HILLSBOROUGH TPO ELECTRIC VEHICLE INFRASTRUCTURE PLAN

Final Report

June 2023

Plan Hillsborough's Document Accessibility Disclaimer

"Persons needing assistance reading or interpreting items in this document, free of charge, are encouraged to contact Joshua Barber, (813) 272-5940, or barberj@plancom.org. Plan Hillsborough (the Planning Commission, the Hillsborough MPO, and the Hillsborough River Board) cannot ensure accessibility for items produced by other agencies or organizations.

Se recomienda a las personas que necesiten ayuda para leer o interpretar este documento, sin costo alguno, que se pongan en contacto con Joshua Barber, (813) 272-5940, o barberj@plancom.org. Plan Hillsborough (la Comisión de Planificación, el MPO de Hillsborough y la Junta del Río Hillsborough) no puede asegurar la accesibilidad de los documentos publicados por otras agencias u organizaciones. Si sólo habla español, por favor llame a la línea de ayuda en español al (813) 272-5940 marque el número 1."

Commented [ma1]: This is actually me now. Could you please change Josh's contact info to me macdonaldc@plancom.org 813-946-5334

Prepared For:
Hillsborough Transportation Planning Organization
601 E. Kennedy Boulevard., 18th Floor
Tampa, FL 33602
(813) 272-5940

Prepared By:
Kittelson & Associates, Inc.
400 N. Tampa Street, Suite 1460
Tampa, FL 33602

June 2023

CONTENTS

FIGURES

TABLES

"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 (Plan) to provide a framework for developing widespread, convenient, and accessible EV charging in Hillsborough County, Florida. 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, as displayed in Figure 1. 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.

Commented [ma2]: EVIP

Figure 1: Desired Outcomes of EV Plan

Help Communities Experience Benefits of EVs

Inform Planning

Access Funding Opportunities

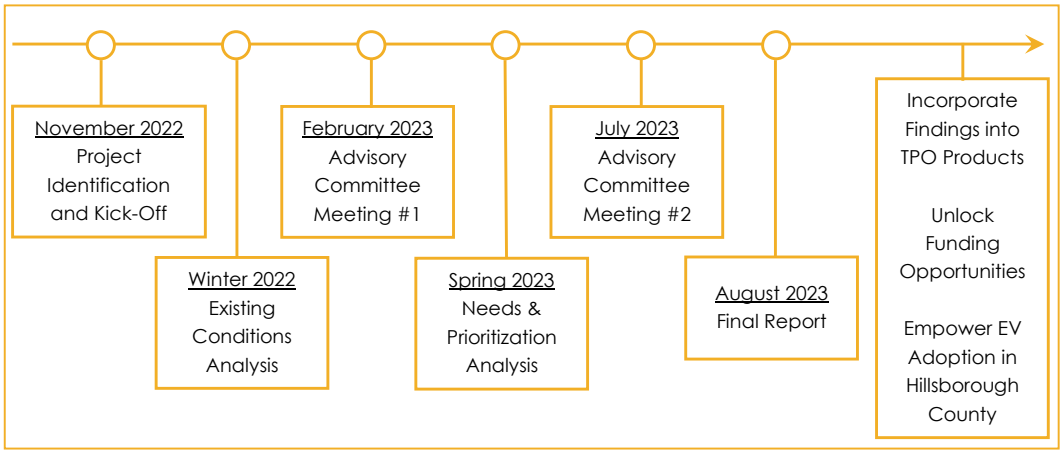
The development of this Plan occurs at a time when EV adoption is trending substantially upward throughout Hillsborough County, the country, and world. In 2021, there were about 6,000 registered EVs within the County's overall total of 1 million registered vehicles (<1%). However, various forecasts anticipate 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 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 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: EV Plan Development Process



"Timeline of Plan 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).

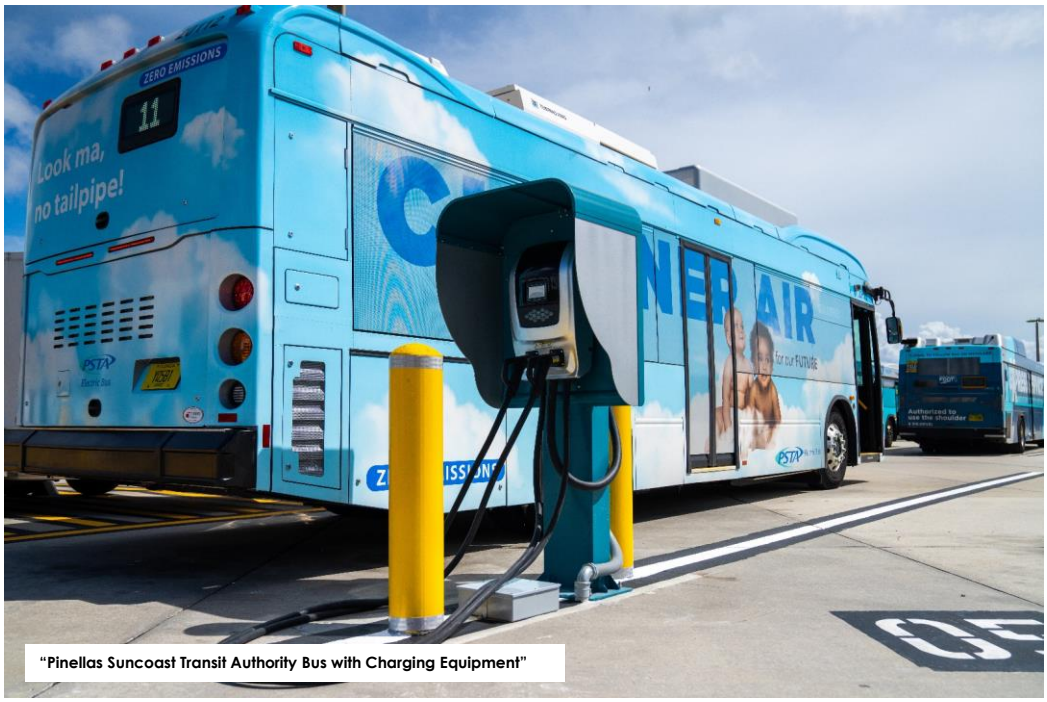
Commented [ma3]: If it's not too much work at this point in the game, could we add a quick summary of the Downtown Partnership's analysis. This wasn't mentioned in our advisory groups, but was brought up during the LRC presentation. My apologies for not bringing it back sooner. https://www.tampasdowntown.com/wp-content/uploads/2022/08/Downtown-Tampa-EV-Charging-Study_2021.03.25-Final.pdf

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 Plan.



"Pinellas Suncoast Transit Authority Bus with Charging Equipment"

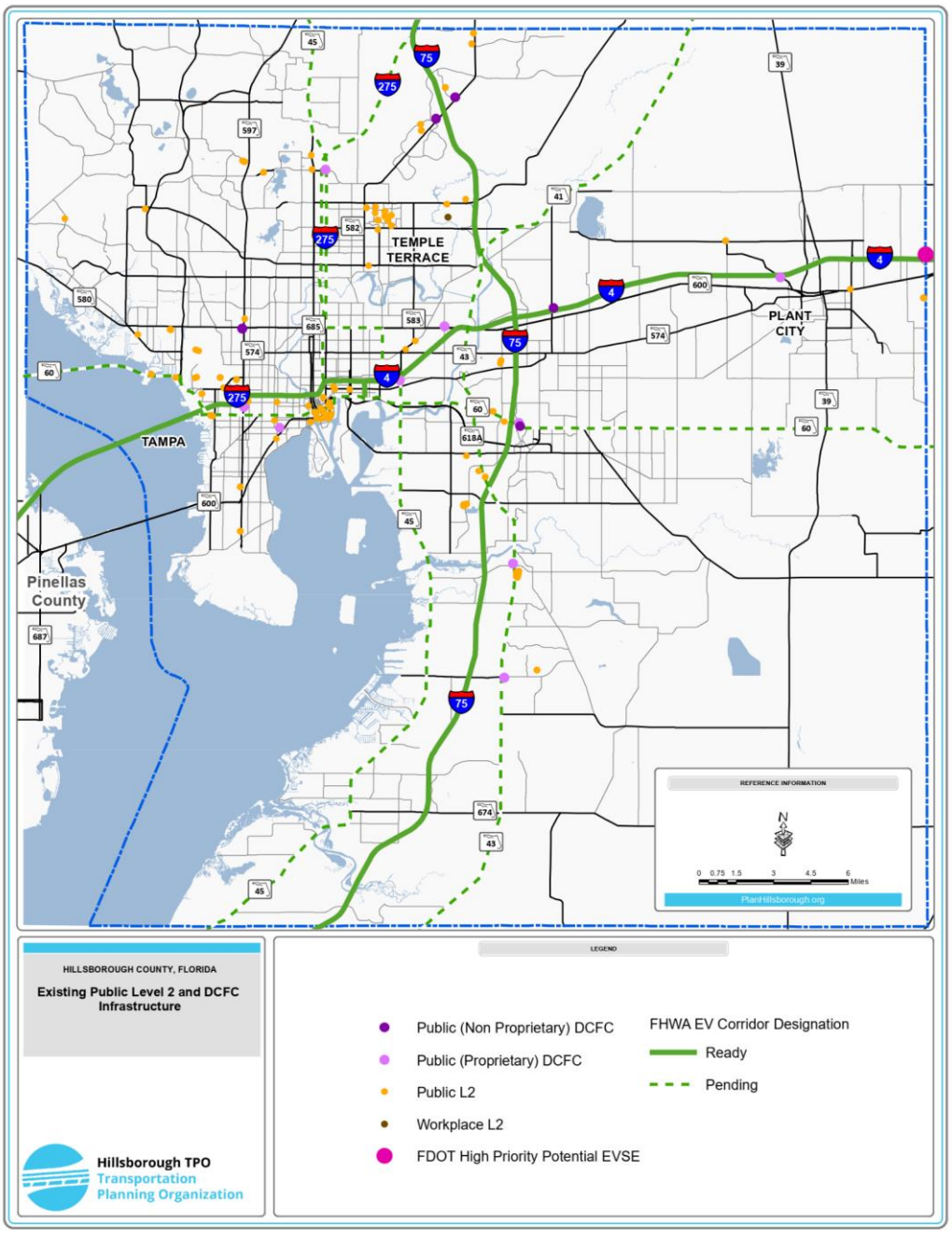
EV Charging Infrastructure & Supportive Land Uses

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 Plan 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 Plan.

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 Plan 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 Plan to inform upcoming code revisions
- Some local agencies are seeing an increase in multi-unit dwelling development
- **[Other notes to be included from Advisory Committee Meeting #2]**

Stakeholder Listening Sessions

A series of stakeholder listening sessions were held during the development of the Plan to educate stakeholders about the Plan'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 EV Plan.

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 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 faciliteis or charging infrastructure

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

Commented [ma4]: facilities

- 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 EV Plan 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 EV Plan. 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 EV Plan in the LRTP, to clearly state the vision of the TPO. The TPO intends to use this EV Plan 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:

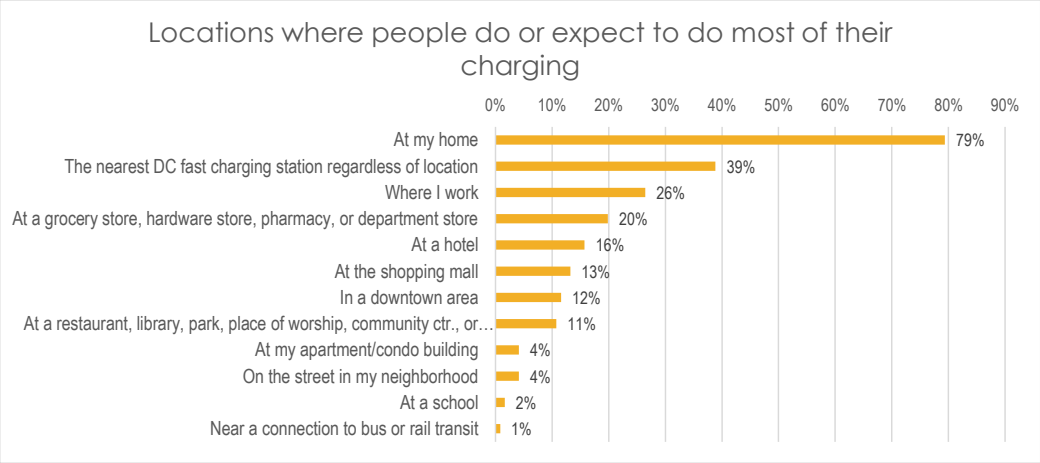
- 64 responses were from EV drivers
- 87 respondents live in Hillsborough County
- 75 respondents work in Hillsborough County

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.

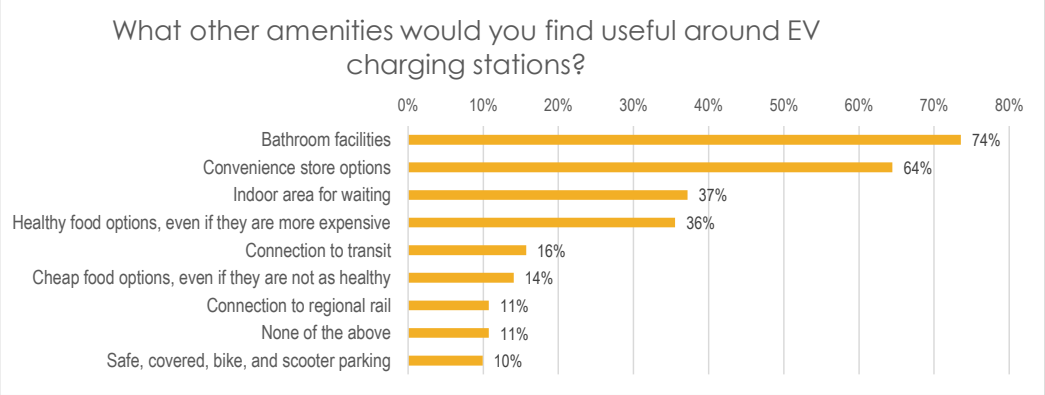
Figure 4. Survey Result - Distribution of (Expected) Charging Locations



