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Utilization Assessment of Target Electrification Vehicles at Naval Air Station Whidbey Island: Task 3

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ABSTRACT

Battelle Energy Alliance, LLC, managing and operating contractor for the U.S. Department of Energy's Idaho National Laboratory, is the lead laboratory for the U.S. Department of Energy's advanced vehicle testing. Battelle Energy Alliance, LLC contracted with Intertek Testing Services, North America (Intertek) to conduct several U.S. Department of Defense-based studies to identify potential U.S. Department of Defense transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs).

Task 2 involved identifying daily operational characteristics of select vehicles and initiating data logging of vehicle movements in order to characterize the vehicle's mission. Individual observations of these selected vehicles provide the basis for recommendations related to PEV adoption and whether a battery electric vehicle or plug-in hybrid electric vehicle (collectively referred to as PEVs) can fulfill the mission requirements and provide observations related to placement of PEV charging infrastructure.

This report provides the results of the data analysis and observations related to replacement of current vehicles with PEVs. This fulfills part of the Task 3 requirements. Task 3 also includes an assessment of the charging infrastructure required to support this replacement, which is the subject of a separate report.

Intertek acknowledges the support of Idaho National Laboratory, Naval Facilities Engineering Command Northwest, and Naval Air Station Whidbey Island fleet managers and personnel for participation in this study.

Intertek is pleased to provide this report and is encouraged by enthusiasm and support from Naval Facilities Engineering Command Northwest personnel.

EXECUTIVE SUMMARY

Federal agencies are mandated[a] to purchase alternative fuel vehicles, increase consumption of alternative fuels, and reduce petroleum consumption. Available plug-in electric vehicles (PEVs) provide an attractive option for selection of alternative fuel vehicles. PEVs, which consist of both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), have significant advantages over internal combustion engine (ICE) vehicles in terms of energy efficiency, reduced petroleum consumption, and reduced production of greenhouse gas (GHG) emissions, and they provide performance benefits with quieter, smoother operation. This study intended to evaluate the extent to which Naval Air Station Whidbey Island (NASWI) could convert part or all of their fleet of vehicles from petroleum-fueled vehicles to PEVs.

It is likely that more fuel-efficient ICE vehicles, including hybrid electric vehicles, exist that may provide improvements for the current fleet; however, this study's focus is on replacing ICE vehicles with suitable PEVs.

BEVs provide the greatest benefit when it comes to fuel and emissions savings because all motive power is provided by the energy stored in the onboard battery pack. These vehicles use no petroleum and emit no pollutants at their point of use. PHEVs provide similar savings when their battery provides the motive power, but they also have the ability to extend their operating range with an onboard ICE. Because a PHEV can meet all transportation range needs, the adoption of a PHEV will be dependent on its ability to meet other transportation needs such as cargo or passenger carrying. Operation of PHEVs in battery-only mode can be increased with opportunity charging at available charging stations; however, it should be noted that not all PHEVs have a mode in which the battery provides all motive power at all speeds. This study focuses on the mission requirements of the fleet of vehicles with the objective of identifying vehicles that may be replaced with PEVs, with emphasis on BEVs that provide maximum benefit.

NASWI is located on Whidbey Island on the Puget Sound in Washington State. It is the premier naval aviation installation in the Pacific Northwest and home of all Navy tactical electronic attack squadrons flying the EA-6B Prowler and EA-18G Growler. In addition, there are four P-3 Orion Maritime Patrol squadrons and two Fleet Reconnaissance squadrons flying the EP-3E Aries.[b]

The relatively small geographic size of NASWI and close proximity to other naval facilities create significant opportunities for conversion of some vehicles to PEVs. NASWI identified 324 vehicles in its fleet, with 175 of those vehicles being selected to be part of this study. From these 175 vehicles, 60 vehicles that are representative of the full fleet were selected for closer monitoring. Fleet vehicle mission categories are defined in Section 4 and, while NASWI vehicles conduct many different missions, three (i.e., pool, support, and enforcement missions) were selected to be part of this fleet evaluation. The selected vehicles included many vehicle types.

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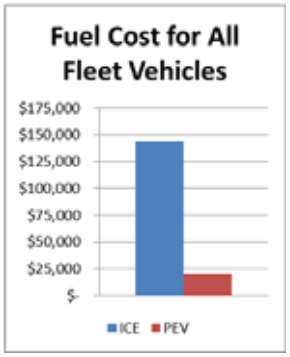
[a] Energy Policy Act of 1992, Energy Policy Act of 2005, Executive Order 13423, and Energy Independence and Security Act of 2007.

[b] http://www.military.com/base-guide/naval-air-station-whidbey-island [accessed December 15, 2014].

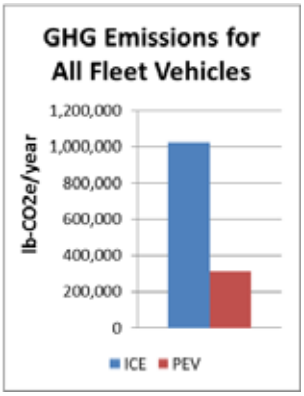
The non-tactical fleet at NASWI is managed by the Transportation group of Naval Facilities Engineering Command Northwest. NASWI is composed of 25 tenant commands (i.e., Commands) and air station divisions and departments (i.e., Departments). The Commands operate 69 vehicles and the Departments operate the remaining 106 vehicles to be evaluated. This report actually provides three reports: one for the Commands, one for the Departments, and an overall report. It observes that a mix of BEVs and PHEVs are capable of performing most of the required missions and of providing an alternative vehicle for the pool, support, and enforcement vehicles, because, while some vehicles travel long distances, the group could support some BEVs for the short trips and PHEVs for the longer trips. The recommended mix of vehicles will provide sufficient range for individual trips and time is available each day for charging to accommodate multiple trips per day. Replacement of vehicles in the current fleet could result in significant reductions in the emission of GHGs and in petroleum use, as well as reduced fleet operating costs.



PEVs currently commercially available cannot replace certain vehicles and missions (such as those requiring heavy-duty trucks and certain specialty usage vehicles). However, based on data collected for the monitored vehicles, the 60-vehicle fleet subset could possibly consist of 32 BEVs and 28 PHEVs.

Puget Sound Energy provides the electric power for NASWI and its generation capacity consists mostly of hydroelectricity. Hydroelectricity generally provides lower electrical costs and lower generation GHG emissions than the national averages. Replacement of 60 ICE vehicles with PEVs potentially results in an annual fuel savings of over $42,500 (86% reduction) and GHG savings of over 245,000 lb-CO_2e (70% reduction).

The monitored vehicles represent 60 vehicles of 175 on-road-rated vehicles in these represented fleets. Assuming that the balance of these fleets operates in a manner similar to those monitored and without consideration of specific cargo or other mission requirements not previously identified, Intertek suggests the total fleet composition could consist of 92 BEVs and 83 PHEVs. This replacement of ICE vehicles with PEVs could potentially result in an annual fuel savings of over $123,000 (86% reduction) and annual GHG emissions avoided of over 700,000 lb-CO_2e (70% reduction).



The average vehicle monitored traveled approximately 5,090 miles per year. This is an average of less than 100 miles per week. This may reflect the opportunity to increase the percentage of BEVs over that analyzed in Section 5. Intertek suggests NASWI may wish to move forward in the near future with the replacement of pool, support, and enforcement vehicles with PEVs as current budget and vehicle replacement schedules allow. Certainly, the vehicle types studied in this report may be candidates for immediate replacement.

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FIGURES

TABLES

ACRONYMS

AC	alternating current
BEV	battery electric vehicle
CD	charge depletion
CS	charge sustaining
DC	direct current
EPA	U.S. Environmental Protection Agency
EVSE	electric vehicle supply equipment
GHG	greenhouse gas emissions
GSA	General Services Administration
ICE	internal combustion engine
Intertek	Intertek Testing Services, North America
NASWI	Naval Air Station Whidbey Island
OEM	original equipment manufacturer
PEV	plug-in electric vehicle (includes BEVs and PHEVs, but not hybrid electric vehicles)
PHEV	plug-in hybrid electric vehicle
SUV	sports utility vehicle

Utilization Assessment of Target Electrification Vehicles at Naval Air Station Whidbey Island: Task 3

1. INTRODUCTION

The U.S. Department of Energy and the U.S. Department of Defense signed a memorandum of understanding on July 22, 2010, for strengthening the coordination of efforts to enhance national energy security and to demonstrate federal government leadership in transitioning the United States to a low-carbon economy. The memorandum of understanding included efforts in the areas of energy efficiency, fossil fuels, alternative fuels, efficient transportation technologies and fueling infrastructure, grid security, smart grid, and energy storage.

In support of the memorandum of understanding, the Idaho National Laboratory, with funding provided by the U.S. Department of Energy's Vehicle Technologies Office and Federal Energy Management Program, directed Intertek Testing Services, North America (Intertek) to conduct several U.S. Department of Defense-based studies to identify potential transportation systems that are strong candidates for introduction or expansion of plug-in electric vehicles (PEVs). Intertek previously has conducted similar fleet, city, state, and countrywide studies using their micro-climate assessment process, which consists of the following four main tasks:

- Task 1: Conduct a non-tactical fleet and infrastructure assessment
- Task 2: Select vehicles for mission and fleet characterizations
- Task 3: Perform detailed assessment of selected vehicles and charging infrastructure needs
- Task 4: Prepare adoption approach for PEV and charging infrastructure

Assessment of the potential for replacing Naval Air Station Whidbey Island (NASWI) fleet vehicles with PEVs starts with assessment of the fleet vehicles' missions and vehicle characteristics. This assessment was conducted through a thorough review of fleet records and discussions with Naval Facilities Engineering Command (NAVFAC) Northwest personnel. The Task 1 report, titled, *Assessment of Data and Survey Results for Naval Air Station Whidbey Island*, dated January 2015, provided a summary and fleet assessment.

PEVs generally are classified into two vehicle types: battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). A BEV contains an onboard battery that provides all motive power. PHEVs also have an onboard battery that provides some motive power but the battery is supplemented by another power source (such as a gasoline engine). Collectively, BEVs and PHEVs are referred to as PEVs.

The Task 1 effort led to identification of fleet vehicles that appear to be good candidates for replacement by PEVs. The Task 2 report, titled, *Identification of Naval Air Station Whidbey Island Vehicles for Installation of Data Loggers*, dated March 2015, identified the 60 vehicles within the candidate groups for further monitoring and analysis through addition of vehicle data loggers. The data loggers were installed and data collected on these selected vehicles. This Task 3 report provides a summary and the details of that data collection. The charging infrastructure assessment is the subject of a separate report.

2. METHODS

2.1 Fleet Vehicle Survey

NASWI, NAVFAC, and Intertek identified 60 vehicles for further study (i.e., vehicles were identified in the Task 2 report). This subset of vehicles contains 19 sedans, nine minivans, three sports utility

vehicles (SUVs), 16 pickup trucks, four cargo vans, and nine passenger vans. This distribution is approximately representative of the entire non-tactical fleet. Figure 1 shows vehicle type distribution for all vehicles for comparison (taken from Task 1).

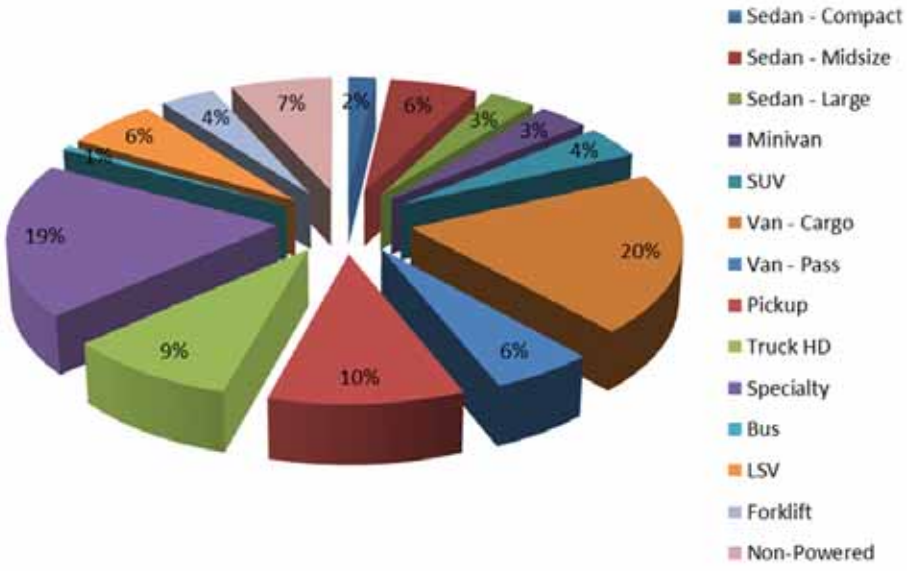


Figure 1. Vehicle type distribution for all vehicles.

Figures 2 through 6 present comparisons of model year, cumulative distance driven, and monthly distance driven of the vehicles monitored. The figures show that the selected vehicles are representative of a wide range of vehicle and mission types. The selection shifted the monitored vehicle types toward a larger percentage of smaller vans, which are the more likely candidates for replacement by PEVs in the near future. It also did not include many of the oldest vehicles, which are cargo vans and pickups, whose performances are better represented by newer models.

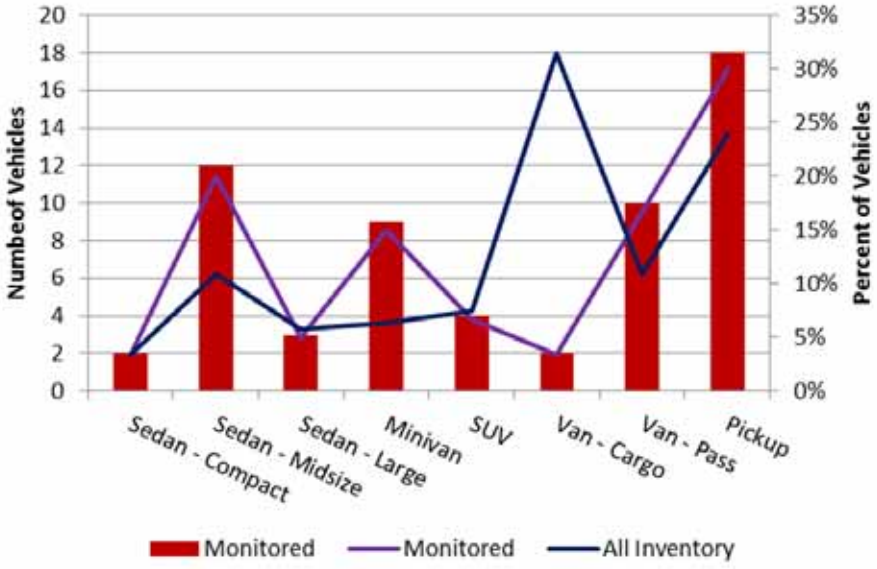


Figure 2. Vehicle types for vehicles with data loggers.

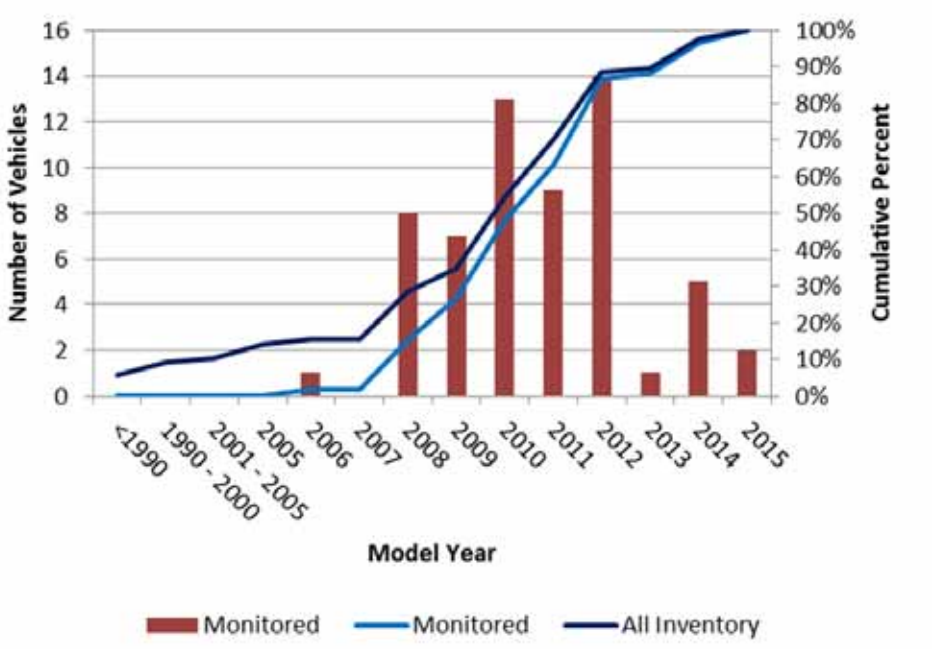


Figure 3. Model year for vehicles with data loggers.

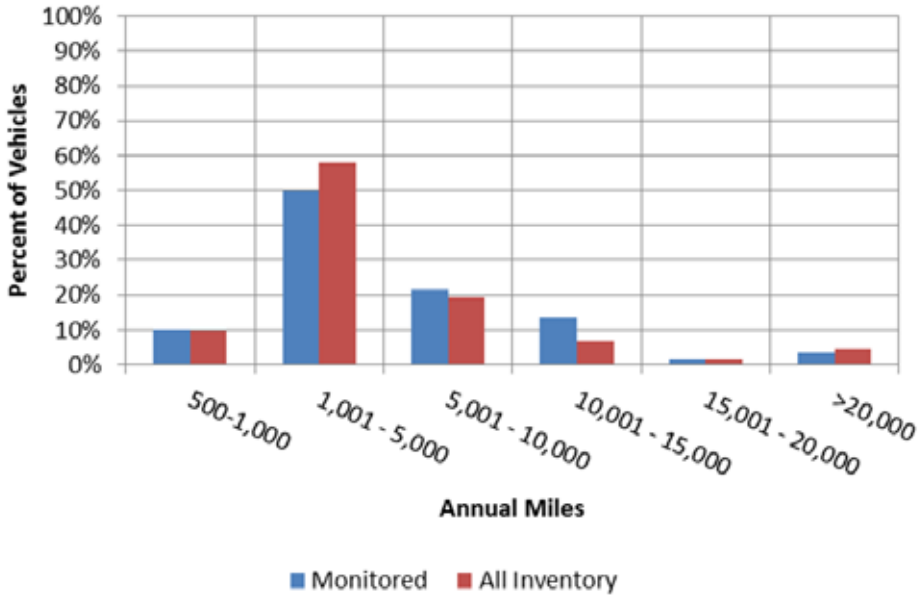


Figure 4. Annual mileage for vehicles with data loggers.

