0.4
120570004011	0.349	741	174	21				5746	0.112	1309	0.179	1.4	2.5	0.5	1.0	5.0	9.0
120570112062	0.281	1753	305	57				5328	0.104	509	0.069	2.9	5.3	1.2	2.0	1.9	3.5
120570124031	4.512	1780	288	2				2889	0.056	105	0.014	1.0	1.8	0.4	0.7	0.4	0.7
120570013002	0.306	1401	315	0				2228	0.044	96	0.013	0.6	1.1	0.2	0.4	0.4	0.7
120570015002	0.147	799	213	0				2658	0.052	151	0.021	0.8	1.4	0.3	0.6	0.6	1.0
120570130032	2.956	1182	317	0				2918	0.057	363	0.050	0.7	1.3	0.3	0.5	1.4	2.5
120570133234	0.480	3668	799	91				30369	0.594	1551	0.212	12.4	22.4	4.9	8.6	5.9	10.7
120570133235	0.229	1453	415	29				3629	0.071	68	0.009	1.2	2.1	0.5	0.8	0.3	0.5
120570133101	0.206	821	199	0				906	0.018	12	0.002	0.5	0.9	0.2	0.4	0.0	0.1
120570102171	0.233	2103	456	82				1588	0.031	28	0.004	3.5	6.4	1.4	2.5	0.1	0.2
120570139232	3.057	5037	1507	17				8993	0.176	628	0.086	4.0	7.2	1.6	2.8	2.4	4.3
120570118053	0.119	860	152	59				950	0.019	1	0.000	1.3	2.4	0.5	0.9	0.0	0.0
120570139252	0.399	2045	478	0				3287	0.064	80	0.011	1.0	1.7	0.4	0.7	0.3	0.6
120570108192	0.079	1101	103	75				2436	0.048	149	0.020	2.0	3.7	0.8	1.4	0.6	1.0
120570110173	2.324	275	68	0				5965	0.117	159	0.022	1.2	2.2	0.5	0.8	0.6	1.1
120570065033	0.017	585	54	10				834	0.016	23	0.003	2.0	3.6	0.8	1.4	0.1	0.2
120570138043	2.368	2177	519	0				9456	0.185	48	0.007	1.9	3.4	0.7	1.3	0.2	0.3
120570007021	0.149	995	192	30				1934	0.038	9	0.001	1.3	2.3	0.5	0.9	0.0	0.1
120570144002	1.351	3175	781	33				13045	0.255	2709	0.370	5.0	9.1	2.0	3.5	10.3	18.7
120570139133	1.143	1644	283	44				3787	0.074	92	0.013	1.7	3.0	0.7	1.1	0.3	0.6
120570140082	1.320	1962	619	2				13633	0.267	342	0.047	2.7	5.0	1.1	1.9	1.3	2.4
120570140171	3.010	3003	1081	5				7183	0.140	246	0.034	1.6	3.0	0.6	1.1	0.9	1.7
120570102184	0.540	1912	358	36				3539	0.069	90	0.012	2.2	3.9	0.8	1.5	0.3	0.6
120570117141	1.258	2396	619	47				7857	0.154	576	0.079	3.3	5.9	1.3	2.3	2.2	4.0
120570117133	0.240	1926	473	69				4356	0.085	218	0.030	3.2	5.7	1.2	2.2	0.8	1.5
120570117134	0.142	1311	272	76				922	0.018	51	0.007	2.6	4.6	1.0	1.8	0.2	0.4
120570116173	0.373	1605	418	26				9032	0.177	416	0.057	2.5	4.5	1.0	1.7	1.6	2.9
120570001014	0.456	466	57	10				5604	0.110	1550	0.211	2.3	4.2	0.9	1.6	5.9	10.7
120570143001	26.003	1580	302	1				3902	0.076	113	0.015	1.0	1.8	0.4	0.7	0.4	0.8
120570102162	1.181	4321	1006	0				6078	0.119	281	0.038	1.5	2.8	0.6	1.1	1.1	1.9
120570115252	0.193	1443	435	0				657	0.013	103	0.014	0.4	0.7	0.1	0.3	0.4	0.7
120570108092	0.252	934	124	69				7457	0.146	619	0.084	3.1	5.5	1.2	2.1	2.4	4.3
120570115162	0.387	1493	296	60				9381	0.183	781	0.107	3.6	6.6	1.4	2.5	3.0	5.4
120570027013	0.159	1749	405	4				3192	0.062	77	0.011	1.1	2.0	0.4	0.8	0.3	0.5
120570027022	0.230	2142	599	3				6701	0.131	275	0.038	2.1	3.8	0.8	1.5	1.0	1.9
120570126004	0.399	1316	290	36				7764	0.152	183	0.025	2.2	3.9	0.9	1.5	0.7	1.3
120570003022	0.268	979	205	0				4707	0.092	170	0.023	1.1	2.1	0.4	0.8	0.6	1.2
120570113031	0.191	978	250	2				1445	0.028	27	0.004	0.4	0.7	0.1	0.3	0.1	0.2
120570111073	1.239	1503	484	14				3494	0.068	540	0.074	0.8	1.5	0.3	0.6	2.1	3.7
120570121101	0.503	2794	858	2				3515	0.069	3	0.000	1.4	2.6	0.6	1.0	0.0	0.0
120570003021	0.180	2051	265	0				3547	0.069	52	0.007	2.0	3.7	0.8	1.4	0.2	0.4
120570143002	9.452	1316	313	0				2513	0.049	150	0.020	0.7	1.2	0.3	0.5	0.6	1.0
120570141212	6.427	2683	832	15				16634	0.325	783	0.107	4.5	8.1	1.8	3.1	3.0	5.4
120570130043	3.101	994	300	0				2288	0.045	354	0.048	0.5	0.9	0.2	0.4	1.3	2.4
120570108173	0.184	1903	405	14				2509	0.049	239	0.033	1.6	2.8	0.6	1.1	0.9	1.6
120570108221	0.255	1177	150	49				5973	0.117	617	0.084	2.7	4.9	1.1	1.9	2.3	4.3
120570121102	0.504	1450	345	22				9027	0.176	236	0.032	2.9	5.2	1.1	2.0	0.9	1.6
120570003014	0.154	895	133	24				2200	0.043	44	0.006	1.0	1.8	0.4	0.7	0.2	0.3
120570108222	0.080	1027	193	86				2874	0.056	85	0.012	3.0	5.4	1.2	2.1	0.3	0.6
120570108212	0.160	1346	197	76				4248	0.083	75	0.010	3.3	5.9	1.3	2.3	0.3	0.5
120570003013	0.197	2562	458	49				6549	0.128	306	0.042	3.9	7.0	1.5	2.7	1.2	2.1
120570115272	1.039	2169	631	0				4618	0.090	68	0.009	0.9	1.6	0.3	0.6	0.3	0.5
120570115283	0.815	1944	534	11				1474	0.029	110	0.015	0.5	0.9	0.2	0.3	0.4	0.8
120570110172	0.405	1040	249	0				1131	0.022	31	0.004	0.2	0.4	0.1	0.1	0.1	0.2
120570110182	0.196	993	115	90				3756	0.073	210	0.029	3.9	7.1	1.5	2.7	0.8	1.4
120570108242	0.023	2217	28	97				2761	0.054	4	0.001	5.2	9.3	2.0	3.6	0.0	0.0

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570108191	0.058	688	41	90				1817	0.036	7	0.001	1.9	3.4	0.7	1.3	0.0	0.0
120570141192	5.738	5329	1500	0				11788	0.230	345	0.047	2.4	4.3	0.9	1.6	1.3	2.4
120570138072	2.976	5116	1297	0				18641	0.364	537	0.073	4.4	8.0	1.7	3.1	2.0	3.7
120570139162	0.667	4045	1180	4				4134	0.081	614	0.084	2.5	4.4	1.0	1.7	2.3	4.2
120570137051	0.666	2521	722	0				7337	0.143	206	0.028	1.5	2.7	0.6	1.0	0.8	1.4
120570110181	0.871	4400	601	76				3860	0.075	159	0.022	8.0	14.5	3.1	5.5	0.6	1.1
120570108115	0.390	1940	292	79				2757	0.054	178	0.024	4.3	7.8	1.7	3.0	0.7	1.2
120570049023	0.128	1414	146	58				10991	0.215	1454	0.198	4.1	7.4	1.6	2.8	5.5	10.0
120570116164	1.081	1303	347	0				3117	0.061	14	0.002	0.7	1.2	0.3	0.5	0.1	0.1
120570116171	0.419	1484	405	42				5815	0.114	503	0.069	2.5	4.5	1.0	1.7	1.9	3.5
120570144001	0.733	1782	396	68				3778	0.074	198	0.027	3.0	5.4	1.2	2.1	0.8	1.4
120570118052	0.126	764	156	85				995	0.019	5	0.001	1.6	3.0	0.6	1.1	0.0	0.0
120570115262	0.672	2565	655	26				4546	0.089	458	0.062	2.5	4.5	1.0	1.7	1.7	3.2
120570110191	0.675	1722	471	0				1775	0.035	82	0.011	0.5	0.9	0.2	0.3	0.3	0.6
120570118061	0.045	252	36	75				833	0.016	79	0.011	0.5	1.0	0.2	0.4	0.3	0.5
120570133231	0.218	1630	447	0				11946	0.234	1119	0.153	2.6	4.6	1.0	1.8	4.3	7.7
120570133233	0.538	2650	551	51				6882	0.135	653	0.089	4.6	8.4	1.8	3.2	2.5	4.5
120570047002	0.163	686	123	14				5857	0.114	747	0.102	1.6	2.9	0.6	1.1	2.8	5.1
120570102043	0.382	1422	439	0				1668	0.033	151	0.021	0.3	0.6	0.1	0.2	0.6	1.0
120570137053	0.719	1679	453	0				9249	0.181	595	0.081	1.8	3.2	0.7	1.2	2.3	4.1
120570065011	0.116	937	135	70				2143	0.042	322	0.044	2.5	4.5	1.0	1.7	1.2	2.2
120570121033	1.610	1285	374	8				17610	0.344	10480	1.430	3.7	6.6	1.4	2.5	39.9	72.2
120570133193	0.846	3939	961	19				17515	0.342	605	0.083	6.3	11.4	2.5	4.4	2.3	4.2
120570122131	0.507	1544	377	0				3209	0.063	1730	0.236	0.8	1.5	0.3	0.6	6.6	11.9
120570141222	2.739	4504	1013	5				19569	0.383	396	0.054	4.4	7.9	1.7	3.0	1.5	2.7
120570116161	0.352	1031	347	4				1472	0.029	47	0.006	0.5	1.0	0.2	0.4	0.2	0.3
120570139194	0.372	990	323	0				3300	0.065	161	0.022	0.7	1.3	0.3	0.5	0.6	1.1
120570116154	0.087	1762	429	63				1142	0.022	23	0.003	2.1	3.8	0.8	1.5	0.1	0.2
120570102111	0.491	982	370	0				913	0.018	105	0.014	0.2	0.4	0.1	0.2	0.4	0.7
120570115261	0.432	1145	263	60				2626	0.051	8	0.001	2.1	3.8	0.8	1.5	0.0	0.1
120570108201	0.126	1044	39	98				2940	0.057	391	0.053	4.5	8.2	1.8	3.1	1.5	2.7
120570137062	0.036	2073	664	10				621	0.012	2	0.000	4.0	7.2	1.6	2.7	0.0	0.0
120570102181	0.546	1597	386	6				4223	0.083	160	0.022	1.1	1.9	0.4	0.7	0.6	1.1
120570139262	2.685	2276	555	0				3252	0.064	71	0.010	0.9	1.7	0.4	0.7	0.3	0.5
120570115213	0.976	981	180	70				2438	0.048	55	0.008	2.7	4.8	1.0	1.8	0.2	0.4
120570139152	2.077	6201	1589	2				24489	0.479	150	0.020	6.1	11.1	2.4	4.2	0.6	1.0
120570118062	0.151	2440	545	81				1766	0.035	21	0.003	3.7	6.8	1.5	2.6	0.1	0.1
120570139223	0.440	2794	645	0				5595	0.109	59	0.008	1.2	2.2	0.5	0.9	0.2	0.4
120570071021	0.236	1337	202	92				1282	0.025	34	0.005	3.6	6.4	1.4	2.5	0.1	0.2
120570051023	0.037	429	71	90				2212	0.043	192	0.026	1.8	3.2	0.7	1.2	0.7	1.3
120570102112	0.197	974	322	0				960	0.019	79	0.011	0.3	0.5	0.1	0.2	0.3	0.5
120570117161	0.125	820	150	10				2426	0.047	49	0.007	2.7	4.8	1.0	1.8	0.2	0.3
120570133192	0.116	942	231	32				3019	0.059	8	0.001	1.3	2.4	0.5	0.9	0.0	0.1
120570108112	0.273	916	249	19				5004	0.098	227	0.031	1.2	2.2	0.5	0.9	0.9	1.6
120570117152	0.238	1089	237	0				6120	0.120	448	0.061	1.3	2.3	0.5	0.9	1.7	3.1
120570133152	1.098	1082	210	98				24920	0.487	4750	0.648	7.6	13.8	3.0	5.3	18.1	32.7
120570141182	1.043	1754	603	3				2509	0.049	121	0.017	0.7	1.3	0.3	0.5	0.5	0.8
120570119072	0.086	1592	309	10				1309	0.026	21	0.003	3.8	6.8	1.5	2.6	0.1	0.1
120570119103	0.089	1260	377	92				2014	0.039	14	0.002	2.5	4.5	1.0	1.7	0.1	0.1
120570119101	0.164	1216	317	0				5418	0.106	349	0.048	1.4	2.5	0.5	1.0	1.3	2.4
120570027011	0.479	1490	301	33				13897	0.272	1779	0.243	3.3	6.1	1.3	2.3	6.8	12.3
120570073003	1.068	1785	417	16				1149	0.022	76	0.010	1.4	2.5	0.5	0.9	0.3	0.5
120570115092	1.466	3027	763	0				5157	0.101	198	0.027	1.1	1.9	0.4	0.7	0.8	1.4
120570117151	0.240	2114	325	61				6642	0.130	292	0.040	2.9	5.3	1.2	2.0	1.1	2.0
120570051012	0.548	924	100	99				35930	0.702	64952	8.862	9.3	16.8	3.6	6.4	247.1	447.4
120570108211	0.065	1533	318	10				1703	0.033	326	0.044	3.1	5.7	1.2	2.2	1.2	2.2
120570055003	0.178	1391	333	35				4841	0.095	898	0.123	2.2	3.9	0.9	1.5	3.4	6.2
120570140112	0.310	1451	374	9				2334	0.046	8	0.001	0.7	1.2	0.3	0.5	0.0	0.1
120570126003	0.574	2188	518	19				10912	0.213	618	0.084	3.0	5.3	1.2	2.0	2.4	4.3
120570112033	0.210	758	197	70				1518	0.030	49	0.007	1.7	3.0	0.7	1.1	0.2	0.3
120570065032	0.078	709	109	80				3261	0.064	103	0.014	2.5	4.5	1.0	1.7	0.4	0.7
120570049012	0.297	1352	253	38				6778	0.133	1095	0.149	2.7	4.9	1.1	1.9	4.2	7.5
120570141093	2.189	3926	881	0				4861	0.095	161	0.022	1.3	2.3	0.5	0.9	0.6	1.1
120570139153	0.316	1846	328	0				3699	0.072	39	0.005	1.3	2.4	0.5	0.9	0.1	0.3
120570130042	2.876	1757	352	0				2055	0.040	94	0.013	0.7	1.2	0.3	0.5	0.4	0.6
120570110034	0.177	1178	216	65				5235	0.102	78	0.011	3.2	5.7	1.2	2.2	0.3	0.5