**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

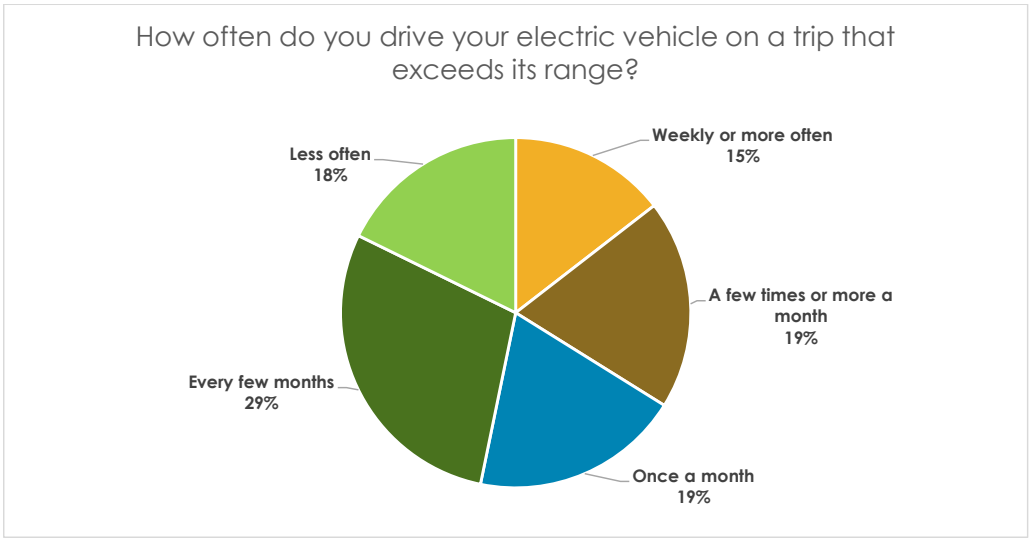
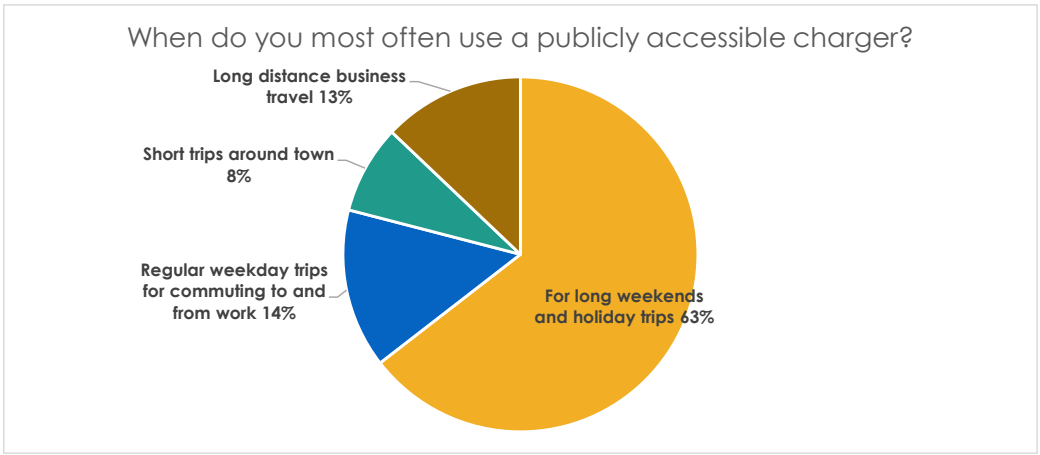
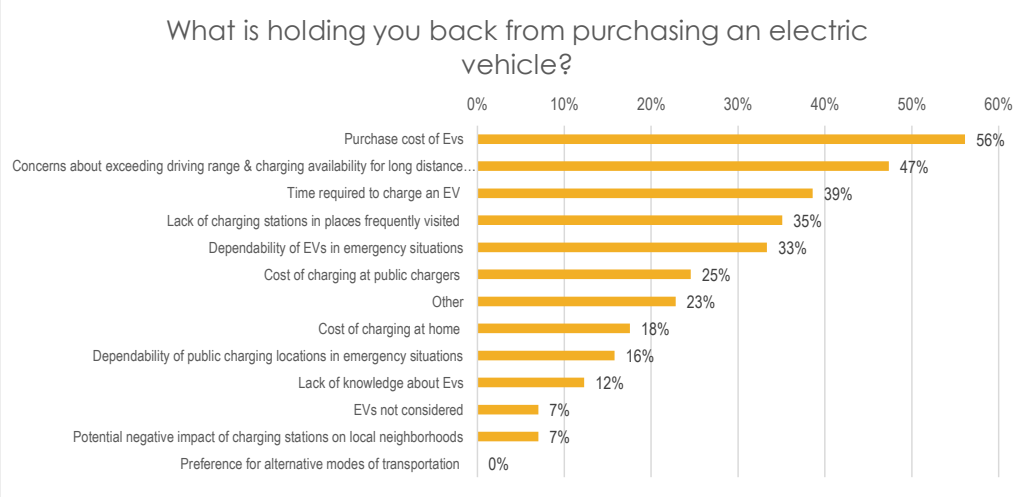


Figure 7. Survey Result - EV Drivers' Usage of Public Chargers



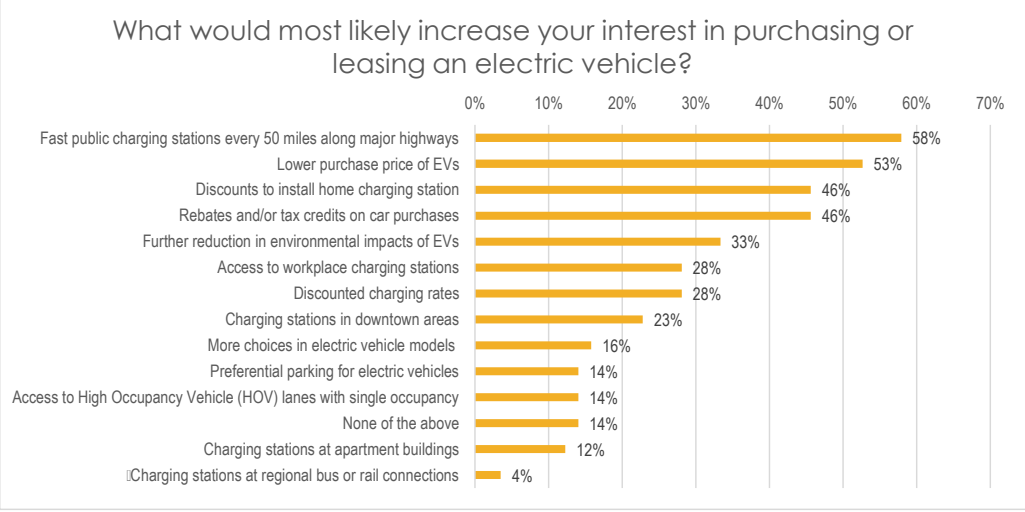
The survey findings for non-EV drivers offer valuable insights into the barriers and motivations for EV adoption (Figure 8 and Figure 9). More than half of non-EV drivers identify purchase cost as a barrier to adopting EVs. Similarly, reducing the upfront costs through incentives such as rebates and 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

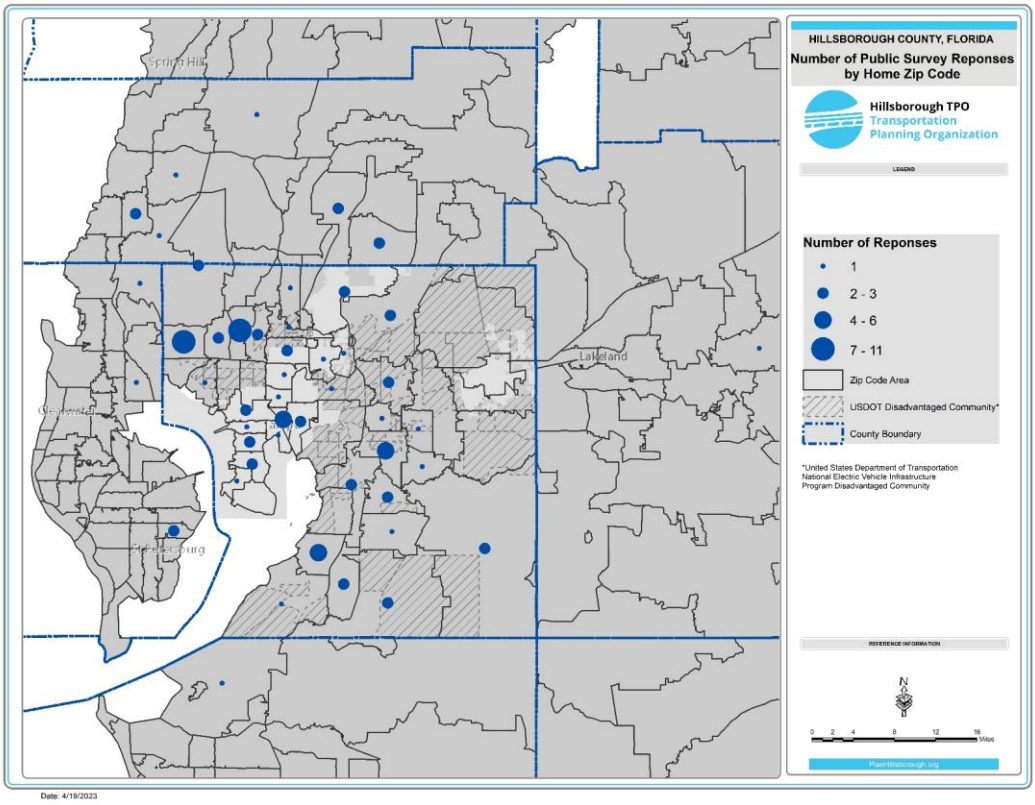
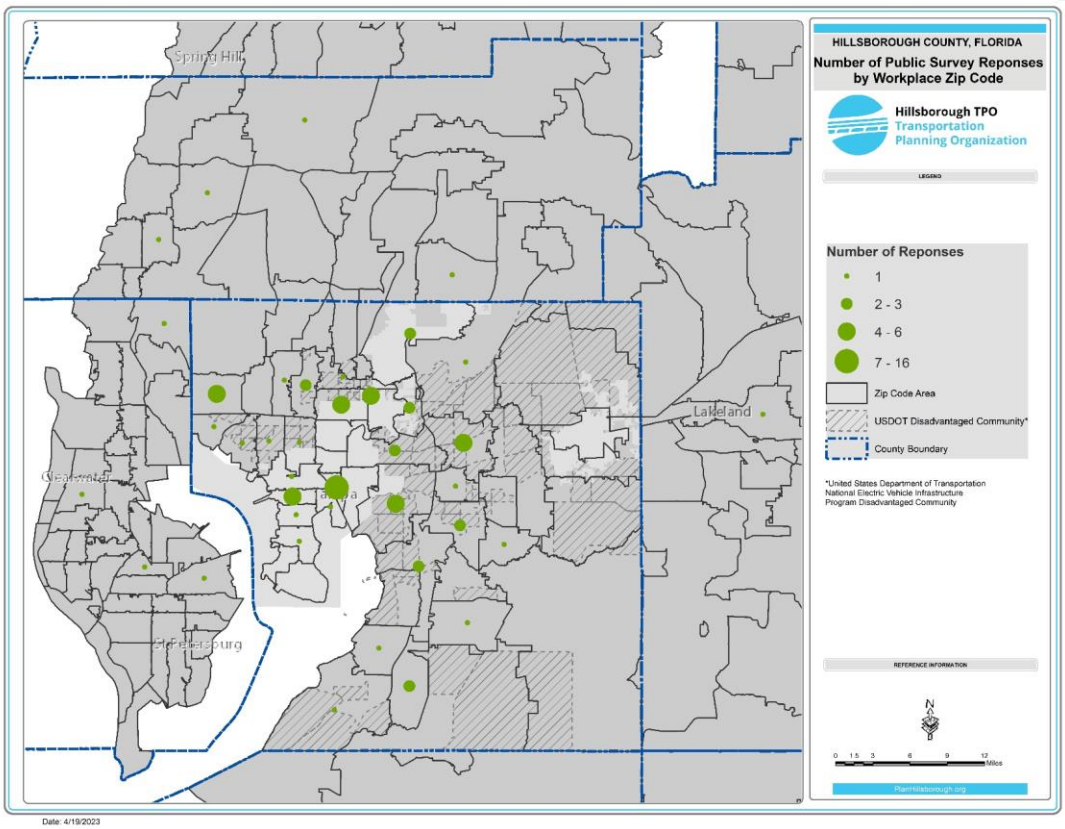


Figure 11. Number of Public Survey Responses by Workplace Zip Code



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

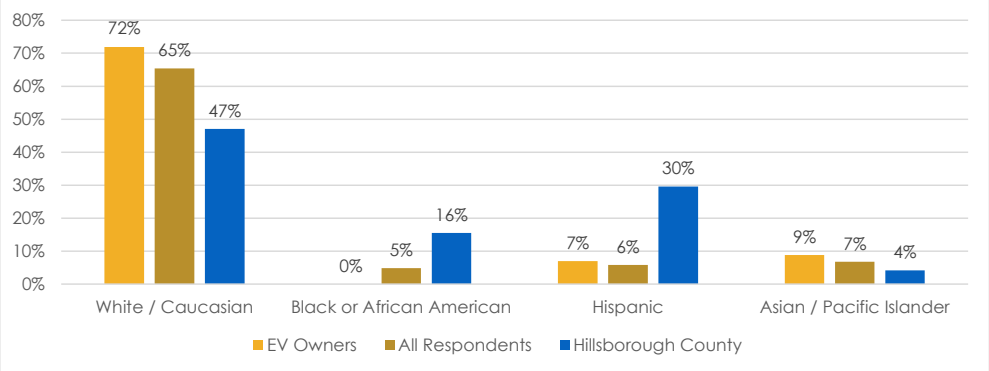
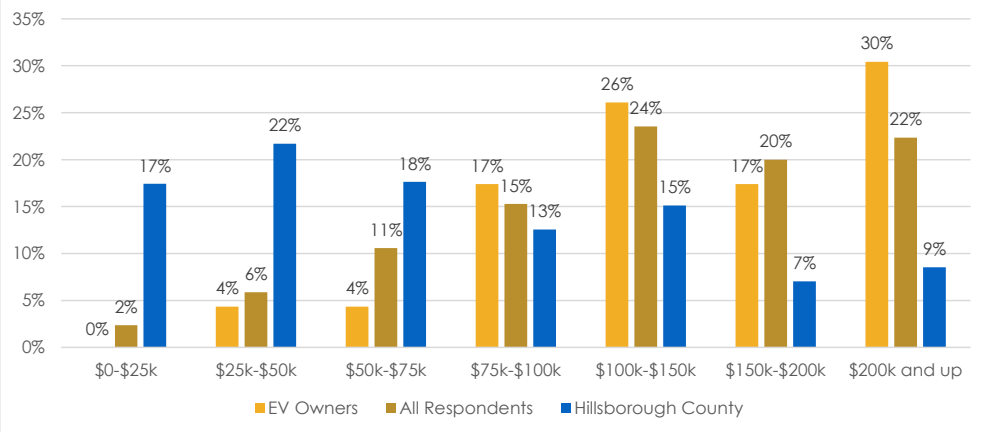


Figure 13. Household Income Profile of EV Owners (Who Responded to the Survey), All Respondents, and Hillsborough County Population



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 plan 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 Plan, 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 Plan.

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 Plan 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 1 mile of a DCFC charging opportunity;
- Portion multi-unit dwellings within 1 mile 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.

Commented [ma5]: Could we elaborate on why the distance is different for residential access to DCFC. I also think 1 mile may be a little too large

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 Plan 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 3 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 <1 mi	8%	10%	DAC residents tend to have greater access to DCFC
	% Multi-unit dwellings with DCFC <1 mi	Condo: 11% < 10 units: 16% ≥10 units: 18%	Condo: 11% < 10 units: 12% ≥10 units: 13%	MUDs in DAC tend to have lower access to DCFC
	% Multi-unit dwellings 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 1 mile of DCFC**: A small fraction (8%) of the county's total population lives within a one-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, show more access with between 30-60%, of residents living within 1 mile of existing DCFC infrastructure. Neighborhoods in Egypt Lake-Leto and the University areas also demonstrate some access.
- **Portion of multi-unit dwellings with access to L2 and DCFC**: A relatively small fraction of condo units in Hillsborough County (10.8%) currently have convenient access to fast charging infrastructure within a 1-mile radius. This percentage is lower compared to multifamily developments with 10 or more units (18%) and those with less than 10 units (15.5%). It is noteworthy that 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 similar to or slightly lower than the county-wide averages. This highlights the importance of addressing potential disparities in EV adoption and accessibility by prioritizing efforts to provide 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.

Commented [ma6]: Another thought is driving distance vs. as the crow flies. Many suburban neighborhoods that might not be identified as a DAC may have a different sort of access due to sprawl design.. cul-de-sacs, winding roads, etc.