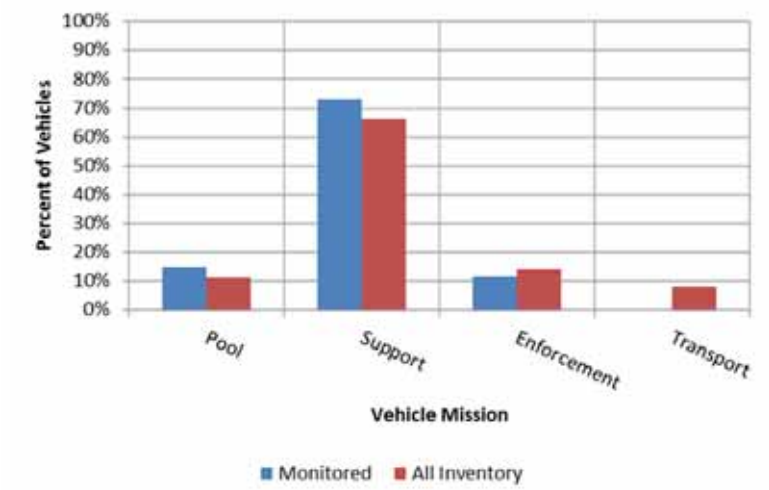


Figure 5. Vehicle mission for vehicles with data loggers.

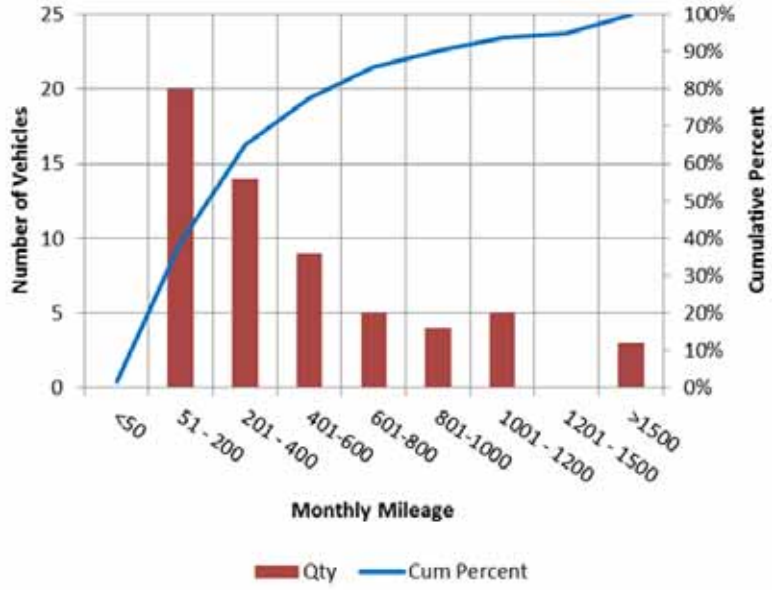


Figure 6. Distribution of monthly distance driven for vehicles with data loggers.

If one assumes a battery range of 70 miles for a BEV and 21 working days per month, then a vehicle that consistently travels the same distance each day would have to travel greater than approximately 1,500 miles per month to exceed the battery capacity. Fully 95% of the monitored vehicles average less than 1,500 miles per month in travel. This is the same percentage as the entire fleet inventory. Therefore, barring charging constraints associated with the timing of daily mission activities, payload requirements, and the range issues associated with off-base trips, a significant number of vehicles should be eligible for replacement by BEVs.

NASWI identified 175 fleet vehicles in its non-tactical, onroad fleet. Table 1 compares the monitored vehicles to the full fleet by mission type. (Note that Section 3 provides descriptions of the vehicle mission types.)

Intertek coordinated with NASWI fleet managers to identify specific vehicles for inclusion in the study. The vehicle selections represent high-interest vehicles based on vehicle missions and vehicle

type/class. Selection also favored a typical cross section of the full fleet. Because data loggers rely on the vehicle's battery power, non-use of the vehicle can result in the vehicle having a depleted battery. Intertek received no reports of depleted batteries during the study at NASWI.

Table 1. Fleet evaluation.

Vehicle Mission	Study Vehicles	Total Fleet Reported	Percentage Studied
Pool Vehicles	9	20	45%
Support Vehicles	44	116	38%
Enforcement Vehicles	7	25	28%
Transport Vehicles	—	14	—
Total Fleet Vehicles	60	175	34%

2.2 Data Collection

Individual privacy concerns exist when monitoring vehicle movement with data loggers. Data collection occurs through vehicle identification as identified by Intertek, data logger number, and an agency-assigned vehicle number. Intertek receives no information related to the vehicle operator and provides no raw data to the fleet managers. In this manner, Intertek does not collect, analyze, or report on individual driving habits.

2.2.1 Data Logger

Non-intrusive data loggers produced by InTouchMVC[3] and depicted in Figure 7 were installed into the vehicle's onboard diagnostic port to collect and transmit the relevant data. Installation of the data logger and manual recording of information about the vehicle that ties the logger and vehicle together in the data typically takes less than 5 minutes. Once installed and activated (during vehicle use), the data loggers transmit vehicle information every minute during vehicle operation by cellular communication to the data center.

Figure 7. InTouchMVC data logger.[4]

Intertek maintains the data logger's connectivity and verifies data transmission weekly. Missing data (reported as "null" values) are frequently the result of lost global positioning system reception, logger device removal, or extended periods in regions with insufficient cellular reception. Intertek filters the vehicle and data logger information if these null values present a significant impact on the data collected and no resolution is possible. This report also identifies the statistics on this validation process.

[3] www.intouchmvc.com [accessed March 12, 2015].

[4] ibid.

NASWI requested and installed 60 data loggers into their fleet. NASWI removed and shipped the data loggers to Intertek at the conclusion of the data collection period.

2.2.2 Data Captured

Data consist of key-on events, key-off events, and position updates logged every minute while the vehicle is keyed-on. InTouchMVC fleet reporting converted these data points into records of trip events, stop events, and idle events.

From these data points, the following information was available for evaluation:

- Trip start and stop time and location
- Trip distance and duration
- Idle start time, location, and duration
- Stop start time, location, and duration.

2.3 Data Analysis

2.3.1 Definitions

Figure 8 illustrates a vehicle outing, which is comprised of trips, stops, and idle events, that may occur over 1 day or several days. The following list provides a definition of these terms:

1. **Outing**: An outing is the combination of trips and stops that begin at the home base and includes all travel until the vehicle returns home.
2. **Trip**: A trip begins with a key-on event and ends with the next key-off event.
3. **Vehicle stop**: A vehicle stop includes a key-off/key-on event pair.
4. **Idle time**: Idle time is the amount of time a vehicle spends stationary after a key-on event when the vehicle is not moving for a period of 3 minutes or longer.
5. **Trip travel time**: Trip travel time is the amount of time required to complete a trip, excluding stops, but including idle time.

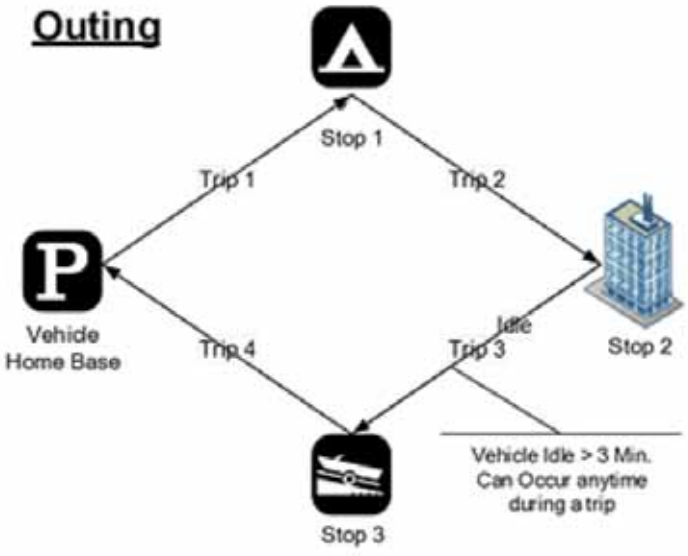


Figure 8. Vehicle outing.

Definitions of additional analysis and survey terms are as follows:

1. **Operating shift**: Fleet manager-defined period worked
2. **Study days**: Days during which the data loggers are connected
3. **Vehicle days**: Study days during which a vehicle is used
4. **Null values**: Data record unusable for analysis for various reasons.

2.3.2 Data Evaluation

Processing the data involves removal of null values and aggregation by different spatial and temporal scales. Aggregation was by day, by trip, and by outing to produce figures showing the patterns of use. Aggregation by vehicle mission followed to characterize use for the agency fleet. Section 4 presents these results. Data were extrapolated to provide overall fleet usage and benefit analysis when fleet information was provided. Section 5 presents these benefits. Intertek observations are included in Section 6.

Statistical data analysis uses Microsoft® Excel and Tableau® software. Frequency distributions summarize the travel behavior of each vehicle and vehicle mission during the study period. Rounding of the tables and figures are to three significant digits.

3. VEHICLES

3.1 Vehicle Missions

Vehicle mission is an important characteristic in the fleet study. Information used to define the vehicle mission includes the vehicle's configuration, vehicle use, classification per 40 CFR Part 600.315-82 and the U.S. Environmental Protection Agency (EPA), the participating agency use, and generally understood vehicle uses. Based on fleet information gathered, Intertek has established the following seven mission/vehicle categories for analysis, which are depicted in Figure 9:

1. **Pool vehicles**: A pool vehicle is any automobile (other than the low-speed vehicles identified below) manufactured primarily for use in passenger transportation, with not more than 10 passengers.
2. **Enforcement vehicles**: Vehicles specifically approved in an agency's appropriation act for use in apprehension, surveillance, police, or other law enforcement work. This category also includes site security vehicles, parking enforcement, and general use, but the vehicles are capable of requirements to support enforcement activities. Appendix A provides further definition.
3. **Support vehicles**: Vehicles assigned to a specific work function or group to support the mission of that group. Vehicles are generally passenger vehicles or light-duty pickup trucks and may contain after-market modifications to support the mission.
5. **Transport vehicles**: Light, medium, or heavy-duty trucks used to transport an operator and tools or equipment of a non-specific design or nature. The vehicle's uses include repair, maintenance, or delivery.
6. **Specialty vehicles**: Vehicles designed to accommodate a specific purpose or mission (such as ambulances, mobile cranes, and handicap controls).
7. **Shuttles/buses**: Vehicles designed to carry more than 12 passengers and further outlined in 49 CFR 532.2.
8. **Low-speed vehicles:** Vehicles that are legally limited to roads with posted speed limits up to 35 or 45 mph (depending on state law) and that have a limited load-carrying capability.

Figure 9. Vehicle missions.

3.2 Alternative Fuel Vehicles

As the operating agency, NASWI has a unique opportunity to plan for adoption of BEVs and PHEVs, along with planning for supporting infrastructure. The adoption of PHEVs and BEVs is a primary goal of the General Services Administration (GSA) and supports many directives in this area.

As GSA increases its certification of PHEVs and BEVs, agencies can plan for vehicle replacement through GSA for passenger vehicles and trucks. Table 2 presents the replacement requirements for fleet vehicles. Note that both the age and mileage requirements need to be met in order for the vehicle to qualify for replacement, except where noted as "or."

Table 2. GSA vehicle replacement requirements.

GSA Vehicle Replacement Requirements[5]			
	Fuel Type	Years	Miles
Passenger vehicles	Gasoline or alternative fuel vehicle	3 4 5 Any age	36,000 24,000 Any mileage 75,000
	Hybrid	5	Any mileage
	Low-speed BEV	6	Any mileage
Light trucks 4 x 2	Non-diesel	7 or	65,000
	Diesel	8 or	150,000
	Hybrid	7	Any mileage
Light trucks 4 x 4	Non-diesel	7 or	60,000
	Diesel	8 or	150,000
	Hybrid	7	Any mileage

[5] http://www.gsa.gov/graphics/fas/VehicleReplacementStandardsJune2011Redux.pdf [accessed March 12, 2015].

GSA Vehicle Replacement Requirements[5]			
	Fuel Type	Years	Miles
Medium trucks	Non-diesel	10 or	100,000
	Diesel	10 or	150,000
Heavy Trucks	Non-diesel	12 or	100,000
	Diesel	12 or	250,000

3.3 Battery Electric Vehicle and Plug-In Hybrid Electric Vehicle Benefits/Challenges

BEVs are powered completely by the battery energy storage system onboard the vehicle. The Nissan LEAF is an example of a BEV. Because the BEV has no other energy source for propulsion, the range, power requirements, and mission of the needed vehicle factor greatly in purchasing decisions. Maximizing BEV capabilities typically requires batteries more than an order of magnitude larger than the batteries in hybrid electric vehicles.

PHEVs obtain their power from two energy sources. The typical PHEV configuration uses a battery and an ICE, which is powered by either gasoline or diesel. PHEV designs differ between manufacturers. All PHEVs have a charge-depleting (CD) mode, in which the battery discharges its stored energy to propel the vehicle, and a charge-sustaining (CS) mode (or extended-range mode) that is entered after CD mode is complete, in which the battery and ICE work together to provide propulsion, while the state of charge of the battery is maintained between set limits. Some CD modes are purely electric, while other vehicle designers employ the engine to supplement the battery power during the initial battery depletion to a set state of charge (usually below 50%).

3.3.1 Battery Electric Vehicle Benefits/Challenges

EPA identifies the following benefits and challenges of BEVs:[6]

- **Energy efficient:** Electric vehicles convert about 59 to 62% of electrical energy from the grid to power at the wheels, whereas conventional gasoline vehicles only convert about 17 to 21% of the energy stored in gasoline to power at the wheels.
- **Environmentally friendly:** PEVs emit no tailpipe pollutants, although the power plant producing the electricity may emit them. Electricity from nuclear, hydro, solar, or wind-powered plants causes no air pollutants.
- **Performance benefits:** Electric motors provide quiet, smooth operation and exhibit maximum torque at zero and low speeds, while also requiring less maintenance than ICEs.
- **Reduce energy dependence:** Electricity is a domestic energy source.

EPA also identifies challenges associated with BEVs, including the following:

- **Driving range:** Most BEVs can only travel about 100 to 200 miles (or less) before recharging, whereas gasoline vehicles can often travel over 300 miles before refueling and some much further.
- **Recharge time:** Fully recharging the battery pack can take 4 to 8 hours. Even a "fast charge" to 80% capacity can take 30 minutes.
- **Battery cost:** The large battery packs are expensive and may need to be replaced one or more times.

[6] http://www.fueleconomy.gov/feg/evtech.shtml [accessed March 12, 2015].

- **Bulk and weight:** Battery packs are heavy and take up considerable vehicle space.

3.3.2 Plug-In Hybrid Electric Vehicle Benefits/Challenges

EPA identifies the following benefits and challenges of PHEVs:[7]

- **Less petroleum use:** PHEVs are expected to use about 40 to 60% less petroleum than conventional vehicles. Because electricity is produced primarily from domestic resources, PHEVs reduce dependence on oil.
- **Fewer GHG emissions:** PHEVs are expected to emit fewer GHG emissions than conventional vehicles, but, as with BEVs, the difference depends largely on the type of power plant supplying the electricity.
- **Higher vehicle costs, lower fuel costs:** PHEVs will likely cost $1,000 to $7,000 more than comparable non-PHEVs. Fuel will cost less because electricity is much cheaper than gasoline, but the fuel savings depends on how much of the driving is done on the off-board electrical energy.
- **Recharging takes time:** Recharging the battery typically takes several hours. However, PHEVs do not have to be plugged in to be driven. They can be fueled solely with gasoline, but will not achieve maximum range, fuel economy, or fuel savings without charging.
- **Measuring fuel economy:** Because a PHEV can operate on electricity alone, gasoline alone, or a mixture of the two, EPA provides a fuel economy estimate for gasoline-only operation (CS mode), electric-only operation (all-electric CD mode), or combined gasoline and electric operation (blended CD mode).

In most cases, the PEV's retail cost is higher than a non-PEV model. This incremental purchase cost may be a fleet budget challenge; however, many original equipment manufacturers (OEMs) have offered incentives to encourage the use and adoption of BEVs and PHEVs. Some OEMs have recently reduced vehicle cost, while also increasing vehicle range. Additionally, federal and state incentives have increased the attractiveness of purchasing a PEV. A common assumption is that increasing PEV sales will result in a reduction in this incremental purchase cost and a positive feedback loop will ensue.

3.4 Plug-In Hybrid Electric Vehicle Availability

GSA provides a summary of the light and medium-duty passenger vehicles that are available for lease or purchase through the GSA portal,[8] although not all BEVs and PHEVs currently on the market are 'certified' to be GSA replacements. Vehicles not on the GSA list of 'certified' vehicles require an agency to self-certify a functional need or alternative measures for exemptions. Tables 3 and 4 summarize the vehicles that may be suitable replacements and are certified replacements through GSA. Note that the "CD/CS" column provides the EPA fuel economy values for CD and CS modes. The fuel economy of CD mode is provided in units of miles-per-gallon-of-gasoline-equivalent (MPGe). This metric allows for electricity consumption during CD mode to be compared with fuel consumption during CS mode (or against conventional vehicles). The Nissan Leaf and Mitsubishi i-MiEV are not included in the alternative fuel guide for 2014, but they have appeared in previous guides.

Replacement is dependent on vehicle configuration characteristics and vehicle mission. Further evaluation related to vehicle purpose, mission, and need should be completed.

OEMs provide information related to a vehicle's range in CD mode and EPA provides test results. However, actual results may vary depending on several factors other than travel, including changes in the

[7] http://www.fueleconomy.gov/feg/phevtech.shtml [accessed March 12, 2015].

[8] http://www.gsa.gov/portal/content/104211 [accessed March 12, 2015].

battery's capacity over time, area topography, weather conditions (e.g., cabin cooling/heating), and payload, that may also deplete a vehicle's battery. This report will identify a BEV's "safe range" as 70 miles because this is typically less than the advertised range of most BEV OEMs; a PHEV's safe range is 40 miles in CD mode.

Tables 5 through 8 provide summaries of PHEVs and BEVs either currently available or near commercialization in both passenger cars and pickup trucks, but do not appear on the GSA 'certified' vehicle list. These vehicles may qualify for use by the agency through demonstrating a functional need.

Table 3. GSA-certified PHEVs for 2014.

Make/Model	GSA Class	Type	CD/CS	GSA Incremental Price
Chevrolet Volt	Sedan, Subcompact	PHEV	98 MPGe/37 mpg	$17,087.18
Ford C-MAX Energi	Sedan, Subcompact	PHEV	88/38 mpg	$14,899.52
Ford Fusion Energi	Sedan, Compact	PHEV	88/38 mpg	$19,289.99

Table 4. GSA-certified BEVs.

Make/Model	GSA Class	Type	City/Highway	GSA Incremental Price
Ford Focus Electric	Sedan, Subcompact	BEV	110/99 MPGe	$16,573.09

Note that EPA differs in vehicle class. EPA identifies the Volt as a compact, the C-MAX Energi as a midsize, the Fusion Energi as a midsize, and the Focus as a compact.[9]

Table 5. OEM PHEV cars and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Chevrolet	Compact	Volt	2011
Ford	Midsize	C-MAX Energi	2013
Ford	Midsize	Fusion Energi	2013
Toyota	Midsize	Prius PHEV	2012
Honda	Midsize	Accord PHEV	2014
BMW	Subcompact	i3 REx	2014
BMW	Subcompact	i8	2014
Audi	Compact	A3 eTron PHEV	2015 (estimate)
Volvo	SUV	V60 Plug-in	2016 (estimate)

Table 6. OEM BEV cars and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Nissan	Midsize	Leaf	2011
Ford	Compact	Focus Electric	2012
Tesla	Large	Model S	2012
Fiat	Mini	500e	2013
Honda	Small Station Wagon	Fit EV	2013

[9] http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=34130 [accessed March 12, 2015].