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120570003011	0.177	920	156	66				2183	0.043	28	0.004	1.5	2.7	0.6	1.0	0.1	0.2
120570061031	0.310	1039	187	95				5201	0.102	1343	0.183	4.4	8.0	1.7	3.1	5.1	9.3
120570108172	0.117	1489	242	43				1500	0.029	18	0.002	1.8	3.3	0.7	1.3	0.1	0.1
120570108241	0.166	484	24	98				6464	0.126	5118	0.698	3.1	5.5	1.2	2.1	19.5	35.3
120570139261	30.914	1591	382	5				5013	0.098	410	0.056	1.2	2.2	0.5	0.8	1.6	2.8
120570115271	2.315	1634	512	4				2570	0.050	122	0.017	0.6	1.0	0.2	0.4	0.5	0.8
120570115282	1.485	96	37	46				2695	0.053	2	0.000	0.5	1.0	0.2	0.4	0.0	0.0
120570108202	0.129	1594	255	10				1712	0.033	384	0.052	2.9	5.2	1.1	2.0	1.5	2.6
120570108243	0.055	2231	0	99				1715	0.034	146	0.020	3.7	6.8	1.5	2.6	0.6	1.0
120570139241	1.436	4216	1028	2				12368	0.242	464	0.063	2.5	4.6	1.0	1.8	1.8	3.2
120570139172	0.767	2114	462	6				4484	0.088	307	0.042	1.1	2.0	0.4	0.8	1.2	2.1
120570139163	4.595	7176	2008	0				29764	0.582	317	0.043	6.4	11.5	2.5	4.4	1.2	2.2
120570115061	2.013	2415	695	16				5618	0.110	353	0.048	1.7	3.0	0.7	1.1	1.3	2.4
120570108113	0.130	1593	135	61				2140	0.042	158	0.022	2.5	4.6	1.0	1.8	0.6	1.1
120570116163	0.118	2218	452	0				2769	0.054	28	0.004	0.8	1.4	0.3	0.5	0.1	0.2
120570117132	0.114	718	77	10				2309	0.045	16	0.002	2.8	5.0	1.1	1.9	0.1	0.1
120570003012	0.174	837	171	21				1159	0.023	6	0.001	0.8	1.5	0.3	0.6	0.0	0.0
120570001013	0.125	1754	405	71				1546	0.030	92	0.013	2.9	5.2	1.1	2.0	0.3	0.6
120570116172	0.218	851	210	15				1095	0.021	71	0.010	0.3	0.6	0.1	0.2	0.3	0.5
120570122122	0.473	1039	201	53				12294	0.240	520	0.071	3.4	6.1	1.3	2.3	2.0	3.6
120570133232	0.247	1856	327	4				3083	0.060	154	0.021	0.8	1.5	0.3	0.6	0.6	1.1
120570121092	1.198	2350	493	73				8237	0.161	487	0.066	5.5	9.9	2.2	3.8	1.9	3.4
120570049021	0.094	417	10	96				4118	0.081	1346	0.184	2.0	3.7	0.8	1.4	5.1	9.3
120570102041	0.494	1931	415	37				2499	0.049	52	0.007	1.8	3.2	0.7	1.2	0.2	0.4
120570139251	0.310	920	148	0				8179	0.160	275	0.038	1.7	3.1	0.7	1.2	1.0	1.9
120570121032	0.787	1769	440	87				7597	0.149	2394	0.327	4.0	7.2	1.6	2.8	9.1	16.5
120570066002	0.148	1642	224	58				6410	0.125	1719	0.235	3.2	5.8	1.3	2.2	6.5	11.8
120570007022	0.240	1570	364	22				2107	0.041	13	0.002	1.5	2.7	0.6	1.0	0.0	0.1
120570007011	0.291	2338	416	23				4443	0.087	231	0.032	2.6	4.7	1.0	1.8	0.9	1.6
120570007012	0.160	1360	305	16				3171	0.062	50	0.007	1.5	2.6	0.6	1.0	0.2	0.3
120570115202	0.375	2479	655	43				2594	0.051	694	0.095	3.1	5.7	1.2	2.2	2.6	4.8
120570114164	0.509	781	177	30				7077	0.138	3273	0.447	1.6	3.0	0.6	1.1	12.4	22.5
120570116165	0.698	4453	1160	13				8926	0.174	326	0.044	3.5	6.3	1.4	2.4	1.2	2.2
120570102172	0.544	1914	597	0				1776	0.035	369	0.050	0.6	1.1	0.2	0.4	1.4	2.5
120570119081	0.237	1686	371	90				8317	0.163	1872	0.255	5.4	9.7	2.1	3.7	7.1	12.9
120570119082	0.116	609	169	65				3889	0.076	830	0.113	1.8	3.2	0.7	1.2	3.2	5.7
120570119071	0.443	2190	471	54				9818	0.192	1277	0.174	3.9	7.1	1.5	2.7	4.9	8.8
120570119091	0.425	1252	376	24				12511	0.245	1525	0.208	2.9	5.3	1.1	2.0	5.8	10.5
120570118063	0.189	470	61	54				11274	0.220	281	0.038	3.1	5.6	1.2	2.2	1.1	1.9
120570119093	0.238	859	175	0				9975	0.195	490	0.067	2.0	3.5	0.8	1.4	1.9	3.4
120570119092	0.188	1453	321	3				2138	0.042	56	0.008	0.6	1.0	0.2	0.4	0.2	0.4
120570065042	0.166	316	69	89				1103	0.022	14	0.002	0.9	1.7	0.4	0.6	0.1	0.1
120570116162	0.387	1662	485	0				2266	0.044	92	0.013	0.4	0.8	0.2	0.3	0.3	0.6
120570118051	0.356	2534	736	46				4448	0.087	535	0.073	2.9	5.2	1.1	2.0	2.0	3.7
120570119102	0.373	1686	336	25				2359	0.046	41	0.006	1.4	2.4	0.5	0.9	0.2	0.3
120570119112	0.244	2467	479	73				5495	0.107	179	0.024	5.2	9.3	2.0	3.6	0.7	1.2
120570119111	0.234	1004	209	5				2182	0.043	63	0.009	0.5	0.8	0.2	0.3	0.2	0.4
120570027021	0.256	1332	271	0				3165	0.062	208	0.028	0.6	1.1	0.2	0.4	0.8	1.4
120570115102	1.351	2332	658	3				2729	0.053	49	0.007	0.6	1.1	0.2	0.4	0.2	0.3
120570117083	0.576	1758	353	85				6691	0.131	3207	0.438	5.5	10.0	2.2	3.8	12.2	22.1
120570132054	0.427	2547	468	0				3893	0.076	51	0.007	1.7	3.1	0.7	1.2	0.2	0.4
120570110193	2.602	5885	1630	5				5128	0.100	317	0.043	2.0	3.6	0.8	1.4	1.2	2.2
120570117163	0.411	1298	309	3				6998	0.137	2723	0.372	1.5	2.8	0.6	1.1	10.4	18.8
120570108231	0.133	2153	218	85				3331	0.065	377	0.051	4.9	8.9	1.9	3.4	1.4	2.6
120570117162	0.404	3289	579	79				6452	0.126	3417	0.466	6.4	11.6	2.5	4.4	13.0	23.5
120570046021	1.905	2372	588	65				32869	0.643	28061	3.829	9.6	17.3	3.8	6.6	106.7	193.3
120570046011	0.513	1662	295	80				48921	0.956	11892	1.622	13.2	23.8	5.2	9.1	45.2	81.9
120570046012	0.188	1621	259	89				12672	0.248	2822	0.385	6.2	11.3	2.4	4.3	10.7	19.4
120570073002	0.215	338	13	0				252	0.005	54	0.007	0.1	0.2	0.0	0.1	0.2	0.4
120570142002	0.182	1113	221	87				3044	0.060	728	0.099	2.9	5.2	1.1	2.0	2.8	5.0
120570142003	0.264	941	65	89				11029	0.216	4831	0.659	5.2	9.4	2.0	3.6	18.4	33.3
120570142001	0.183	758	174	10				2585	0.051	2149	0.293	2.6	4.7	1.0	1.8	8.2	14.8
120570110171	1.409	549	122	72				3449	0.067	3983	0.543	1.8	3.2	0.7	1.2	15.2	27.4
120570115064	1.530	2788	697	29				9146	0.179	213	0.029	3.3	6.0	1.3	2.3	0.8	1.5
120570065041	0.079	531	136	0				675	0.013	58	0.008	0.4	0.7	0.2	0.3	0.2	0.4
120570065031	0.260	0	0	0				90	0.002	0	0.000	0.0	0.0	0.0	0.0	0.0	0.0

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570119113	0.328	2835	552	75				13227	0.259	673	0.092	6.5	11.7	2.5	4.5	2.6	4.6
120570027012	0.260	1242	315	28				9760	0.191	734	0.100	2.5	4.6	1.0	1.8	2.8	5.1
120570142004	0.201	388	75	65				8414	0.164	3401	0.464	1.9	3.5	0.8	1.3	12.9	23.4
120570102152	3.418	4451	1009	4				5313	0.104	265	0.036	1.2	2.2	0.5	0.8	1.0	1.8
120570102182	0.185	1091	418	0				984	0.019	50	0.007	0.6	1.0	0.2	0.4	0.2	0.3
120570115244	0.229	997	198	10				6123	0.120	166	0.023	3.0	5.4	1.2	2.1	0.6	1.1
120570102161	0.973	2569	624	0				4261	0.083	381	0.052	1.3	2.3	0.5	0.9	1.4	2.6
120570110192	0.972	2285	643	96				27915	0.546	1450	0.198	9.9	17.9	3.9	6.9	5.5	10.0
120570102151	2.522	3982	1078	1				7902	0.154	283	0.039	1.7	3.1	0.7	1.2	1.1	1.9
120570121091	0.773	276	84	0				7439	0.145	2109	0.288	1.7	3.0	0.7	1.2	8.0	14.5
120570139173	0.812	3471	990	0				4947	0.097	118	0.016	1.3	2.4	0.5	0.9	0.4	0.8
120570138042	2.103	5152	1352	0				8368	0.164	149	0.020	2.4	4.3	0.9	1.7	0.6	1.0
120570115251	0.357	635	183	90				5754	0.112	854	0.117	3.1	5.6	1.2	2.1	3.2	5.9
120570102183	0.293	1552	411	0				1972	0.039	136	0.019	0.6	1.1	0.2	0.4	0.5	0.9
120570115243	0.117	959	235	86				2077	0.041	469	0.064	2.6	4.8	1.0	1.8	1.8	3.2
120570115281	1.631	3786	1002	13				7808	0.153	3763	0.513	2.2	4.0	0.9	1.5	14.3	25.9
120570057001	0.128	1054	289	48				5206	0.102	1053	0.144	2.2	4.0	0.9	1.5	4.0	7.3
120570117131	0.138	1304	189	78				1114	0.022	42	0.006	2.9	5.3	1.1	2.0	0.2	0.3
120570127014	0.597	1254	274	21				3287	0.064	178	0.024	1.1	2.0	0.4	0.8	0.7	1.2
120570057002	0.128	1014	175	79				5940	0.116	1471	0.201	3.6	6.5	1.4	2.5	5.6	10.1
120570057003	0.128	945	164	22				4176	0.082	690	0.094	1.3	2.4	0.5	0.9	2.6	4.8
120570049011	0.102	714	95	59				2592	0.051	423	0.058	1.4	2.5	0.5	0.9	1.6	2.9
120570139263	7.260	4205	1093	0				9440	0.185	336	0.046	2.0	3.6	0.8	1.4	1.3	2.3
120570049022	0.079	1283	164	71				3450	0.067	111	0.015	3.1	5.7	1.2	2.2	0.4	0.8
120570137032	0.774	4400	962	39				12358	0.242	128	0.017	5.8	10.5	2.3	4.0	0.5	0.9
120570139222	1.205	3922	903	1				15295	0.299	1238	0.169	3.4	6.2	1.3	2.4	4.7	8.5
120570133162	0.807	2660	576	97				41339	0.808	3848	0.525	11.7	21.1	4.6	8.1	14.6	26.5
120570009024	0.115	1483	168	75				4228	0.083	59	0.008	4.7	8.6	1.9	3.3	0.2	0.4
120570009021	0.082	654	108	78				1653	0.032	33	0.005	1.9	3.4	0.7	1.3	0.1	0.2
120570137033	0.953	2360	477	33				17021	0.333	2840	0.387	5.6	10.1	2.2	3.8	10.8	19.6
120570133172	0.570	1642	239	97				9703	0.190	4609	0.629	5.9	10.7	2.3	4.1	17.5	31.7
120570137061	0.174	839	152	10				3356	0.066	39	0.005	3.8	6.9	1.5	2.6	0.1	0.3
120570137052	0.709	575	194	12				2320	0.045	233	0.032	0.7	1.2	0.3	0.5	0.9	1.6
120570137054	0.406	2526	657	81				5243	0.102	122	0.017	4.0	7.3	1.6	2.8	0.5	0.8
120570061032	0.048	436	112	85				1049	0.021	95	0.013	1.0	1.8	0.4	0.7	0.4	0.7
120570139253	0.620	2452	528	3				5595	0.109	55	0.008	1.6	2.9	0.6	1.1	0.2	0.4
120570143003	5.985	2080	538	0				1008	0.020	119	0.016	0.3	0.6	0.1	0.2	0.5	0.8
120570115253	0.941	2034	580	0				3440	0.067	270	0.037	0.8	1.4	0.3	0.5	1.0	1.9
120570065012	0.131	1089	227	43				4066	0.079	493	0.067	1.5	2.7	0.6	1.0	1.9	3.4
120570018003	0.139	497	141	24				1353	0.026	63	0.009	0.6	1.2	0.3	0.4	0.2	0.4
120570114133	0.253	1134	357	0				1771	0.035	49	0.007	0.4	0.8	0.2	0.3	0.2	0.3
120570115091	1.000	1251	386	3				558	0.011	29	0.004	0.2	0.4	0.1	0.2	0.1	0.2
120570116053	2.529	1411	258	2				34472	0.674	17943	2.448	6.6	12.0	2.6	4.6	68.3	123.6
120570135031	0.326	2026	390	21				2252	0.044	131	0.018	1.4	2.5	0.5	1.0	0.5	0.9
120570135032	0.358	926	205	31				5719	0.112	1148	0.157	1.8	3.2	0.7	1.2	4.4	7.9
120570135042	0.246	1361	322	0				2176	0.043	54	0.007	0.5	1.0	0.2	0.4	0.2	0.4
120570135052	0.273	785	180	39				5579	0.109	406	0.055	1.6	2.9	0.6	1.1	1.5	2.8
120570116031	0.388	2397	598	25				11549	0.226	526	0.072	3.2	5.8	1.3	2.2	2.0	3.6
120570116032	0.435	1356	290	12				2469	0.048	17	0.002	0.8	1.5	0.3	0.6	0.1	0.1
120570116033	0.464	748	181	21				9020	0.176	803	0.110	1.9	3.5	0.8	1.3	3.1	5.5
120570130022	2.442	1759	429	0				2506	0.049	154	0.021	0.7	1.3	0.3	0.5	0.6	1.1
120570130023	3.462	2828	601	27				23389	0.457	2639	0.360	5.8	10.4	2.3	4.0	10.0	18.2
120570130031	2.251	2292	465	47				19082	0.373	1340	0.183	5.6	10.2	2.2	3.9	5.1	9.2
120570132032	0.497	1064	301	0				7344	0.144	267	0.036	1.4	2.5	0.5	0.9	1.0	1.8
120570132051	0.816	1784	448	1				2702	0.053	180	0.025	0.8	1.4	0.3	0.5	0.7	1.2
120570132052	0.521	2423	505	0				3030	0.059	74	0.010	0.8	1.4	0.3	0.5	0.3	0.5
120570132072	1.866	2151	578	0				3181	0.062	64	0.009	0.7	1.3	0.3	0.5	0.2	0.4
120570132082	1.818	2936	846	0				5680	0.111	168	0.023	1.2	2.1	0.5	0.8	0.6	1.2
120570133072	0.500	1286	335	65				18526	0.362	1857	0.253	5.1	9.2	2.0	3.5	7.1	12.8
120570133113	0.400	1062	249	16				7740	0.151	643	0.088	2.0	3.6	0.8	1.4	2.4	4.4
120570133121	0.224	706	239	27				6282	0.123	475	0.065	1.6	3.0	0.6	1.1	1.8	3.3
120570133122	0.336	1626	401	0				10400	0.203	416	0.057	2.8	5.0	1.1	1.9	1.6	2.9
120570133131	0.513	1974	513	4				3235	0.063	108	0.015	0.7	1.4	0.3	0.5	0.4	0.7
120570133132	0.806	1600	423	0				6440	0.126	496	0.068	1.4	2.5	0.5	1.0	1.9	3.4
120570133142	0.506	1092	286	12				5595	0.109	318	0.043	1.2	2.2	0.5	0.9	1.2	2.2
120570134061	0.447	1436	291	10				5467	0.107	364	0.050	1.7	3.0	0.7	1.2	1.4	2.5