Figure 14. Proportion of Residents with DCFC Access at Census Block Level (A 1-Mile) Range

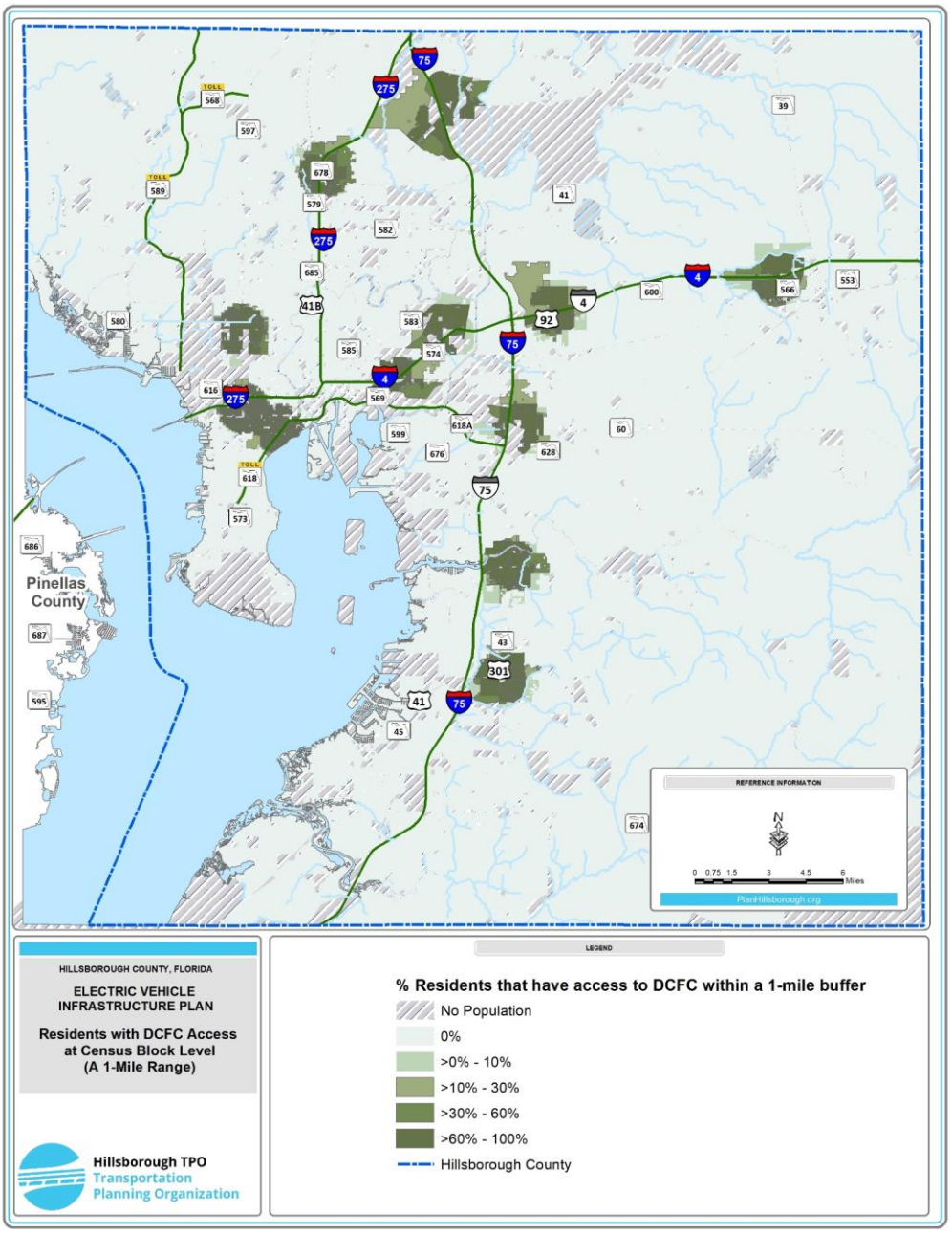


Figure 15. Proportion of Multifamily Developments (10 or More Units) with L2 Charging Access at Census Block Level (A 0.5-Mile) Range

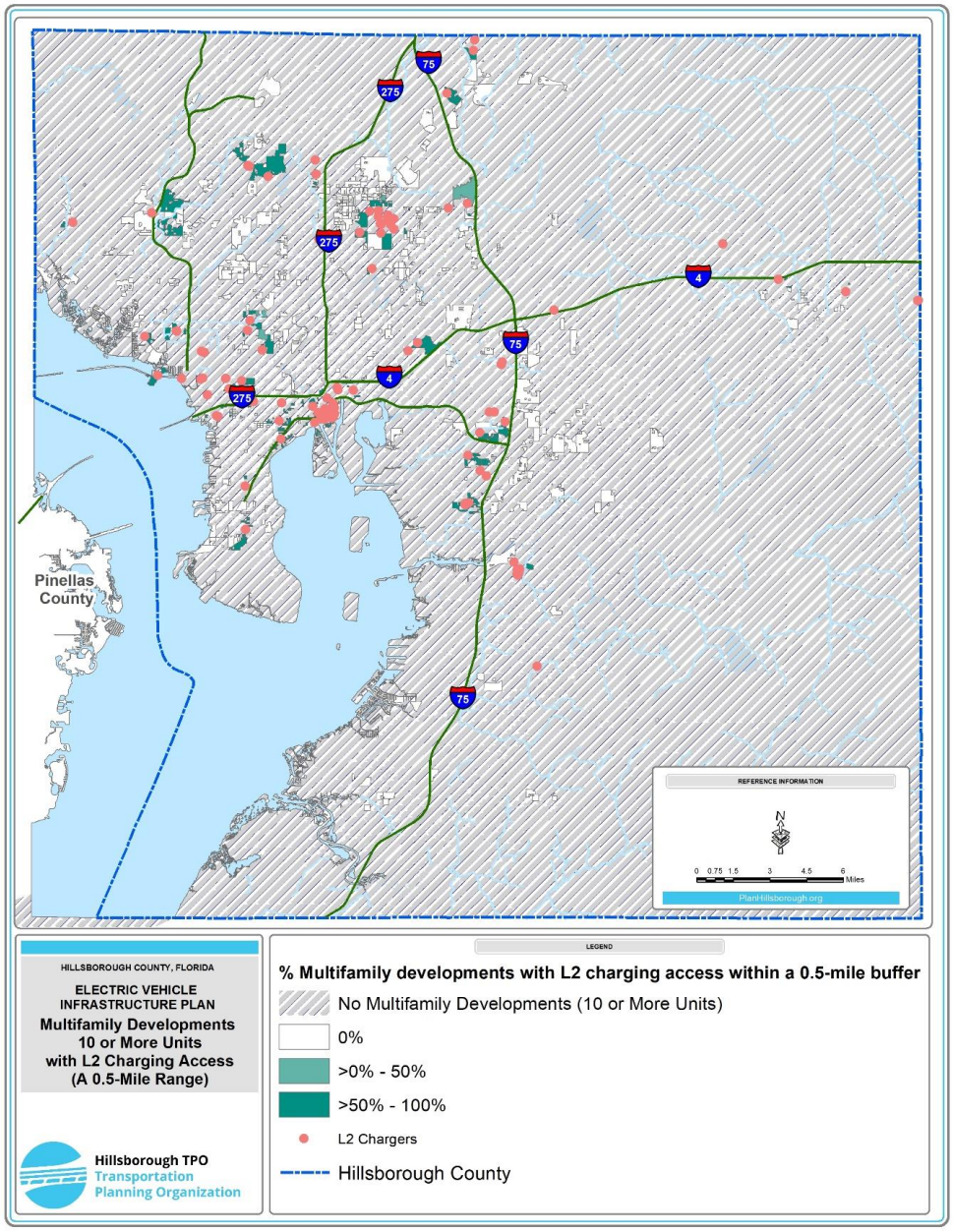


Figure 16. Proportion of Jobs with L2 Charging Access at Census Block Level (A 0.5-Mile) Range

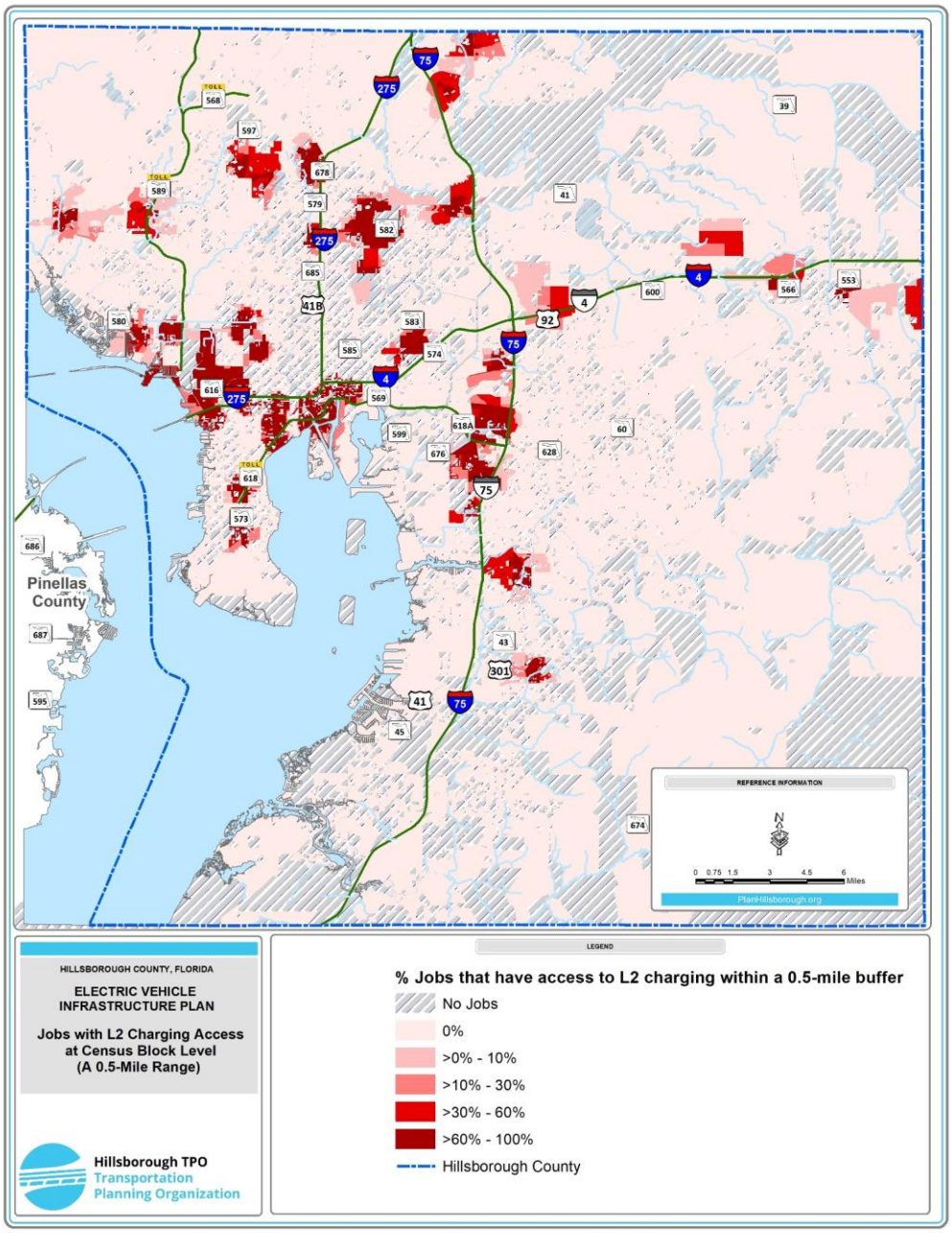


Figure 17. Proportion of Activity Centers with L2 Charging Access at Census Block Level (A 0.5-Mile Range)

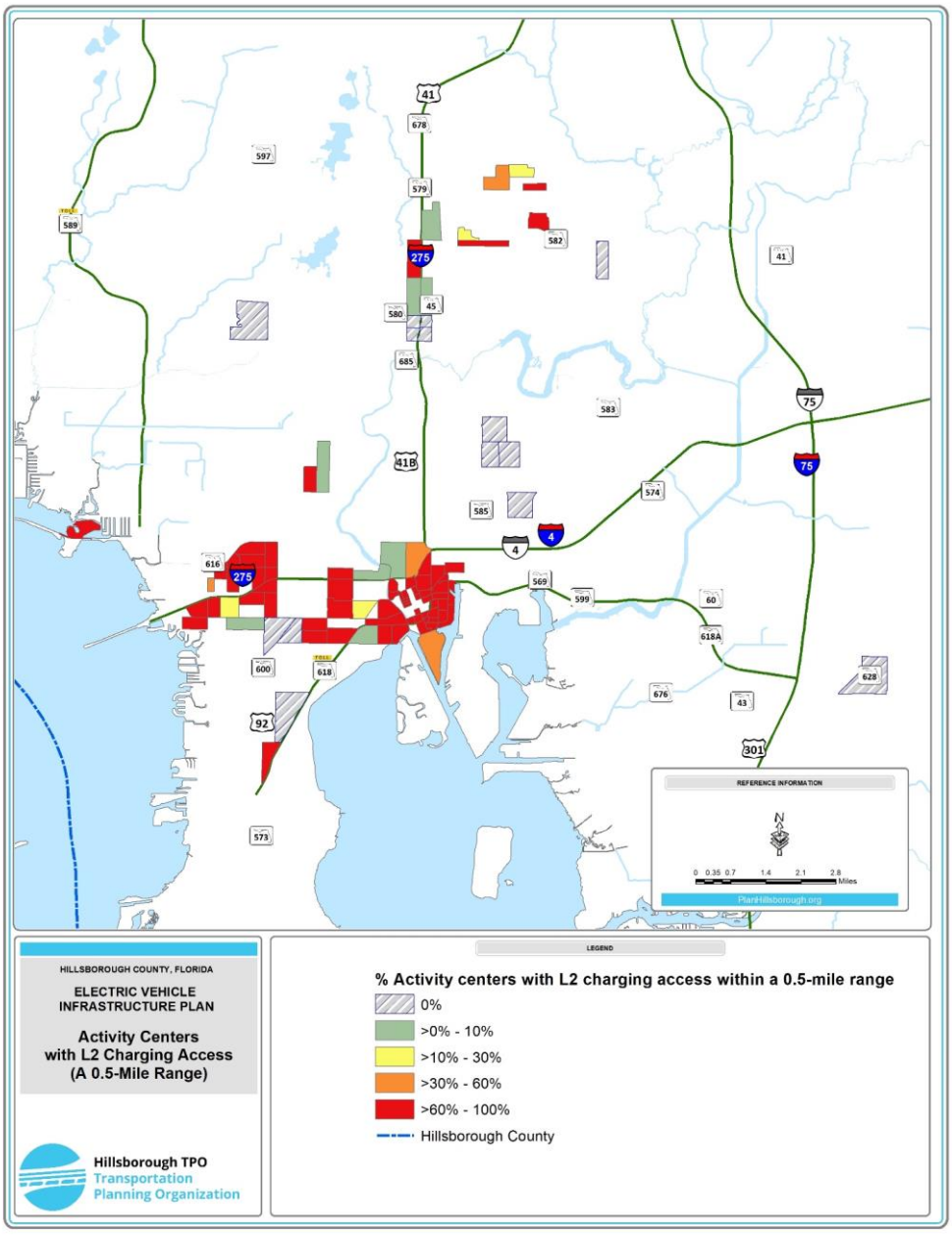
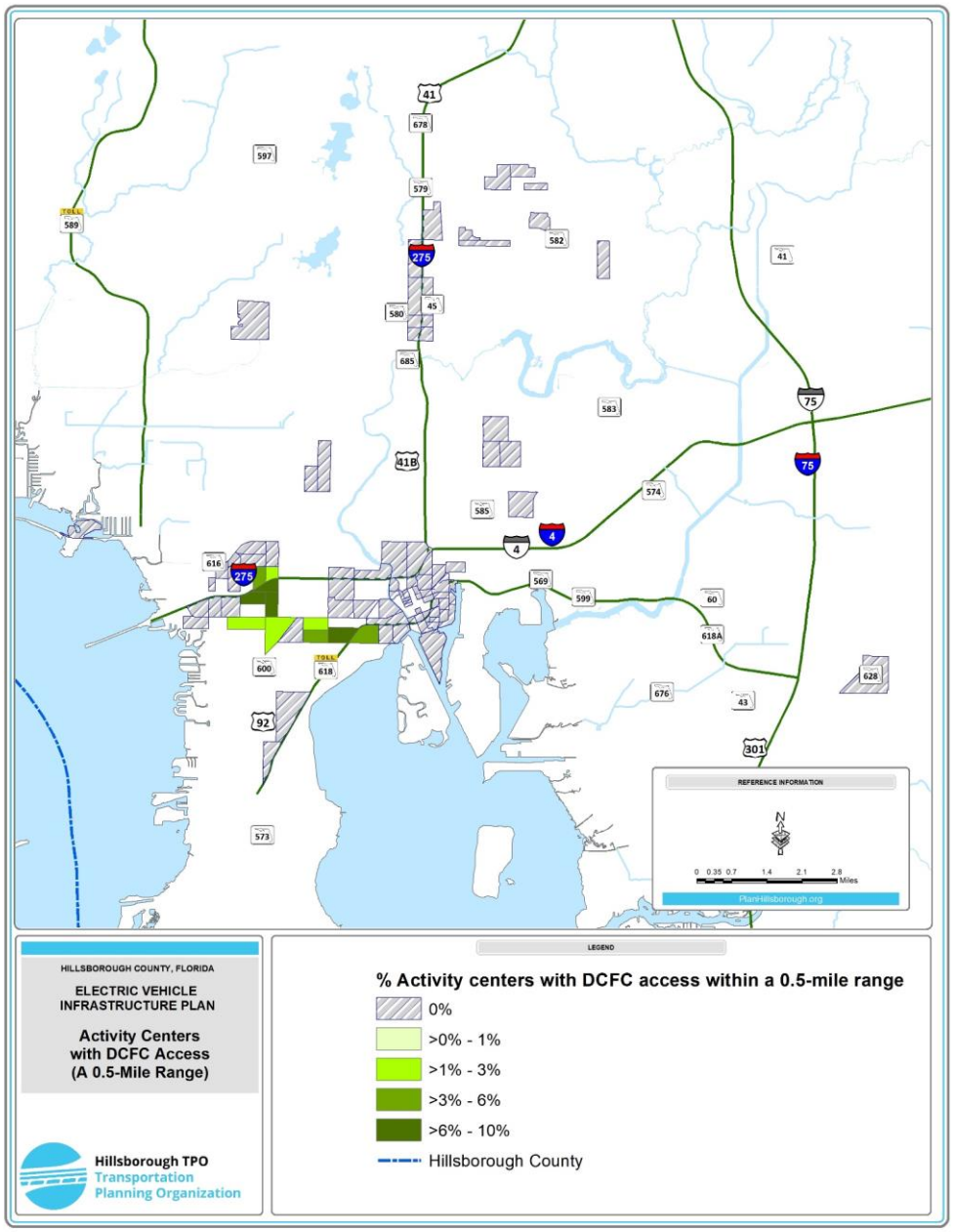