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
BMW	Subcompact	i3	2014
Chevrolet	Subcompact	Spark EV	2014
smart	Two Seater	ED	2014
Kia	Small Station Wagon	Soul EV	2014
Volkswagen	Compact	Golf e-Golf	2015
Mercedes-Benz	Midsize	B-Class ED	2015 (estimate)
Volvo	Compact	C30 Electric	2016 (estimate)

Table 7. OEM PHEV trucks, vans, and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Via	Standard Pickup Truck	VTRUX VR300	2013
Via	Special Purpose Vehicle	VTRUX Cargo Van	2013
Via	Vans, Cargo Type	VTRUX Pass Van	2013
Mitsubishi	Small SUV	Outlander PHEV	2015 (estimate)
Land Rover	Standard SUV	C30 Electric	2016 (estimate)

Table 8. OEM BEV trucks, vans, and availability.

Make	EPA Class	Model	Model Year/Estimated Year for Commercialization
Toyota	SUV	RAV4 EV	2013 (California only – nationwide release date unknown)
Tesla	Standard SUV	Model X	2015 (estimate)
Land Rover	Standard SUV	C30 Electric	2016 (estimate)

As further indication of the expanding market for PEVs, companies are offering after-market vehicle upgrades involving the addition of plug-in capabilities to OEM vehicles. For example, Echo Automotive headquartered in Scottsdale, Arizona offers a "…low-cost, bolt-on, plug-in hybrid system that can quickly be installed on new or existing fleet vehicles to increase fuel efficiency and decrease operating costs – all without affecting the OEM power train or requiring costly infrastructure."[10] EVAOS conducts conversions of Ford F-series pickup trucks to PHEV models and has delivered vehicles to the U.S. Air Force.[11] Options such as this company's conversions might be of benefit to the passenger vans identified in the NASWI fleet, but for which no replacement PEV is currently available.

3.5 Plug-In Electric Vehicle Charging

Refueling electric vehicles presents some challenges and some opportunities not encountered when refueling petroleum-fueled vehicles. Recharging the battery of a PHEV follows the same methodology as that for BEVs. This section provides basic information on recharging PEVs.

[10] http://www.echoautomotive.com/index.php?option=com_content&view=article&id=8 [accessed March 12, 2015].

[11] http://www.evaos.com [accessed March 12, 2015].

3.5.1 Electric Vehicle Supply Equipment Design

3.5.1.1 Charging Components. Electric vehicle supply equipment (EVSE) stations deliver electric power from the utility to the applicable charge port on the vehicle. Figure 10 illustrates the primary components of a typical alternating current (AC) Level 2 EVSE.

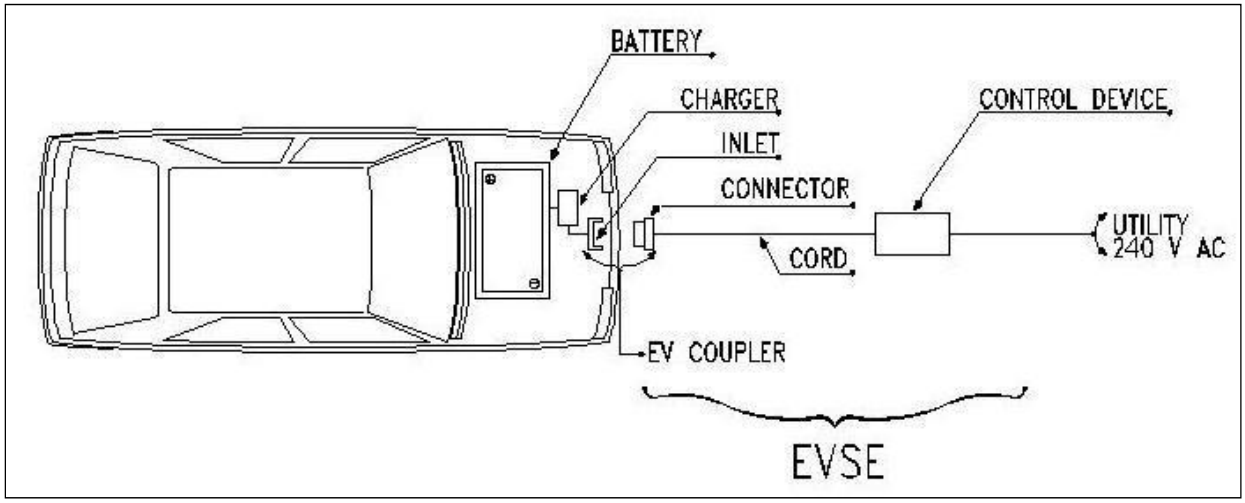


Figure 10. AC Level 2 charging diagram.[12]

The electric utility delivers AC current to the charging location. The conversion from AC to the direct current (DC) electricity necessary for battery charging can occur either on or off board the vehicle. Section 3.5.1.2 provides further explanation of the different EVSE configurations. For onboard conversion, AC current flows through the PEV inlet to the onboard charger. The charger converts AC to the DC current required to charge the battery. A connector attached to the EVSE inserts into a PEV inlet to establish an electrical connection to the PEV for charging and information/data exchange. Off-board conversion, also known as DC charging, proceeds in a similar manner except that the AC to DC conversion occurs in a charger that is off board the vehicle and, thus, bypasses any onboard charger. For both AC and DC charging, the PEV's battery management system onboard the vehicle controls the battery rate of charge, among other functions. All current PEVs have an onboard charger; some BEVs (but no PHEVs currently) accommodate DC charging.

3.5.1.2 Charging Configurations and Ratings. The Society of Automotive Engineers standardized the requirements, configurations, and equipment followed by most PEV suppliers in the United States in the J1772 Standard. Figure 11 summarizes these attributes and the estimated recharge times. Actual recharge times depend on the onboard equipment, including the charger, battery, and battery management system.

Most PEV manufacturers supply an AC Level 1 cordset with the vehicle, which provides sufficient capabilities for some drivers, but more typically provides an emergency backup capability because of the long recharge times. AC recharging capabilities found in the public arena more typically are AC Level 2. Figure 12 depicts a typical J1772-compliant inlet and connector for both AC Levels 1 and 2.

The J1772 standard also identifies requirements for DC charging. For PEVs that accept both AC and DC inputs, the Society of Automotive Engineers approved a single connector and inlet design. Figure 13 shows this connector, which is colloquially known as the J1772 "combo connector."

[12] http://avt.inl.gov/pdf/EVProj/EVChrgInfraDeployGuidelinesPhoenixVer3.2.pdf [accessed March 12, 2015].

SAE International

SAE Charging Configurations and Ratings Terminology

AC level 1 (SAE J1772™)	PEV includes on-board charger	*DC Level 1	EVSE includes an off-board charger
	120V, 1.4 kW @ 12 amp 120V, 1.9 kW @ 16 amp		200-450 V DC, up to 36 kW (80 A)
	Est. charge time:		Est. charge time (20 kW off-board charger):
	PHEV: 7hrs (SOC* - 0% to full)		PHEV: 22 min. (SOC* - 0% to 80%)
	BEV: 17hrs (SOC – 20% to full)		BEV: 1.2 hrs. (SOC – 20% to 100%)
AC level 2 (SAE J1772™)	PEV includes on-board charger (see below for different types)	*DC Level 2	EVSE includes an off-board charger
	240 V, up to 19.2 kW (80 A)		200-450 V DC, up to 90 kW (200 A)
	Est. charge time for 3.3 kW on-board charger		Est. charge time (45 kW off-board charger):
	PEV: 3 hrs (SOC* - 0% to full)		PHEV: 10 min. (SOC* - 0% to 80%)
	BEV: 7 hrs (SOC – 20% to full)		BEV: 20 min. (SOC – 20% to 80%)
	Est. charge time for 7 kW on-board charger		
	PEV: 1.5 hrs (SOC* - 0% to full)	*DC Level 3 (TBD)	EVSE includes an off-board charger
	BEV: 3.5 hrs (SOC – 20% to full)		200-600V DC (proposed) up to 240 kW (400 A)
	Est. charge time for 20 kW on-board charger		Est. charge time (45 kW off-board charger):
	PEV: 22 min. (SOC* - 0% to full)		BEV (only): <10 min. (SOC* - 0% to 80%)
	BEV: 1.2 hrs (SOC – 20% to full)		
*AC Level 3 (TBD)	> 20 kW, single phase and 3 phase		

*Not finalized
Voltages are nominal configuration voltages, not coupler ratings
Rated Power is at nominal configuration operating voltage and coupler rated current
Ideal charge times assume 90% efficient chargers, 150W to 12V loads and no balancing of Traction Battery Pack

Notes:
1) BEV (25 kWh usable pack size) charging always starts at 20% SOC, faster than a 1C rate (total capacity charged in one hour) will also stop at 80% SOC instead of 100%
2) PHEV can start from 0% SOC since the hybrid mode is available.

Developed by the SAE Hybrid Committee ver. 031611

Figure 11. Society of Automotive Engineers charging configurations and ratings terminology.[13]

Figure 12. J1772 connector and inlet.[14]

[13] http://www.sae.org/smartgrid/chargingspeeds.pdf [accessed March 12, 2015].

[14] http://carstations.com/types/j09 [accessed March 12, 2015].

Figure 13. J1772-compliant combo connector.[15]

Some PEVs delivered in the United States prior to the approval of the J1772 standard for DC charging employed the CHAdeMO standard for connector and inlet design. Figure 14 shows this connector. EVSE units that are either J1772-compliant or CHAdeMO-compliant are both known as DC fast chargers (DCFCs).

Figure 14. CHAdeMO-compliant connector.[16]

The presence of the two separate standards for DC charging presents challenges for vehicle owners to ensure that the EVSE accessed provides the appropriate connector for their vehicle inlet. Not all PEV suppliers include DC charging options. BEV suppliers more typically provide DC inlets than PHEV suppliers do, because the rapid recharging provides opportunities for expanded vehicle range with minimal operator wait times. PHEV operators can rely on the gasoline drive in the event they deplete the vehicle's battery; at present, no PHEV on the market or near commercialization has DC charging capability (although the Mitsubishi Outlander PHEV is rumored to be offering DC charging capability as an option). It is noted that DC Level 1 and DC Level 2 charging are commonly combined and labeled DCFC.

Because the battery of a BEV is typically much larger than that of a PHEV, recharge times are longer (see Figure 11). BEVs that see daily mileage near the limits of the advertised range do better when recharged using AC Level 2 EVSE or DCFC, because AC Level 1 recharge times are usually extensive. PHEVs, on the other hand, generally can use AC Level 1 EVSE for overnight charging to ensure a fully charged battery at the start of daily use. AC Level 2 EVSE units provide greater range in the shortest

[15] http://www.zemotoring.com/news/2012/10/sae-standardizes-j1772-fast-dc-charging-up-to-100-kw [accessed March 12, 2015].

[16] https://radio.azpm.org/p/azspot/2012/5/10/1632-electric-cars/ [accessed March 12, 2015].

amount of time when intermediate or opportunity charging. DCFC provides the fastest recharge capability for those vehicles equipped with DCFC inlets.

3.5.2 Electric Vehicle Supply Equipment Stations

AC Level 2 charging is the predominant rating of publicly accessible EVSE because of its wide acceptance by auto manufacturers and faster recharge times than AC Level 1. Purchase and installation costs are more manageable than DCFCs and less space is required. There are several manufacturers of AC Level 2 equipment and the agency should review brands for comparison purposes. Figure 15 provides an example of a public AC Level 2 EVSE unit.[17]

Figure 15. Public AC Level 2 unit.

DCFCs also are available from several manufacturers. Figure 16 illustrates one such charger.18 This particular unit uses the CHAdeMO connector standard.

In general, installation costs are higher for DCFC because of the higher voltage requirements and the inclusion of the AC to DC converter and other safety and design features. Costs for both types are highly dependent on site characteristics such as distance to the nearest power source, asphalt or concrete cutting and repair, conduit requirements, and payment systems, if any.

Payment and equipment control systems included by some suppliers provide the potential for use by privately owned vehicles for a fee, but allow agency fleet vehicle use without direct payment. These systems allow for accurate record keeping of vehicle charging requirements.

[17] http://www.chargepoint.com/files/73-001061-01-2_BR-CT4000-01.pdf [accessed March 7, 2015].

[18] http://evsolutions.avinc.com/products/public_charging/public_charging_b [accessed March 7, 2015].

Figure 16. Public DCFC unit.

4. NAVAL AIR STATION WHIDBEY ISLAND ANALYSIS

Sixty vehicles belonging to the Commands and Departments groups were included in the study at NASWI. Analysis by user is conducted first and is followed by aggregating across all users and vehicles. The Commands and Departments groups use the fleet vehicles for a variety of purposes. The Commands group includes Electronic Attack Wing Pacific, Patrol and Reconnaissance Wing, Fleet Logistics Support, Explosive Ordnance Disposal Detachment Northwest, Fleet Readiness Center Northwest, and others. The Departments group includes air operations support, security, housing, public works, and others.

4.1 Analysis Results – Commands

This section summarizes and aggregates data collection for the Commands group. The details of each vehicle monitored are included in Appendix B. Appendix D presents the full detailed analysis for the vehicles monitored and for the Commands fleet as a whole.

The Commands group manages 69 of the fleet vehicles, with 18 of those vehicles included with the monitored vehicles in this study. Table 9 provides a summary of all vehicles in this fleet by mission type and vehicle type. The 18 monitored vehicles serve only the support mission category and consist of four sedans, six minivans, one SUV, one cargo van, one passenger van, and five pickup trucks.

Table 9. Commands total fleet summary.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	Mini-Van	SUV	Cargo Van	Pass. Van	Pickup Truck	Total
Support	1	5	1	7	2	18	5	17	56
Transport						13			13
Total	1	5	1	7	2	31	5	17	69

4.1.1 Commands Support Vehicles Evaluation

Grouping the vehicles by mission creates an aggregated view of mission requirements to provide observations related to PEV replacement. All vehicles assigned to the Commands group are support vehicles.

Support vehicles provide a specific work function, facilitating the mission of a particular group. The vehicles are generally passenger or light-duty pickup trucks or vans and may contain after-market modifications to support the mission. Incorporation of BEVs and/or PHEVs into the support mission is a definite possibility. Support vehicles used for shorter trips or outings qualify for BEV or PHEV replacement, while other support vehicle activities that are associated with longer trips may require PHEV capabilities.

Appendix B provides the vehicle data sheets for each of the support vehicles monitored. Table 10 summarizes support travel during the study period for those days in which the vehicle was driven. The vehicles monitored traveled 9,831miles, logged 505 hours, and idled for 99 hours during the 47-day study period.

Table 10. Command support vehicles travel summary.

Support Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	26.4/379.7	17.5/713.2	5.0/228.1	9,831
Travel Time (Minutes)	74.6/458.0	38.0/1,043.0	455.5/264.0	30,308
Idle Time (Minutes)	13.3/NA	5.4/NA	1.7/NA	5,964

Figure 17 shows the travel history for the Commands group vehicles. Vehicles were not used every day, but were used frequent enough to suggest retention of all vehicles. Figure 18 shows the typical day-shift operation.

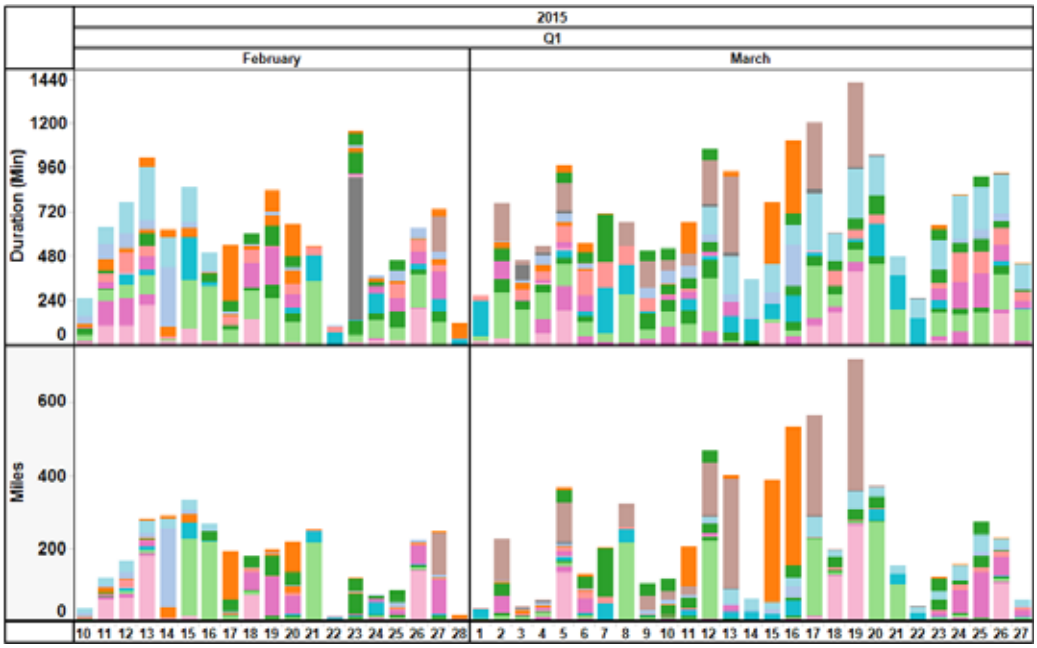


Figure 17. Commands group support vehicles history.

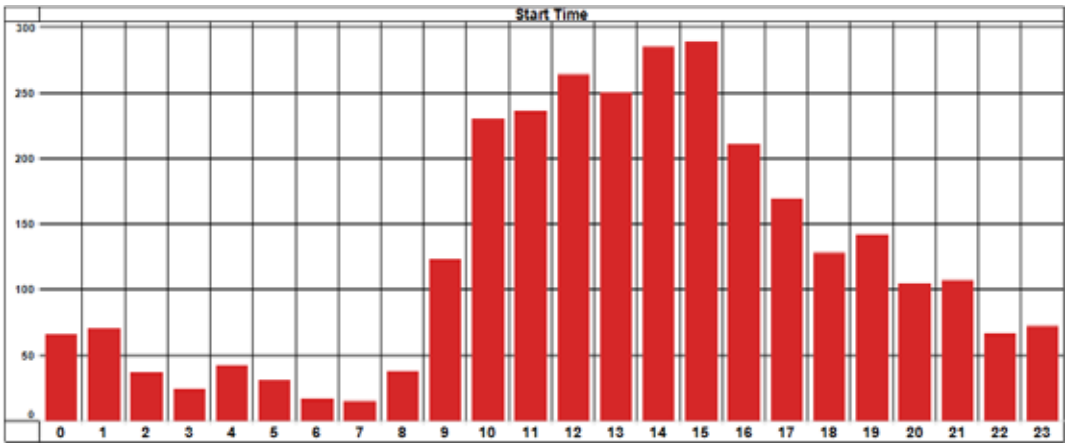


Figure 18. Commands group daily use profile.

The distance a PEV can travel in CD mode between charge opportunities is the most important factor in considering vehicle replacement. The two most significant factors in vehicle analysis include the vehicle daily travel and vehicle outings. Section 2.3 provides the definitions of these terms. In both graphs of daily travel and outings, the distance axis was divided into 10-mile segments, with green bars indicating all travel less than 40 miles. Forty miles is a typical PHEV range in CD mode. The blue bars indicate travel between 40 and 70 miles. Seventy miles is considered to be within the BEV safe range (blue and green bars). While BEV range can vary based on several factors, most BEVs provide at least 70 miles of vehicle range on a single battery charge. All travel greater than 70 miles is shown by the gray bars and indicate travel beyond the capability of a BEV. Figure 19 shows the daily travel summary for the monitored vehicles. For example, the figure shows that 60% of daily travel was less than 10 miles per day.