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570134072	0.633	1078	296	17				19071	0.373	947	0.129	4.2	7.6	1.6	2.9	3.6	6.5
120570101051	4.051	1589	439	2				3158	0.062	155	0.021	0.8	1.4	0.3	0.5	0.6	1.1
120570062002	0.163	1373	382	32				6834	0.134	491	0.067	2.1	3.7	0.8	1.4	1.9	3.4
120570108152	0.131	576	77	97				12363	0.242	5825	0.795	3.1	5.6	1.2	2.1	22.2	40.1
120570115161	0.423	1534	396	8				8986	0.176	996	0.136	2.0	3.5	0.8	1.4	3.8	6.9
120570028001	0.194	855	272	0				2137	0.042	58	0.008	0.5	0.9	0.2	0.3	0.2	0.4
120570067004	0.178	696	248	20				1621	0.032	76	0.010	0.5	0.8	0.2	0.3	0.3	0.5
120570122081	0.949	3102	903	0				2950	0.058	114	0.016	0.5	1.0	0.2	0.4	0.4	0.8
120570133111	0.554	872	193	42				22349	0.437	5518	0.753	5.2	9.4	2.0	3.6	21.0	38.0
120570029001	0.220	984	228	6				2682	0.052	191	0.026	0.8	1.4	0.3	0.5	0.7	1.3
120570127011	0.893	1869	427	63				18691	0.365	1013	0.138	6.3	11.3	2.5	4.3	3.9	7.0
120570127012	0.414	487	62	27				8483	0.166	1671	0.228	1.7	3.1	0.7	1.2	6.4	11.5
120570127013	0.453	2916	684	0				2174	0.042	161	0.022	1.0	1.8	0.4	0.7	0.6	1.1
120570127021	0.438	940	176	0				2905	0.057	450	0.061	0.7	1.3	0.3	0.5	1.7	3.1
120570123033	0.301	1081	200	29				6818	0.133	384	0.052	2.1	3.8	0.8	1.4	1.5	2.6
120570123041	0.257	915	254	0				1108	0.022	24	0.003	0.4	0.7	0.1	0.3	0.1	0.2
120570123042	0.673	2104	609	43				24169	0.472	1247	0.170	6.6	12.0	2.6	4.6	4.7	8.6
120570124011	1.268	607	167	9				5174	0.101	226	0.031	1.1	2.1	0.4	0.8	0.9	1.6
120570124012	2.503	1184	340	0				1618	0.032	154	0.021	0.3	0.6	0.1	0.2	0.6	1.1
120570124013	1.475	936	240	0				2077	0.041	333	0.045	0.7	1.3	0.3	0.5	1.3	2.3
120570124014	1.179	2016	413	12				4631	0.091	348	0.047	2.1	3.9	0.8	1.5	1.3	2.4
120570124021	1.459	1082	204	4				2784	0.054	219	0.030	0.8	1.5	0.3	0.6	0.8	1.5
120570124022	4.573	2012	435	1				3189	0.062	356	0.049	0.8	1.5	0.3	0.6	1.4	2.5
120570125011	0.851	1189	316	0				3283	0.064	158	0.022	0.9	1.6	0.3	0.6	0.6	1.1
120570125012	0.972	930	182	0				1668	0.033	86	0.012	0.4	0.8	0.2	0.3	0.3	0.6
120570126001	0.365	1111	309	35				5468	0.107	378	0.052	1.8	3.2	0.7	1.2	1.4	2.6
120570126002	0.584	832	176	14				4052	0.079	1169	0.159	1.3	2.4	0.5	0.9	4.4	8.1
120570116113	0.234	1374	319	9				14609	0.286	602	0.082	3.0	5.5	1.2	2.1	2.3	4.1
120570060002	0.200	1352	280	58				7541	0.147	882	0.120	2.9	5.3	1.1	2.0	3.4	6.1
120570139032	78.709	1438	435	0				2689	0.053	27	0.004	0.7	1.3	0.3	0.5	0.1	0.2
120570107012	0.514	2194	525	26				10476	0.205	713	0.097	3.1	5.6	1.2	2.1	2.7	4.9
120570105012	0.323	3312	750	50				3541	0.069	68	0.009	3.8	7.0	1.5	2.7	0.3	0.5
120570106001	0.231	1259	261	54				7016	0.137	422	0.058	2.6	4.8	1.0	1.8	1.6	2.9
120570107011	0.492	1207	307	0				2788	0.055	54	0.007	0.5	1.0	0.2	0.4	0.2	0.4
120570107013	0.250	1199	313	27				2374	0.046	99	0.014	1.1	2.0	0.4	0.8	0.4	0.7
120570107021	0.376	1278	293	32				12124	0.237	751	0.102	3.2	5.8	1.3	2.2	2.9	5.2
120570132053	0.341	3201	633	0				2728	0.053	10	0.001	1.0	1.8	0.4	0.7	0.0	0.1
120570132081	1.338	2320	683	1				9967	0.195	765	0.104	2.4	4.3	0.9	1.6	2.9	5.3
120570058002	0.142	851	181	34				5421	0.106	602	0.082	1.7	3.0	0.7	1.1	2.3	4.1
120570107014	0.182	1053	194	87				13533	0.265	1989	0.271	4.0	7.3	1.6	2.8	7.6	13.7
120570132031	0.503	2234	505	0				4934	0.096	220	0.030	1.2	2.1	0.5	0.8	0.8	1.5
120570107022	0.630	2064	435	0				6564	0.128	411	0.056	1.3	2.3	0.5	0.9	1.6	2.8
120570108114	0.152	1519	314	97				2017	0.039	54	0.007	4.1	7.5	1.6	2.9	0.2	0.4
120570005004	0.284	1403	378	1				4734	0.093	653	0.089	1.0	1.7	0.4	0.7	2.5	4.5
120570010023	0.244	1114	221	12				2417	0.047	28	0.004	0.9	1.6	0.3	0.6	0.1	0.2
120570010024	0.322	1558	371	15				6971	0.136	712	0.097	2.3	4.1	0.9	1.6	2.7	4.9
120570011001	0.135	871	144	11				2216	0.043	95	0.013	0.8	1.4	0.3	0.5	0.4	0.7
120570011002	0.138	762	115	4				959	0.019	16	0.002	0.5	0.9	0.2	0.3	0.1	0.1
120570012001	0.167	1158	223	59				3419	0.067	102	0.014	2.3	4.2	0.9	1.6	0.4	0.7
120570012002	0.373	2123	423	10				6674	0.130	245	0.033	1.7	3.1	0.7	1.2	0.9	1.7
120570108081	0.264	2647	359	97				8379	0.164	563	0.077	6.2	11.3	2.4	4.3	2.1	3.9
120570108082	0.135	456	26	10				15285	0.299	678	0.093	4.6	8.4	1.8	3.2	2.6	4.7
120570110033	0.461	962	299	74				13540	0.265	1487	0.203	3.7	6.7	1.5	2.6	5.7	10.2
120570110031	1.025	1975	376	51				2743	0.054	68	0.009	2.7	4.8	1.0	1.8	0.3	0.5
120570110071	1.043	1281	345	0				2149	0.042	346	0.047	0.6	1.1	0.2	0.4	1.3	2.4
120570110073	0.999	362	103	0				972	0.019	481	0.066	0.2	0.4	0.1	0.2	1.8	3.3
120570009013	0.121	745	144	0				1377	0.027	4	0.001	0.4	0.7	0.1	0.3	0.0	0.0
120570122064	0.568	1605	466	2				1728	0.034	51	0.007	0.4	0.8	0.2	0.3	0.2	0.4
120570122072	1.186	2827	664	0				3099	0.061	68	0.009	1.1	2.0	0.4	0.8	0.3	0.5
120570122082	0.350	1316	363	0				4989	0.098	124	0.017	0.9	1.7	0.4	0.6	0.5	0.9
120570029003	0.133	394	68	28				1628	0.032	138	0.019	0.6	1.1	0.2	0.4	0.5	1.0
120570063003	0.183	1177	342	0				2959	0.058	143	0.020	0.5	1.0	0.2	0.4	0.5	1.0
120570133052	1.169	1673	437	0				30332	0.593	779	0.106	5.7	10.3	2.2	3.9	3.0	5.4
120570118022	0.423	3406	608	43				9216	0.180	738	0.101	3.6	6.5	1.4	2.5	2.8	5.1
120570118024	0.159	1172	264	0				2356	0.046	36	0.005	0.4	0.8	0.2	0.3	0.1	0.2
120570118041	0.444	2200	543	28				12669	0.248	613	0.084	3.5	6.4	1.4	2.5	2.3	4.2

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570118042	0.190	1389	323	0				3245	0.063	29	0.004	1.0	1.8	0.4	0.7	0.1	0.2
120570116134	0.277	1348	279	5				12532	0.245	433	0.059	2.8	5.0	1.1	1.9	1.6	3.0
120570120023	0.319	1006	218	9				2807	0.055	76	0.010	0.9	1.5	0.3	0.6	0.3	0.5
120570116121	0.371	682	154	0				6433	0.126	300	0.041	1.2	2.2	0.5	0.8	1.1	2.1
120570116122	0.167	940	342	0				1991	0.039	33	0.005	0.4	0.8	0.2	0.3	0.1	0.2
120570116131	0.282	1296	355	0				4048	0.079	94	0.013	1.0	1.9	0.4	0.7	0.4	0.6
120570116132	0.321	2499	392	70				16076	0.314	682	0.093	6.4	11.6	2.5	4.4	2.6	4.7
120570120021	1.261	1927	463	25				7123	0.139	7269	0.992	2.5	4.5	1.0	1.7	27.6	50.1
120570002022	0.257	2096	545	55				9651	0.189	412	0.056	4.9	8.8	1.9	3.4	1.6	2.8
120570001011	0.537	964	13	91				5580	0.109	782	0.107	2.3	4.2	0.9	1.6	3.0	5.4
120570001022	0.188	2043	500	7				1888	0.037	13	0.002	0.8	1.4	0.3	0.5	0.0	0.1
120570118043	0.121	947	235	6				5167	0.101	465	0.063	1.0	1.9	0.4	0.7	1.8	3.2
120570117082	0.676	1074	159	10				5839	0.114	6398	0.873	4.1	7.4	1.6	2.8	24.3	44.1
120570118021	0.374	1364	366	1				11300	0.221	874	0.119	2.2	3.9	0.8	1.5	3.3	6.0
120570133141	0.729	2275	586	23				4635	0.091	252	0.034	1.6	2.8	0.6	1.1	1.0	1.7
120570139072	49.958	681	226	0				1409	0.028	141	0.019	0.4	0.7	0.2	0.3	0.5	1.0
120570001012	0.187	1295	314	15				1552	0.030	25	0.003	0.7	1.2	0.3	0.5	0.1	0.2
120570004012	0.191	905	176	13				4519	0.088	124	0.017	1.6	2.9	0.6	1.1	0.5	0.9
120570004013	0.223	1042	211	0				2636	0.052	195	0.027	0.6	1.1	0.2	0.4	0.7	1.3
120570004021	0.379	1284	350	23				8336	0.163	598	0.082	2.4	4.4	0.9	1.7	2.3	4.1
120570004022	0.199	1089	183	8				5049	0.099	1333	0.182	1.3	2.3	0.5	0.9	5.1	9.2
120570004023	0.179	1141	226	22				2996	0.059	92	0.013	0.9	1.7	0.4	0.6	0.3	0.6
120570116133	0.290	929	208	0				3888	0.076	288	0.039	0.8	1.4	0.3	0.5	1.1	2.0
120570005002	0.308	1034	247	20				2462	0.048	47	0.006	0.8	1.5	0.3	0.6	0.2	0.3
120570005003	0.255	806	210	0				2294	0.045	228	0.031	0.4	0.8	0.2	0.3	0.9	1.6
120570006022	0.288	1289	215	42				16740	0.327	1056	0.144	4.0	7.3	1.6	2.8	4.0	7.3
120570123013	0.241	680	167	89				10785	0.211	758	0.103	3.9	7.0	1.5	2.7	2.9	5.2
120570123014	0.614	2220	527	42				17432	0.341	705	0.096	5.0	9.0	1.9	3.4	2.7	4.9
120570123031	0.253	1481	521	1				6765	0.132	292	0.040	1.5	2.8	0.6	1.1	1.1	2.0
120570133222	0.302	2089	532	51				2401	0.047	29	0.004	2.6	4.6	1.0	1.8	0.1	0.2
120570133112	0.452	1371	318	67				8061	0.158	604	0.082	3.4	6.2	1.3	2.4	2.3	4.2
120570122083	0.788	1534	445	2				2732	0.053	83	0.011	0.7	1.3	0.3	0.5	0.3	0.6
120570123032	0.207	1658	332	68				2249	0.044	191	0.026	2.3	4.2	0.9	1.6	0.7	1.3
120570115242	0.424	2144	495	26				17828	0.349	1011	0.138	4.6	8.4	1.8	3.2	3.8	7.0
120570139132	0.628	1732	384	8				1415	0.028	46	0.006	1.0	1.9	0.4	0.7	0.2	0.3
120570122061	0.358	2528	568	0				3305	0.065	45	0.006	0.9	1.7	0.4	0.7	0.2	0.3
120570122062	0.417	1507	357	0				2711	0.053	145	0.020	0.8	1.5	0.3	0.6	0.6	1.0
120570034001	0.145	996	209	42				2445	0.048	278	0.038	1.2	2.3	0.5	0.9	1.1	1.9
120570132063	0.493	1074	299	0				1713	0.033	79	0.011	0.4	0.8	0.2	0.3	0.3	0.5
120570020003	0.179	1265	220	0				2886	0.056	312	0.043	0.7	1.3	0.3	0.5	1.2	2.1
120570118044	0.521	1481	345	10				6410	0.125	5145	0.702	2.9	5.3	1.1	2.0	19.6	35.4
120570061012	0.112	961	216	58				6144	0.120	852	0.116	2.5	4.5	1.0	1.7	3.2	5.9
120570135053	0.178	1458	407	0				2152	0.042	29	0.004	0.8	1.5	0.3	0.6	0.1	0.2
120570104022	0.039	683	161	10				1413	0.028	0	0.000	1.6	2.9	0.6	1.1	0.0	0.0
120570110086	0.114	1210	133	96				838	0.016	442	0.060	1.9	3.4	0.7	1.3	1.7	3.0
120570133133	0.514	1300	225	0				2904	0.057	82	0.011	0.6	1.1	0.2	0.4	0.3	0.6
120570068022	0.258	1032	291	11				3941	0.077	294	0.040	1.1	1.9	0.4	0.7	1.1	2.0
120570002023	0.129	1681	336	55				2468	0.048	9	0.001	2.1	3.8	0.8	1.4	0.0	0.1
120570108053	0.187	2645	474	82				3887	0.076	95	0.013	4.9	8.8	1.9	3.4	0.4	0.7
120570059005	0.174	896	180	0				898	0.018	76	0.010	0.2	0.3	0.1	0.1	0.3	0.5
120570060006	0.073	600	114	30				826	0.016	19	0.003	0.7	1.3	0.3	0.5	0.1	0.1
120570067002	0.272	1121	332	34				2202	0.043	184	0.025	1.2	2.2	0.5	0.8	0.7	1.3
120570061033	0.152	942	285	51				1634	0.032	238	0.032	0.9	1.7	0.4	0.6	0.9	1.6
120579804001	13.649	139	39	0				466	0.009	32	0.004	0.1	0.2	0.0	0.1	0.1	0.2
120570124033	2.942	3613	777	0				5696	0.111	150	0.020	1.6	2.8	0.6	1.1	0.6	1.0
120570008001	0.535	1870	352	12				8589	0.168	687	0.094	2.4	4.3	0.9	1.6	2.6	4.7
120570131001	12.223	1513	410	0				4112	0.080	250	0.034	1.1	1.9	0.4	0.7	1.0	1.7
120570131002	15.854	1457	277	10				2046	0.040	125	0.017	0.8	1.4	0.3	0.5	0.5	0.9
120570134143	0.807	2474	764	0				3194	0.062	146	0.020	0.6	1.1	0.2	0.4	0.6	1.0
120570137021	0.273	1935	471	0				2383	0.047	23	0.003	0.9	1.6	0.4	0.6	0.1	0.2
120570134144	0.293	2268	536	0				3367	0.066	43	0.006	1.0	1.9	0.4	0.7	0.2	0.3
120570141211	1.581	2796	744	0				2310	0.045	577	0.079	0.8	1.5	0.3	0.6	2.2	4.0
120570140081	0.782	1216	333	32				2529	0.049	20	0.003	1.8	3.2	0.7	1.2	0.1	0.1
120570138041	0.679	2921	582	6				947	0.019	227	0.031	0.8	1.5	0.3	0.6	0.9	1.6
120570138031	1.071	1499	296	3				13711	0.268	728	0.099	3.1	5.7	1.2	2.2	2.8	5.0
120570138021	1.141	2237	400	9				4426	0.087	130	0.018	1.7	3.1	0.7	1.2	0.5	0.9