Figure 18. Proportion of Activity Centers with DCFC Access at Census Block Level (A 0.5-Mile Range)



EV ADOPTION SCENARIOS

This section outlines the adoption projections for each of the EV use cases established in the 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).

EV Use Cases 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.

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

Commented [ma7]: Could we elaborate on why these are not estimated? I would really like to have a full medium need scenario if possible.

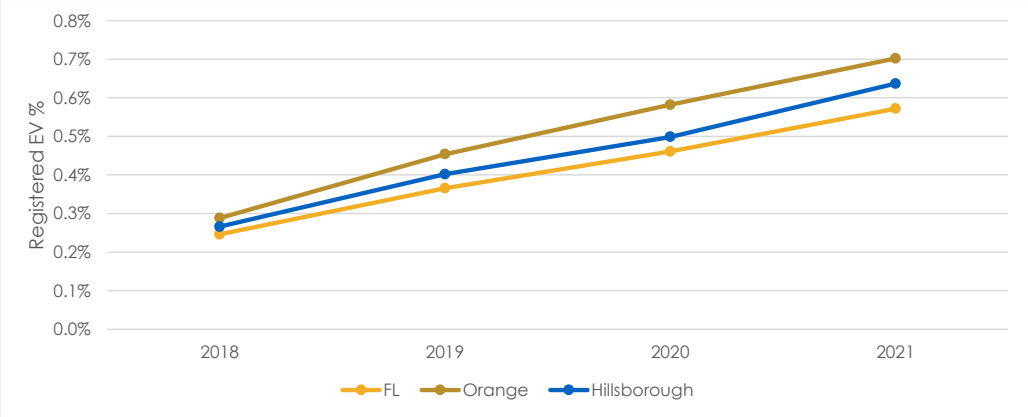
Light Duty Vehicles (Urban & Rural)

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)

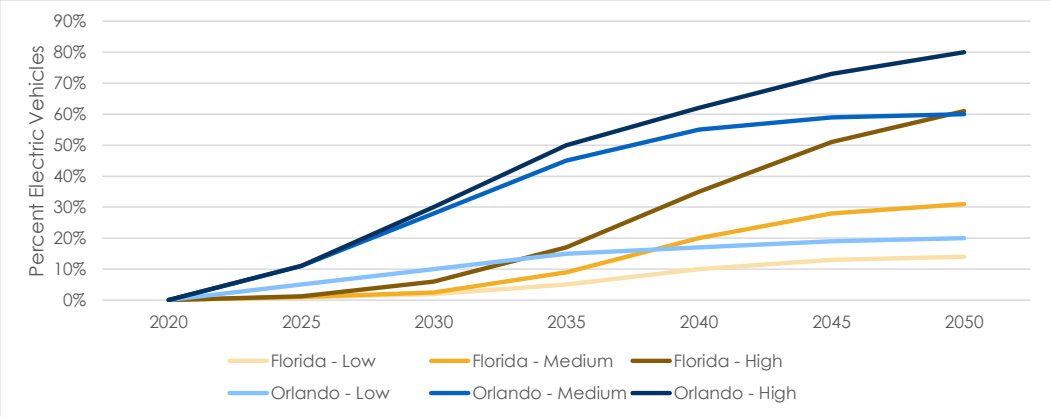
Estimated EV Adoption Scenarios

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

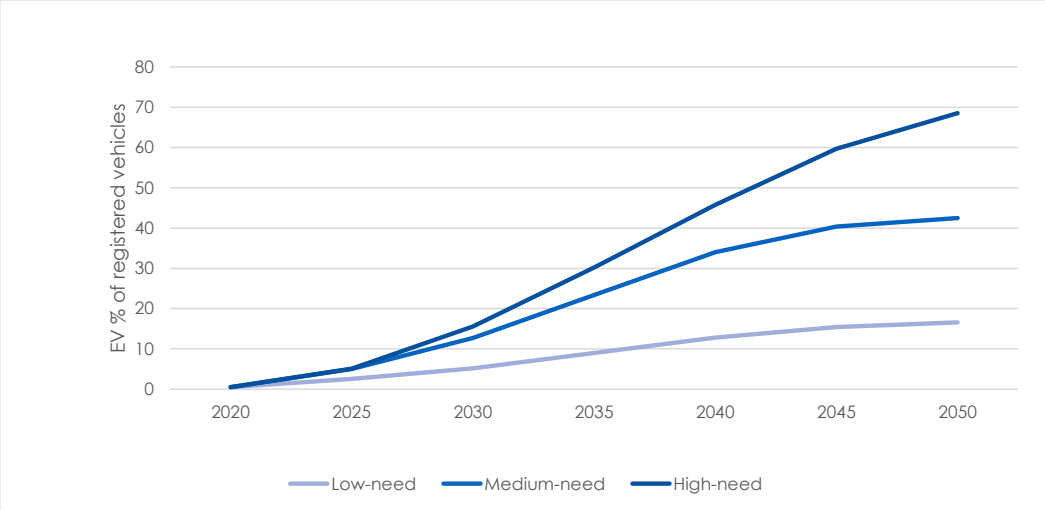
Based on these adoption scenarios and historic trends, EV adoption for Hillsborough County is estimated as being between the projections from Orlando and FDOT. The projections for EV adoption in Hillsborough County, as percent of total registered vehicles, are shown in Table 3 and Figure 21. These EV 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.

---

[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:

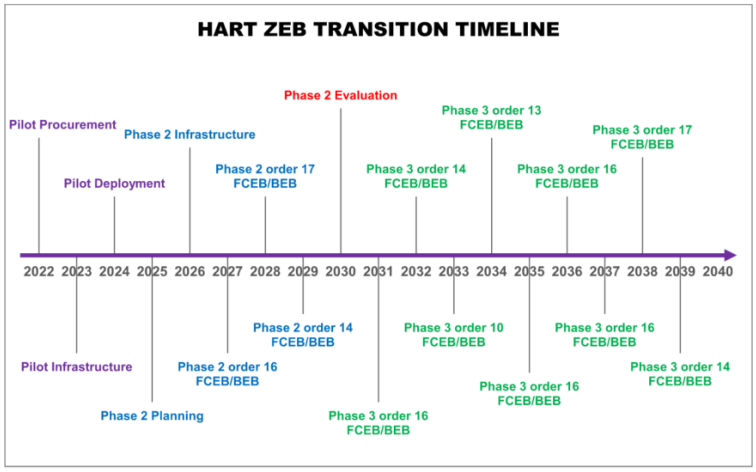
- Development of business models that rent vehicles to gig drivers and provide charging solutions, for example the collaboration between EVgo and Maven
- TNC companies shifting priorities from electrifying fleets
- Adoption of automated vehicles for TNC applications
- Changes in the operating and purchase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

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 8. 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 8. 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 9. 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

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

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 9. According to these assumptions, 75% of people 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.

Commented [ma8]: households?

Table 9: 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**

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 10.

EV Chargers Needed
2023: 500
2035: 2k – 7k
2050: 4k – 16k

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.

[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

Table 10. Estimated Number of Public Charging Plugs Needed in Hillsborough TPO Planning Area by 2035 and 2050

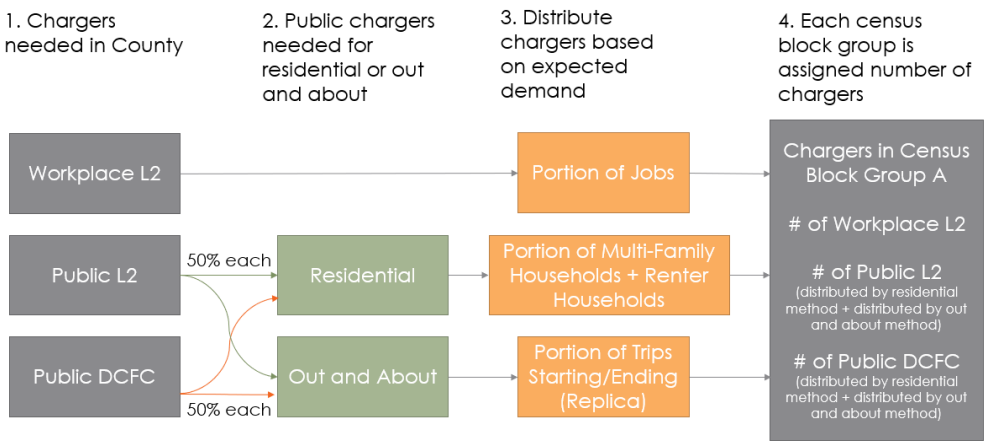
	2035			2050		
	Low	**Medium**	**High**	**Low**	**Medium**	**High**
Number of EVs	89,947	229,864	299,823	169,900	419,752	689,592
Workplace Level 2 Charging Plugs	1,177	2,788	3,621	2,036	5,049	8,263
Public Level 2 Charging Plugs	781	1,880	2,440	1,385	3,399	5,556
Public DC Fast Charging Plugs	333	737	945	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 11.

Table 11: 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 12. 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 12: 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