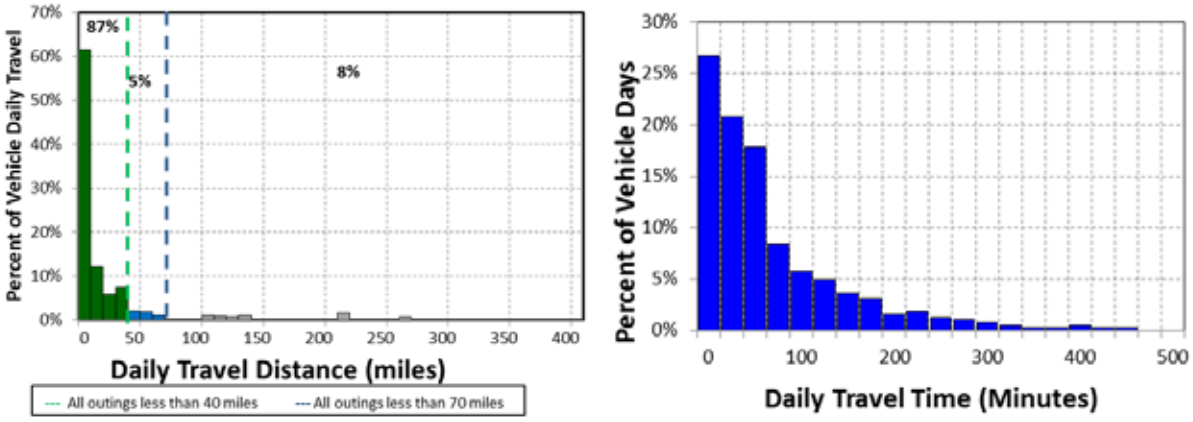


Figure 19. Command group support vehicle daily travel miles and time (all vehicles).

The average travel distance per day when driven for support vehicles was 26.4 miles. On 92% of these vehicle days, the daily travel was less than 70 miles and within the BEV safe range. Meanwhile, only 8% of support daily travel was greater than 70 miles, with 87% of vehicle travel days less than 40 miles. A very basic look might suggest that considering only daily travel, a fleet consisting of 92% BEVs and 8% PHEVs would meet vehicle travel needs. However, other considerations will apply.

Figure 20 shows the outings for all vehicles (two outings of 713 and 601 miles were not shown for clarity). The figure notes that more than 90% of all vehicle outings travel was less than 10 miles.

The average travel outing when driven for support vehicles was 17.5 miles. On 98% of these vehicle outings, the distance traveled was less than the 70 miles and considered to be within the BEV safe range. Meanwhile, only 2% of support outing travel was greater than 70 miles, with 98% of vehicle travel outings less than the 40 miles considered to be within the CD range of a PHEV.

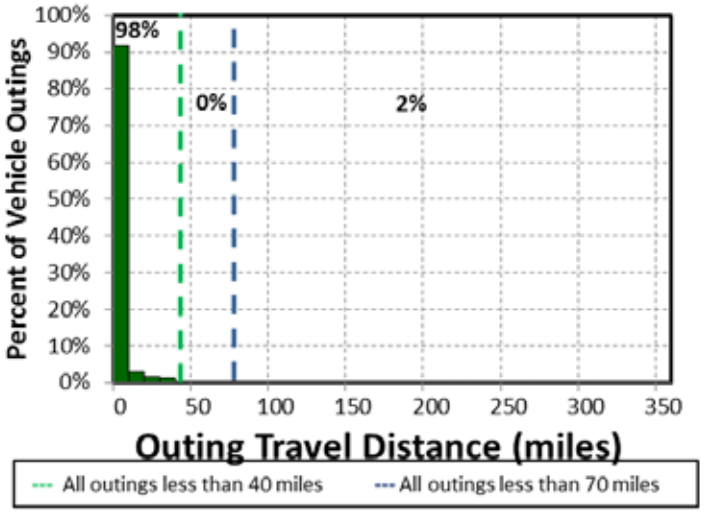


Figure 20. Command support vehicle combined outings.

4.1.1.1 Command Support Vehicle Observations/Summary.

In summary, the vast majority of daily travel and outings were short and well within the capabilities of BEVs. This is consistent with the optimum goal to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHGs. A conservative approach to vehicle usage suggests that 11 BEVs with seven PHEVs would meet the needs of the support vehicles.

Considering a full complement of 56 support vehicles in the Commands fleet, Intertek suggests that a mixed fleet may be possible. These remaining vehicles were not monitored, but using the data collected for the 18 that were, Intertek suggests that a fleet of 34 BEVs and 22 PHEVs would conservatively meet vehicle travel requirements.

4.1.1.2 Commands Support Vehicle Charging Needs.

As noted previously, AC Level 2 (240-VAC) overnight charging of BEVs is typical, whereas overnight charging of PHEVs can usually be accomplished with AC Level 1 (110-VAC) charging. Intertek's experience suggests that each vehicle should have an assigned charging location at its home base. Assigned stations require less management attention to ensure completion of overnight charging. BEVs and PHEVs not assigned to these locations also benefit during visits to the location as part of their normal operation. For the entire fleet of support vehicles, 34 BEVs require 34 AC Level 2 EVSE units for overnight charging and 22 PHEV requires 22 AC Level 1 outlets for home base charging. Intertek recommends a minimum of two EVSE at each location to maximize charge capability without a significant increase in installation costs. The PHEVs can use the AC Level 2 EVSE at the home base during the day to increase the amount of vehicle miles traveled in CD mode.

At times, fleet vehicles obtain benefit from using public charging infrastructure. Figure 21 displays the availability of public charging at the time of this writing for the NASWI area. The identified sites are AC sites, indicating AC Level 1 and Level 2 public locations.

Significant development in public charging infrastructure in the NASWI area is due to great public interest in PEV adoption and earlier emphasis on infrastructure through DOE-granted programs and EVSE supplier interests. Data show that most daily travel can be accomplished without the need for

additional charging throughout the day. However, PHEVs that may travel longer distances can increase the benefits of travel in CD mode if additional charge opportunities at public charging sites are accomplished.

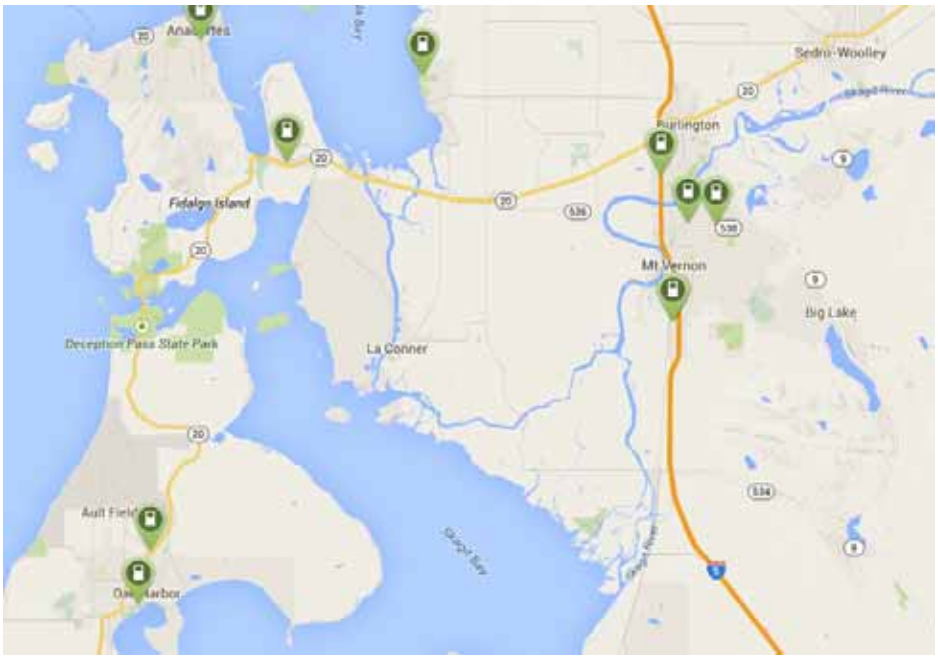


Figure 21. Public EVSE in NASWI region.[19]

4.1.2 Commands Transport Fleet

Table 9 identifies 13 cargo vans in the Commands fleet with the transport mission. One cargo van with a support mission was monitored in this study and all of its daily travel and outings were less than 40 miles, suggesting that all cargo vans could be replaced with BEV. However, a more conservative approach would be to use the same ratio used above, resulting in eight BEVs and five PHEVS.

4.1.3 Commands Fleet Vehicles Mileage

The vehicle's annual miles factored into the calculations for replacement of vehicles as noted in Section 5 and Appendix D. NASWI provided vehicle information that identified the average monthly miles and vehicle mileage.

For the entire Commands fleet, the actual miles would project approximately 4,800 miles per year, whereas the provided information would suggest 7,700 miles. In either case, this reflects positively on the use of BEVs in the fleet.

4.1.4 Commands Group Vehicle Utilization

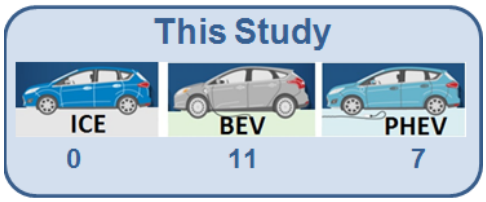
Vehicle utilization is an important factor in the evaluation of vehicles from an inventory perspective and for charging availability. During the study period, the average daily use for the total Commands fleet was 45% or 21 days of the 47-day study.

The average daily usage of each was 1.1 hours. In general, the vehicles were used on frequent days, but average usage per day was quite low.

[19] http://www.plugshare.com/ [accessed February 10, 2015].

4.1.5 Commands Fleet Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified within the Commands group. The study indicates that PEVs offer alternatives to vehicles in the existing fleet, provided any specific cargo requirements are met by the PEV. In general, a mixed fleet of BEVs and PHEVs is suggested.



The fleet of support vehicles in this study included four sedans, six minivans, one SUV, one cargo van, one passenger van, and five pickup trucks. Section 3.4 provides information on PEVs currently or soon to be available in the automotive market. Without consideration of specific cargo requirements, replacement PEVs currently exist for all of these vehicles. Based on these travel data, Intertek suggests that replacing these 18 vehicles with 11 BEVs and seven PHEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix D provides specific recommendations.

The vehicles studied were utilized on 45% of the study days and averaged 1.2 hours of use per day. While daily usage was quite low, the vehicles were used often enough that eliminating a vehicle is not recommended.

Considering a full complement of 69 support vehicles in the Commands fleet, Intertek suggests that a mixed fleet may be possible. Based on the data collected for the monitored vehicles, Intertek suggests a fleet of 42 BEVs and 27 PHEVs conservatively meets vehicle travel requirements.

With potential replacement by PEVs established, Section 5 provides further evaluation of the benefits of such replacements. This will be factored into further observations and suggestions related to the business case and schedule for any replacements for the Commands fleet. Those observations will be addressed in Task 4 of this project.

4.2 Analysis Results – Departments Fleet

The Departments fleet contains 106 vehicles. Table 11 identifies these vehicles by vehicle type according to site records. The mission assignments identified in Table 11 are based on agency records and general assumptions. Forty-two vehicles were monitored as part of this study, including 15 sedans, three minivans, two SUVS, one cargo van, eight passenger vans, and 13 pickup trucks. This section summarizes and aggregates data collection for the Departments fleet. The details of each vehicle monitored are included in Appendix C. Appendix E presents the full detailed analysis for the vehicles monitored and for the group as a whole.

Table 11. Departments total fleet characterization.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	Mini-van	SUV	Cargo Van	Pass. Van	Pickup Truck	Total
Pool	1	7	—	2	1	1	6	2	20
Support	3	6	1	2	—	18	7	23	60
Enforcement	—	2	8	—	10	3	1	1	25
Transport	—	—	—	—	—	1	—	—	1
Total	4	15	9	4	11	23	14	26	106

Grouping the vehicles by mission creates an aggregated view of mission requirements to provide observations related to PEV replacement. Analysis by mission type is provided in the following subsections.

4.2.1 Departments Group Pool Vehicles Analysis

Pool vehicles typically are light-duty motor vehicles for use in passenger transportation, with not more than 10 passengers. Pool missions can vary by agency, location, and jurisdiction. For the Departments group, the pool vehicles include four pickups, two passenger vans, and two minivans. Although currently there are no PEVs available to replace passenger vans, it is assumed that usage of these pool vehicles can be of value in considering the remaining pool vehicles in the Departments fleet. Pickups and minivans may be replaced by currently available PEVs.

Incorporation of BEVs and/or PHEVs into the pool mission is a definite possibility. Pool vehicles used for shorter trips or outings qualify for BEV or PHEV replacement, while other pool vehicle activities that are associated with longer trips may require PHEV capabilities.

4.2.1.1 Summary for Departments Group Pool Vehicles. Appendix C provides the vehicle data sheets for each of the nine pool vehicles monitored. This section aggregates data for all pool vehicles. Table 12 summarizes pool vehicle travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0700 and 1500 hours daily and they traveled 9,525 miles, logged 247 hours, and idled for 21 hours during the 47-day study period.

Table 12. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	80.8/396.6	92.5/1,008.4	16.8/162.1	9,525
Travel Time (Minutes)	125.4/486.0	143.7/1,202.0	26.2/237.0	14,802
Idle Time (Minutes)	10.6/NA	12.2/NA	2.2/NA	1,255

Figure 22 shows the travel history for the Departments group vehicles. Figure 23 shows the mostly typical day-shift operation.

The distance a PEV can travel in CD mode between charge opportunities is the most important factor in considering vehicle replacement. The two most significant factors in vehicle analysis include vehicle daily travel and vehicle outings. Section 2.3 provides the definitions of these terms. Figure 24 shows the travel summary for all monitored pool vehicles.

The average travel distance per day when driven for pool vehicles was 80.8 miles. On 51% of the vehicle travel days, the daily travel was less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure 24). Meanwhile, 48% of vehicle travel days were less than the 40 miles considered to be within the CD range of a PHEV (green bars of Figure 24).

The pool vehicles were used, on average, 28% of the study days. However, there were periods where each vehicle operated several days in a row and days that several vehicles were in use. Figure 25 shows the outings for all vehicles. It does not include outings of 559 and 1,008 miles for clarity of scale.

Appendix E provides the details of each of the pool vehicle's outings. The average travel outing when driven for pool vehicles was 92.5 miles, with 54% of the outings being less than the 70 miles considered to be within the BEV safe range. Furthermore, 53% of pool outings were less than the 40 miles considered to be within the CD mode range of a PHEV.

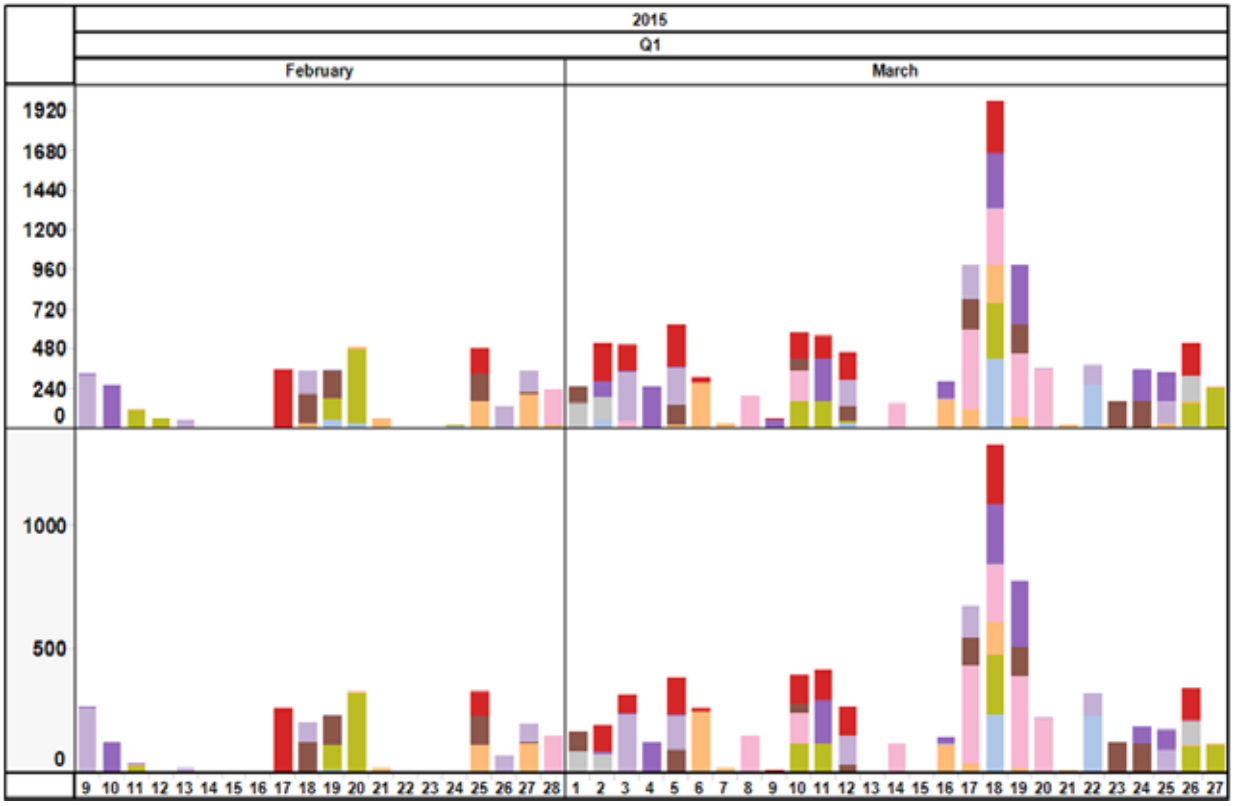


Figure 22. Departments group support vehicles history.

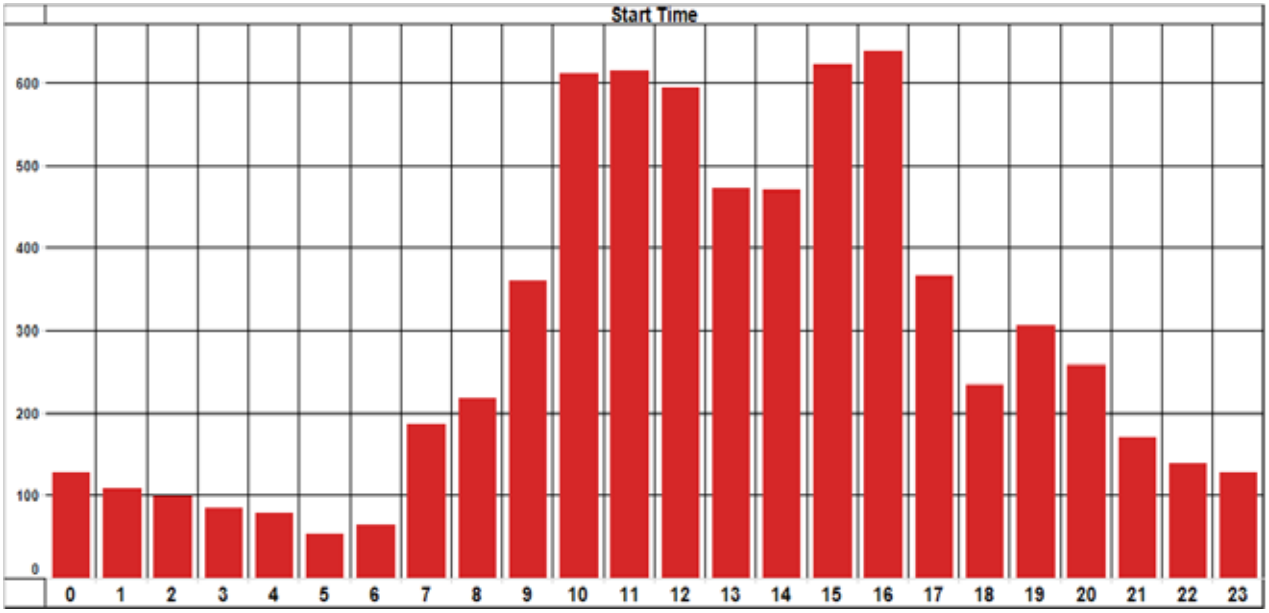


Figure 23. Departments group daily use profile.