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120570140131	4.990	1171	268	1				2166	0.042	170	0.023	0.7	1.3	0.3	0.5	0.6	1.2
120570141221	1.157	2538	621	24				5094	0.100	345	0.047	2.3	4.1	0.9	1.6	1.3	2.4
120570140071	7.358	7371	1829	20				35717	0.698	2004	0.273	9.2	16.7	3.6	6.4	7.6	13.8
120570113043	0.808	1871	557	40				13722	0.268	1451	0.198	3.5	6.3	1.4	2.4	5.5	10.0
120570114072	0.297	1122	337	34				1176	0.023	262	0.036	1.2	2.2	0.5	0.8	1.0	1.8
120570114082	0.348	741	273	0				1352	0.026	56	0.008	0.3	0.5	0.1	0.2	0.2	0.4
120570114102	0.889	1773	458	2				1926	0.038	58	0.008	0.6	1.1	0.2	0.4	0.2	0.4
120570114121	0.900	1816	402	25				17422	0.341	1464	0.200	4.3	7.7	1.7	3.0	5.6	10.1
120570114122	1.664	1167	238	56				34252	0.670	2435	0.332	8.2	14.9	3.2	5.7	9.3	16.8
120570114132	0.199	958	212	0				1398	0.027	26	0.004	0.4	0.7	0.1	0.3	0.1	0.2
120570103051	1.735	1292	299	0				1924	0.038	144	0.020	0.6	1.1	0.2	0.4	0.5	1.0
120570108051	0.374	793	212	0				8888	0.174	791	0.108	2.2	3.9	0.9	1.5	3.0	5.4
120570110063	0.756	2043	470	3				2846	0.056	82	0.011	0.7	1.2	0.3	0.5	0.3	0.6
120570122073	0.506	2233	646	0				5096	0.100	225	0.031	1.3	2.3	0.5	0.9	0.9	1.5
120570132061	0.520	685	219	0				2585	0.051	154	0.021	0.6	1.2	0.3	0.4	0.6	1.1
120570141091	1.556	1562	273	2				3970	0.078	201	0.027	1.1	1.9	0.4	0.7	0.8	1.4
120570140111	0.455	1466	214	32				2982	0.058	250	0.034	2.6	4.7	1.0	1.8	1.0	1.7
120570140121	0.384	1248	463	8				2668	0.052	1	0.000	0.8	1.4	0.3	0.5	0.0	0.0
120570119051	0.255	2256	402	47				9186	0.180	502	0.068	3.3	6.0	1.3	2.3	1.9	3.5
120570115063	0.675	2513	548	63				4023	0.079	1301	0.178	4.5	8.2	1.8	3.1	4.9	9.0
120570103043	6.620	1201	241	19				2108	0.041	227	0.031	0.9	1.7	0.4	0.6	0.9	1.6
120570117081	0.935	2181	582	24				4911	0.096	5424	0.740	2.0	3.6	0.8	1.4	20.6	37.4
120570139142	4.504	5310	1262	0				11522	0.225	403	0.055	2.6	4.7	1.0	1.8	1.5	2.8
120570116051	0.182	1332	249	7				2814	0.055	49	0.007	0.7	1.3	0.3	0.5	0.2	0.3
120570112041	0.245	913	216	0				1740	0.034	24	0.003	0.4	0.8	0.2	0.3	0.1	0.2
120570112044	0.449	1081	323	0				2799	0.055	174	0.024	0.6	1.1	0.2	0.4	0.7	1.2
120570112051	0.283	1042	228	0				3650	0.071	240	0.033	0.7	1.4	0.3	0.5	0.9	1.7
120570112052	0.250	839	261	6				931	0.018	24	0.003	0.2	0.4	0.1	0.1	0.1	0.2
120570112053	0.460	1366	303	3				3560	0.070	163	0.022	1.0	1.8	0.4	0.7	0.6	1.1
120570113012	0.607	2291	543	11				4051	0.079	489	0.067	1.3	2.4	0.5	0.9	1.9	3.4
120570112063	0.253	1005	246	8				3132	0.061	340	0.046	0.9	1.7	0.4	0.6	1.3	2.3
120570114173	0.168	1053	228	24				2926	0.057	57	0.008	1.1	2.0	0.4	0.8	0.2	0.4
120570115141	0.567	1710	440	4				1945	0.038	70	0.010	0.7	1.3	0.3	0.5	0.3	0.5
120570051011	0.230	1468	268	10				9509	0.186	1975	0.269	6.9	12.5	2.7	4.8	7.5	13.6
120570008002	0.633	1832	487	31				6458	0.126	179	0.024	2.5	4.5	1.0	1.7	0.7	1.2
120570011003	0.357	1022	227	4				2008	0.039	31	0.004	0.6	1.1	0.2	0.4	0.1	0.2
120570013005	0.390	1123	301	0				3884	0.076	417	0.057	0.8	1.5	0.3	0.6	1.6	2.9
120570017003	0.263	748	140	0				4339	0.085	401	0.055	0.9	1.7	0.4	0.7	1.5	2.8
120570017005	0.162	853	186	0				5388	0.105	283	0.039	1.4	2.5	0.5	0.9	1.1	1.9
120570030003	0.165	1058	197	19				1984	0.039	172	0.023	0.9	1.6	0.4	0.6	0.7	1.2
120570031004	0.094	777	170	61				1668	0.033	24	0.003	1.7	3.1	0.7	1.2	0.1	0.2
120570032003	0.092	486	105	4				1413	0.028	115	0.016	0.5	0.9	0.2	0.3	0.4	0.8
120570034003	0.214	915	172	6				1654	0.032	303	0.041	0.8	1.5	0.3	0.6	1.2	2.1
120570009011	0.074	1030	172	90				2676	0.052	42	0.006	2.7	4.9	1.1	1.9	0.2	0.3
120570024002	0.279	1414	351	38				2460	0.048	93	0.013	1.7	3.1	0.7	1.2	0.4	0.6
120570054011	0.705	841	193	0				2512	0.049	207	0.028	0.5	0.8	0.2	0.3	0.8	1.4
120570054012	0.346	1617	437	0				1861	0.036	25	0.003	0.3	0.6	0.1	0.2	0.1	0.2
120570055001	0.111	541	86	92				3310	0.065	1662	0.227	2.1	3.7	0.8	1.4	6.3	11.4
120570069001	0.404	2012	499	0				1754	0.034	51	0.007	1.0	1.8	0.4	0.7	0.2	0.4
120570069003	0.111	510	96	79				980	0.019	95	0.013	1.0	1.8	0.4	0.7	0.4	0.7
120570036002	0.229	1767	281	16				3307	0.065	34	0.005	1.3	2.4	0.5	0.9	0.1	0.2
120570045004	0.127	937	218	6				1958	0.038	89	0.012	0.9	1.6	0.3	0.6	0.3	0.6
120570035003	0.140	868	184	10				886	0.017	21	0.003	0.7	1.2	0.3	0.5	0.1	0.1
120570048006	0.115	562	94	0				2745	0.054	356	0.049	0.9	1.6	0.3	0.6	1.4	2.5
120570050002	0.205	936	173	53				3296	0.064	983	0.134	1.9	3.5	0.8	1.3	3.7	6.8
120570054013	0.135	568	147	13				1072	0.021	39	0.005	0.3	0.6	0.1	0.2	0.1	0.3
120570054014	0.500	1237	258	71				15004	0.293	13765	1.878	5.0	9.1	2.0	3.5	52.4	94.8
120570132062	0.501	2792	741	0				3754	0.073	106	0.014	1.1	2.0	0.4	0.8	0.4	0.7
120570133123	0.557	2529	683	0				7612	0.149	241	0.033	1.6	2.9	0.6	1.1	0.9	1.7
120570133224	0.339	2398	581	50				4087	0.080	63	0.009	3.0	5.4	1.2	2.1	0.2	0.4
120570133191	0.232	1926	575	43				4504	0.088	16	0.002	3.4	6.2	1.3	2.4	0.1	0.1
120570137031	0.185	832	176	0				26	0.001	196	0.027	0.1	0.1	0.0	0.0	0.7	1.4
120570054015	0.235	782	159	41				1618	0.032	63	0.009	1.2	2.1	0.5	0.8	0.2	0.4
120570069004	0.192	1066	264	17				2637	0.052	149	0.020	1.1	2.1	0.4	0.8	0.6	1.0
120570133221	0.436	1457	318	42				4147	0.081	212	0.029	2.8	5.0	1.1	1.9	0.8	1.5
120570060003	0.132	1329	374	4				3097	0.061	106	0.014	0.9	1.5	0.3	0.6	0.4	0.7

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570060004	0.356	591	169	0				3446	0.067	369	0.050	0.7	1.2	0.3	0.5	1.4	2.5
120570062004	0.192	1444	398	11				3812	0.075	140	0.019	1.3	2.3	0.5	0.9	0.5	1.0
120570064001	0.237	789	271	0				1238	0.024	103	0.014	0.4	0.7	0.2	0.3	0.4	0.7
120570064002	0.312	749	233	0				1515	0.030	46	0.006	0.3	0.6	0.1	0.2	0.2	0.3
120570064003	0.203	1195	334	0				2382	0.047	78	0.011	0.4	0.8	0.2	0.3	0.3	0.5
120570069002	0.253	970	218	0				1816	0.036	31	0.004	0.6	1.1	0.2	0.4	0.1	0.2
120570103052	4.502	2514	525	0				7643	0.149	1178	0.161	2.1	3.7	0.8	1.4	4.5	8.1
120570134101	0.732	2242	499	20				13192	0.258	312	0.043	3.4	6.1	1.3	2.3	1.2	2.1
120570139192	1.167	1336	324	0				3022	0.059	250	0.034	0.7	1.3	0.3	0.5	1.0	1.7
120570134074	1.348	2290	645	0				2756	0.054	136	0.019	0.5	0.9	0.2	0.4	0.5	0.9
120570114101	1.943	1252	327	3				3225	0.063	169	0.023	0.7	1.2	0.3	0.5	0.6	1.2
120570139231	2.746	3966	1054	1				6649	0.130	204	0.028	1.5	2.7	0.6	1.0	0.8	1.4
120570139221	0.449	1638	361	0				1792	0.035	104	0.014	0.7	1.3	0.3	0.5	0.4	0.7
120570111061	0.343	2402	515	59				2336	0.046	65	0.009	3.8	6.9	1.5	2.7	0.2	0.4
120570111072	0.469	1541	334	0				11452	0.224	1052	0.144	2.3	4.1	0.9	1.6	4.0	7.2
120570111092	0.781	1465	458	0				1742	0.034	40	0.005	0.3	0.6	0.1	0.2	0.2	0.3
120570114171	0.456	1090	288	20				8107	0.158	71	0.010	2.0	3.5	0.8	1.4	0.3	0.5
120570114181	0.337	623	216	3				768	0.015	14	0.002	0.2	0.3	0.1	0.1	0.1	0.1
120570114182	0.428	1395	440	22				1834	0.036	127	0.017	1.2	2.1	0.5	0.8	0.5	0.9
120570115094	3.135	761	304	0				1978	0.039	281	0.038	0.4	0.7	0.1	0.3	1.1	1.9
120570115144	0.192	972	255	0				1251	0.024	32	0.004	0.3	0.5	0.1	0.2	0.1	0.2
120570115152	0.391	1970	546	0				2387	0.047	53	0.007	0.7	1.2	0.3	0.5	0.2	0.4
120570110081	5.562	1704	277	14				4214	0.082	568	0.077	1.1	2.0	0.4	0.7	2.2	3.9
120570070022	0.193	1516	370	85				1759	0.034	89	0.012	2.3	4.2	0.9	1.6	0.3	0.6
120570070021	0.129	798	245	51				2651	0.052	13	0.002	1.5	2.7	0.6	1.0	0.0	0.1
120570070023	0.199	856	178	85				2159	0.042	138	0.019	2.2	3.9	0.9	1.5	0.5	1.0
120570141041	15.400	1595	449	1				3273	0.064	287	0.039	1.1	2.0	0.4	0.8	1.1	2.0
120579802001	32.519	0	0	0				0	0.000	0	0.000	0.0	0.0	0.0	0.0	0.0	0.0
120570139131	12.092	7220	2338	1				14520	0.284	190	0.026	3.2	5.7	1.2	2.2	0.7	1.3
120570141171	2.019	1435	499	16				4085	0.080	236	0.032	1.4	2.5	0.5	1.0	0.9	1.6
120570141191	1.335	3950	1001	0				1646	0.032	77	0.011	0.9	1.7	0.4	0.6	0.3	0.5
120570138061	1.769	2791	739	4				17973	0.351	1144	0.156	3.7	6.7	1.4	2.5	4.4	7.9
120570140122	1.330	1486	453	3				3881	0.076	9	0.001	1.1	1.9	0.4	0.7	0.0	0.1
120570115181	4.184	733	222	0				1242	0.024	275	0.038	0.3	0.6	0.1	0.2	1.0	1.9
120570115182	2.837	1009	280	0				1463	0.029	254	0.035	0.4	0.7	0.2	0.3	1.0	1.7
120570115183	1.997	2244	654	0				3741	0.073	236	0.032	0.7	1.3	0.3	0.5	0.9	1.6
120570115223	0.398	516	151	57				9281	0.181	1697	0.232	2.4	4.3	0.9	1.7	6.5	11.7
120570116101	0.245	1284	323	0				1759	0.034	8	0.001	0.7	1.2	0.3	0.5	0.0	0.1
120570116144	0.113	981	249	0				2386	0.047	15	0.002	0.6	1.2	0.3	0.4	0.1	0.1
120570116151	0.294	1416	349	7				3191	0.062	56	0.008	1.0	1.8	0.4	0.7	0.2	0.4
120570102031	1.155	822	199	51				3208	0.063	295	0.040	1.9	3.5	0.8	1.3	1.1	2.0
120570069005	0.252	845	193	13				2364	0.046	95	0.013	0.7	1.3	0.3	0.5	0.4	0.7
120570073001	8.497	532	108	14				7209	0.141	2521	0.344	1.6	2.9	0.6	1.1	9.6	17.4
120570101071	4.368	1721	416	0				2368	0.046	128	0.017	0.6	1.2	0.3	0.4	0.5	0.9
120570102032	0.543	1249	270	15				6241	0.122	743	0.101	1.6	3.0	0.6	1.1	2.8	5.1
120570103053	2.946	448	84	0				3981	0.078	607	0.083	1.1	2.0	0.4	0.7	2.3	4.2
120570140091	2.098	1854	506	63				22603	0.442	3015	0.411	6.7	12.2	2.6	4.6	11.5	20.8
120570140101	0.614	1214	428	1				9071	0.177	882	0.120	2.0	3.6	0.8	1.4	3.4	6.1
120570140141	0.357	1447	289	60				5633	0.110	564	0.077	3.9	7.1	1.5	2.7	2.1	3.9
120570140102	0.758	1222	351	11				3008	0.059	124	0.017	1.1	2.0	0.4	0.8	0.5	0.9
120570139171	0.147	1743	521	0				283	0.006	6	0.001	1.1	2.0	0.4	0.8	0.0	0.0
120570139151	0.677	1228	335	4				5506	0.108	1283	0.175	1.3	2.3	0.5	0.9	4.9	8.8
120570139181	2.890	1137	311	0				2352	0.046	129	0.018	0.7	1.2	0.3	0.5	0.5	0.9
120570140113	0.783	1422	417	16				3464	0.068	161	0.022	1.3	2.4	0.5	0.9	0.6	1.1
120570069006	0.153	715	212	0				1224	0.024	51	0.007	0.3	0.5	0.1	0.2	0.2	0.4
120570120011	0.994	976	239	0				5255	0.103	336	0.046	1.3	2.4	0.5	0.9	1.3	2.3
120570121061	1.838	950	247	0				6929	0.135	616	0.084	1.3	2.4	0.5	0.9	2.3	4.2
120570121062	1.925	2745	730	0				5081	0.099	560	0.076	1.2	2.3	0.5	0.9	2.1	3.9
120570121063	1.903	1219	310	3				4267	0.083	1261	0.172	1.0	1.8	0.4	0.7	4.8	8.7
120570121073	0.673	2801	636	23				17135	0.335	578	0.079	4.6	8.3	1.8	3.2	2.2	4.0
120570122101	0.784	4651	1159	14				10307	0.201	286	0.039	3.6	6.6	1.4	2.5	1.1	2.0
120570122132	0.988	3514	982	31				4364	0.085	135	0.018	3.0	5.4	1.2	2.0	0.5	0.9
120570135043	0.191	975	283	0				2886	0.056	29	0.004	0.6	1.1	0.2	0.4	0.1	0.2
120570133051	1.082	3205	906	0				4500	0.088	203	0.028	1.1	2.0	0.4	0.8	0.8	1.4
120570121031	1.407	5276	1210	34				9674	0.189	9525	1.300	5.6	10.2	2.2	3.9	36.2	65.6
120570133151	1.031	3963	695	92				19961	0.390	1910	0.261	13.6	24.6	5.4	9.4	7.3	13.2