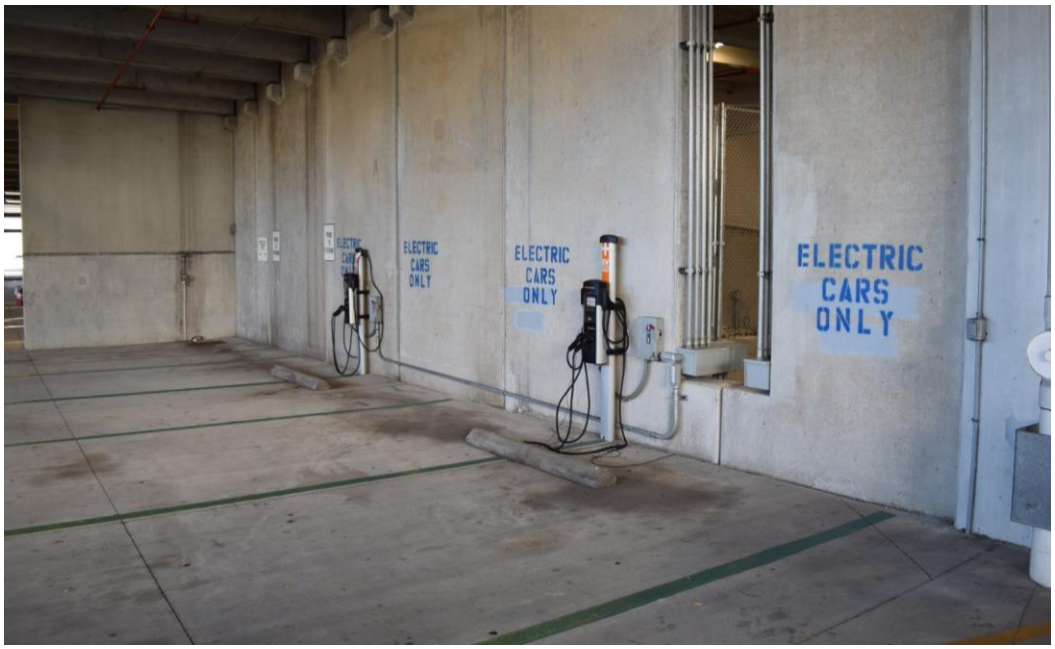
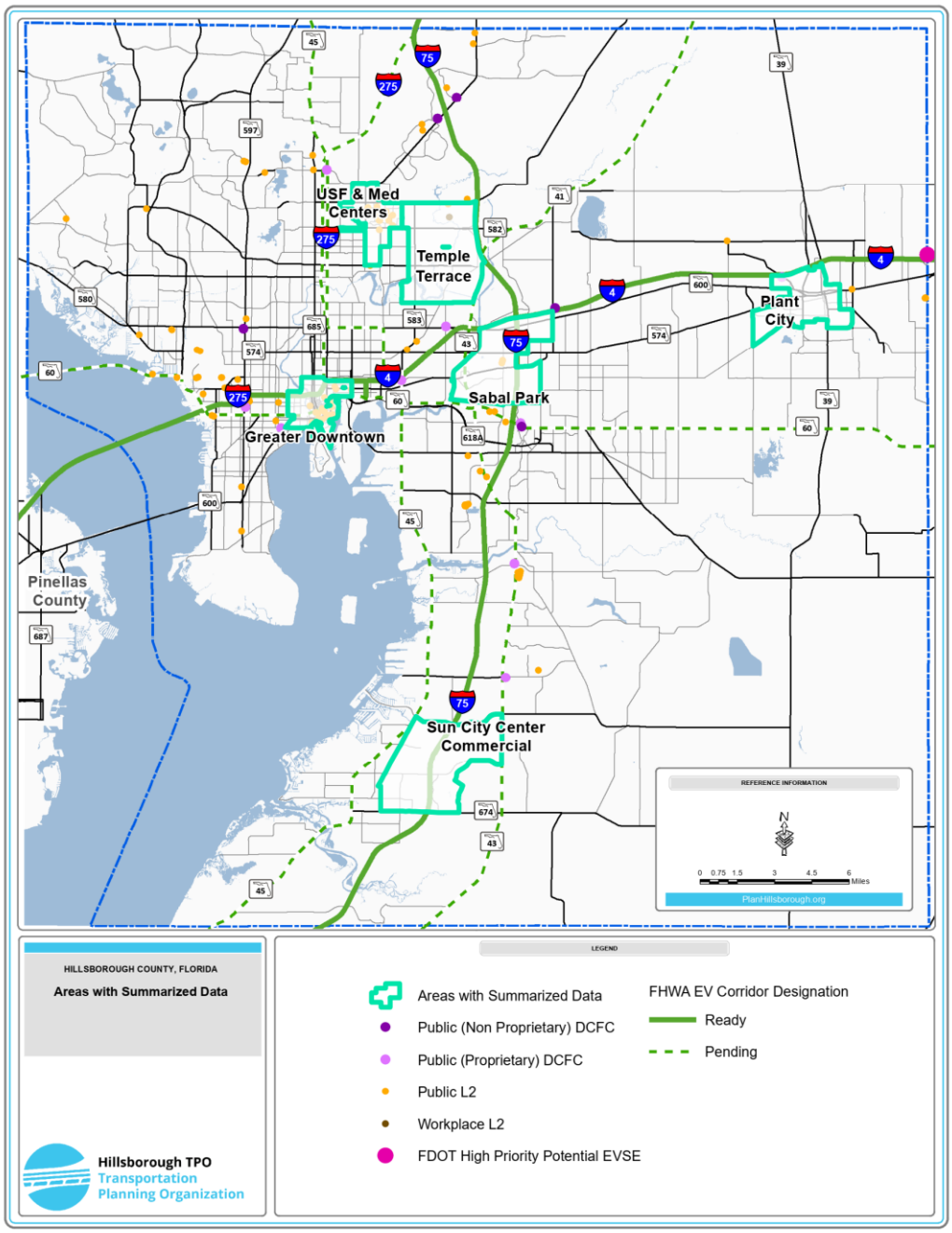
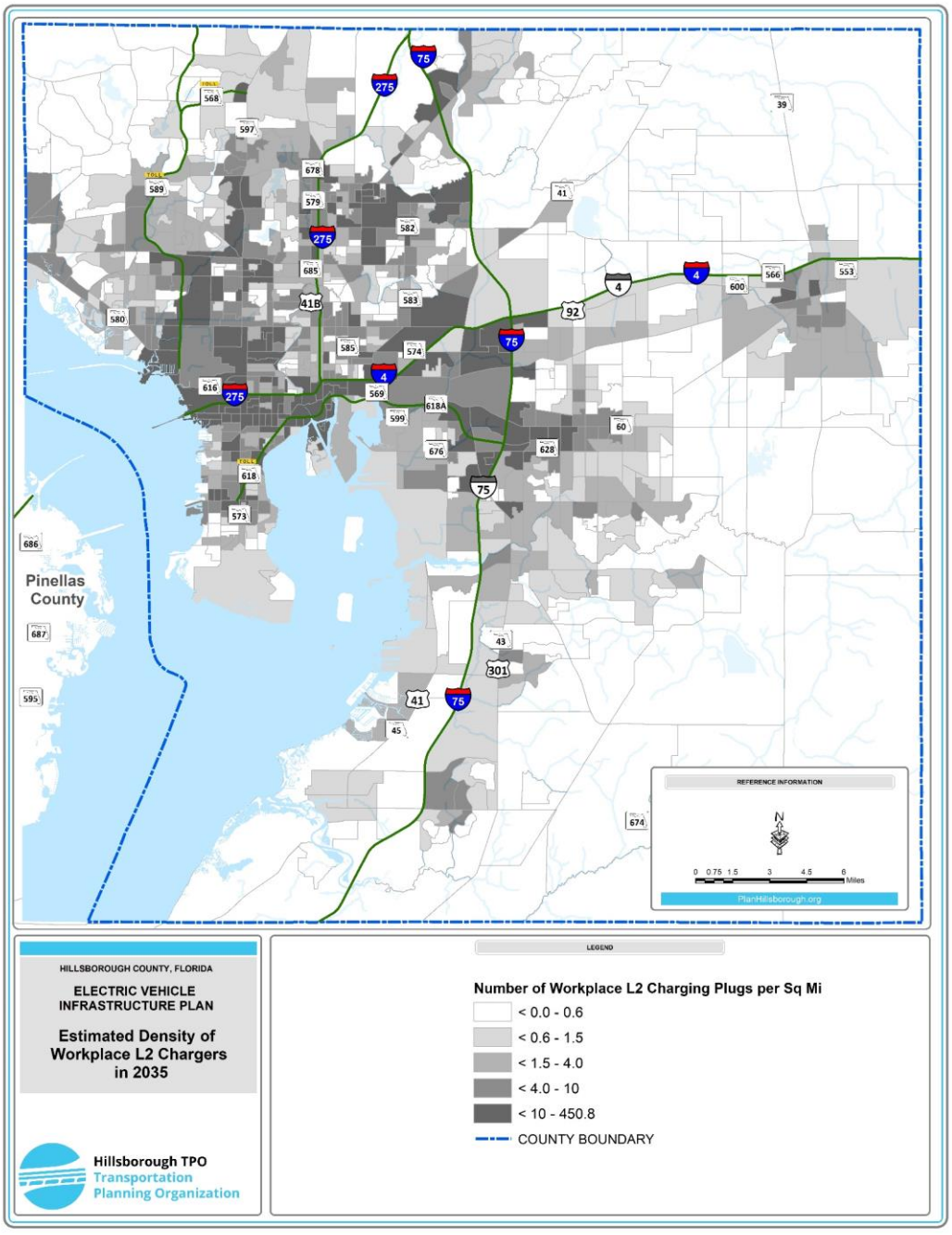
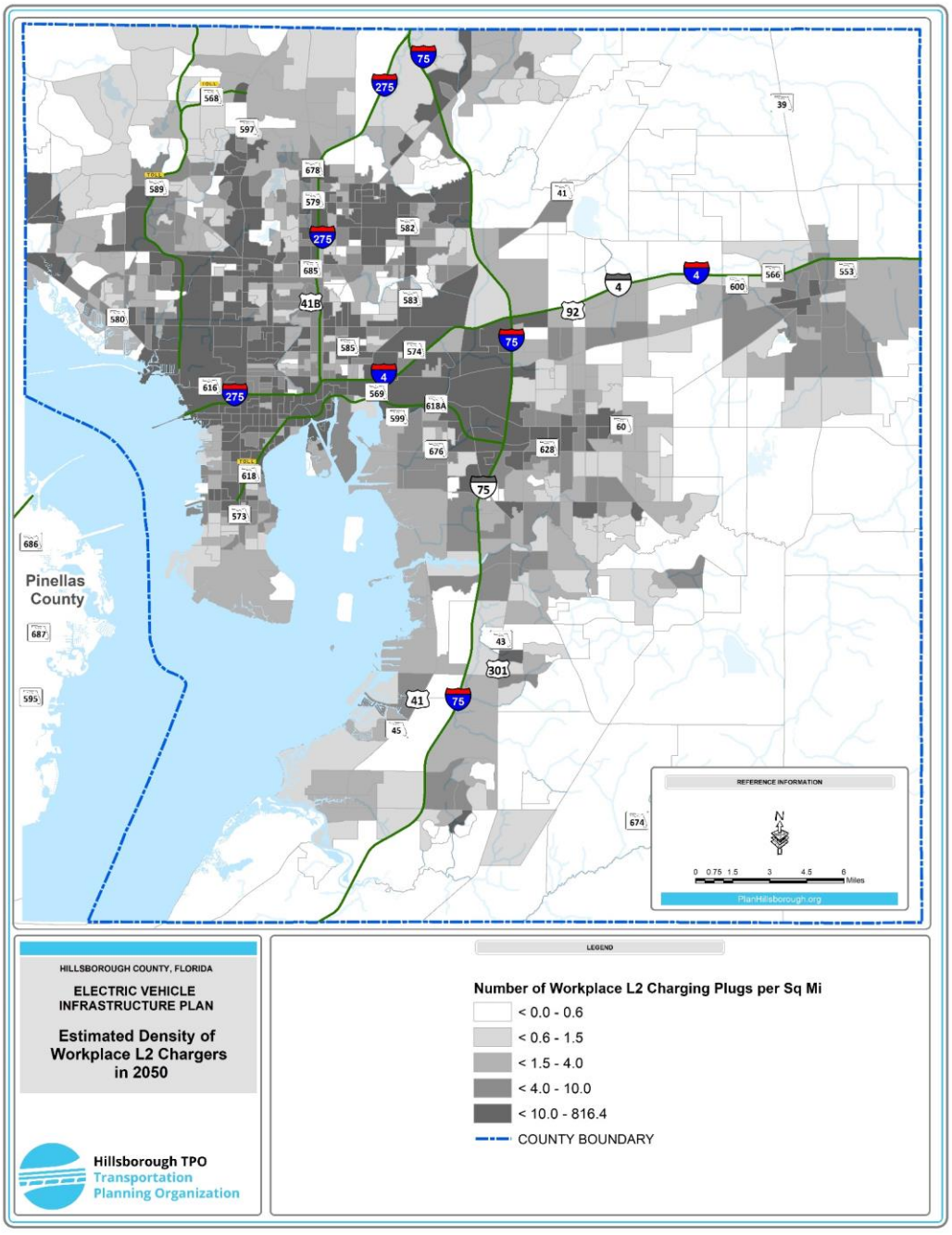
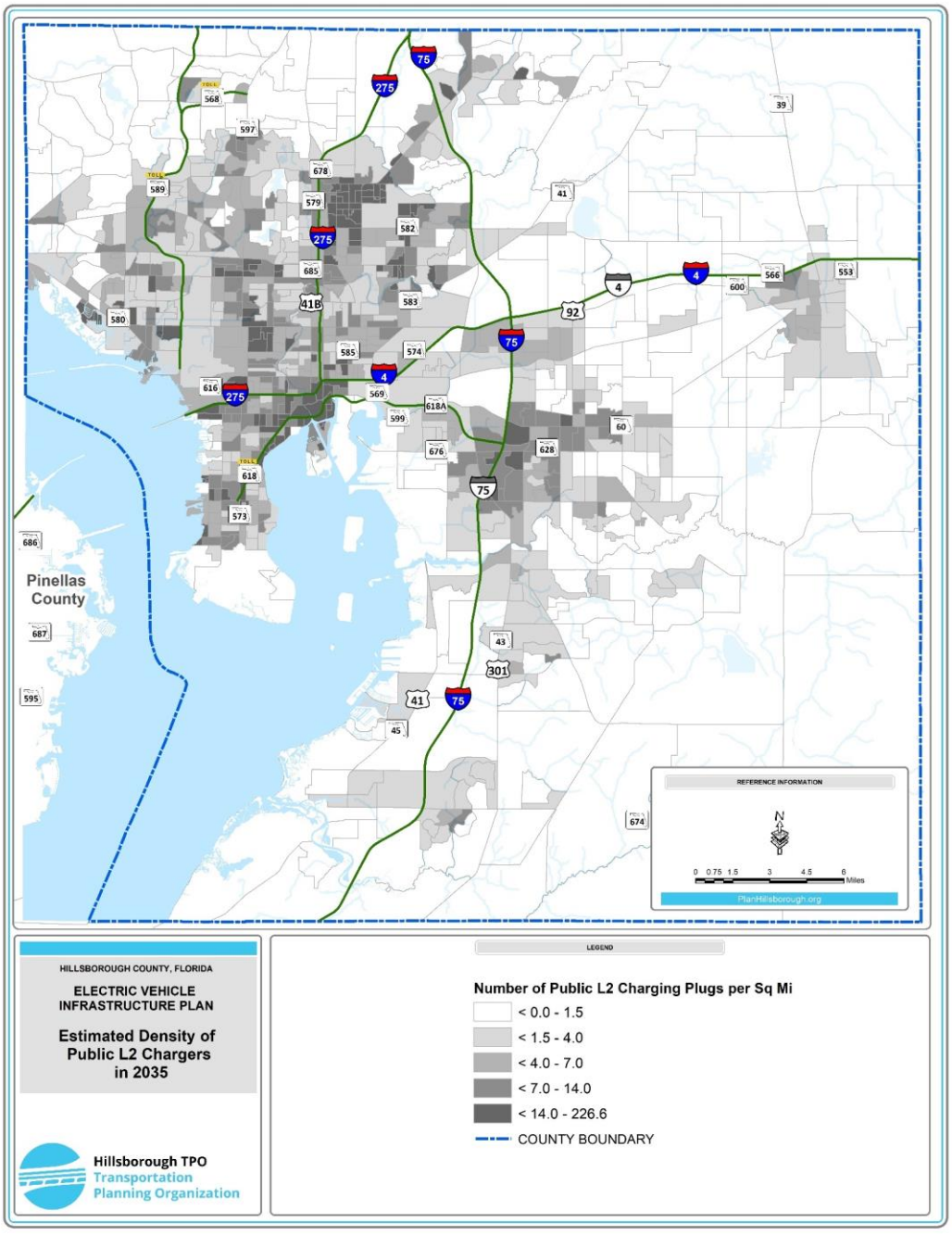