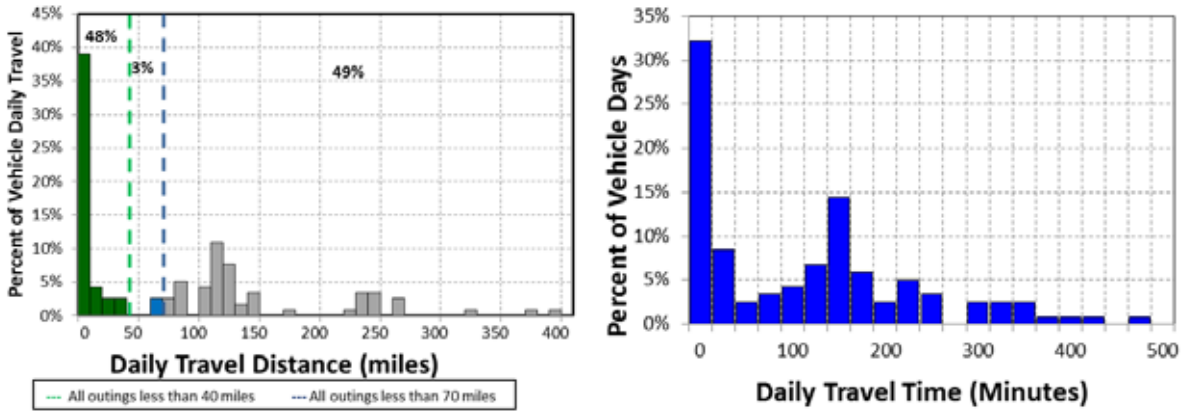


Figure 24. Pool vehicle daily travel miles and time (all vehicles).

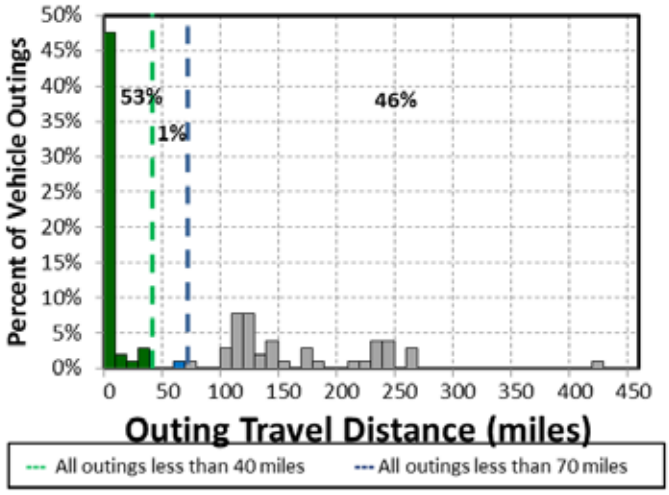


Figure 25. Pool vehicle combined outings.

4.2.1.2 Pool Vehicle Observations/Summary. Approximately half of the daily travel and outings were within the capabilities of BEVs. However, reviewing the individual vehicle data sheets identifies that all but one typically exceeded the BEV range. Thus, a more conservative approach is required. PHEVs would provide benefits for the remaining pool vehicles.

The fleet of pool vehicles in this study included one pickup truck, one minivan, six sedans, and one passenger van. Vehicles in the pool fleet have replacements types available and Intertek would suggest that one suitably styled BEV and eight PHEVs could meet mission requirements. Section 3.4 provides information on PEVs currently or soon to be available in the automotive market and Section 5 provides details on the suggestions.

Considering a full complement of 20 pool vehicles in the entire Departments group fleet, Intertek suggests that in extrapolating the collected data to the entire fleet, a mixed fleet of two BEVs and 18 PHEVs is possible.

The vehicle summary shows sufficient time for charging at the base location during the course of the day and additional opportunities at intermediate charging stations. These stations also provide charging opportunities for the visiting public, whose fees may assist in offsetting operating costs.

4.2.1.3 Pool Vehicle Charging Needs. Upon review of these data, Intertek suggests replacement of the Departments pool fleet with two BEVs and 18 PHEVs.

As noted previously, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can be accomplished with AC Level 1 charging.

Intertek's experience suggests that each vehicle have an assigned charging location at their home base. Assigned stations require less management attention to ensure completion of overnight charging. BEVs and PHEVs not assigned to these locations also benefit during visits to the location as part of their normal operation. Intertek recommends a minimum of two EVSE at each location to maximize charge capability without a significant increase in installation costs. The PHEVs can utilize the AC Level 2 EVSE at the home base during the day to increase the amount of vehicle miles traveled in CD mode.

At times, fleet vehicles obtain benefits from using public charging infrastructure. Figure 21 displays the availability of public charging for the NASWI area at the time of this writing. Because frequent travel was off base and to longer distances, there may be benefit in using public charging for PHEVs in the Departments group pool vehicles.

4.2.2 Departments Support Vehicles Analysis

Support vehicles provide a specific work function, facilitating the mission of a particular group. The vehicles are generally passenger or light-duty pickup trucks and may contain after-market modifications to support the mission. While assigned to maintenance and service areas, missions may vary depending on agency needs.

As shown above, Departments group support vehicles that were monitored included six sedans, 11 pickup trucks, two minivans, and seven passenger vans.

4.2.2.1 Summary for Departments Support Vehicles. Appendix C provides the vehicle data sheets for each of the 26 support vehicles monitored. This section aggregates the data for all support vehicles.

Table 13 summarizes support vehicle travel during the study period. The 26 support vehicles traveled 6,934 miles, logged 516 hours, and idled for 157 hours during the study period.

Table 13. Departments support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	11.0/212.1	19.4/1,008.4	2.1/102.7	6,934
Travel Time (Minutes)	49.0/338.0	19.4/338.0	9.2/192.0	30,971
Idle Time (Minutes)	14.9/NA	5.9/NA	2.8/NA	9,426

Figure 26 shows the travel history for the Departments group support vehicles. Figure 27 shows the mostly typical day-shift operation.

The distance a PEV can travel in CD mode between charge opportunities is the most important factor in considering vehicle replacement. The two most significant factors in vehicle analysis include the vehicle daily travel and vehicle outings. Section 2.3 provides the definitions of these terms. Figure 28 shows the travel summary for the support vehicles monitored.

The average travel distance per day when driven for support vehicles was 11 miles. On 97% of these vehicle days, the daily travel was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 3% percent of support vehicle daily travel was greater than 70 miles. Furthermore, 95% of vehicle travel days were less than the 40 miles considered to be within the CD mode range of a PHEV. Figure 29 shows the daily travel for all support vehicles combined.

Appendix C provides the details of each of the support vehicle's daily travel.

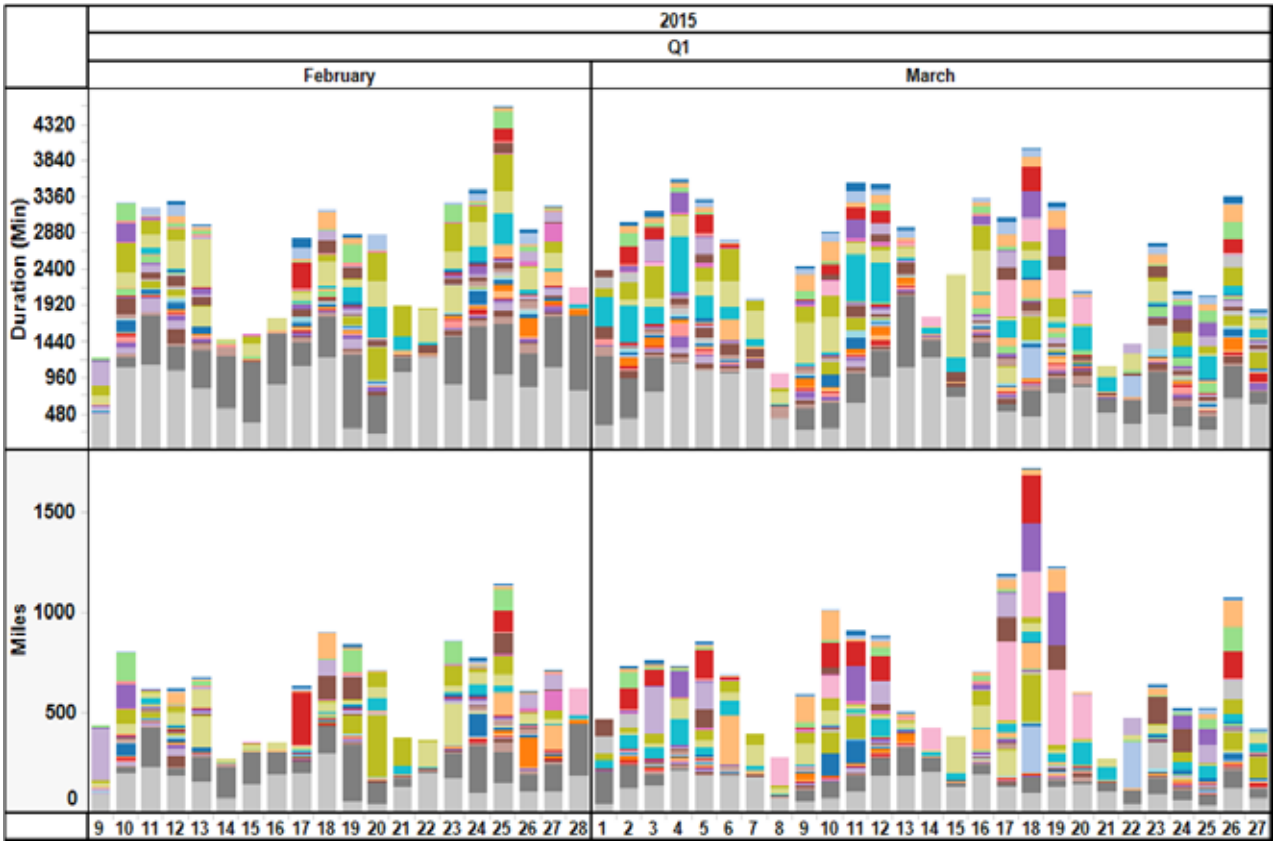


Figure 26. Departments group support vehicles history.

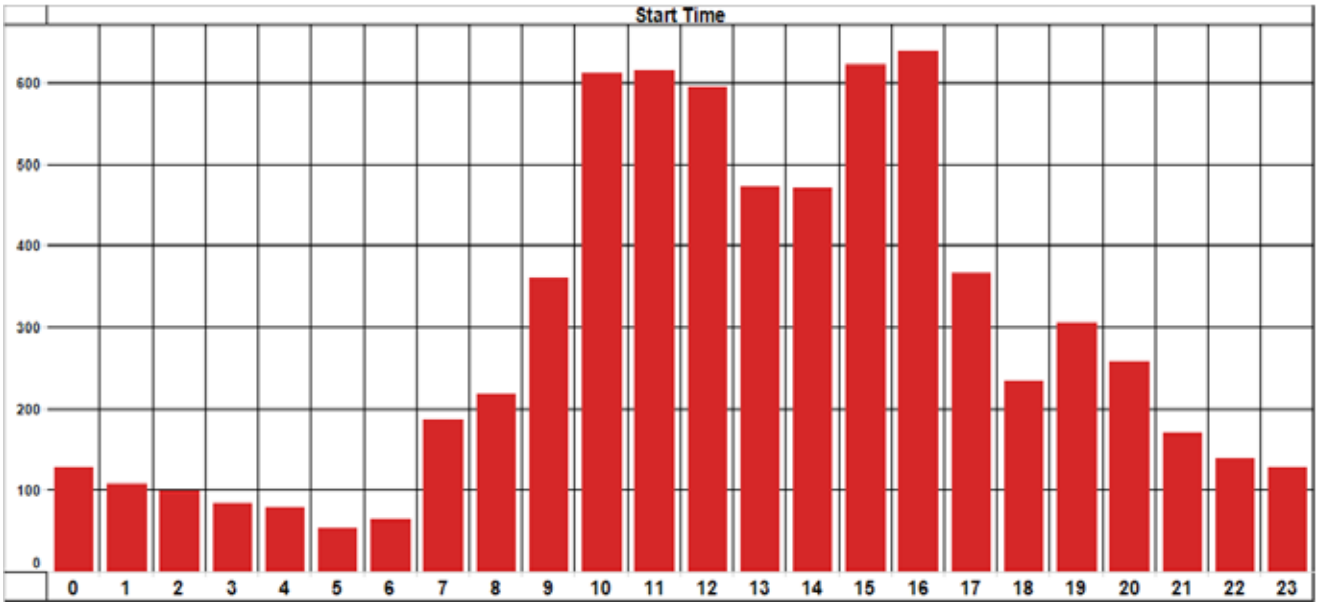


Figure 27. Departments group support vehicle daily use profile.

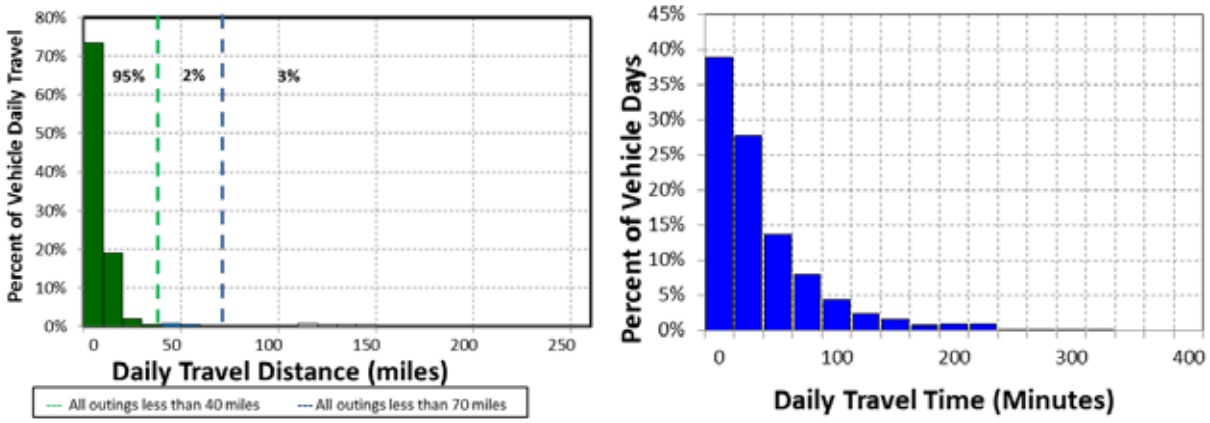


Figure 28. Departments group support vehicle daily travel miles and usage time (all vehicles).

The outings for all Department group support vehicles are shown in Figure 29.

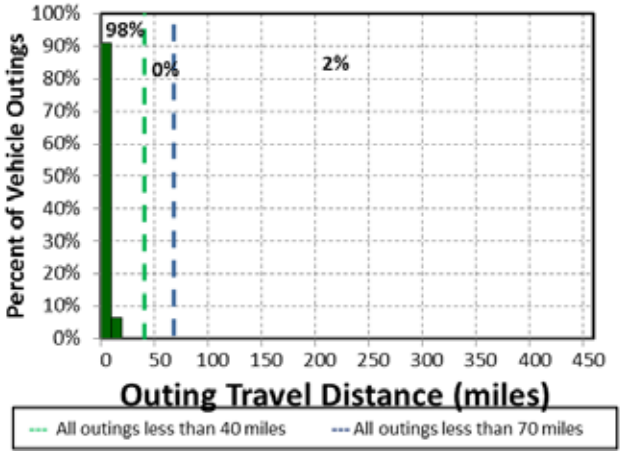


Figure 29. Support vehicle combined outings.

The average travel outing, when driven, for support vehicles was 19.4 miles. On 98% of these vehicle outings, the distance traveled was less than the 70 miles considered to be within the BEV safe range. Furthermore, 98% of vehicle travel outings were less than the 40 miles considered to be within the CD mode range of a PHEV.

4.2.2.2 Departments Support Vehicle Observations/Summary. The vast majority of daily travel and outings are short and well within the capabilities of BEVs. This is consistent with the optimum goal to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHGs.

The fleet of support vehicles in this study included six sedans, 11 pickup trucks, two minivans, and seven passenger vans. Figure 28 would suggest that 97% of the support vehicles could be BEVs, but this does not allow for more flexibility. Intertek would suggest 18 suitably styled BEVs and eight PHEVs could meet mission requirements. Section 3.4 provides information on PEVs currently or soon to be available in the automotive market and Section 5 provides details on the suggestions.

Considering a full complement of 60 support vehicles in the entire Departments group support fleet, Intertek suggests that in extrapolating the collected data to the entire fleet, a mixed fleet may of 42 BEVs and 18 PHEVs may be possible.

The vehicle summary shows sufficient time for charging at the base location during the course of the day and additional opportunities at intermediate charging stations. These stations also provide charging opportunities for the visiting public, whose fees may assist in offsetting operating costs.

4.2.2.3 Departments Support Vehicle Charging Needs.

As noted above, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can be accomplished with AC Level 1 charging. Opportunity charging at intermediate stops obtains greater benefits from AC Level 2 EVSE.

Greater management attention provides the possibility of reducing the overall number of AC Level 2 EVSE units. A ratio of two AC Level 2 charging stations to three vehicles typically sustains a normal fleet operation. Fleet managers rotate vehicles on the charger to complete charging of all vehicles in the allotted time. This analysis does assume a fully recharged battery at the start of each day. NASWI will gain experience in this management as the PEV fleet grows.

4.2.3 Departments Enforcement Vehicles Analysis

Enforcement vehicles are typically light-duty motor vehicles specifically approved in an agency's appropriation act for use in apprehension, surveillance, police, or other law enforcement work. Enforcement missions can vary by agency, location, and jurisdiction; however, they typically utilize sedans, minivans, vans, or small pickup trucks and typically do not carry specific cargo or equipment.

As shown above, Departments group enforcement vehicles that were monitored included three sedans, two SUVs, one pickup truck, and one cargo van.

4.2.3.1 Summary for Departments Enforcement Vehicles.

Appendix C provides the vehicle data sheets for each of the seven enforcement vehicles monitored. This section aggregates the data for all enforcement vehicles.