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120570135051	1.258	1116	237	6				12910	0.252	3461	0.472	2.6	4.7	1.0	1.8	13.2	23.8
120570136021	1.591	1003	225	2				9143	0.179	1621	0.221	1.8	3.3	0.7	1.3	6.2	11.2
120570053021	3.002	1166	250	6				15495	0.303	2855	0.390	3.5	6.4	1.4	2.4	10.9	19.7
120570102121	0.726	2707	825	36				2834	0.055	68	0.009	2.4	4.3	0.9	1.6	0.3	0.5
120570139182	0.375	497	107	0				1548	0.030	27	0.004	0.3	0.6	0.1	0.2	0.1	0.2
120570140142	0.428	725	289	0				1180	0.023	3	0.000	0.2	0.4	0.1	0.2	0.0	0.0
120570141092	1.395	1475	342	0				2257	0.044	218	0.030	0.7	1.2	0.3	0.5	0.8	1.5
120570026002	1.734	630	91	48				40572	0.793	13351	1.822	8.3	15.0	3.2	5.7	50.8	92.0
120570139141	9.135	2410	514	0				3635	0.071	438	0.060	1.1	1.9	0.4	0.7	1.7	3.0
120570064004	0.263	1470	333	0				3855	0.075	273	0.037	0.8	1.5	0.3	0.6	1.0	1.9
120570112061	0.253	647	96	58				5808	0.114	1057	0.144	2.1	3.7	0.8	1.4	4.0	7.3
120570110082	0.662	1637	333	68				8555	0.167	5583	0.762	3.9	7.0	1.5	2.7	21.2	38.5
120570105011	0.082	1749	262	10				1135	0.022	1	0.000	2.6	4.8	1.0	1.8	0.0	0.0
120570009023	0.051	1150	306	87				1873	0.037	65	0.009	2.5	4.5	1.0	1.7	0.2	0.4
120570102122	0.847	2687	774	0				2085	0.041	126	0.017	0.6	1.1	0.2	0.4	0.5	0.9
120570102102	0.614	1586	440	4				1734	0.034	64	0.009	0.6	1.0	0.2	0.4	0.2	0.4
120570102101	0.803	3803	903	71				4905	0.096	115	0.016	5.2	9.4	2.0	3.6	0.4	0.8
120570112032	0.203	1473	347	7				1519	0.030	181	0.025	0.6	1.0	0.2	0.4	0.7	1.2
120570115122	1.305	1057	329	0				1720	0.034	308	0.042	0.3	0.6	0.1	0.2	1.2	2.1
120570114172	0.290	3104	592	62				2834	0.055	18	0.002	4.0	7.3	1.6	2.8	0.1	0.1
120570114183	0.404	1664	395	50				3464	0.068	122	0.017	2.1	3.8	0.8	1.5	0.5	0.8
120570114134	0.309	1030	289	0				4769	0.093	162	0.022	1.1	1.9	0.4	0.7	0.6	1.1
120570106002	0.398	1113	261	0				4832	0.094	29	0.004	0.9	1.7	0.4	0.7	0.1	0.2
120570104023	2.849	3774	983	53				24628	0.481	8210	1.120	8.4	15.3	3.3	5.8	31.2	56.6
120570065013	0.299	1859	345	46				3409	0.067	119	0.016	2.9	5.3	1.1	2.0	0.5	0.8
120570071031	0.248	1364	324	13				4534	0.089	331	0.045	1.3	2.4	0.5	0.9	1.3	2.3
120570072003	0.291	1314	246	15				1850	0.036	31	0.004	1.0	1.9	0.4	0.7	0.1	0.2
120570072002	2.149	1407	377	4				3644	0.071	238	0.032	1.0	1.9	0.4	0.7	0.9	1.6
120570102131	7.812	1902	470	2				5496	0.107	585	0.080	1.5	2.8	0.6	1.1	2.2	4.0
120570103031	1.290	908	170	0				3753	0.073	864	0.118	1.0	1.8	0.4	0.7	3.3	6.0
120570102042	0.920	2791	474	30				3666	0.072	145	0.020	2.0	3.6	0.8	1.4	0.6	1.0
120570134073	0.270	1636	446	0				2485	0.049	29	0.004	0.7	1.2	0.3	0.5	0.1	0.2
120570001023	0.171	770	87	75				819	0.016	7	0.001	1.6	2.9	0.6	1.1	0.0	0.0
120570115143	0.394	1143	298	14				1688	0.033	72	0.010	0.8	1.4	0.3	0.5	0.3	0.5
120570025002	0.158	1821	593	30				11833	0.231	682	0.093	3.3	6.0	1.3	2.3	2.6	4.7
120570025001	0.270	1825	318	72				3922	0.077	250	0.034	3.8	6.9	1.5	2.6	1.0	1.7
120570025003	0.412	1922	337	83				12707	0.248	8547	1.166	6.4	11.6	2.5	4.4	32.5	58.9
120570030001	0.276	657	155	19				5350	0.105	258	0.035	1.6	2.9	0.6	1.1	1.0	1.8
120579806001	3.712	128	14	10				30039	0.587	6222	0.849	5.7	10.3	2.2	3.9	23.7	42.9
120570043003	0.092	32	0	68				613	0.012	0	0.000	0.6	1.1	0.2	0.4	0.0	0.0
120570043002	0.069	396	91	87				811	0.016	237	0.032	1.1	2.0	0.4	0.8	0.9	1.6
120570043001	0.184	363	57	90				2634	0.051	42	0.006	1.5	2.7	0.6	1.0	0.2	0.3
120570116153	0.115	1155	227	15				1626	0.032	23	0.003	0.7	1.2	0.3	0.5	0.1	0.2
120570114103	1.167	3657	1034	16				11745	0.230	761	0.104	3.7	6.6	1.4	2.5	2.9	5.2
120570115062	0.730	911	303	0				1079	0.021	39	0.005	0.3	0.5	0.1	0.2	0.1	0.3
120570115121	1.253	1546	473	0				3951	0.077	193	0.026	0.7	1.3	0.3	0.5	0.7	1.3
120570115042	3.545	1765	475	0				3379	0.066	365	0.050	0.7	1.3	0.3	0.5	1.4	2.5
120570115142	0.488	2548	847	0				4404	0.086	53	0.007	1.0	1.8	0.4	0.7	0.2	0.4
120570116103	0.241	1383	389	37				3635	0.071	108	0.015	2.0	3.5	0.8	1.4	0.4	0.7
120570110162	0.420	1441	379	75				2823	0.055	219	0.030	2.4	4.3	0.9	1.7	0.8	1.5
120570110061	4.941	2337	668	0				3293	0.064	272	0.037	0.8	1.5	0.3	0.6	1.0	1.9
120570108171	0.123	1354	213	70				3198	0.063	133	0.018	3.1	5.6	1.2	2.2	0.5	0.9
120570111091	3.458	2813	714	15				13178	0.258	1182	0.161	3.5	6.3	1.4	2.4	4.5	8.1
120570115101	1.229	3505	791	0				2224	0.043	218	0.030	0.7	1.2	0.3	0.5	0.8	1.5
120570122111	3.785	2512	6	0				29674	0.580	9427	1.286	5.5	9.9	2.1	3.8	35.9	64.9
120570122121	0.590	2387	461	69				16372	0.320	2166	0.296	7.4	13.3	2.9	5.1	8.2	14.9
120570108102	0.802	2052	445	73				8638	0.169	7044	0.961	4.9	8.9	1.9	3.4	26.8	48.5
120570135012	1.418	3228	756	8				7760	0.152	1270	0.173	2.6	4.6	1.0	1.8	4.8	8.7
120570135011	1.930	1325	323	42				5399	0.106	958	0.131	2.4	4.3	0.9	1.6	3.6	6.6
120570136041	10.154	1271	272	5				13918	0.272	2547	0.348	3.2	5.8	1.3	2.2	9.7	17.5
120570053012	0.127	1533	266	97				5312	0.104	702	0.096	4.6	8.3	1.8	3.2	2.7	4.8
120570116104	0.213	1393	296	30				2627	0.051	136	0.019	2.1	3.7	0.8	1.4	0.5	0.9
120570115192	0.369	1254	399	3				1393	0.027	406	0.055	0.4	0.7	0.2	0.3	1.5	2.8
120570115201	1.268	2416	741	0				7659	0.150	443	0.060	1.6	2.9	0.6	1.1	1.7	3.1
120570116102	0.266	1634	475	0				2540	0.050	10	0.001	0.8	1.5	0.3	0.6	0.0	0.1
120570116141	0.403	1181	238	11				5218	0.102	423	0.058	1.5	2.7	0.6	1.0	1.6	2.9

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570114071	0.682	956	281	26				20399	0.399	2027	0.277	4.2	7.7	1.7	2.9	7.7	14.0
120570117122	0.396	1639	361	88				1544	0.030	27	0.004	4.0	7.3	1.6	2.8	0.1	0.2
120570114091	0.223	587	170	0				1143	0.022	49	0.007	0.2	0.4	0.1	0.1	0.2	0.3
120570114092	1.138	2209	581	32				23378	0.457	3860	0.527	6.0	10.9	2.4	4.2	14.7	26.6
120570115151	0.487	2027	563	1				6259	0.122	485	0.066	1.3	2.3	0.5	0.9	1.8	3.3
120570114111	0.658	2395	605	0				8017	0.157	526	0.072	1.7	3.0	0.7	1.1	2.0	3.6
120570116111	1.678	1052	315	57				24783	0.484	17277	2.357	5.6	10.1	2.2	3.9	65.7	119.0
120570102113	1.651	4015	898	53				10256	0.200	772	0.105	4.9	8.9	1.9	3.4	2.9	5.3
120570110131	1.089	2571	608	47				7165	0.140	5615	0.766	3.5	6.2	1.4	2.4	21.4	38.7
120570110132	0.287	1592	332	83				7459	0.146	396	0.054	4.4	8.0	1.7	3.0	1.5	2.7
120570061034	0.111	1247	302	58				2764	0.054	219	0.030	2.3	4.2	0.9	1.6	0.8	1.5
120570061013	0.287	747	222	0				1296	0.025	88	0.012	0.3	0.6	0.1	0.2	0.3	0.6
120570055002	0.101	1209	313	95				5364	0.105	1254	0.171	3.7	6.6	1.4	2.5	4.8	8.6
120570061011	0.093	682	135	15				1240	0.024	44	0.006	0.6	1.1	0.2	0.4	0.2	0.3
120570110051	3.816	2877	790	0				3685	0.072	365	0.050	0.9	1.6	0.3	0.6	1.4	2.5
120570104011	0.277	1861	373	89				1679	0.033	40	0.005	3.9	7.1	1.5	2.7	0.2	0.3
120570115211	0.619	991	306	2				853	0.017	24	0.003	0.2	0.3	0.1	0.1	0.1	0.2
120570116142	0.323	3469	883	16				3726	0.073	119	0.016	2.2	4.0	0.9	1.5	0.5	0.8
120579801001	6.514	0	0	0				661	0.013	0	0.000	0.1	0.2	0.0	0.1	0.0	0.0
120570115221	1.902	1796	646	0				6379	0.125	561	0.077	1.3	2.4	0.5	0.9	2.1	3.9
120570116123	0.623	1779	385	0				7416	0.145	272	0.037	1.9	3.4	0.7	1.3	1.0	1.9
120570117121	0.337	1278	400	51				13539	0.265	826	0.113	3.9	7.1	1.5	2.7	3.1	5.7
120570121072	0.620	1302	235	34				14005	0.274	521	0.071	4.0	7.2	1.6	2.7	2.0	3.6
120570134111	1.094	3016	780	8				13659	0.267	720	0.098	3.6	6.6	1.4	2.5	2.7	5.0
120570132071	8.237	2020	394	0				5318	0.104	170	0.023	1.4	2.6	0.6	1.0	0.6	1.2
120570133102	0.274	1635	387	30				2196	0.043	110	0.015	1.8	3.2	0.7	1.2	0.4	0.8
120570125032	0.581	1792	388	74				4178	0.082	573	0.078	3.9	7.0	1.5	2.7	2.2	3.9
120570138022	0.693	1198	253	40				9586	0.187	887	0.121	3.6	6.5	1.4	2.5	3.4	6.1
120570059006	0.152	695	246	0				1226	0.024	36	0.005	0.2	0.4	0.1	0.2	0.1	0.2
120570010022	0.190	747	176	0				3067	0.060	69	0.009	0.8	1.5	0.3	0.6	0.3	0.5
120570061014	0.135	1225	303	50				3095	0.061	332	0.045	2.2	3.9	0.9	1.5	1.3	2.3
120570066003	0.433	2558	513	55				6629	0.130	782	0.107	4.4	7.9	1.7	3.0	3.0	5.4
120570068013	0.132	720	131	5				2155	0.042	75	0.010	0.6	1.0	0.2	0.4	0.3	0.5
120570070012	0.185	608	183	9				1594	0.031	245	0.033	0.5	0.9	0.2	0.3	0.9	1.7
120570070011	0.311	558	75	90				7980	0.156	960	0.131	3.3	6.0	1.3	2.3	3.7	6.6
120570071022	0.680	1945	573	72				5265	0.103	861	0.117	4.5	8.1	1.8	3.1	3.3	5.9
120570116152	0.083	787	216	92				1037	0.020	20	0.003	2.1	3.8	0.8	1.5	0.1	0.1
120570117124	0.345	2177	495	24				2614	0.051	128	0.017	1.1	1.9	0.4	0.7	0.5	0.9
120570121082	0.511	1926	337	0				3723	0.073	41	0.006	1.1	2.0	0.4	0.8	0.2	0.3
120570133223	0.283	1653	420	0				4117	0.080	43	0.006	1.2	2.1	0.5	0.8	0.2	0.3
120570121081	0.525	1954	488	3				6435	0.126	201	0.027	1.5	2.8	0.6	1.1	0.8	1.4
120570122092	2.548	3758	1050	0				5004	0.098	107	0.015	1.9	3.5	0.8	1.3	0.4	0.7
120570123012	0.557	1889	432	2				3413	0.067	141	0.019	0.8	1.5	0.3	0.6	0.5	1.0
120570124032	1.515	1098	217	0				3946	0.077	76	0.010	0.8	1.5	0.3	0.6	0.3	0.5
120570125033	0.648	1119	351	0				1371	0.027	23	0.003	0.3	0.5	0.1	0.2	0.1	0.2
120570125031	0.972	1908	492	2				3126	0.061	201	0.027	0.7	1.2	0.3	0.5	0.8	1.4
120570133071	0.477	758	134	93				8689	0.170	1382	0.189	3.2	5.8	1.3	2.2	5.3	9.5
120570050003	0.300	3841	61	94				19771	0.386	3805	0.519	5.9	10.7	2.3	4.1	14.5	26.2
120570058005	0.376	1637	362	16				20098	0.393	1670	0.228	4.5	8.1	1.8	3.1	6.4	11.5
120570071032	0.223	1690	365	5				2224	0.043	26	0.004	1.1	2.0	0.4	0.7	0.1	0.2
120570105022	0.772	2323	464	64				10683	0.209	1568	0.214	4.9	8.9	1.9	3.4	6.0	10.8
120570108151	0.129	1350	286	99				3253	0.064	90	0.012	4.1	7.4	1.6	2.8	0.3	0.6
120579805001	3.901	0	0	0				227	0.004	0	0.000	0.0	0.1	0.0	0.0	0.0	0.0
120570114083	0.247	1480	326	55				5264	0.103	252	0.034	2.7	4.9	1.1	1.9	1.0	1.7
120570116112	0.274	2273	488	12				3678	0.072	241	0.033	1.5	2.7	0.6	1.0	0.9	1.7
120570122063	0.499	1219	309	4				1654	0.032	55	0.008	0.6	1.0	0.2	0.4	0.2	0.4
120570138011	7.136	1044	294	6				7199	0.141	1737	0.237	1.8	3.2	0.7	1.2	6.6	12.0
120570139193	0.527	2872	652	0				4456	0.087	22	0.003	1.1	2.0	0.4	0.8	0.1	0.2
120570127022	0.289	935	269	28				4040	0.079	856	0.117	1.3	2.4	0.5	0.9	3.3	5.9
120570127023	0.479	2026	439	46				4550	0.089	431	0.059	3.2	5.8	1.3	2.2	1.6	3.0
120570128001	1.207	2851	780	1				6720	0.131	825	0.113	1.8	3.3	0.7	1.3	3.1	5.7
120570129001	0.421	1183	224	3				2734	0.053	53	0.007	0.9	1.7	0.4	0.6	0.2	0.4
120570129002	1.001	2199	448	25				6367	0.124	1225	0.167	2.4	4.3	0.9	1.7	4.7	8.4
120570130011	8.980	4021	932	25				10380	0.203	3081	0.420	4.2	7.6	1.6	2.9	11.7	21.2
120570114141	1.092	5130	1149	48				15090	0.295	1014	0.138	8.2	14.8	3.2	5.6	3.9	7.0
120570114142	0.155	1341	280	0				1810	0.035	26	0.004	0.8	1.4	0.3	0.5	0.1	0.2