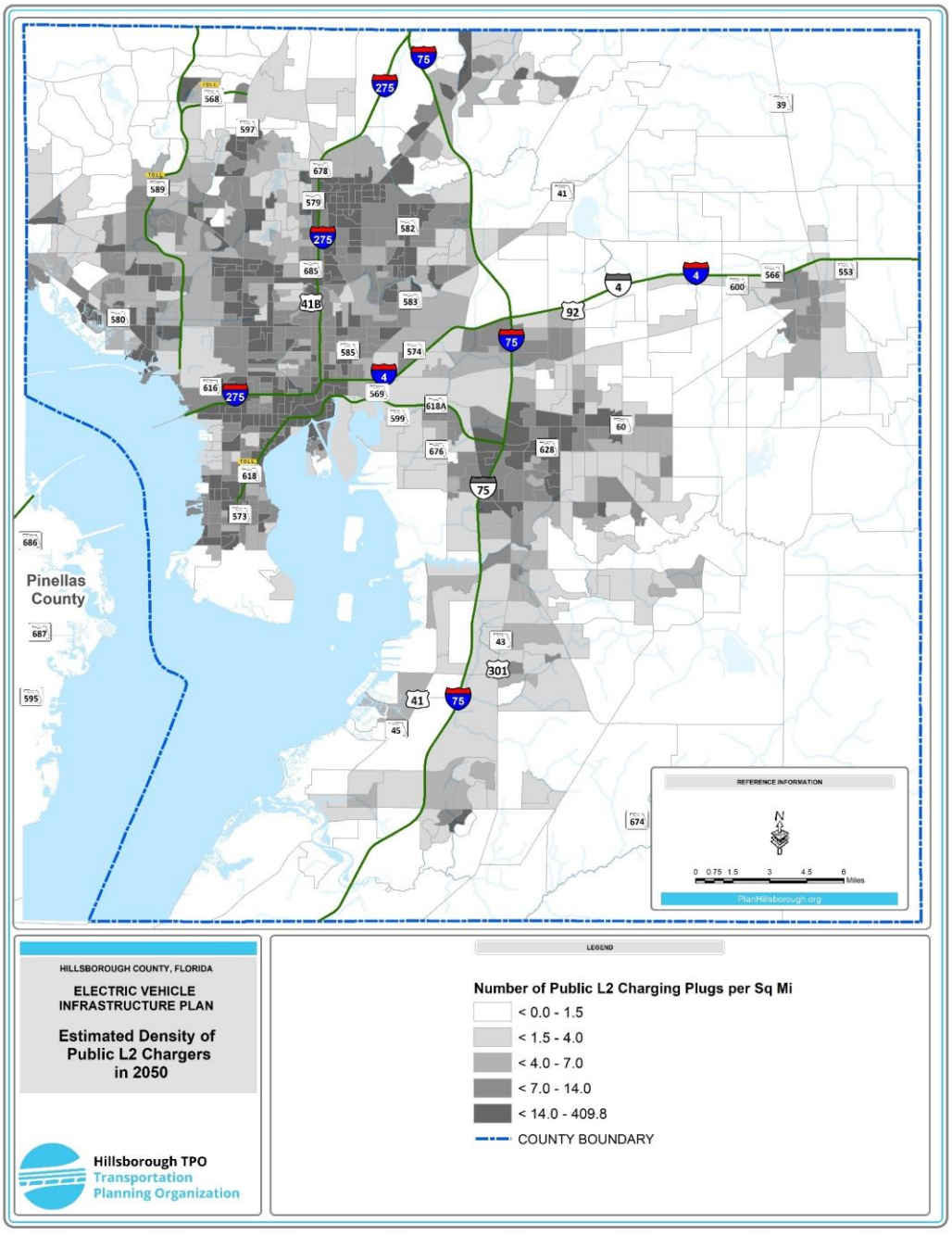
Figure 24: Areas with Summarized Data

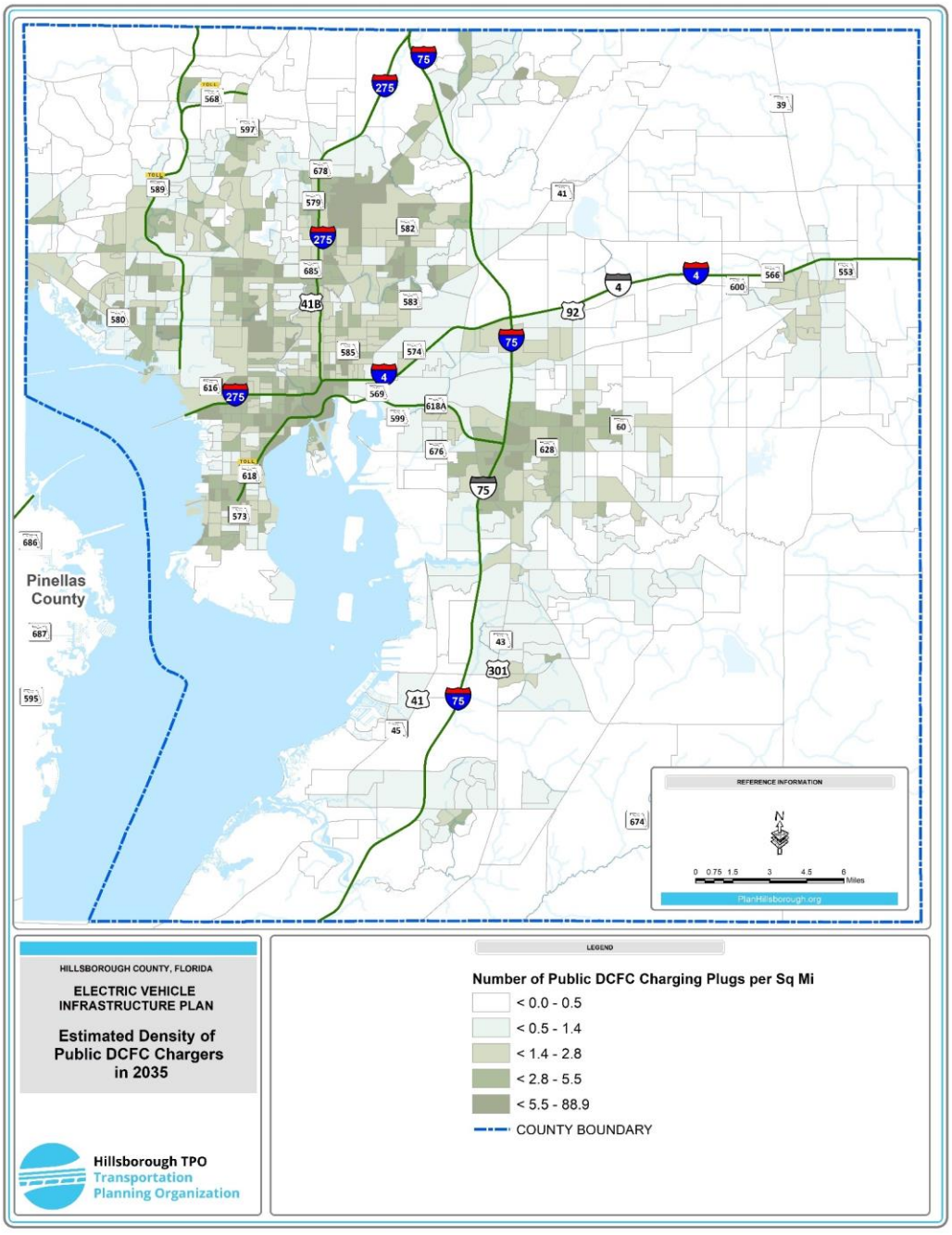


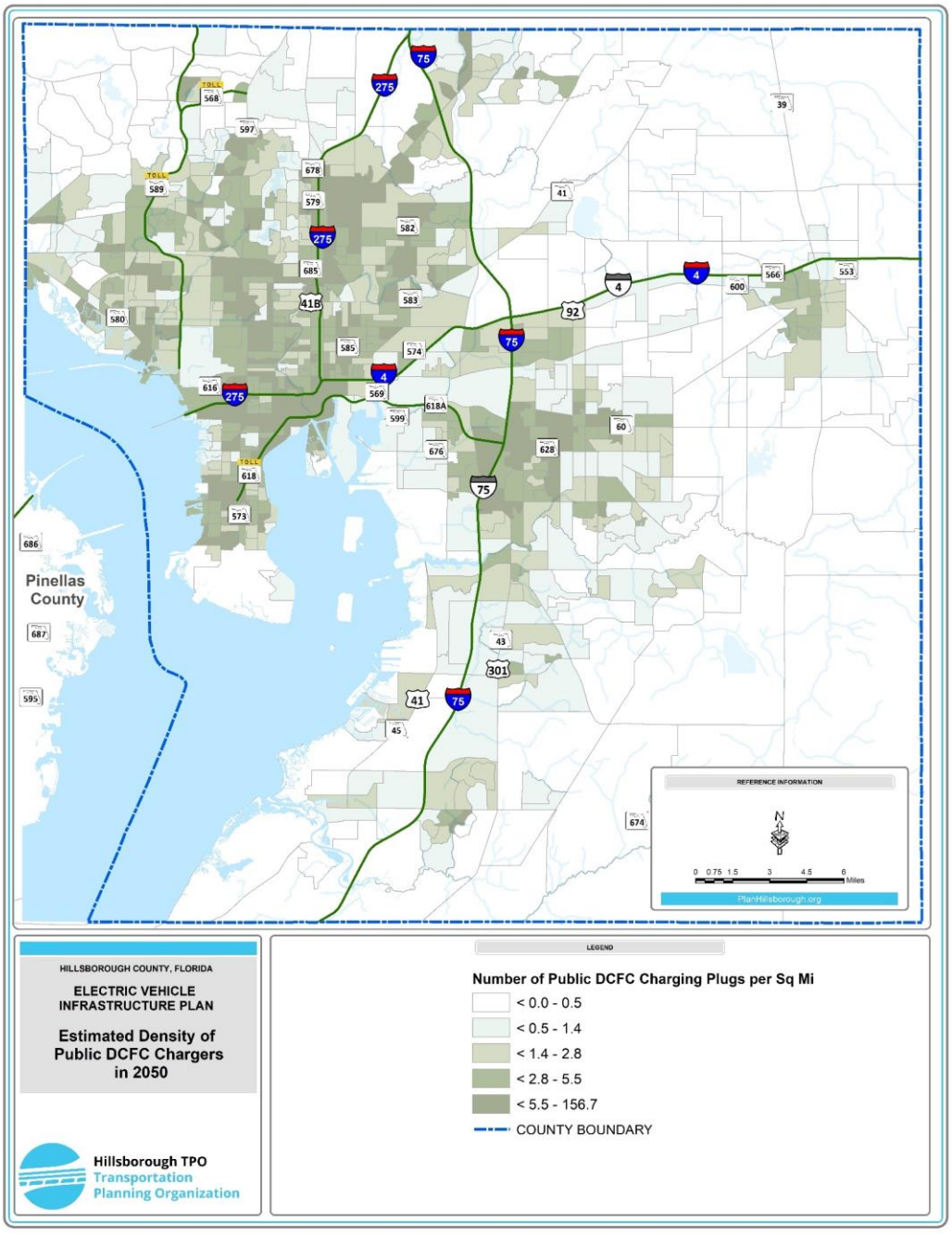

Pinellas County
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org
HILLSBOROUGH COUNTY, FLORIDA
ELECTRIC VEHICLE INFRASTRUCTURE PLAN
Estimated Density of Workplace L2 Chargers in 2035
Hillsborough TPO
Transportation Planning Organization
LEGEND
Number of Workplace L2 Charging Plugs per Sq Mi
< 0.0 - 0.6
< 0.6 - 1.5
< 1.5 - 4.0
< 4.0 - 10
< 10 - 450.8
COUNTY BOUNDARY


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 Workplace L2 Chargers in 2050
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 - 10.0
< 10.0 - 816.4
COUNTY BOUNDARY


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
< 0.0 - 1.5
< 1.5 - 4.0
< 4.0 - 7.0
< 7.0 - 14.0
< 14.0 - 226.6
COUNTY BOUNDARY
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org
Pinellas 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
Estimated Density of Public L2 Chargers in 2050
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 - 409.8
COUNTY BOUNDARY


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 Public DCFC Chargers in 2035
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
COUNTY BOUNDARY


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
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org
Pinellas County

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 13.

Table 13: 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.

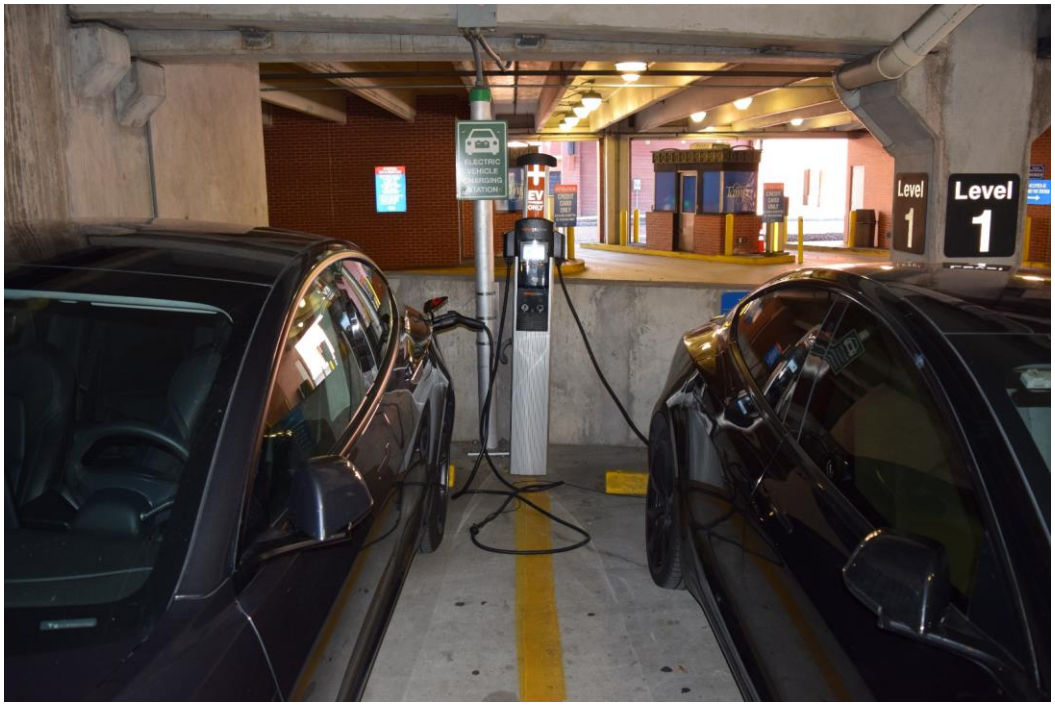
The needs of disadvantaged communities throughout Hillsborough County may be different from one another. Stakeholder engagement during the identification of station locations and design of stations is important.

[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 14. 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 14: 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 to illustrate the variability in infrastructure needs. The infrastructure needs should continue to be developed as part of HARTs planning.

Table 15. 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 Medium 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.

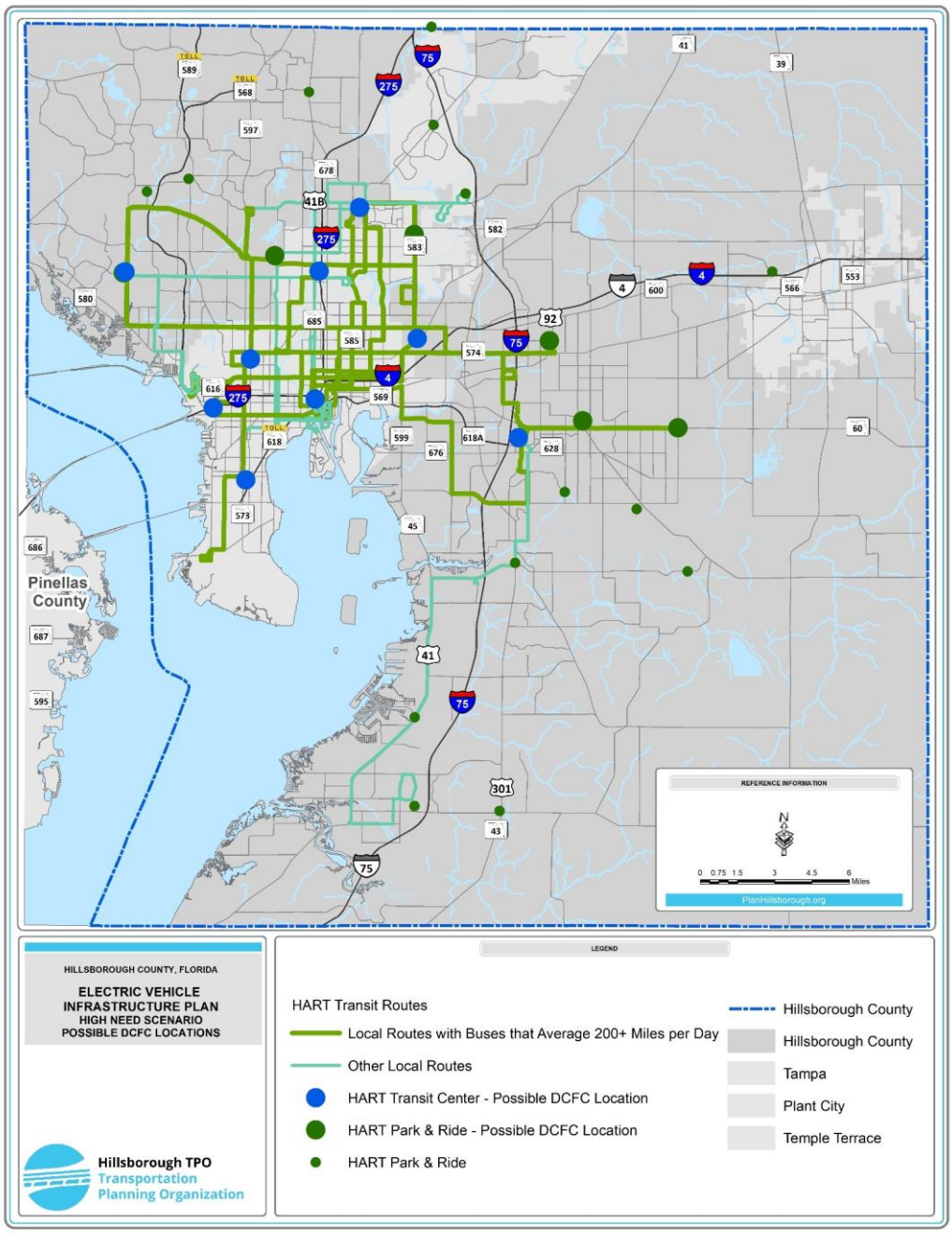
To implement on-route charging that would support "top ups" in battery range for buses on routes that average over 200 miles per day, HART can identify locations that serve multiple routes and align with schedule stops (for example beginning/ending of route). Figure 25 displays the possible locations 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.