Table 14 summarizes enforcement vehicle travel during the study period. The seven enforcement vehicles traveled 15,219 miles, logged 1,322 hours, and idled for 526 hours during the study period.

Table 14. Enforcement vehicle travel summary.

Enforcement Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	60.2/294.5	16.5/232.5	4.9/86.7	15,219
Travel Time (Minutes)	313.5/1,232.0	86.0/1,072.0	25.5/555.0	79,315
Idle Time (Minutes)	124.8/NA	34.2/NA	10.2/NA	31,570

Figure 30 shows the travel history for enforcement vehicles. Figure 31 shows the daily all-day operation.

The distance a PEV can travel in CD mode between charge opportunities is the most important factor in considering vehicle replacement. The two most significant factors in vehicle analysis include the vehicle daily travel and vehicle outings. Section 2.3 provides the definitions of these terms. Figure 32 shows the travel summary for the enforcement vehicles monitored.

The average travel distance per day when driven for enforcement vehicles was 60.2 miles. On 70% of these vehicle days, the daily travel was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 30% percent of enforcement vehicle daily travel was greater than 70 miles. Furthermore, 48% of vehicle travel days were less than the 40 miles considered to be within the CD mode range of a PHEV. Appendix C provides the details of each of the enforcement vehicle's daily travel and outings. The

outings summary for the enforcement vehicles is shown in Figure 33**Error! Reference source not found.**.

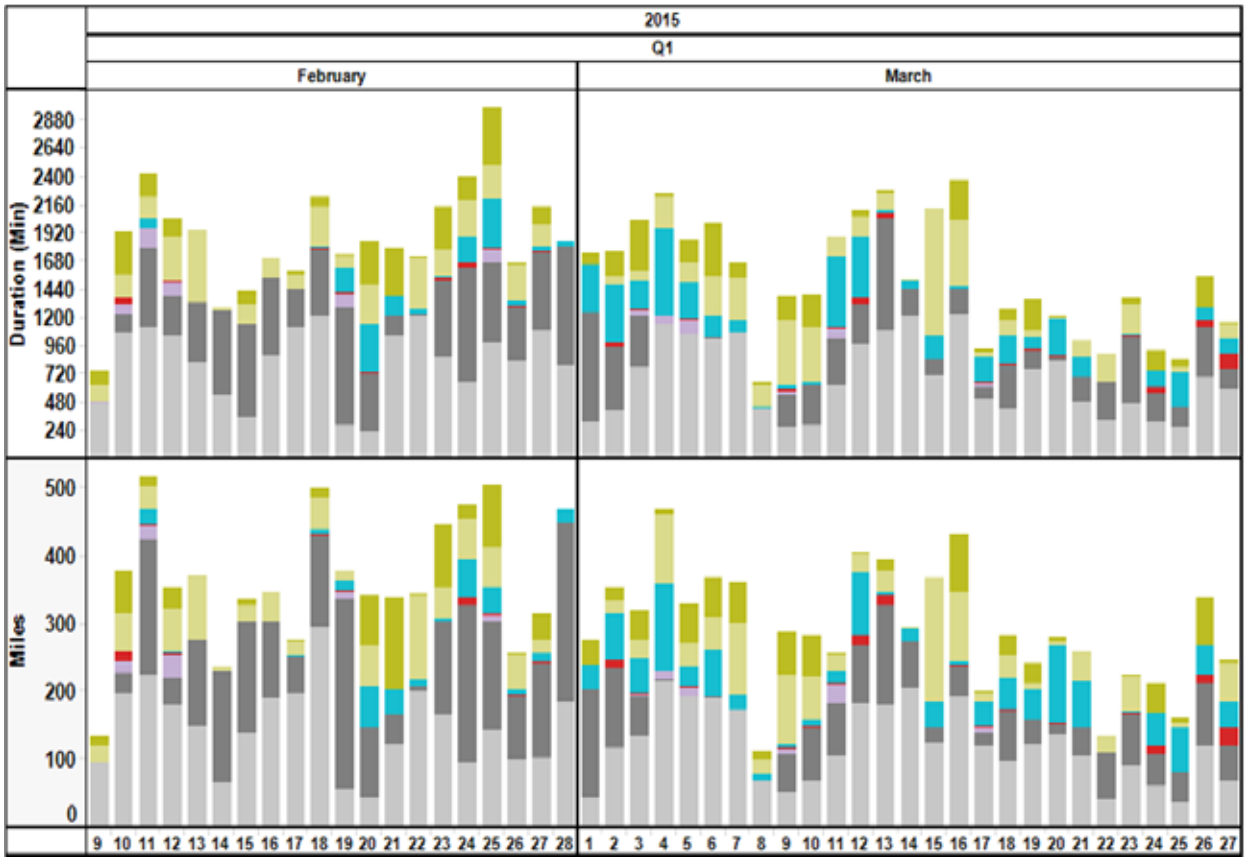


Figure 30. Departments group enforcement vehicles history.

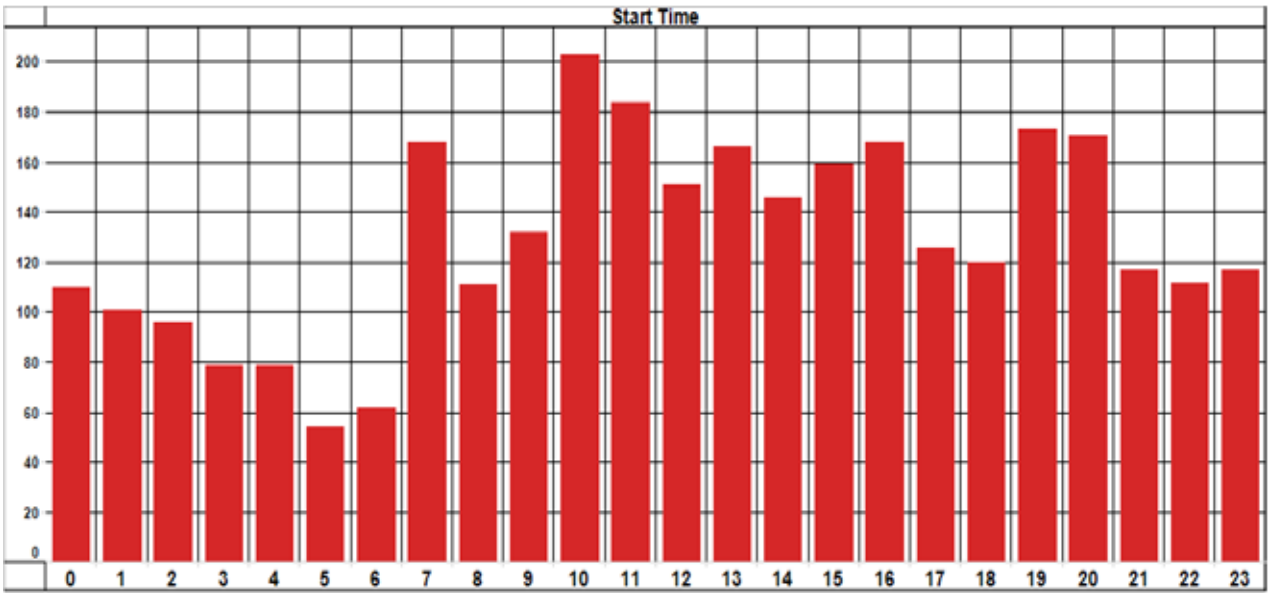


Figure 31. Departments group enforcement vehicles daily use profile.

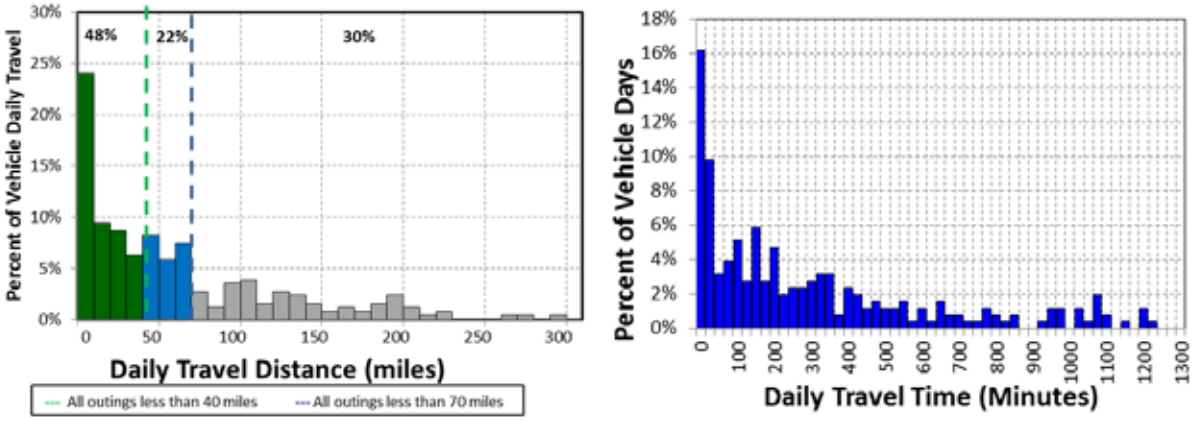


Figure 32. Enforcement vehicle daily travel miles and usage time (all vehicles).

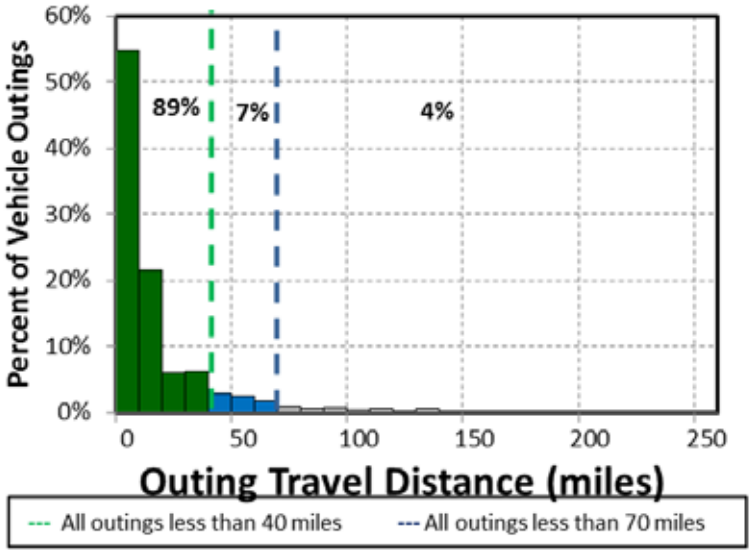


Figure 33. Enforcement vehicle combined outings.

The average travel outing when driven for enforcement vehicles was 16.5 miles. On 96% of these vehicle outings, the distance traveled was less than the 70 miles considered to be within the BEV safe range. Furthermore, 89% of vehicle travel outings were less than the 40 miles considered to be within the CD mode range of a PHEV.

4.2.3.2 Departments Enforcement Vehicle Observations/Summary. The vast majority of daily travel and outings were short and well within the capabilities of BEVs. This is consistent with the optimum goal to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHGs.

The fleet of pool vehicles in this study included three sedans, two SUVs, one pickup truck, and one cargo van. Figure 32 suggests 70% of this fleet could be BEVs; however, fleet managers typically desire vehicles that have no range limitations for most enforcement vehicles. Intertek would suggest that two suitably styled BEVs and five PHEVs could meet mission requirements. Section 3.4 provides information on PEVs currently or soon to be available in the automotive market and Section 5 provides details on the suggestions.

Considering a full complement of 25 enforcement vehicles in the entire Departments group enforcement fleet, Intertek suggests when extrapolating the collected data to the entire fleet that a mixed fleet of six BEVs and 19 PHEVs may be possible.

The vehicle summary shows sufficient time for charging at the base location during the course of the day and additional opportunities at intermediate charging stations. These stations also provide charging opportunities for the visiting public, whose fees may assist in offsetting operating costs.

4.2.3.3 Departments Enforcement Vehicle Charging Needs.

As noted above, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can be accomplished with AC Level 1 charging. Opportunity charging at intermediate stops obtains greater benefits from AC Level 2 EVSE. Most vehicles returned to their home base daily, with the exception of long trips lasting several days.

Greater management attention provides the possibility of reducing the overall number of AC Level 2 EVSE units. A ratio of two AC Level 2 charging stations to three vehicles typically sustains a normal fleet operation. Fleet managers rotate vehicles on the charger to complete charging of all vehicles in the allotted time. This analysis does assume a fully recharged battery at the start of each day. NASWI will gain experience in this management as the PEV fleet grows.

4.2.4 Departments Transport Vehicles Analysis

Table 11 shows that the Departments group has one cargo van with the transport mission. Because it was not monitored, a suitable styled PHEV is suggested to provide replacement of this vehicle.

4.2.5 Departments Group Vehicles Mileage

The vehicle's annual miles factor into the calculations for replacement of the vehicle as noted in Section 5. The actual miles measured during the study were extrapolated to identify the calculated annual miles in the study. NASWI also provided vehicle information that identified the average monthly miles and vehicle mileage.

For the entire Departments group fleet, the extrapolated study miles yielded 5,800 average annual miles per vehicle and the annual miles provided by NASWI averaged 5,600 miles per vehicle. This is relatively low mileage and, on an average basis, reflects positively on the use of BEVs in the fleet.

4.2.6 Departments Group Vehicle Utilization

Vehicle utilization is an important factor in the evaluation of vehicles from an inventory perspective and for charging availability. During the study period, the average daily utilization for the total Departments fleet was 50% or 23 days of the 47-day study.

The average daily usage of each was 1.8 hours. In general, the vehicles were used on frequent days, but average usage per day was quite low.

4.2.7 Departments Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the Departments group. The study indicates that PEVs offer alternatives to existing vehicles, provided that any specific cargo requirements may be met by the PEV. In general, a mixed fleet of BEVs and PHEVs is suggested.

The vehicles monitored in this study included 42 pool, support, and enforcement vehicles. They were used on 51% of the study days and averaged 1.7 hours of use per day. Based on the travel data, Intertek suggests that replacing the vehicles with 21 BEVs and 21 PHEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix E provides specific recommendations.

The Departments group's full fleet of vehicles contains 106 vehicles. Intertek suggests a fleet of 50 BEVs and 56 PHEVs would conservatively meet the balance of vehicle travel requirements.

With potential replacement by PEVs established, Section 5 and Appendix E provide further evaluation of the benefits of such replacements. This will be factored into further observations and suggestions related to the business case and schedule for any replacements for the Departments group. Those observations will be addressed in Task 4 of this project.

4.3 Analysis Results – Combined Groups

The full fleet in the study contains 175 vehicles, not including the low-speed vehicles and non-powered trailer type vehicles. Table 15 identifies these vehicles by vehicle type according to site records. The mission assignments identified in this table are based on survey responses received and extrapolated to the entire fleet.

Table 15. All fleet vehicles by type and mission.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	Mini-Van	SUV	Cargo Van	Pass. Van	Pickup Truck	Total
Pool	1	7	—	2	1	1	6	2	20
Support	4	11	2	9	2	36	12	40	116
Enforcement	—	2	8	—	10	3	1	1	25
Transport	—	—	—	—	—	14	—	—	14
Total	5	20	10	11	13	54	19	43	175

Grouping the vehicles by mission creates an aggregated view of mission requirements to provide observations related to PEV replacement. Analysis by mission type is provided in the following subsections.

4.3.1 All Vehicles Pool Analysis

All 20 pool vehicles are assigned to the Departments group and fully detailed in Section 4.2.1.

4.3.2 All Support Vehicles Analysis

Both Commands and Departments groups contain support vehicles as detailed in Sections 4.1.1 and 4.2.2. This section provides the combined analysis

4.3.2.1 Summary for All Support Vehicles. Table 16 summarizes support vehicle travel during the study period. Support vehicles traveled 16,766 miles, logged 1021 hours, and idled for 256 hours during the study period.

Table 16. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	16.6/379.7	5.6/1,008.4	2.6/228.1	16,766
Travel Time (Minutes)	60.5/458.0	20.6/1,043.0	9.6/264.0	61,279
Idle Time (Minutes)	15.2/NA	5.2/NA	2.4/NA	15,390

The history and shift profiles are shown in Figures 17, 18, 22, 23, 26, and 27. The combined graphics are similar.

The distance a PEV can travel in CD mode between charge opportunities is the most important factor in considering vehicle replacement. The two most significant factors in vehicle analysis include the vehicle's daily travel and vehicle outings. Figure 34 shows the travel summary for all support vehicles by vehicle.

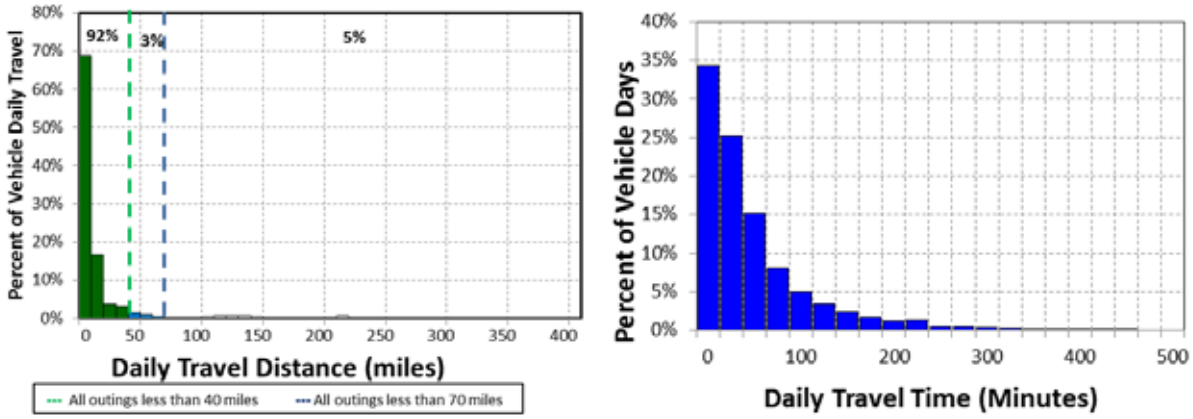


Figure 34. All support vehicle daily travel miles and time.

The average travel distance per day when driven for support vehicles was 16.6 miles. On 95% of these vehicle days, the daily travel was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 5% percent of support vehicle daily travel was greater than 70 miles. Furthermore, 92% of vehicle travel days were less than the 40 miles considered to be within the CD range of a PHEV.

Figure 35 shows the outings for all support vehicles combined. It does not show outings of 601, 713, and 1,008 miles for clarity of scale. All outings of greater than 70 miles represent 2% of all the travel and do not show clearly on the figure. Details are provided in the vehicle data sheets of Appendices B and C.

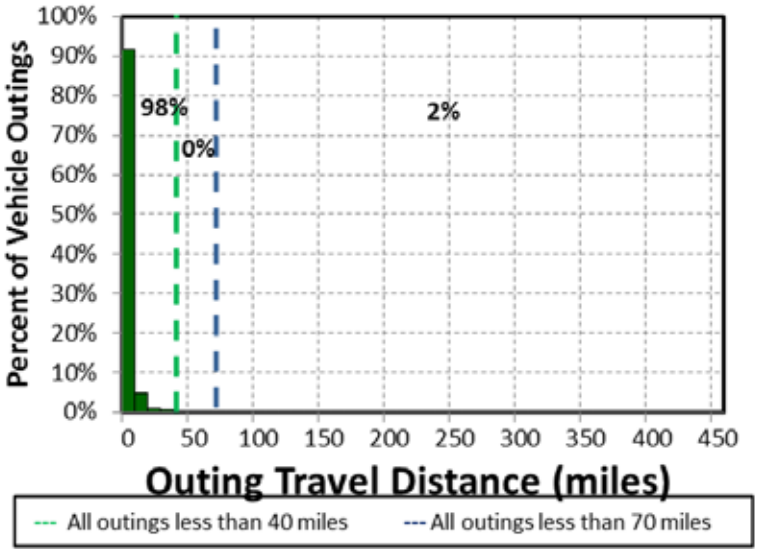


Figure 35. All vehicles support vehicle combined outings.