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570114143	0.752	2164	444	0				6574	0.129	677	0.092	1.5	2.7	0.6	1.0	2.6	4.7
120570114151	0.498	3039	843	7				8687	0.170	312	0.043	2.8	5.0	1.1	1.9	1.2	2.1
120570114152	0.608	2068	456	29				5233	0.102	307	0.042	2.2	4.0	0.9	1.5	1.2	2.1
120570114161	0.350	3061	595	0				6349	0.124	161	0.022	1.8	3.3	0.7	1.3	0.6	1.1
120570114162	0.319	2064	527	0				2137	0.042	44	0.006	1.0	1.9	0.4	0.7	0.2	0.3
120570114163	0.235	1666	337	51				2738	0.054	38	0.005	2.6	4.7	1.0	1.8	0.1	0.3
120570115041	8.273	978	250	1				1573	0.031	172	0.023	0.4	0.8	0.2	0.3	0.7	1.2
120570130021	1.374	804	168	0				1787	0.035	867	0.118	0.5	0.8	0.2	0.3	3.3	6.0
120570134091	0.286	1112	289	0				5363	0.105	721	0.098	1.1	2.0	0.4	0.8	2.7	5.0
120570134092	0.097	1524	377	0				1692	0.033	8	0.001	0.6	1.0	0.2	0.4	0.0	0.1
120570110163	0.739	1540	395	39				2603	0.051	55	0.008	1.8	3.3	0.7	1.2	0.2	0.4
120570122102	0.762	1562	409	1				5152	0.101	219	0.030	1.2	2.1	0.5	0.8	0.8	1.5
120570108141	0.037	1355	250	10				1441	0.028	7	0.001	2.9	5.2	1.1	2.0	0.0	0.0
120579807001	0.889	0	0	0				266	0.005	0	0.000	0.0	0.1	0.0	0.0	0.0	0.0
120570116055	0.035	903	213	10				1132	0.022	6	0.001	1.9	3.5	0.8	1.3	0.0	0.0
120570114153	0.346	820	120	0				4266	0.083	171	0.023	1.0	1.8	0.4	0.7	0.7	1.2
120570116143	0.183	2259	520	0				2859	0.056	18	0.002	0.9	1.7	0.4	0.6	0.1	0.1
120570133073	0.300	1960	339	47				5635	0.110	327	0.045	3.1	5.6	1.2	2.2	1.2	2.3
120570139122	8.399	4365	961	0				6766	0.132	123	0.017	1.5	2.7	0.6	1.0	0.5	0.8
120570140021	8.627	1662	478	0				684	0.013	26	0.004	0.7	1.2	0.3	0.5	0.1	0.2
120570140022	1.664	1188	426	0				3532	0.069	72	0.010	0.7	1.2	0.3	0.5	0.3	0.5
120570139121	1.348	1576	258	0				6041	0.118	87	0.012	1.5	2.7	0.6	1.0	0.3	0.6
120570140031	7.103	1675	498	0				1791	0.035	55	0.008	0.3	0.6	0.1	0.2	0.2	0.4
120570013004	0.140	1023	278	0				1306	0.026	14	0.002	0.4	0.8	0.2	0.3	0.1	0.1
120570018004	0.243	1890	375	2				2652	0.052	44	0.006	1.2	2.2	0.5	0.8	0.2	0.3
120570033003	0.095	376	69	15				1514	0.030	242	0.033	0.5	0.9	0.2	0.4	0.9	1.7
120570053013	0.050	1178	156	98				3941	0.077	667	0.091	5.5	10.0	2.2	3.8	2.5	4.6
120570044003	0.136	684	96	9				3742	0.073	221	0.030	1.1	2.0	0.4	0.8	0.8	1.5
120570045005	0.111	511	107	10				1655	0.032	112	0.015	0.6	1.0	0.2	0.4	0.4	0.8
120570051022	0.051	1608	407	99				1844	0.036	1508	0.206	4.9	8.8	1.9	3.4	5.7	10.4
120570054016	0.071	562	124	61				4621	0.090	384	0.052	2.0	3.7	0.8	1.4	1.5	2.6
120570063004	0.199	1435	373	13				3488	0.068	147	0.020	1.1	2.1	0.4	0.8	0.6	1.0
120570115191	1.175	738	223	0				900	0.018	76	0.010	0.2	0.4	0.1	0.1	0.3	0.5
120570117123	0.148	749	170	0				714	0.014	13	0.002	0.3	0.5	0.1	0.2	0.0	0.1
120570103041	4.883	1467	407	0				5483	0.107	379	0.052	1.2	2.1	0.5	0.8	1.4	2.6
120570137024	0.654	1011	246	6				1142	0.022	86	0.012	0.3	0.5	0.1	0.2	0.3	0.6
120570139031	10.841	1689	531	1				2910	0.057	540	0.074	0.7	1.3	0.3	0.5	2.1	3.7
120570141061	1.773	1626	420	13				16908	0.331	1311	0.179	4.2	7.5	1.6	2.9	5.0	9.0
120570141062	0.500	2306	513	0				5264	0.103	235	0.032	1.4	2.5	0.5	1.0	0.9	1.6
120570139071	22.069	2667	426	0				3680	0.072	850	0.116	0.8	1.5	0.3	0.6	3.2	5.9
120570141082	0.738	3189	738	15				5078	0.099	193	0.026	2.3	4.2	0.9	1.6	0.7	1.3
120570141083	1.339	1819	422	17				4222	0.083	421	0.057	1.6	3.0	0.6	1.1	1.6	2.9
120570005001	0.298	945	222	0				1690	0.033	48	0.007	0.3	0.6	0.1	0.2	0.2	0.3
120570068023	0.132	821	209	38				1702	0.033	45	0.006	1.1	1.9	0.4	0.7	0.2	0.3
120570133171	0.179	1287	265	10				1990	0.039	602	0.082	3.0	5.5	1.2	2.1	2.3	4.1
120570134122	1.032	2726	705	9				15494	0.303	940	0.128	3.6	6.5	1.4	2.5	3.6	6.5
120570137022	0.115	1316	193	0				1553	0.030	0	0.000	0.7	1.3	0.3	0.5	0.0	0.0
120570138071	0.749	4176	1023	0				3131	0.061	64	0.009	1.2	2.2	0.5	0.8	0.2	0.4
120570026001	0.937	419	70	65				26210	0.512	5100	0.696	5.9	10.6	2.3	4.1	19.4	35.1
120570006021	0.229	1703	361	4				4791	0.094	114	0.016	1.4	2.6	0.6	1.0	0.4	0.8
120570024003	0.155	1581	368	75				1884	0.037	34	0.005	2.8	5.0	1.1	1.9	0.1	0.2
120570037001	4.048	1001	225	11				36377	0.711	9845	1.343	7.2	13.0	2.8	5.0	37.4	67.8
120570108101	0.697	1845	333	98				3815	0.075	1196	0.163	5.4	9.7	2.1	3.7	4.5	8.2
120570053011	0.203	842	163	10				6126	0.120	1128	0.154	3.1	5.6	1.2	2.1	4.3	7.8
120579803001	9.142	0	0	0				567	0.011	0	0.000	0.1	0.2	0.0	0.1	0.0	0.0
120570104021	0.288	919	186	67				1823	0.036	49	0.007	2.2	4.0	0.9	1.5	0.2	0.3
120579900000	130.475	0	0	0				0	0.000	0	0.000	0.0	0.0	0.0	0.0	0.0	0.0
120570013001	0.551	1857	350	53				16876	0.330	559	0.076	6.0	10.9	2.4	4.1	2.1	3.9
120570013003	0.120	774	209	0				2638	0.052	74	0.010	0.5	1.0	0.2	0.4	0.3	0.5
120570014001	0.359	2098	515	1				3943	0.077	473	0.065	1.1	2.0	0.4	0.8	1.8	3.3
120570014002	0.298	1215	293	36				1789	0.035	30	0.004	1.3	2.3	0.5	0.9	0.1	0.2
120570014003	0.137	1151	286	16				2298	0.045	54	0.007	1.0	1.9	0.4	0.7	0.2	0.4
120570014004	0.147	430	90	16				6058	0.118	229	0.031	1.4	2.5	0.6	1.0	0.9	1.6
120570015001	0.190	738	169	0				1744	0.034	148	0.020	0.4	0.8	0.2	0.3	0.6	1.0
120570015003	0.262	946	238	19				2674	0.052	94	0.013	1.0	1.8	0.4	0.7	0.4	0.6
120570016002	0.372	1400	326	12				9569	0.187	413	0.056	2.4	4.4	1.0	1.7	1.6	2.8

Block Group ID	Area (Sq. Mi.)	Population	Households	Households in MUD	Households Renting	% of Households in MUD or Renting in HC	% of Public Ports for Home Charging Need	Trips Begin/End	% of Trips Begin/End in HC	Jobs	% of Jobs in HC	Need for Public L2 in 2035	Need for Public L2 in 2050	Need for Public DCFC in 2035	Need for Public DCFC in 2050	Need for Work L2 in 2035	Need for Work L2 in 2050
120570017001	0.250	1379	311	6				3991	0.078	544	0.074	1.0	1.8	0.4	0.7	2.1	3.7
120570017002	0.150	943	204	0				921	0.018	14	0.002	0.2	0.4	0.1	0.2	0.1	0.1
120570017004	0.188	722	242	10				4033	0.079	298	0.041	1.0	1.8	0.4	0.7	1.1	2.1
120570018002	0.352	2702	554	65				5067	0.099	378	0.052	3.7	6.7	1.4	2.6	1.4	2.6
120570110083	0.408	1986	492	96				2603	0.051	81	0.011	4.3	7.8	1.7	3.0	0.3	0.6
120570110084	1.533	651	213	5				1697	0.033	416	0.057	0.4	0.7	0.2	0.3	1.6	2.9
120570111031	2.248	2159	652	1				4047	0.079	422	0.058	0.9	1.6	0.3	0.6	1.6	2.9
120570019001	0.379	569	96	12				10900	0.213	860	0.117	2.2	4.1	0.9	1.6	3.3	5.9
120570019002	0.192	1428	287	15				1790	0.035	8	0.001	1.0	1.8	0.4	0.7	0.0	0.1
120570019003	0.188	1180	218	6				2523	0.049	290	0.040	0.9	1.6	0.3	0.6	1.1	2.0
120570020001	0.183	1406	253	1				5770	0.113	242	0.033	1.5	2.7	0.6	1.0	0.9	1.7
120570020002	0.142	1007	187	9				1213	0.024	48	0.007	0.6	1.1	0.2	0.4	0.2	0.3
120570021001	0.177	752	192	12				4141	0.081	358	0.049	1.2	2.1	0.5	0.8	1.4	2.5
120570021002	0.130	1017	182	5				1684	0.033	17	0.002	0.5	1.0	0.2	0.4	0.1	0.1
120570022001	0.507	1669	340	9				13957	0.273	361	0.049	3.6	6.5	1.4	2.5	1.4	2.5
120570023001	0.301	1204	300	20				5672	0.111	596	0.081	1.7	3.1	0.7	1.2	2.3	4.1
120570023003	0.173	666	122	41				2900	0.057	389	0.053	1.5	2.8	0.6	1.1	1.5	2.7
120570024001	0.332	646	170	0				10116	0.198	1242	0.169	1.9	3.5	0.8	1.3	4.7	8.6
120570024004	0.175	461	74	0				4303	0.084	323	0.044	0.8	1.5	0.3	0.6	1.2	2.2
120570111032	1.257	1225	319	3				5882	0.115	552	0.075	1.2	2.2	0.5	0.9	2.1	3.8
120570028002	0.139	801	97	8				996	0.019	11	0.002	0.7	1.3	0.3	0.5	0.0	0.1
120570028003	0.202	530	158	11				891	0.017	22	0.003	0.3	0.6	0.1	0.2	0.1	0.2
120570028004	0.161	1180	244	7				1819	0.036	46	0.006	0.6	1.1	0.2	0.4	0.2	0.3
120570029002	0.154	843	132	20				1706	0.033	76	0.010	0.8	1.4	0.3	0.5	0.3	0.5
120570031001	0.125	659	128	20				1823	0.036	413	0.056	0.7	1.2	0.3	0.5	1.6	2.8
120570031002	0.128	596	141	3				1065	0.021	15	0.002	0.4	0.7	0.1	0.3	0.1	0.1
120570031003	0.159	986	134	60				2137	0.042	258	0.035	2.0	3.6	0.8	1.4	1.0	1.8
120570032001	0.126	1319	203	34				2117	0.041	56	0.008	1.9	3.4	0.7	1.3	0.2	0.4
120570032002	0.098	833	192	10				1644	0.032	109	0.015	0.9	1.7	0.4	0.6	0.4	0.8
120570033001	0.084	676	143	22				917	0.018	19	0.003	0.6	1.0	0.2	0.4	0.1	0.1
120570034002	0.157	1134	264	25				1655	0.032	577	0.079	1.2	2.1	0.5	0.8	2.2	4.0
120570035001	0.131	589	138	8				1052	0.021	71	0.010	0.6	1.0	0.2	0.4	0.3	0.5
120570035002	0.110	365	65	6				915	0.018	27	0.004	0.6	1.0	0.2	0.4	0.1	0.2
120570035004	0.221	823	178	4				1861	0.036	681	0.093	0.7	1.2	0.3	0.5	2.6	4.7
120570036001	0.618	1016	188	12				3899	0.076	1401	0.191	1.2	2.1	0.5	0.8	5.3	9.7
120570038001	0.838	1077	191	14				9807	0.192	2384	0.325	2.5	4.5	1.0	1.7	9.1	16.4
120570041001	0.077	621	118	45				1270	0.025	42	0.006	0.8	1.5	0.3	0.6	0.2	0.3
120570044001	0.103	585	127	36				2455	0.048	447	0.061	1.0	1.8	0.4	0.7	1.7	3.1
120570045001	0.229	739	128	2				5961	0.117	318	0.043	1.3	2.3	0.5	0.9	1.2	2.2
120570045003	0.135	987	292	2				3085	0.060	104	0.014	0.7	1.3	0.3	0.5	0.4	0.7
120570047001	0.270	814	123	72				16282	0.318	8466	1.155	4.1	7.5	1.6	2.9	32.2	58.3
120570047003	0.268	1384	314	41				5368	0.105	789	0.108	2.3	4.1	0.9	1.6	3.0	5.4
120570048003	0.141	788	209	8				1599	0.031	387	0.053	0.6	1.1	0.2	0.4	1.5	2.7
120570048004	0.105	597	145	0				1381	0.027	48	0.007	0.5	0.9	0.2	0.3	0.2	0.3
120570048005	0.151	852	207	6				2200	0.043	552	0.075	0.6	1.1	0.2	0.4	2.1	3.8
120570050001	0.231	1818	237	69				8530	0.167	580	0.079	4.6	8.4	1.8	3.2	2.2	4.0
120570053022	1.409	825	185	22				3355	0.066	272	0.037	1.2	2.2	0.5	0.8	1.0	1.9
120570058004	0.214	706	207	4				6350	0.124	554	0.076	1.2	2.2	0.5	0.8	2.1	3.8
120570059002	0.242	1280	353	53				10575	0.207	3933	0.537	3.8	6.8	1.5	2.6	15.0	27.1
120570134071	0.693	1962	571	0				5245	0.103	284	0.039	1.0	1.8	0.4	0.7	1.1	2.0
120570059001	0.704	1457	379	12				3231	0.063	2988	0.408	0.9	1.5	0.3	0.6	11.4	20.6
120570059003	0.289	1540	473	0				3226	0.063	127	0.017	0.6	1.1	0.2	0.4	0.5	0.9
120570060001	0.176	736	209	13				4305	0.084	320	0.044	1.0	1.7	0.4	0.7	1.2	2.2
120570060007	0.195	440	102	0				6361	0.124	373	0.051	1.2	2.2	0.5	0.8	1.4	2.6
120570060005	0.108	583	201	37				2389	0.047	435	0.059	1.0	1.8	0.4	0.7	1.7	3.0
120570058003	0.281	1204	324	15				5860	0.115	669	0.091	1.5	2.7	0.6	1.1	2.5	4.6
120570058001	0.140	1032	210	46				2376	0.046	647	0.088	1.4	2.5	0.6	1.0	2.5	4.5
120570062001	0.135	857	231	12				3003	0.059	340	0.046	0.8	1.5	0.3	0.6	1.3	2.3
120570063002	0.162	1146	288	0				1684	0.033	490	0.067	0.3	0.6	0.1	0.2	1.9	3.4
120570062003	0.148	1039	304	1				1468	0.029	116	0.016	0.3	0.6	0.1	0.2	0.4	0.8
120570066001	0.186	411	110	25				4959	0.097	227	0.031	1.2	2.3	0.5	0.9	0.9	1.6
120570067006	0.106	1440	364	5				2186	0.043	295	0.040	0.5	0.9	0.2	0.4	1.1	2.0
120570067005	0.109	566	205	0				1115	0.022	36	0.005	0.3	0.5	0.1	0.2	0.1	0.2
120570067003	0.148	1126	288	0				1556	0.030	28	0.004	0.5	0.9	0.2	0.3	0.1	0.2
120570067001	0.421	1165	219	72				22329	0.437	1697	0.232	6.2	11.2	2.4	4.3	6.5	11.7
120570068011	0.066	831	153	90				8712	0.170	303	0.041	3.5	6.4	1.4	2.5	1.2	2.1