Commented [ma9]: High?

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 16: 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.

Commented [CM10]: Could we add a table of all charging need together? LDV+TNC+HART+Commercial delivery to get a full number of the chargers need in a low, medium, and high scenario?

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 scoring system is included, 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 17: 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 1 mile	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	

Commented [ma11]: Can we find a way to more clearly operationalize this? I'd like to see a way to score potential locations

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 Plan, 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 18, the complete tables are included in Appendix D.

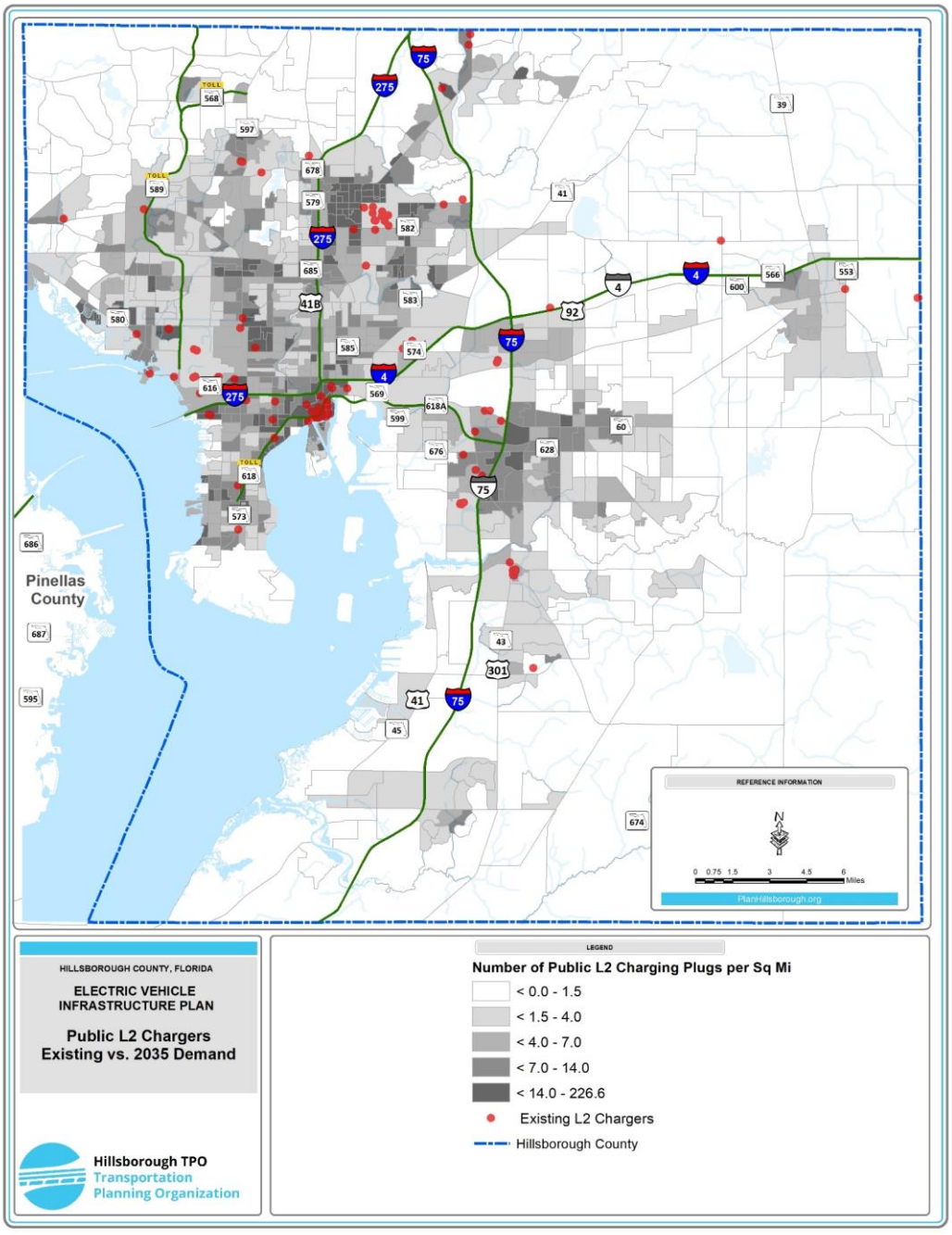
Table 18: Time Spent Doing Different Activities (Bureau of Labor Statistics)

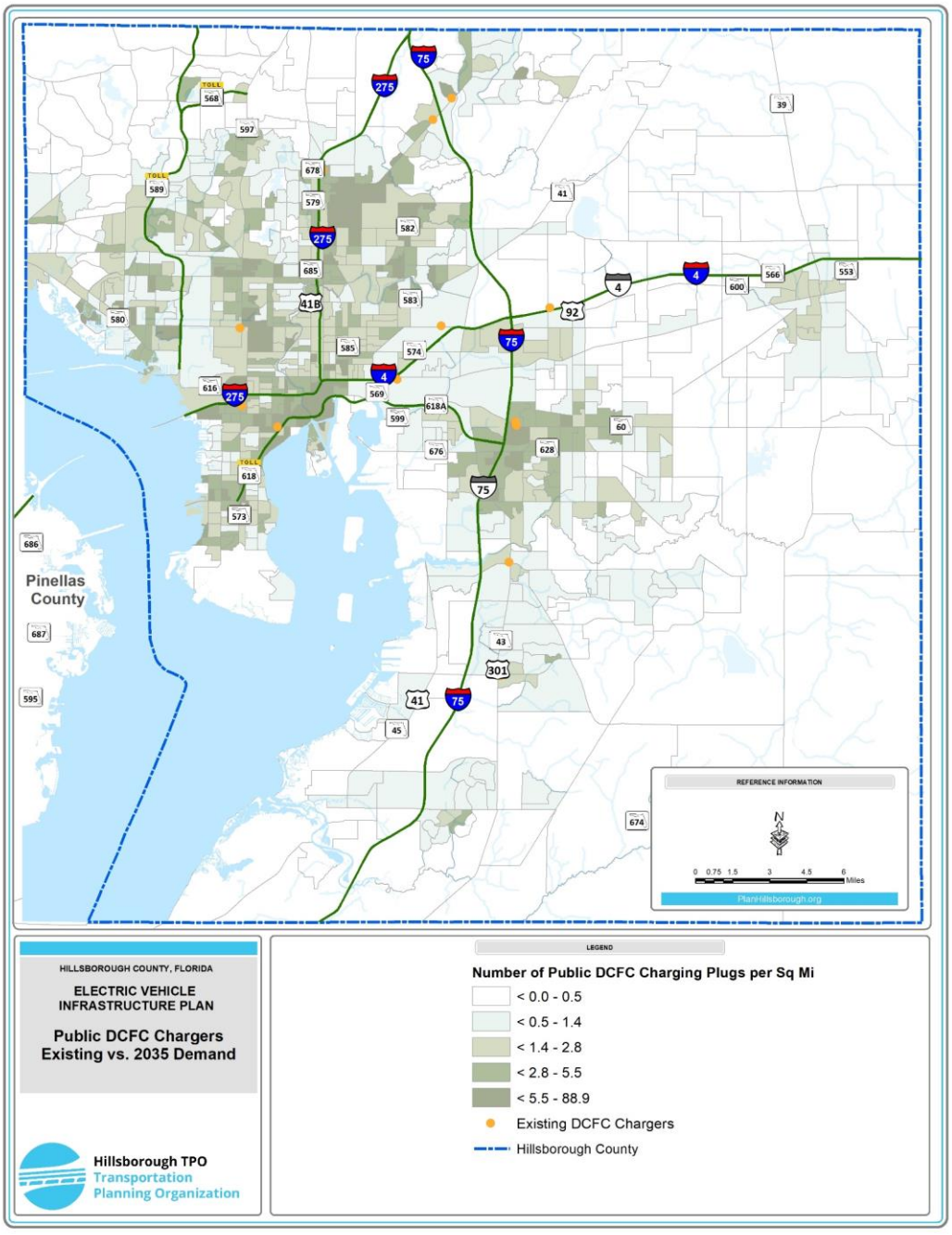
Activity	Average Hours per Day for Persons Who Engage in the Activity	Portion of People Who Engage in the Activity per Day
Grocery Shopping	0.8	13%
Working	7.7	42%
Attending Religious Services	1.9	4%
Participating in Sports	1.4	20%
Medical and Care Services	1.5	4%

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


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
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org
Pinellas 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 two 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.

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

Table 19. 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.

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.

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]

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:

[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

- 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,

- A reduction in the required minimum parking in return for offering EV charging, 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. 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.

[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

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 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

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.
- **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.

[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

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.

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]

---

[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

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 include 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 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]

---

[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/

[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

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]
- 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]

---

[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

[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

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

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 Plan will be used to inform planning processes such as the 2050 Long Range Transportation Plan. Local agencies may refer to this plan 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

Appendix B: Public & Stakeholder Engagement

Advisory Committee Meetings

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

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 20, 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.

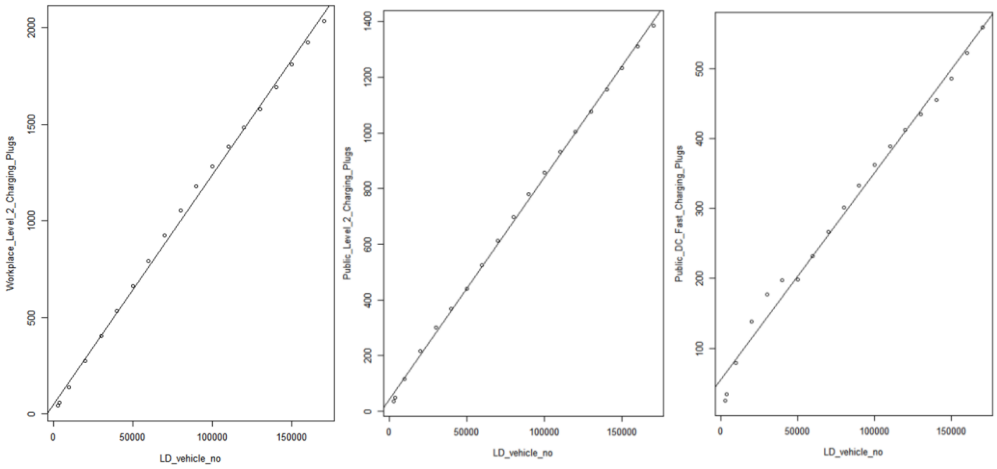
Table 20. Data Points Retrieved from EVI-Pro Lite Tool

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 21. 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)