The average travel outing when driven for support vehicles was 5.6 miles. On 98% of these vehicle outings, the distance traveled was less than the 70 miles considered to be within the BEV safe range.

Meanwhile, 2% of support outing travel was greater than 70 miles. Furthermore, 98% of vehicle travel outings were less than the 40 miles considered to be within the CD range of a PHEV.

4.3.2.2 All Vehicles Support Vehicle Observations/Summary.

Combining the results noted in Sections 4.1.2 and 4.2.2 for support vehicles, Intertek would suggest that 18 BEVs and eight PHEVs could meet mission requirements for the vehicles monitored. Considering a full complement of 60 support vehicles in the entire fleet, Intertek suggests a mixed fleet of 42 BEVs and 18 PHEVs may be possible.

4.3.3 All Enforcement Vehicles Analysis

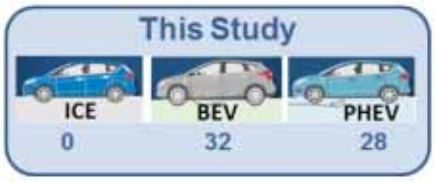
All 25 enforcement vehicles are assigned to the Departments group and fully analyzed in Section 4.2.3.

4.3.4 All Vehicles Transport Vehicles Analysis

The information provided by the Commands and Departments groups for transport vehicles are found in Sections 4.1.2 and 4.2.4, respectively. No transport vehicles were monitored, except for the single transport mission cargo van, where a PHEV was suggested.

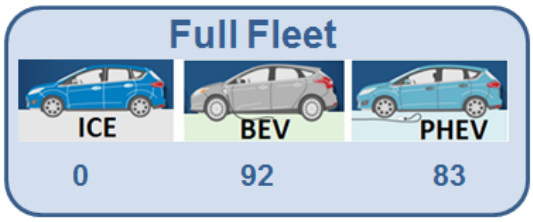
4.3.5 All Vehicles Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with all vehicles. The study indicates that PEVs offer alternatives to vehicles in the existing fleet, provided any specific cargo requirements are met by the PEV. In general, a mixed fleet of BEVs and PHEVs is suggested.



The vehicles monitored in this study included 19 sedans, nine minivans, three SUVs, nine passenger vans, 18 pickup trucks, and two cargo vans (all conventional ICE based). Based on the travel data, Intertek suggests that replacing these vehicles with 32 PHEVs and 28 BEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendices D and E provide specific recommendations.

The full fleet contains 175 vehicles. Intertek suggests that a fleet of 92 BEVs and 83 PHEVs would conservatively meet the vehicle travel requirements.



With potential replacement by PEVs established, Section 5 and Appendices D and E provide further evaluation of the benefits of these replacements. This will be factored into further observations and suggestions related to the business case and schedule for any replacements Commands and Departments groups. Those observations will be addressed in Task 4 of this project.

5. GREENHOUSE GAS EMISSIONS AVOIDED AND FUEL COST REDUCTION ANALYSIS

5.1 Background and Methods

PEV substitution for an existing conventional vehicle avoids GHG emissions and reduces fuel costs. The GHG emissions avoided occur due to the difference in emissions associated with power plant electricity generation versus fuel combustion that occurs in the engine of a conventional vehicle. This analysis does not account for life-cycle emissions that occur outside of electricity generation and fuel combustion phases (i.e., materials and resource extraction, production supply chains, and decommissioning are not accounted for). These phases are beyond the scope of this report due to the

significant effort required to conduct an accurate environmental life-cycle assessment for a transportation system in a very specific setting. The analysis used is known as a "tank-to-wheel" analysis, rather than a "well-to-wheel" analysis that would include the aforementioned phases. Cost reduction also occurs because the cost of electricity is much less than the cost of gasoline and PEVs are more efficient than conventional ICE vehicles. Because fuel logs were not kept, the mileage accumulated by each vehicle during the study is compared to the average miles reported by NASWI. The NASWI report provides the source of fuel consumption estimates for the study vehicles.

Several PEV types are available for potential replacement in the NASWI fleets (see Section 3). For this analysis, Table 17 provides the vehicles suggested as replacement vehicles for those identified in the analysis of Section 4. The EPA class of the replacement PEV is the same or similar to the current vehicle class. The energy consumption values for each PEV are displayed with the vehicle; note that for PHEVs, the energy consumption is only for CD mode.

Table 17. PEV substitutions for current vehicles.

Vehicle Class	Current Vehicle Example	Replacement PHEV	Replacement BEV
Sedan – Compact/Subcompact	 Dodge Avenger	 Chevrolet Volt 350 Wh/mi	 Ford Focus Electric 310 Wh/mi
Sedan – Midsize/Large	 Chevrolet Malibu	 Ford Fusion Energi 370 Wh/mi	 Nissan Leaf 300 Wh/mi
SUV and Minivan	 Chevrolet Tahoe	 Mitsubishi Outlander PHEV 440 Wh/mi	 Honda FIT EV 290 Wh/mi
Pickup Truck	 Dodge Dakota	 Via Motors VTRUX 475 Wh/mi	 Nissan eNV200 400 Wh/mi

Vehicle Class	Current Vehicle Example	Replacement PHEV	Replacement BEV
Pickup Truck (alternate)	 Ford F150	 Mitsubishi Outlander PHEV 440 Wh/mi	 Toyota RAV4 EV 440 Wh/mi
Cargo Van	 Chevrolet G2500	 Via eREV Van 475 Wh/mi	 Nissan eNV200 400 Wh/mi
Passenger Van	 Ford E350	 Via eREV Van 475 Wh/mi	 Nissan eNV200 400 Wh/mi

In order to perform the analysis, EPA fuel economy ratings are used.[20] The ratings for each vehicle are recorded in the vehicle data sheets of Appendices B and C. Because these data are estimates, assumptions include the following:

1. PHEVs operate in CD mode only for the percentage of travel less than 40 miles per day. This is reasonable for most daily operations, as described in Section 4, and is conservative because additional charge time exists between most outings. It is also conservative in that the replacement PEV typically will have greater fuel economy when operating in CS mode. BEVs operate in electric mode for 100% of travel.
2. Annual miles in the study are compared to NASWI reported miles. NASWI reported miles are used because these records have been collected over a greater period. The NASWI reported miles are extrapolated to a full 365-day year. Miles in CD mode are the extrapolated miles times the percent of daily travel less than 40 miles for the PHEV replacement and full extrapolated miles for the BEV replacement.
3. Energy consumption for the Mitsubishi Outlander is the same as the RAV4 and energy consumption for the Via Motors vehicles and Nissan eNV200 are estimated because EPA has not yet created ratings for these vehicles.
4. SUV-type vehicles (as shown above) may replace some of the existing pickup trucks.

Calculations provided for GHG emissions and fuel savings include both a total U.S. perspective and a perspective for the local area. The electricity generation mix of power plants for the total United States is different from the local mix of generation in the NASWI area. Likewise, the national average cost for petroleum fuel is different from the local cost for fuel. This analysis includes both approaches in order to

[20] http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=33558 [accessed March 12, 2015].

allow for local evaluation and to provide the potential benefit for fleet vehicles in other locations of the United States that may be of interest. The final report from Intertek to Idaho National Laboratory primarily will consider the national figures.

For the GHG emissions avoided portion of the analysis, the GHG emissions (in pounds of carbon dioxide equivalent, which accounts for other GHGs such as methane and nitrous oxide [lb-CO_2e]) from combustion of gasoline is 20.1 lb-CO_2e/gallon.[21] The United States' average for GHG emissions for the production of electricity is 1.53 lb-CO_2e/kWh.[22]

NASWI reported receiving base power from Puget Sound Energy. Puget Sound Energy reports a mix of its own generation and power provided by other sources. Puget Sound Energy's overall GHG emission intensity from generated and purchased electricity decreased from 1.03 lb/kWh in 2010 to 0.87 lb/kWh in 2011.[23] The 0.87 lb-CO_2e/kWh emission rate reflects the high local reliance on hydroelectricity as the generation source and, thus, emissions are much lower than the national average.

GHG emissions avoided are the annual GHG emitted by the current vehicle (total annual gallons gasoline × GHG emissions/gallon) minus the annual GHG emitted by the replacement PEV (total annual kWh × GHG emissions/kWh). For the PHEVs, only the percentages of outings less than 40 miles are counted for the annual miles saved in CD mode.

For the cost-avoided piece of the analysis, current fuel prices are used. At this report, fuel costs for regular gasoline are $2.46/gallon for the United States and $2.83/gallon for the Washington area.[24] Electrical cost assumptions are 0.13 $/kWh for the United States and 0.057138 $/kWh for industrial customers on Schedule 49 in the Puget Sound Energy service territory.[25] Therefore, fuel costs savings are the current vehicle's calculated annual gasoline cost (total annual gallons gasoline × cost/gallon) minus the electricity cost (total annual kWh × cost/kWh) of the replacement PEV traveling the same distance.

The miles calculated above for CD mode yields estimates for yearly GHG emissions avoided and fuel cost reductions. Appendices D and E provide the details of the results of analyses for each of the fleets studied. While the appendices provide both national and local figures, only the local NASWI area figures are reported here for clarity.

5.2 Monitored Vehicles Fuel Cost Reduction

Tables 18, 19, and 20 provide the summary of potential fuel cost reduction with the replacement of monitored vehicles in the mission identified with PEVs as noted in Appendices D and E. Only the local Washington State fuel costs are considered in these tables. However, because Washington State fuel costs are higher than the national average, local gasoline costs are higher than national figures. Also, because Puget Sound Energy relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower. The comparison to national averages occurs in the appendices.

Tables 18, 19, and 20 provide the results by vehicle mission for all monitored vehicles. Table 21 combines all missions for the overall monitored vehicle reductions.

In summary, if all possible monitored vehicles were replaced with PEVs, over 17,000 gallons of gasoline would be avoided each year. This would save over $42,000 in gasoline fuel costs, while only using about $7,000 of electricity. Appendices D and E provide the details of this information.

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[21] http://avt.inl.gov/pdf/EVProj/106077-891082.ghg.pdf for the methodology for gasoline [accessed March 12, 2015].

[22] ibid.

[23] http://pse.com/aboutpse/Environment/Documents/GHG_Inventory2011.pdf [accessed March 6, 2015].

[24] http://www.gasbuddy.com/GB_Price_List.aspx?cntry=USA#us_cities [accessed March 6, 2015].

[25] http://pse.com/aboutpse/Rates/Documents/summ_elec_prices_2014_01_01.pdf [accessed March 6, 2015].

Table 18. Monitored pool mission PEV replacement fuel cost reduction.

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%
33,203	1,761	$ 4,984	$ 794	$ 4,190	84%

Table 19. Monitored support mission PEV replacement fuel cost reduction (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%
259,190	14,045	$ 39,747	$ 5,579	$ 34,168	86%

Table 20. Monitored enforcement mission PEV replacement fuel cost reduction (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%
26,981	1,669	$ 4,723	$ 545	$ 4,178	88%

Table 21. Monitored vehicle PEV replacement fuel cost reduction (Washington State) all vehicles.

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%
319,373	17,475	$ 49,454	$ 6,918	$ 42,536	86%

5.3 Monitored Vehicles Greenhouse Gas Emissions Reduction

Tables 22, 23, and 24 provide the summary of potential GHG emission reduction with the replacement of monitored vehicles with PEVs in the mission identified as noted in Appendices D and E. Only the local Washington State GHG reductions are considered in these tables. However, as mentioned previously, because NASWI receives it power from Puget Sound Energy and it relies more on cleaner hydroelectric power than the average of all national power providers, electrical emissions in Washington State are lower. Electrical emissions are significantly lower than gasoline emissions.

Table 22. Monitored pool mission PEV replacement GHG emission reduction (Washington State).

Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
33,203	1,761	35,396	12,083	23,313	66%

Table 23. Monitored support mission PEV replacement GHG emission reduction (Washington State).

Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
259,190	14,045	$ 282,301	$ 84,943	$ 197,357	70%

Table 24. Monitored enforcement mission PEV replacement GHG emission reduction (Washington State).

Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
26,981	1,669	33,548	8,303	25,245	75%

Tables 22, 23, and 24 provide the results by vehicle mission for all monitored vehicles. Table 25 combines all missions for the overall monitored vehicle reductions.

Table 25. Monitored vehicle PEV replacement GHG emission reduction (Washington State) all vehicles.

Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
319,373	17,475	351,245	105,330	245,915	70%

In summary, if all possible monitored conventional vehicles are replaced with PEVs, GHG emissions are reduced by over 245,000 lb-CO_2e per year.

5.4 Full Fleet Fuel and Greenhouse Gas Reduction

The full fleet contains 175 vehicles. Section 4 analysis suggests that a fleet of 92 BEVs and 83 PHEVs would conservatively meet the vehicle travel requirements. Table 26 shows the potential reductions in fuel costs and GHG emissions should these replacements occur.

Table 26. Projected fuel costs and GHG reduction potential for all vehicles (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
888,038	50,923	$ 144,112	$ 20,513	$123,599	86%	1,026,453	312,391	714,062	70%

For the vehicles represented by these four groups, the annual potential fuel savings are over $120,000 and the potential annual GHG reduction is over 700,000 lb-CO_2e.

6. OBSERVATIONS

Intertek appreciates the opportunity to present the results of this evaluation. The following observations provide input to the next phases of this study:

- Suggested PEV replacements lead to identification of charging infrastructure needs and locations to be reported separately as part of Task 3.
- Suggested PEV replacements can be considered with vehicle age to prepare a replacement schedule as part of Task 4.
- The replacement schedule will identify the charging infrastructure deployment schedule.
- Vehicle and EVSE schedules can factor into budget considerations for implementing vehicle replacements.
- Vehicle and EVSE schedules can factor into base objectives in fuel cost reductions and GHG emissions reductions.

The average vehicle travels approximately 5,090 miles per year. This is an average of 424 miles per month or less than 100 miles per week. This may reflect the opportunity to increase the percentage of BEVs over that analyzed in Section 5.

Intertek suggests that NASWI may wish to move forward in the near future with replacement of pool, support, and enforcement vehicles with PEVs as current budget and vehicle replacement schedules allow. Certainly, the vehicle types studied in this report may be candidates for immediate replacement.

Appendix A

Definitions

Alternative fuel	An alternative fuel means any fuel other than gasoline and diesel fuels, such as methanol, ethanol, and gaseous fuels (40 CFR 86.1803-01). A fuel type other than petroleum-based gasoline or diesel as defined by the Energy Policy Act (examples include ethanol, methanol, compressed natural gas, propane, and electrical energy).
City fuel economy (MPG)	City fuel economy means the city fuel economy determined by operating a vehicle (or vehicles) over the driving schedule in the federal emission test procedure or determined according to the vehicle-specific 5-cycle or derived 5-cycle procedures (40 CFR 600.001).
Conventional fuel	A petroleum-based fuel (examples include gasoline and diesel fuel).
Daily travel	The sum of daily trips and stops in one day.
Diesel fuel	Diesel means a type of engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The non-use of a throttle during normal operation is indicative of a diesel engine (49 CFR 86-1803).
E85	Ethanol fuel blend of up to 85% denatured ethanol fuel and gasoline or other hydrocarbons by volume.
Electric vehicle	Electric vehicle means a motor vehicle that is powered solely by an electric motor drawing current from a rechargeable energy storage system, such as from storage batteries or other portable electrical energy storage devices, including hydrogen fuel cells, provided that (1) The vehicle is capable of drawing recharge energy from a source off the vehicle, such as residential electric service (2) The vehicle must be certified to the emission standards of Bin #1 of Table S04-1 in § 86.1811-09(c)(6) (3) The vehicle does not have an onboard combustion engine/generator system as a means of providing electrical energy (40 CFR 86-1803).
Ethanol-fueled vehicle	Ethanol-fueled vehicle-means any motor vehicle or motor vehicle engine that is engineered and designed to be operated using ethanol fuel (i.e., a fuel that contains at least 50% ethanol (C_2 H_5 OH) by volume) as fuel (40 CFR 86.1803-01).
Federal vehicle standards	The document that establishes classifications for various types and sizes of vehicles, general requirements, and equipment options. It is issued annually by the GSA Vehicle Acquisition and Leasing Service's Automotive Division.
Government motor vehicle	Any motor vehicle that the government owns or leases. This includes motor vehicles obtained through purchase, excess, forfeiture, commercial lease, or GSA fleet lease.
Gross vehicle weight rating	Gross vehicle weight rating (GVWR) means the value specified by the vehicle manufacturer as the maximum design loaded weight of a single vehicle (e.g., vocational vehicle) (US Government Printing Office 2009)
GSA fleet	GSA fleet lease means obtaining a motor vehicle from the General Services Administration fleet (GSA fleet) (41 CFR 102-34).

Heavy light-duty truck	Heavy light-duty truck means any light-duty truck rated greater than 6,000 lb GVWR. The light-duty truck 3 (LDT3) and LDT4 classifications comprise the heavy light-duty truck category (40 CFR 86.1803-01).
Highway fuel economy (Hwy MPG)	Highway fuel economy means the highway fuel economy determined either by operating a vehicle (or vehicles) over the driving schedule in the federal highway fuel economy test procedure or determined according to either the vehicle-specific, 5-cycle equation, or the derived 5-cycle equation for highway fuel economy (40 CFR 600.001).
Hybrid electric vehicle	Hybrid electric vehicle means a motor vehicle that draws propulsion energy from onboard sources of stored energy that are both an internal combustion engine or heat engine using consumable fuel and a rechargeable energy storage system (such as a battery, capacitor, hydraulic accumulator, or flywheel), where recharge energy for the energy storage system comes solely from sources on board the vehicle.
Idle time	Idle time is logged whenever a vehicle idles with the engine running for 3 minutes or longer.
Law enforcement	Law enforcement motor vehicle means a light-duty motor vehicle that is specifically approved in an agency-s appropriation act for use in apprehension, surveillance, police, or other law enforcement work or specifically designed for use in law enforcement. If not identified in an agency's appropriation language, a motor vehicle qualifies as a law enforcement motor vehicle only in the following cases: (1) A passenger automobile having heavy-duty components for electrical, cooling, and suspension systems and at least the next higher cubic inch displacement or more powerful engine than is standard for the automobile concerned (2) A light truck having emergency warning lights and identified with markings such as "police" (3) An unmarked motor vehicle certified by the agency head as essential for the safe and efficient performance of intelligence, counterintelligence, protective, or other law enforcement duties (4) A forfeited motor vehicle seized by a federal agency that subsequently is used for performing law enforcement activities (41 CFR Part 102-34.35).
Light-duty motor vehicle	Any motor vehicle with a GVWR of 8,500 pounds or less (41 CFR 102-34).
Light-duty truck	Light-duty truck means any motor vehicle rated at 8,500 pounds GVWR or less, which has a curb weight of 6,000 pounds or less and, which has a basic vehicle frontal area of 45 square feet or less, which is as follows: (1) Designed primarily for purposes of transportation of property or is a derivation of such a vehicle (2) Designed primarily for transportation of persons and has a capacity of more than 12 persons (3) Available with special features, enabling off-street or off-highway operation and use. LDT1 means any light light-duty truck up through 3,750-lb loaded vehicle weight. LDT2 means any light light-duty truck greater than 3,750-lb loaded vehicle weight.