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120570068012	0.141	827	153	18				3148	0.062	178	0.024	0.9	1.5	0.3	0.6	0.7	1.2
120570068015	0.155	589	120	54				2875	0.056	108	0.015	1.5	2.8	0.6	1.1	0.4	0.7
120570068014	0.269	1941	563	5				2860	0.056	296	0.040	1.1	2.0	0.4	0.8	1.1	2.0
120570070013	0.239	2205	535	30				2634	0.051	73	0.010	1.6	2.9	0.6	1.1	0.3	0.5
120570070014	0.187	717	179	8				2042	0.040	29	0.004	0.5	0.9	0.2	0.3	0.1	0.2
120570071033	0.279	1308	337	14				1929	0.038	34	0.005	1.1	2.0	0.4	0.8	0.1	0.2
120570072001	0.251	1828	407	66				2419	0.047	144	0.020	3.4	6.2	1.3	2.4	0.5	1.0
120570101052	2.778	1480	324	0				2084	0.041	183	0.025	0.6	1.1	0.2	0.4	0.7	1.3
120570101053	4.142	2271	519	0				2661	0.052	273	0.037	0.8	1.5	0.3	0.6	1.0	1.9
120570101061	2.280	551	137	0				975	0.019	54	0.007	0.3	0.5	0.1	0.2	0.2	0.4
120570101062	5.049	1948	470	1				4581	0.090	201	0.027	1.3	2.3	0.5	0.9	0.8	1.4
120570101063	1.270	375	104	0				1515	0.030	46	0.006	0.3	0.6	0.1	0.2	0.2	0.3
120570101064	3.293	1502	352	0				3106	0.061	358	0.049	0.8	1.4	0.3	0.5	1.4	2.5
120570101081	35.101	793	246	18				967	0.019	152	0.021	0.5	0.9	0.2	0.3	0.6	1.0
120570101082	7.435	1287	303	0				1725	0.034	185	0.025	0.5	0.9	0.2	0.3	0.7	1.3
120570111081	1.321	1660	443	5				12294	0.240	1810	0.247	2.6	4.8	1.0	1.8	6.9	12.5
120570122074	0.254	870	216	4				1301	0.025	61	0.008	0.4	0.6	0.1	0.2	0.2	0.4
120570125013	4.175	2555	600	1				10529	0.206	3460	0.472	2.5	4.5	1.0	1.7	13.2	23.8
120570103032	0.376	1237	268	2				2124	0.042	7	0.001	0.6	1.1	0.2	0.4	0.0	0.0
120570103042	4.324	1076	222	0				7613	0.149	297	0.041	1.6	2.8	0.6	1.1	1.1	2.0
120570104013	0.368	1280	296	44				5088	0.099	277	0.038	2.2	3.9	0.9	1.5	1.1	1.9
120570104012	0.364	2717	509	29				5342	0.104	331	0.045	2.8	5.0	1.1	1.9	1.3	2.3
120570001021	0.752	760	148	43				10504	0.205	2375	0.324	2.6	4.6	1.0	1.8	9.0	16.4
120570108163	0.063	861	120	10				1013	0.020	4	0.001	2.3	4.2	0.9	1.6	0.0	0.0
120570106003	0.373	942	195	0				2092	0.041	9	0.001	0.4	0.7	0.2	0.3	0.0	0.1
120570104024	1.076	1137	256	0				6010	0.117	2572	0.351	1.4	2.5	0.5	1.0	9.8	17.7
120570120012	2.010	2008	488	8				21454	0.419	10654	1.454	4.5	8.1	1.8	3.1	40.5	73.4
120570110102	0.311	1631	184	53				6652	0.130	367	0.050	3.1	5.6	1.2	2.1	1.4	2.5
120570110101	1.736	3428	620	56				3981	0.078	108	0.015	4.7	8.5	1.9	3.3	0.4	0.7
120570110161	0.942	1061	237	12				9334	0.182	714	0.097	2.0	3.6	0.8	1.4	2.7	4.9
120570123043	0.287	1307	310	0				10325	0.202	335	0.046	2.3	4.1	0.9	1.6	1.3	2.3
120570025004	0.193	1193	276	58				7054	0.138	954	0.130	2.9	5.2	1.1	2.0	3.6	6.6
120570141172	0.551	1438	470	22				3175	0.062	357	0.049	1.2	2.3	0.5	0.9	1.4	2.5
120570141181	1.170	2110	702	6				3100	0.061	467	0.064	0.9	1.5	0.3	0.6	1.8	3.2
120570108052	0.175	2845	535	90				7383	0.144	598	0.082	4.8	8.7	1.9	3.3	2.3	4.1
120570125041	1.344	3778	1152	1				5236	0.102	485	0.066	1.3	2.3	0.5	0.9	1.8	3.3
120570133201	0.907	4374	948	51				9649	0.189	522	0.071	6.4	11.6	2.5	4.4	2.0	3.6
120570113042	0.429	1053	340	34				3047	0.060	185	0.025	1.4	2.6	0.6	1.0	0.7	1.3
120570130041	3.637	1029	317	0				1206	0.024	192	0.026	0.4	0.8	0.2	0.3	0.7	1.3
120570133161	0.290	515	144	98				10964	0.214	1345	0.184	3.5	6.3	1.4	2.4	5.1	9.3
120570134102	0.456	2594	659	50				11740	0.230	1348	0.184	4.8	8.7	1.9	3.3	5.1	9.3
120570134121	0.946	1565	399	0				2519	0.049	160	0.022	0.9	1.6	0.3	0.6	0.6	1.1
120570068021	0.391	1145	280	38				2919	0.057	301	0.041	1.5	2.7	0.6	1.0	1.1	2.1
120570115241	0.096	810	194	88				705	0.014	85	0.012	2.1	3.8	0.8	1.5	0.3	0.6
120570132041	0.785	3733	1099	10				7582	0.148	128	0.017	2.8	5.1	1.1	2.0	0.5	0.9
120570121071	0.811	669	181	10				9782	0.191	224	0.031	2.1	3.7	0.8	1.4	0.9	1.5
120570135033	0.324	1079	228	0				5195	0.102	194	0.026	1.0	1.8	0.4	0.7	0.7	1.3
120570041002	0.150	929	141	91				1643	0.032	409	0.056	2.5	4.5	1.0	1.7	1.6	2.8
120570110085	0.290	431	150	0				5517	0.108	443	0.060	1.0	1.8	0.4	0.7	1.7	3.1
120570116054	0.321	1682	397	0				4309	0.084	394	0.054	1.1	2.0	0.4	0.8	1.5	2.7
120570122091	1.643	1365	403	0				3116	0.061	185	0.025	0.8	1.4	0.3	0.5	0.7	1.3
120570009022	0.411	1012	159	53				2224	0.043	24	0.003	2.2	4.0	0.9	1.5	0.1	0.2
120570134093	1.575	3435	723	0				5561	0.109	136	0.019	1.3	2.4	0.5	0.9	0.5	0.9
120570010011	0.887	2203	547	59				4595	0.090	358	0.049	3.4	6.1	1.3	2.3	1.4	2.5
120570105021	0.222	645	157	17				2210	0.043	172	0.023	0.6	1.1	0.2	0.4	0.7	1.2
120570109001	2.423	5299	0	52				51209	1.001	9767	1.333	9.5	17.1	3.7	6.5	37.2	67.3
120570110032	0.487	1855	456	4				1716	0.034	129	0.018	1.1	2.1	0.4	0.8	0.5	0.9
120570108142	0.236	1518	182	83				4435	0.087	526	0.072	3.9	7.0	1.5	2.7	2.0	3.6
120570112031	0.849	1530	463	26				1556	0.030	160	0.022	1.0	1.8	0.4	0.7	0.6	1.1
120570110072	0.759	1633	491	15				2526	0.049	168	0.023	1.0	1.8	0.4	0.7	0.6	1.2
120570132064	0.551	1530	424	0				5803	0.113	312	0.043	1.2	2.1	0.5	0.8	1.2	2.1
120570101073	1.220	853	229	3				2111	0.041	293	0.040	0.6	1.2	0.3	0.4	1.1	2.0
120570101072	0.465	1538	414	0				1549	0.030	269	0.037	0.9	1.6	0.3	0.6	1.0	1.9
120570059004	0.240	636	173	0				1003	0.020	27	0.004	0.2	0.3	0.1	0.1	0.1	0.2
120570141081	0.592	1409	358	13				3328	0.065	171	0.023	1.2	2.2	0.5	0.8	0.7	1.2
120570010021	0.360	2020	561	1				3478	0.068	17	0.002	0.8	1.5	0.3	0.6	0.1	0.1

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120570002021	0.380	1499	266	6				9772	0.191	365	0.050	2.3	4.2	0.9	1.6	1.4	2.5
120570010012	0.315	2315	531	70				5357	0.105	863	0.118	3.4	6.2	1.3	2.4	3.3	5.9
120570139191	1.610	1366	315	0				9987	0.195	523	0.071	2.5	4.5	1.0	1.7	2.0	3.6
120570134131	2.191	3677	985	0				8044	0.157	679	0.093	1.8	3.2	0.7	1.2	2.6	4.7
120570134141	0.210	741	217	33				5534	0.108	146	0.020	1.8	3.2	0.7	1.2	0.6	1.0
120570134142	0.570	984	224	6				2075	0.041	280	0.038	0.6	1.1	0.2	0.4	1.1	1.9
120570134152	0.146	781	159	0				1153	0.023	11	0.002	0.3	0.5	0.1	0.2	0.0	0.1
120570136022	1.488	1010	188	0				5853	0.114	1909	0.260	1.3	2.4	0.5	0.9	7.3	13.2
120570137023	2.860	7122	1705	15				11367	0.222	2272	0.310	5.6	10.0	2.2	3.8	8.6	15.7
120570138012	0.442	1578	246	7				4698	0.092	147	0.020	1.5	2.7	0.6	1.0	0.6	1.0
120570139161	0.691	2787	582	0				344	0.007	120	0.016	0.3	0.6	0.1	0.2	0.5	0.8
120570108161	0.364	1764	334	98				27584	0.539	1846	0.252	8.4	15.2	3.3	5.8	7.0	12.7
120570108091	0.252	1803	171	73				6614	0.129	446	0.061	3.7	6.8	1.5	2.6	1.7	3.1
120570108111	0.105	839	205	55				4783	0.094	127	0.017	1.7	3.1	0.7	1.2	0.5	0.9
120570002011	0.256	1643	262	82				7261	0.142	1097	0.150	5.2	9.4	2.0	3.6	4.2	7.6
120570108162	0.081	805	113	95				1051	0.021	79	0.011	2.5	4.6	1.0	1.8	0.3	0.5
120570006013	0.091	2431	583	92				2590	0.051	58	0.008	5.1	9.2	2.0	3.5	0.2	0.4
120570006011	0.105	1272	241	81				1845	0.036	20	0.003	1.9	3.5	0.8	1.3	0.1	0.1
120570009012	0.143	1037	232	33				2270	0.044	126	0.017	1.0	1.9	0.4	0.7	0.5	0.9
120570001024	0.209	3737	614	81				7381	0.144	243	0.033	6.6	12.0	2.6	4.6	0.9	1.7
120570113041	0.798	2709	729	2				3657	0.071	63	0.009	1.0	1.8	0.4	0.7	0.2	0.4
120570111071	1.683	3997	1119	34				15520	0.303	761	0.104	5.5	10.0	2.2	3.8	2.9	5.2
120570115093	3.175	1830	553	2				1455	0.028	335	0.046	0.3	0.6	0.1	0.2	1.3	2.3
120570115222	1.092	1722	423	0				2983	0.058	330	0.045	0.7	1.2	0.3	0.5	1.3	2.3
120570115231	1.337	2129	551	0				3368	0.066	227	0.031	0.7	1.3	0.3	0.5	0.9	1.6
120570115212	0.574	2541	616	96				1082	0.021	88	0.012	6.2	11.2	2.4	4.3	0.3	0.6
120570115123	1.164	1376	336	6				3430	0.067	175	0.024	1.0	1.8	0.4	0.7	0.7	1.2
120570002012	0.128	1933	306	62				2448	0.048	62	0.008	2.3	4.2	0.9	1.6	0.2	0.4
120570006012	0.326	1847	380	8				3963	0.077	293	0.040	1.1	2.0	0.4	0.8	1.1	2.0
120570113011	0.716	1533	397	36				17768	0.347	2845	0.388	4.1	7.5	1.6	2.9	10.8	19.6
120570113032	0.709	2229	609	57				14478	0.283	1194	0.163	5.8	10.6	2.3	4.0	4.5	8.2
120570105013	0.389	1808	403	51				2820	0.055	48	0.007	2.4	4.3	0.9	1.7	0.2	0.3
120570036004	0.458	918	90	5				7160	0.140	1966	0.268	1.5	2.8	0.6	1.1	7.5	13.5
120570120022	0.550	917	125	3				7273	0.142	1171	0.160	1.5	2.8	0.6	1.1	4.5	8.1
120570063001	0.149	1111	288	0				2281	0.045	163	0.022	0.4	0.8	0.2	0.3	0.6	1.1
120570048002	0.175	557	64	3				1959	0.038	482	0.066	0.5	1.0	0.2	0.4	1.8	3.3
120570016001	0.132	380	93	5				1932	0.038	121	0.017	0.4	0.8	0.2	0.3	0.5	0.8
120570116124	0.209	2529	557	85				5148	0.101	184	0.025	5.0	9.1	2.0	3.5	0.7	1.3
120570030002	0.081	1391	267	91				905	0.018	29	0.004	2.2	4.0	0.9	1.5	0.1	0.2
120570048001	0.297	557	118	15				14534	0.284	2485	0.339	3.0	5.3	1.2	2.0	9.5	17.1
120570057004	0.286	1400	237	58				11291	0.221	1546	0.211	3.7	6.8	1.5	2.6	5.9	10.6
120570135041	0.514	506	71	28				1480	0.029	68	0.009	0.8	1.4	0.3	0.5	0.3	0.5
120570021003	0.195	1468	267	5				2621	0.051	119	0.016	0.8	1.4	0.3	0.5	0.5	0.8
120570110062	1.640	1792	438	0				6391	0.125	846	0.115	1.6	2.8	0.6	1.1	3.2	5.8
120570118023	0.329	717	177	4				5135	0.100	579	0.079	1.2	2.2	0.5	0.8	2.2	4.0
120570023002	0.127	1201	344	5				1675	0.033	61	0.008	0.4	0.8	0.2	0.3	0.2	0.4
120570044002	0.128	835	164	1				1400	0.027	87	0.012	0.8	1.5	0.3	0.6	0.3	0.6
120570112042	0.244	752	193	48				4882	0.095	448	0.061	2.1	3.9	0.8	1.5	1.7	3.1
120570122071	0.235	429	115	0				1419	0.028	73	0.010	0.3	0.6	0.1	0.2	0.3	0.5
120570042001	0.425	1506	304	14				13720	0.268	2284	0.312	3.3	5.9	1.3	2.3	8.7	15.7
120570112043	0.364	1547	306	42				8268	0.162	452	0.062	2.4	4.4	1.0	1.7	1.7	3.1
120570103033	0.358	1445	235	0				1700	0.033	14	0.002	0.7	1.3	0.3	0.5	0.1	0.1
120570051021	0.382	1775	400	50				4667	0.091	2566	0.350	2.6	4.8	1.0	1.8	9.8	17.7
120570036003	0.249	1340	286	48				2063	0.040	179	0.024	1.5	2.7	0.6	1.0	0.7	1.2
120579901000	75.610	0	0	0				0	0.000	0	0.000	0.0	0.0	0.0	0.0	0.0	0.0
120570134151	1.008	3411	873	0				5014	0.098	211	0.029	1.5	2.7	0.6	1.0	0.8	1.5