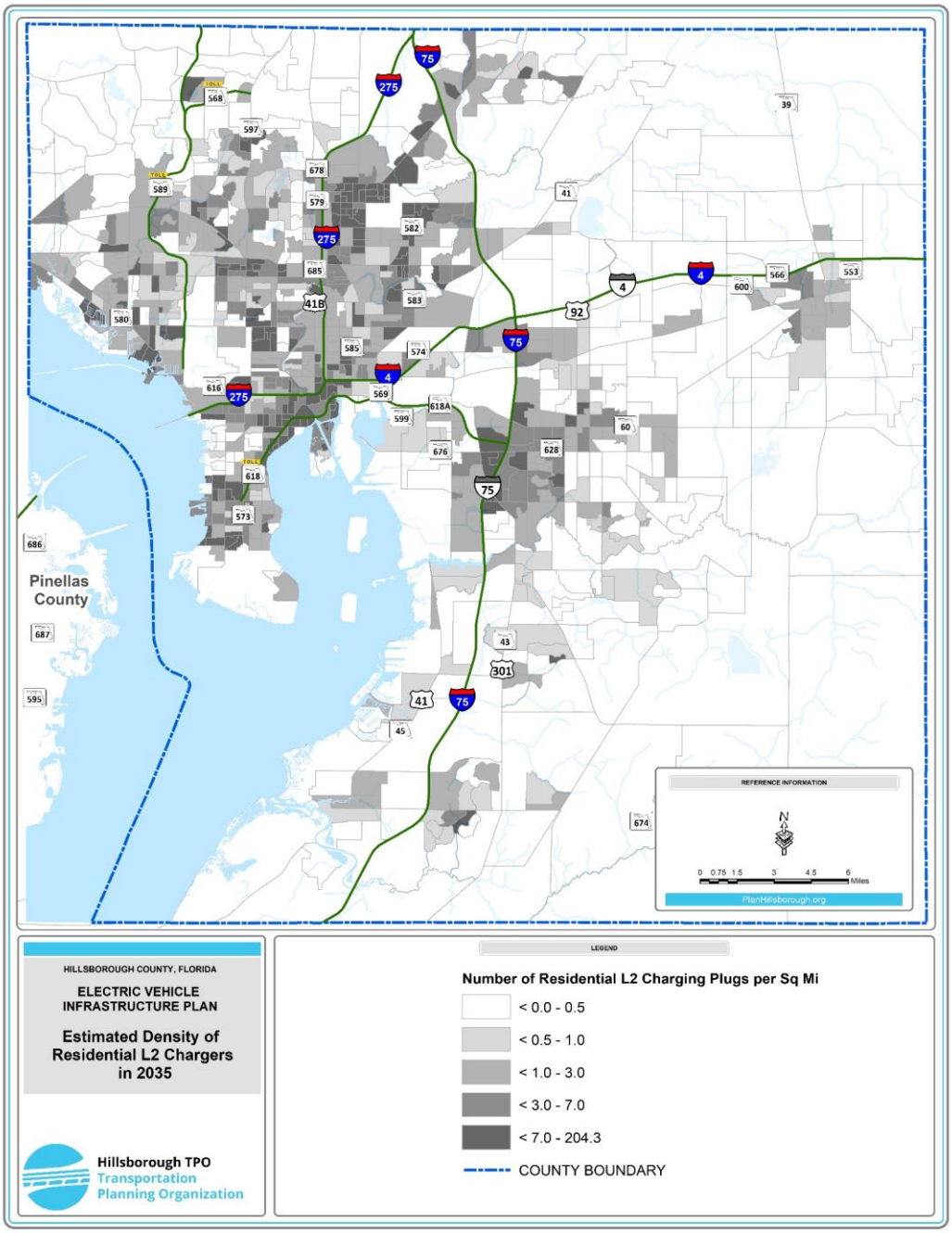


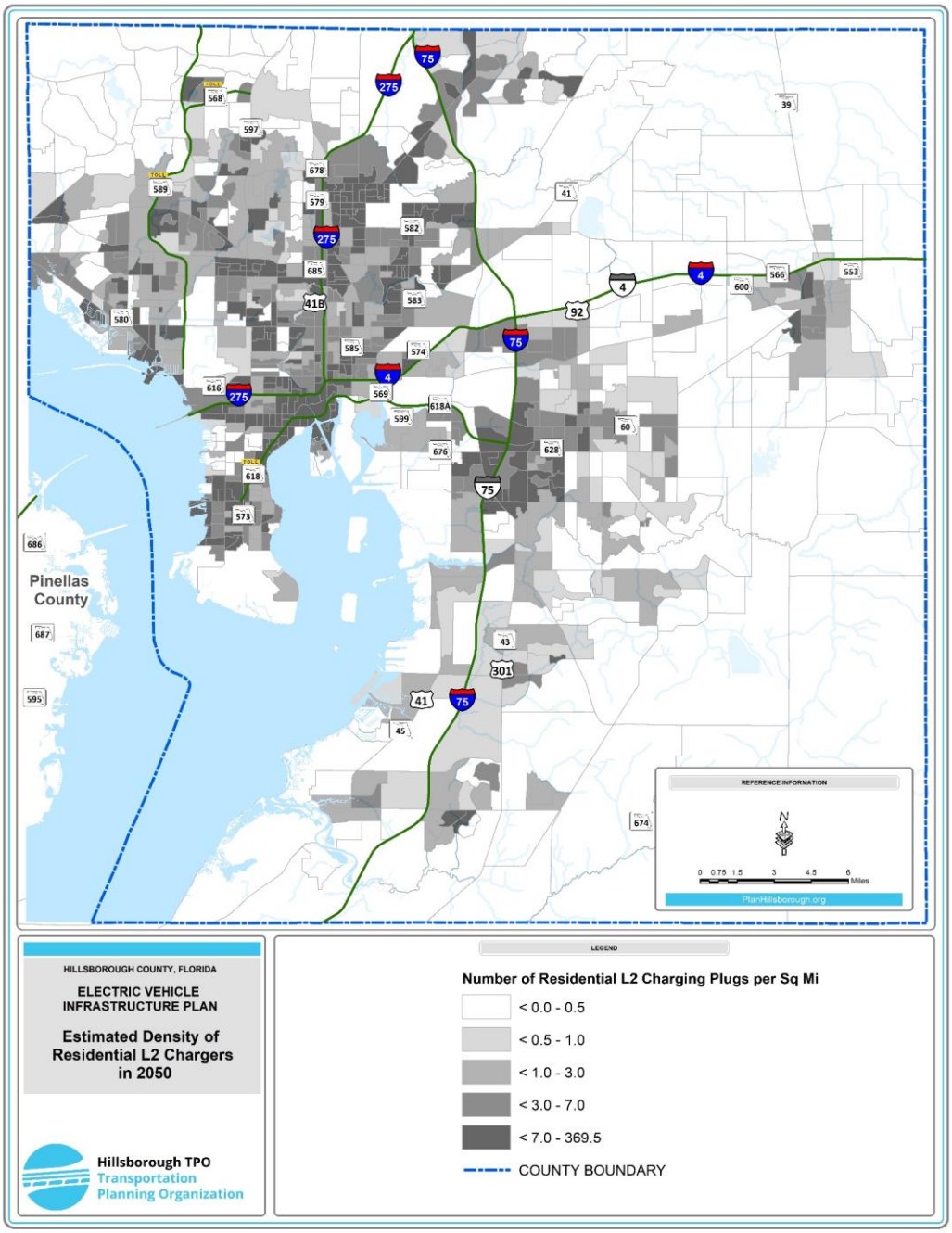
The number of Light-Duty vehicles significantly predicted the numbers of workplace/public L2 DCFC plugs. More than 98% of the variability observed in the number of charging plugs is explained by the regression models. The regression models, suggested in Table 21, were then used to make predictions of the number of charging plugs beyond the limits of the EVI-Pro Lite tool.

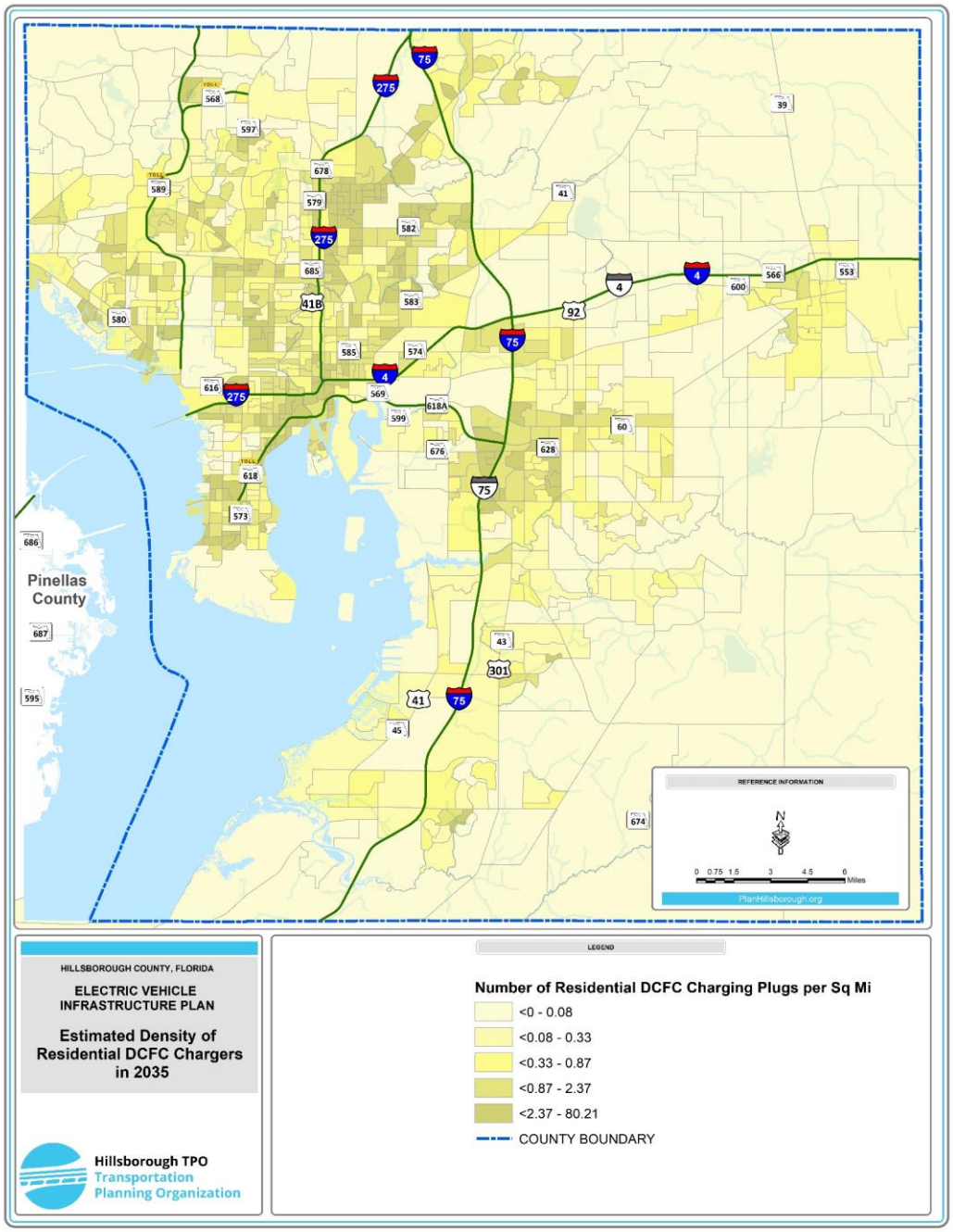
The linear regression equations suggest that the following ratios of EV charging ports per EV in Hillsborough County are needed.

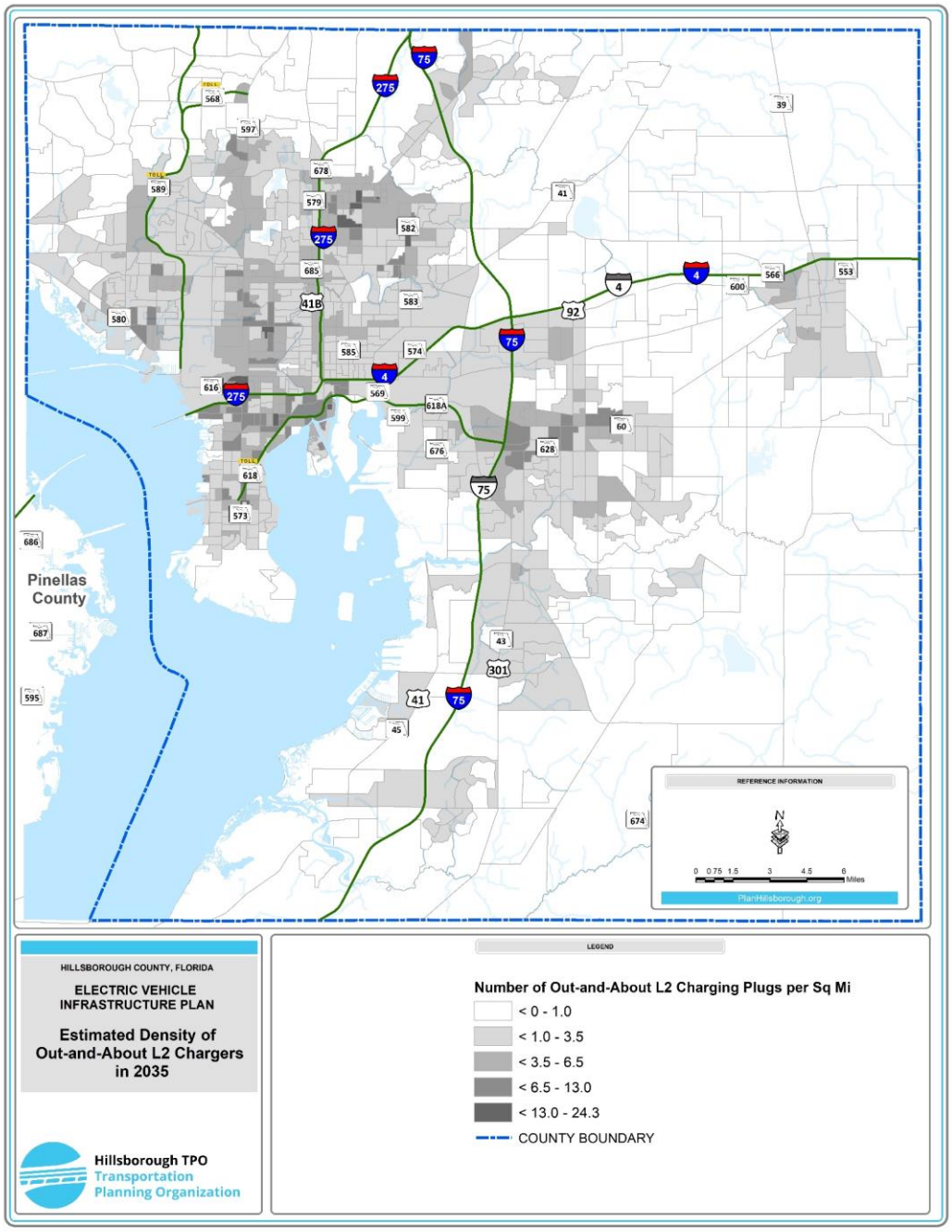
- Public DCFC: 3 plugs per 1,000 EVs
- Public Level 2: 8 plugs per 1,000 EVs
- Workplace Level 2: 12 plugs per 1,000 EVs

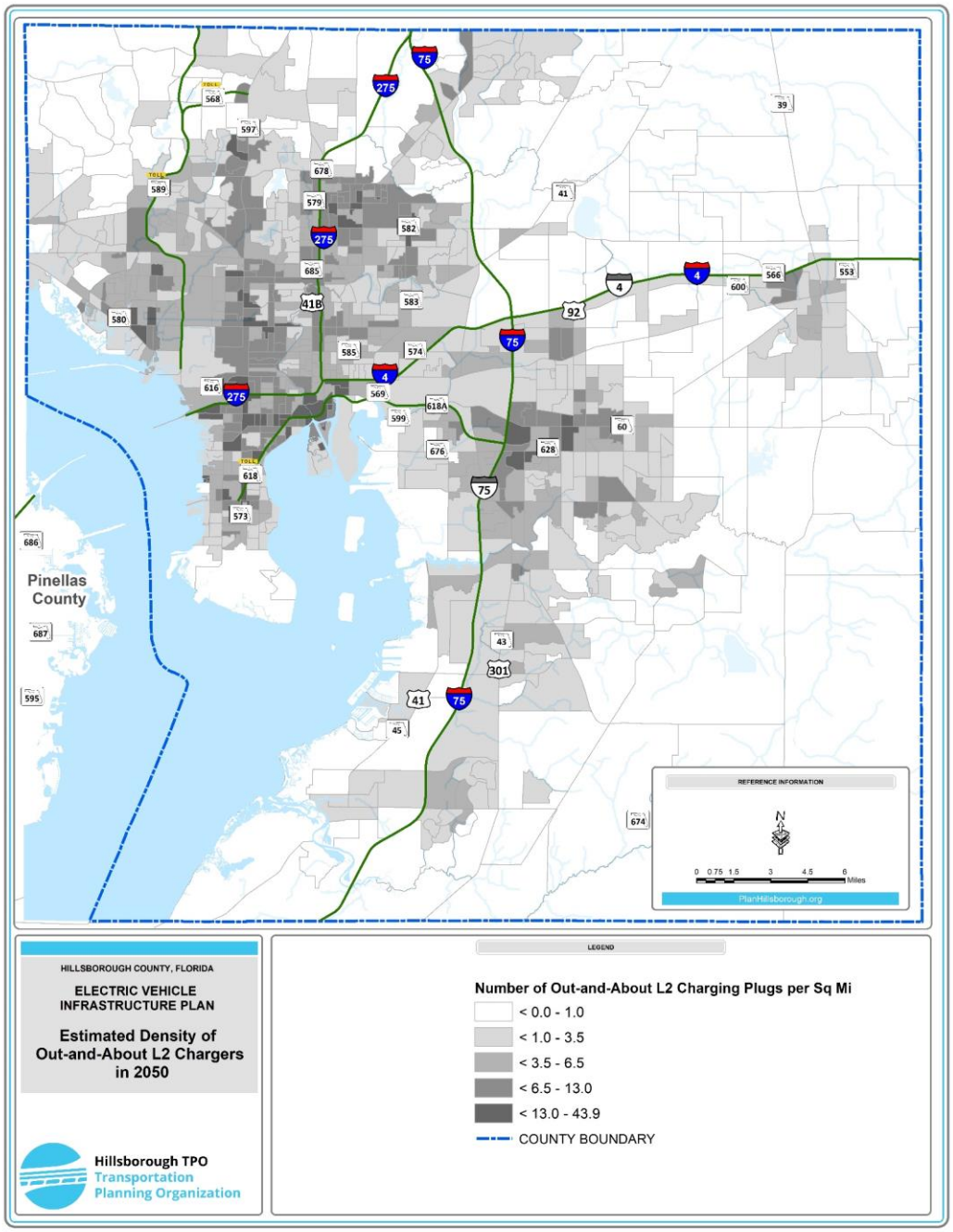
Charging infrastructure is distributed to Census Block Groups throughout Hillsborough County according to the methods described in the Needs Analysis. The total number of charging ports projected for Hillsborough County under each adoption scenario are distributed similarly. The distribution of charging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


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 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


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 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


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 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


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
REFERENCE INFORMATION
0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org
Pinellas County


Pinellas County
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
REFERENCE INFORMATION
N
0 0.75 1.5 3 4.5 6 Miles
PlanHillsborough.org

Appendix D: Bureau of Labor Statistics American Time Use Survey