Appendix D: Bureau of Labor Statistics American Time Use Survey

Table A-1. Time spent in detailed primary activities and percent of the civilian population engaging in each activity, averages per day by sex, 2022 annual averages

Activity	Average hours per day, civilian population			Average percent engaged in the activity per day			Average hours per day for persons who engaged in the activity		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Total, all activities	24.00	24.00	24.00	100.0	100.0	100.0	–	–	–
Personal care activities	9.78	9.54	10.02	99.9	99.9	99.9	9.79	9.55	10.02
Sleeping[1]	9.02	8.90	9.13	99.9	99.9	99.9	9.03	8.91	9.14
Grooming	0.67	0.57	0.77	78.3	75.4	81.0	0.86	0.76	0.95
Health-related self care	0.08	0.05	0.11	6.8	4.9	8.7	1.13	0.93	1.23
Personal activities	0.01	0.01	–[2]	0.3	0.5	0.1	2.06	1.88	–[3]
Travel related to personal care	0.01	0.01	0.01	1.8	1.8	1.9	0.74	0.78	0.71
Eating and drinking	1.23	1.25	1.22	96.1	96.0	96.1	1.28	1.30	1.26
Eating and drinking	1.14	1.15	1.13	96.1	96.0	96.1	1.18	1.20	1.17
Travel related to eating and drinking	0.09	0.10	0.09	16.2	16.1	16.4	0.56	0.60	0.52
Household activities	1.89	1.51	2.26	78.1	70.3	85.4	2.43	2.15	2.65
Housework	0.57	0.31	0.82	35.0	22.2	47.1	1.63	1.40	1.73
Interior cleaning	0.35	0.21	0.48	23.3	13.8	32.4	1.50	1.53	1.49
Laundry	0.17	0.08	0.26	15.5	7.6	23.1	1.12	1.07	1.14
Storing interior household items, including food	0.02	0.01	0.03	6.0	4.7	7.2	0.34	0.28	0.37
Food preparation and cleanup	0.65	0.42	0.87	60.6	49.9	70.8	1.07	0.83	1.23
Food and drink preparation	0.50	0.34	0.66	57.2	46.7	67.2	0.88	0.73	0.98
Kitchen and food cleanup	0.14	0.07	0.20	23.1	14.2	31.7	0.59	0.49	0.63
Lawn and garden care	0.18	0.24	0.12	9.0	10.3	7.7	2.01	2.34	1.58
Household management	0.14	0.12	0.16	16.7	13.7	19.6	0.84	0.88	0.81
Financial management	0.03	0.03	0.03	2.9	2.5	3.2	0.90	1.05	0.79
Household and personal organization and planning	0.11	0.09	0.13	13.8	11.2	16.3	0.81	0.83	0.80
Interior maintenance, repair, and decoration	0.06	0.08	0.04	2.5	2.9	2.1	2.37	2.67	1.98
Exterior maintenance, repair, and decoration	0.05	0.07	0.03	2.4	3.2	1.6	2.04	2.26	1.61
Animals and pets	0.15	0.13	0.17	19.3	16.9	21.5	0.78	0.76	0.79
Care for animals and pets, not veterinary care	0.07	0.07	0.08	13.9	11.9	15.8	0.52	0.55	0.50
Walking, exercising, and playing with animals	0.07	0.06	0.08	8.6	7.7	9.4	0.86	0.81	0.89
Vehicles	0.04	0.08	0.01	2.2	3.6	0.7	2.04	2.27	0.92
Appliances, tools, and toys	0.01	0.02	0.01	1.2	1.5	0.9	1.15	1.32	0.88
Travel related to household activities	0.04	0.03	0.04	6.7	6.0	7.4	0.52	0.54	0.51
Purchasing goods and services	0.66	0.60	0.72	39.1	36.4	41.6	1.70	1.65	1.74
Consumer goods purchases	0.31	0.27	0.35	35.4	32.7	38.0	0.89	0.83	0.93
Grocery shopping	0.10	0.08	0.11	12.9	11.5	14.3	0.77	0.73	0.80
Professional and personal care services	0.08	0.07	0.09	6.5	5.0	7.9	1.23	1.35	1.16
Financial services and banking	–[2]	–[2]	–[2]	1.5	1.3	1.7	0.32	0.36	0.30
Medical and care services	0.06	0.05	0.06	3.8	2.8	4.7	1.48	1.82	1.29

See footnotes at end of table.

Table A-1. Time spent in detailed primary activities and percent of the civilian population engaging in each activity, averages per day by sex, 2022 annual averages — Continued

Activity	Average hours per day, civilian population			Average percent engaged in the activity per day			Average hours per day for persons who engaged in the activity		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Personal care services	0.01	0.01	0.02	1.0	0.7	1.2	1.31	0.84	1.57
Household services	0.02	0.02	0.01	1.6	1.8	1.5	1.02	1.34	0.66
Home maintenance, repair, decoration, and construction (not done by self)	0.01	0.01	–[2]	0.4	0.6	0.3	–[3]	–[3]	0.78
Vehicle maintenance and repair services (not done by self)	0.01	0.01	0.01	0.9	1.0	0.8	0.88	1.04	0.69
Government services	–[2]	–[2]	–[2]	0.3	0.3	0.4	–[3]	–[3]	–[3]
Travel related to purchasing goods and services	0.25	0.24	0.26	36.4	34.2	38.6	0.69	0.69	0.68
Caring for and helping household members	0.48	0.31	0.64	21.6	16.9	26.1	2.21	1.83	2.44
Caring for and helping household children	0.36	0.23	0.48	17.8	13.6	21.9	1.99	1.67	2.19
Caring for and helping household children (except activities related to education and health)	0.32	0.21	0.42	17.3	13.3	21.2	1.84	1.56	2.00
Physical care for household children	0.14	0.08	0.19	12.3	8.5	15.8	1.10	0.89	1.21
Reading to and with household children	0.01	0.01	0.02	2.5	1.7	3.3	0.50	0.53	0.49
Talking with and listening to household children	0.01	0.01	0.02	2.3	1.3	3.3	0.60	0.59	0.61
Playing with household children, not sports	0.09	0.06	0.11	4.8	3.6	6.0	1.78	1.81	1.76
Attending household children's events	0.02	0.02	0.03	1.1	1.0	1.3	2.08	1.96	2.16
Activities related to household children's education	0.03	0.01	0.04	2.5	1.4	3.5	1.14	0.94	1.21
Helping household children with homework	0.02	0.01	0.02	2.1	1.3	2.8	0.87	0.88	0.87
Activities related to household children's health	0.01	–[2]	0.01	0.7	0.2	1.1	1.34	–[3]	1.21
Caring for and helping household adults	0.05	0.03	0.06	4.6	4.1	5.1	0.98	0.84	1.10
Caring for household adults	0.03	0.02	0.04	2.2	1.7	2.7	1.42	–[3]	1.52
Physical care for household adults	0.02	0.01	0.03	1.5	1.0	2.0	–[3]	–[3]	–[3]
Helping household adults	0.01	0.01	0.01	2.7	2.5	2.9	0.50	–[3]	0.50
Travel related to caring for and helping household members	0.08	0.05	0.10	11.1	8.2	13.8	0.69	0.59	0.75
Caring for and helping nonhousehold members	0.18	0.13	0.22	8.8	6.8	10.7	2.01	1.92	2.06
Caring for and helping nonhousehold children	0.06	0.04	0.09	3.2	2.1	4.4	1.99	1.87	2.04
Caring for and helping nonhousehold adults	0.07	0.06	0.08	6.0	4.9	7.0	1.11	1.13	1.10
Caring for nonhousehold adults	0.01	–[2]	0.02	0.7	0.2	1.3	1.94	–[3]	1.51
Helping nonhousehold adults	0.05	0.05	0.06	5.6	4.8	6.3	0.94	0.96	0.92
Travel related to caring for and helping nonhousehold members	0.05	0.04	0.05	7.0	5.9	8.0	0.66	0.65	0.67
Working and work-related activities	3.50	4.12	2.90	43.7	49.7	37.9	8.01	8.29	7.66
Working	3.23	3.77	2.71	42.1	47.7	36.8	7.66	7.91	7.35
Work-related activities	–[2]	–[2]	–[2]	0.2	0.3	0.1	–[3]	–[3]	–[3]
Other income-generating activities	0.03	0.03	0.03	0.8	0.9	0.6	4.06	3.77	4.44

See footnotes at end of table.

Table A-1. Time spent in detailed primary activities and percent of the civilian population engaging in each activity, averages per day by sex, 2022 annual averages — Continued

Activity	Average hours per day, civilian population			Average percent engaged in the activity per day			Average hours per day for persons who engaged in the activity		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Job search and interviewing	0.02	0.03	0.01	1.0	1.3	0.6	2.05	2.23	1.68
Travel related to work	0.22	0.29	0.16	29.6	36.1	23.5	0.74	0.79	0.66
Educational activities	0.44	0.41	0.46	8.0	8.0	8.0	5.46	5.15	5.75
Attending class	0.24	0.22	0.25	4.8	4.9	4.7	4.93	4.54	5.31
Taking class for degree, certificate, or licensure	0.22	0.21	0.24	4.3	4.3	4.4	5.17	4.78	5.55
Homework and research	0.15	0.15	0.16	5.4	5.3	5.5	2.88	2.83	2.93
Travel related to education	0.03	0.03	0.03	4.2	4.1	4.2	0.76	0.85	0.67
Organizational, civic, and religious activities	0.26	0.23	0.29	11.9	9.6	14.2	2.20	2.42	2.05
Religious and spiritual activities	0.13	0.11	0.15	8.5	6.7	10.2	1.54	1.58	1.51
Attending religious services	0.07	0.06	0.08	3.7	3.2	4.3	1.90	2.03	1.81
Participating in religious practices	0.05	0.03	0.06	5.2	3.8	6.5	0.96	0.91	0.98
Volunteering (organizational and civic activities)	0.10	0.09	0.11	4.4	3.4	5.3	2.26	2.63	2.04
Volunteer activities	0.10	0.09	0.11	4.2	3.2	5.1	2.33	2.72	2.09
Administrative and support activities	0.03	0.02	0.03	1.8	1.2	2.3	1.56	1.75	1.47
Social service and care activities (except medical)	0.03	0.02	0.03	1.2	0.7	1.7	2.23	2.99	1.95
Indoor and outdoor maintenance, building, and cleanup activities	–[2]	0.01	–[2]	0.2	0.3	0.1	2.07	2.34	–[3]
Participating in performance and cultural activities	0.01	0.01	0.01	0.3	0.2	0.4	2.40	3.26	2.05
Attending meetings, conferences, and training	0.02	0.02	0.01	0.8	0.8	0.8	2.15	2.63	1.70
Civic obligations and participation	–[2]	–[2]	–[2]	0.2	0.2	0.2	–[3]	–[3]	–[3]
Travel related to organizational, civic, and religious activities	0.03	0.03	0.03	5.7	5.3	6.2	0.55	0.65	0.48
Leisure and sports	5.20	5.58	4.84	95.0	95.8	94.2	5.47	5.82	5.14
Socializing, relaxing, and leisure	4.72	5.04	4.41	93.8	95.0	92.6	5.03	5.30	4.76
Socializing and communicating	0.56	0.51	0.61	28.7	26.8	30.4	1.95	1.90	1.99
Socializing and communicating (except social events)	0.50	0.47	0.54	27.5	25.8	29.2	1.83	1.81	1.84
Attending or hosting social events	0.05	0.04	0.07	1.8	1.4	2.1	3.11	3.04	3.15
Relaxing and leisure	4.09	4.46	3.73	90.2	91.9	88.5	4.53	4.85	4.22
Watching TV	2.79	3.06	2.53	76.5	78.5	74.6	3.65	3.90	3.40
Relaxing and thinking	0.35	0.36	0.35	21.6	21.1	22.1	1.64	1.69	1.60
Playing games	0.37	0.52	0.24	14.4	17.2	11.7	2.59	3.00	2.01
Computer use for leisure, excluding games	0.20	0.20	0.20	13.5	12.5	14.4	1.48	1.62	1.36
Reading for personal interest	0.26	0.21	0.32	16.7	13.6	19.7	1.58	1.54	1.61
Arts and entertainment (other than sports)	0.07	0.07	0.07	2.3	2.3	2.4	3.08	3.13	3.03
Sports, exercise, and recreation	0.32	0.37	0.27	20.8	22.0	19.7	1.52	1.67	1.37

See footnotes at end of table.

Table A-1. Time spent in detailed primary activities and percent of the civilian population engaging in each activity, averages per day by sex, 2022 annual averages — Continued

Activity	Average hours per day, civilian population			Average percent engaged in the activity per day			Average hours per day for persons who engaged in the activity		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Participating in sports, exercise, and recreation	0.29	0.33	0.25	20.1	21.2	19.1	1.44	1.55	1.31
Walking	0.07	0.06	0.08	7.8	6.8	8.7	0.91	0.90	0.92
Attending sporting or recreational events	0.03	0.04	0.02	0.9	1.2	0.6	3.17	3.25	3.04
Travel related to leisure and sports	0.16	0.17	0.16	23.2	23.9	22.6	0.71	0.72	0.70
Telephone calls, mail, and e-mail	0.17	0.12	0.21	18.5	14.7	22.2	0.89	0.82	0.95
Telephone calls (to or from)	0.12	0.08	0.15	12.2	9.3	15.0	0.94	0.90	0.97
Household and personal messages	0.05	0.03	0.06	8.5	6.7	10.3	0.57	0.52	0.61
Household and personal mail and messages	0.02	0.01	0.02	4.0	3.3	4.6	0.39	0.28	0.46
Household and personal e-mail and messages	0.03	0.03	0.04	5.1	3.8	6.4	0.65	0.68	0.64
Travel related to telephone calls	–[2]	–[2]	–[2]	0.4	0.3	0.4	0.39	0.30	–[3]
Other activities, not elsewhere classified	0.21	0.20	0.22	16.3	14.9	17.6	1.30	1.34	1.27

[1] Includes naps and spells of sleeplessness.
[2] Estimate is approximately zero.
[3] Estimate is suppressed because it does not meet the American Time Use Survey publication standards.
- Not applicable.
NOTE: A primary activity refers to an individual's main activity. Other activities done simultaneously are not included. Data refer to persons 15 years and over.
Source: American Time Use Survey, Bureau of Labor Statistics