	LDT3 means any heavy light-duty truck up through 5,750-lb adjusted loaded vehicle weight. LDT4 means any heavy light-duty truck greater than 5,750-lb adjusted loaded vehicle weight (US Government Printing Office 2009)
Light-duty vehicle	Light-duty vehicle means a passenger car or passenger car derivative capable of seating 12 passengers or less.
Low-speed vehicle	Low-speed vehicle means a motor vehicle (1) That is 4-wheeled (2) Whose speed attainable in 1.6 km (1 mile) is more than 32 kilometers per hour (20 miles per hour) and not more than 40 kilometers per hour (25 miles per hour) on a paved level surface (3) Whose GVWR is less than 1,361 kilograms (3,000 pounds) (49 CFR 571.3 – Definitions).
Medium-duty passenger vehicle	Medium-duty passenger vehicle means any heavy-duty vehicle (as defined in this subpart) with a GVWR of less than 10,000 pounds that is designed primarily for transportation of persons. The medium-duty passenger vehicle definition does not include any vehicle which (1) Is an “incomplete truck” as defined in this subpart (2) Has a seating capacity of more than 12 persons (3) Is designed for more than 9 persons in seating rearward of the driver's seat (4) Is equipped with an open cargo area (for example, a pick-up truck box or bed) of 72.0 inches in interior length or more. A covered box not readily accessible from the passenger compartment will be considered an open cargo area for purposes of this definition (US Government Printing Office 2009)
Model year	Model year means the manufacturer's annual production period (as determined by the administrator), which includes January 1 of such calendar year; provided that if the manufacturer has no annual production period, the term “model year” shall mean the calendar year (40 CFR 86-1803.01).
MPG	“MPG” or “mpg” means miles per gallon. This generally may be used to describe fuel economy as a quantity or it may be used as the units associated with a particular value.
MPGe	MPGe means miles per gallon equivalent. This generally is used to quantify a fuel economy value for vehicles that use a fuel other than gasoline. The value represents miles the vehicle can drive with the energy equivalent of one gallon of gasoline: (c) SCF means standard cubic feet (d) SUV means sport utility vehicle (e) CREE means carbon-related exhaust emissions [76 FR 39527, July 6, 2011].
Non-passenger automobile	A non-passenger automobile means an automobile that is not a passenger automobile or a work truck and includes vehicles described in paragraphs (a) and (b) of 49 CFR 523.5.

Owning agency	Owning agency means the executive agency that holds the vehicle title, manufacturer's Certificate of Origin or is the lessee of a commercial lease. This term does not apply to agencies that lease motor vehicles from the GSA fleet (41 CFR Part 102-34.35).
Passenger automobile	A passenger automobile is any automobile (other than an automobile capable of off-highway operation) manufactured primarily for use in the transportation of not more than 10 individuals (49 CFR 523.4 – Passenger automobile). A sedan or station wagon designed primarily to transport people (41 CFR 102-34).
Pickup truck	Pickup truck means a non-passenger automobile, which has a passenger compartment and an open cargo bed (49 CFR 523.2).
Plug-in hybrid electric vehicle	PHEV means a hybrid electric vehicle that has the capability to charge the battery from an off-vehicle electric source, such that the off-vehicle source cannot be connected to the vehicle while the vehicle is in motion (40 CFR 86.1803).
Vehicle class	The designation of motor vehicle types that include sedans, station wagons, ambulances, buses, and trucks, or different categories of vehicles according to Federal vehicle standards and further defined in 49 CFR 600.315-82.
Vehicle configuration	Vehicle configuration means a unique combination of basic engine, engine code, inertia weight class, transmission configuration, and axle ratio.
Vehicle days	The number of days a vehicle was driven or utilized during the (vehicle) study period.
Vehicle home base	The primary assigned outing beginning and ending parking location for the vehicle.
Vehicle study period	The time period the vehicle, within the study, has been equipped with a data logger.

Appendix B

Commands Group Vehicle Data Sheets

Table B-1. NASWI Commands Group vehicle index.

Vehicle Index							
Sheet	Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
1	4	G10-1138M	Chevrolet	Malibu	2012	Sedan - Midsize	Support
2	7	G10-1140M	Chevrolet	Malibu	2012	Sedan - Midsize	Support
3	16	G10-3576L	Chevrolet	Malibu	2015	Sedan - Midsize	Support
4	19	G10-7547F	Dodge	Avenger	2008	Sedan – Midsize	Support
5	38	G41-1136K	Dodge	Grd Caravan SE	2010	Minivan	Support
6	40	G41-1139K	Dodge	Grd Caravan SE	2010	Minivan	Support
7	41	G41-1140K	Dodge	Grd Caravan SE	2010	Minivan	Support
8	43	G41-1155K	Dodge	Grd Caravan SE	2010	Minivan	Support
9	47	G41-1351G	Dodge	Dakota	2008	Pickup	Support
10	74	G41-2911M	Chevrolet	Colorado	2012	Pickup	Support
11	75	G41-3153P	Dodge	Grd Caravan SE	2014	Minivan	Support
12	76	G41-3159P	Dodge	Grd Caravan SE	2014	Minivan	Support
13	80	G42-0587K	Chevrolet	Silverado	2010	Pickup	Support
14	82	G42-0590K	Chevrolet	Silverado	2010	Pickup	Support
15	90	G42-1232M	Ford	F150	2012	Pickup	Support
16	91	G42-1281M	Ford	E-350	2013	Van - Pass	Support
17	100	G43-3437B	Ford	E-350	2006	Van - Cargo	Support
18	103	G61-0513K	Ford	Explorer	2010	SUV	Support

Table B-2. NASWI Commands monitored vehicle summary

Mission	Sedan Compact	Sedan Midsize	Sedan Large	Mini-Van	SUV	Cargo Van	Pass. Van	Pickup Truck	Total
Support	1	3	—	6	1	1	1	5	18

Sheet 1

Make/Model/Year	Chevrolet Malibu - 2012
EPA Class Size	Sedan - Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Near Building 385, Lexington St
Fleet Vehicle ID	G10-1138M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 25/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	4
Total Vehicle Days/Total Study Days	19/47

Vehicle G10-1138M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	58.6/379.7	48.4/713.2	12.4/228.1	1,114
Travel Time (Minutes)	98.9/395.0	81.7/738.0	20.9/220.0	1,880
Idle Time (Minutes)	13.1/NA	10/8/NA	2.8/NA	249

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	52	74.3%	Less than 2	54
10 to 20	8	11.4%	2 to 4	1
20 to 40	1	1.4%	4 to 8	1
40 to 60	9	12.8%	Greater than 8	14

Figure B-1. Vehicle G10-1138 stops.

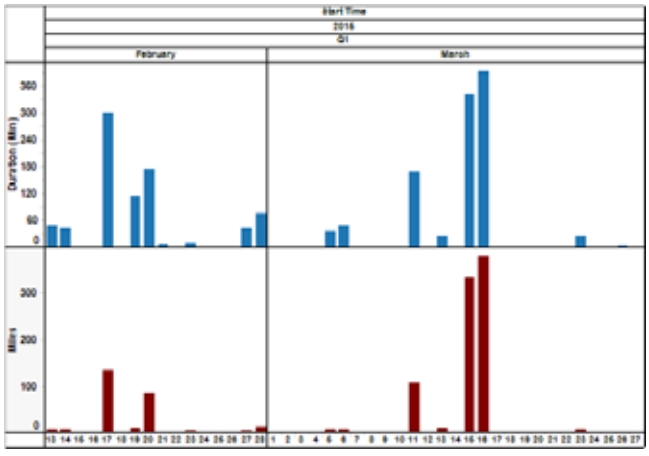

Figure B-2. Vehicle G10-1138 history.

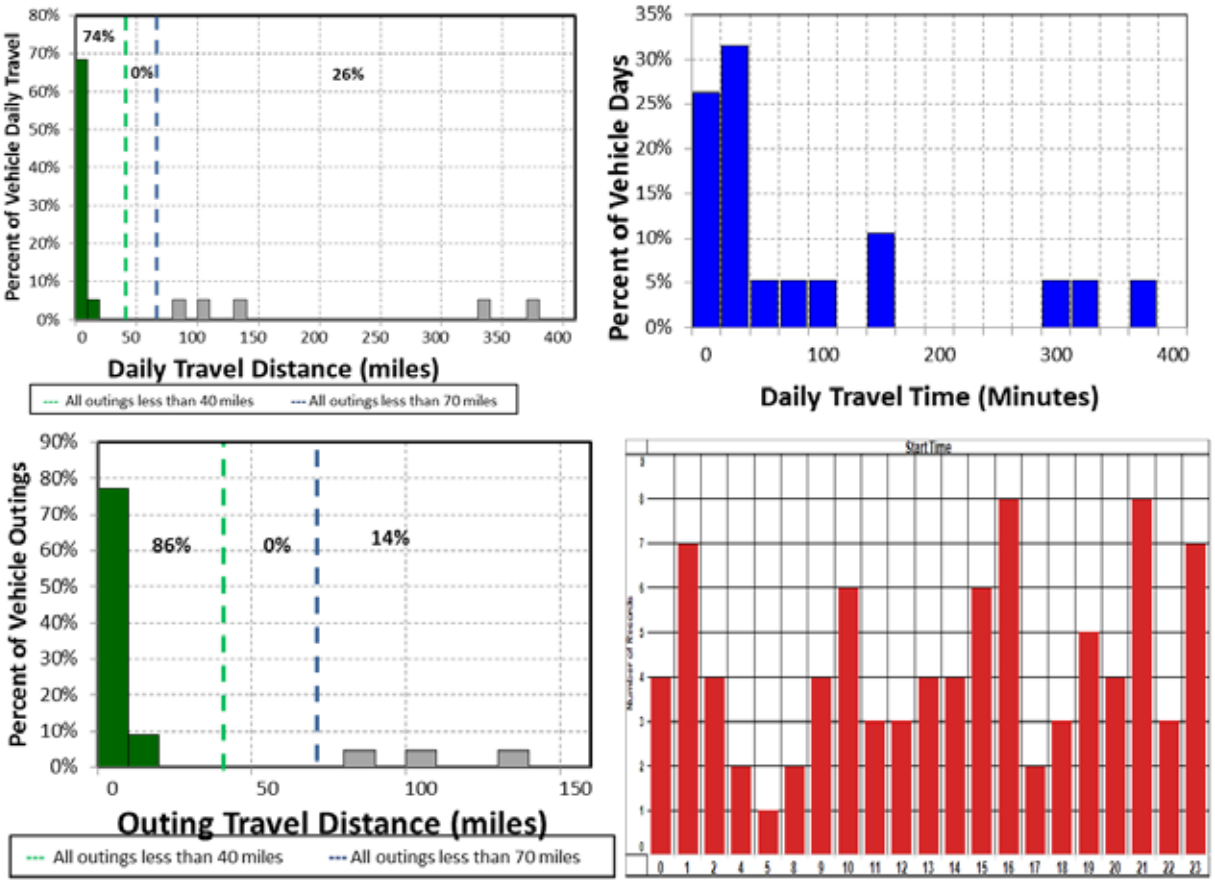

Figure B-3. Vehicle G10-1138M travel and time-of-day graphs. Note: Outing graph does not show single outing of 713 miles for clarity of scale.

Vehicle G10-1138M Observations

Logger 4 collected data on this vehicle for a period of 19 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for the Commands group. This vehicle's data indicate it parks near Building 385 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 17,125 miles at the start of this study and its average annual mileage is 5,024 miles. The vehicle was used on 40% of the available days, with an average daily usage of 1.6 hours and a peak daily usage of 6.6 hours on the days it was used. The vehicle was used during all hours of the day.

Figure B-3 shows that 74% of daily travel was within the typically advertised range of a BEV of approximately 70 miles, with 86% of the outings also within this range. Further, 74% of daily travel and 86% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel. However, significant travel does occur within the capabilities of a BEV and the fleet manager may consider a fleet of vehicles with a mix of BEVs and PHEVs.

Sheet 2

Make/Model/Year	Chevrolet Malibu – 2012
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2593, Orion St
Fleet Vehicle ID	G10-1140M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 25/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	7
Total Vehicle Days/Total Study Days	13/47

Vehicle G10-1140M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	33.3/34.1	24.1/33.7	11.4/16.8	433
Travel Time (Minutes)	58.7/66.0	42.4/60.0	20.1/33.0	763
Idle Time (Minutes)	0.0/NA	0.0/NA	0.0/NA	0

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	21	61.8%	Less than 2	11
10 to 20	13	38.2%	2 to 4	8
20 to 40	0	0	4 to 8	3
40 to 60	0	0	Greater than 8	12

Figure B-4. Vehicle G10-1140M stops.

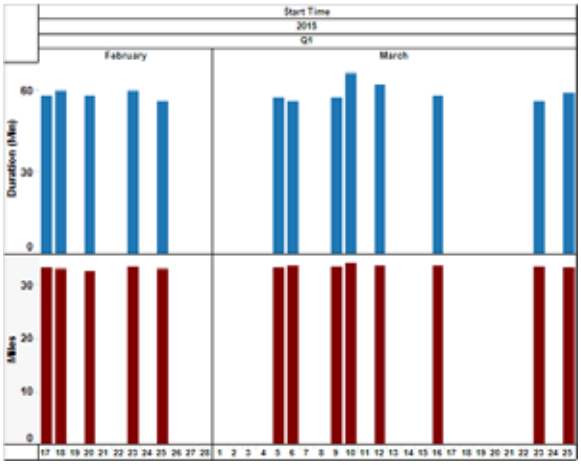

Figure B-5. Vehicle G10-1140M history.

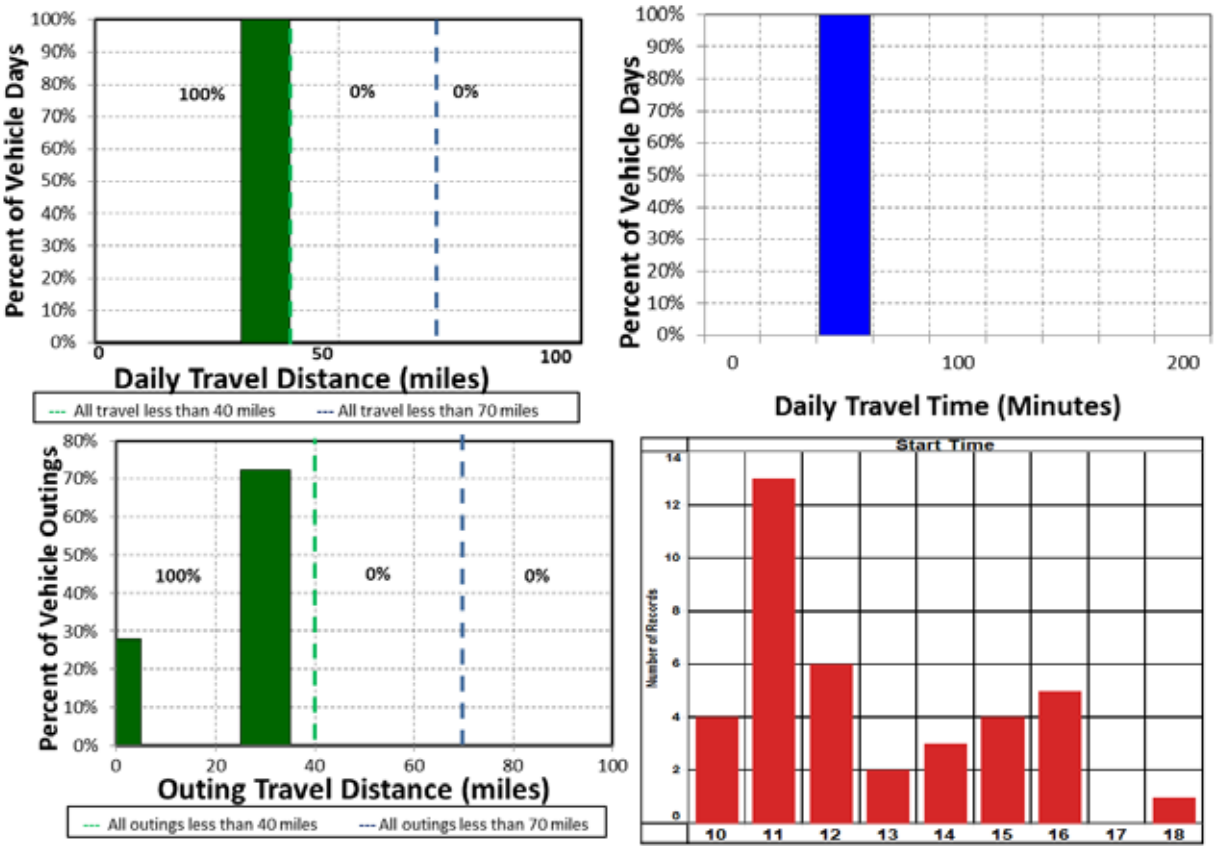

Figure B-6. Vehicle G10-1140M travel and time-of-day graphs.

Vehicle G10-1140M Observations

Logger 7 collected data on this vehicle for a period of 13 days of the47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for the Commands group. This vehicle's data indicate it parks near Building 2593 near Orion Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 9,185 miles at the start of this study and its average annual mileage is 2,756 miles. The vehicle was used on 28% of the available days, with an average daily usage of 1.0 hours and a peak daily usage of 1.1 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure B-6 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All of the outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was assigned a home base.

Sheet 3

Make/Model/Year	Chevrolet Malibu – 2015
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 993, Franklin St
Fleet Vehicle ID	G10-3576L
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	25/36/29
EPA GHG Emissions (Grams CO_2/Mi)	307
Study Logger ID	16
Total Vehicle Days/Total Study Days	16/47

Vehicle G10-3576L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	98.7/358.5	121.5/601.0	5.2/107.3	1,579
Travel Time (Minutes)	154.6/458.0	190.3/1,043.0	8.2/106.0	2,474
Idle Time (Minutes)	12.7/NA	15.6/NA	0.7/NA	203

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	16	15.5%	Less than 2	76
10 to 20	5	4.9%	2 to 4	5
20 to 40	5	4.9%	4 to 8	4
40 to 60	77	74.8%	Greater than 8	18

Figure B-7. Vehicle G10-3576L stops.

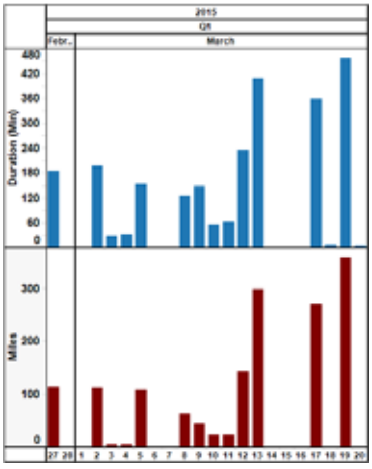

Figure B-8. Vehicle G10-3576L history.

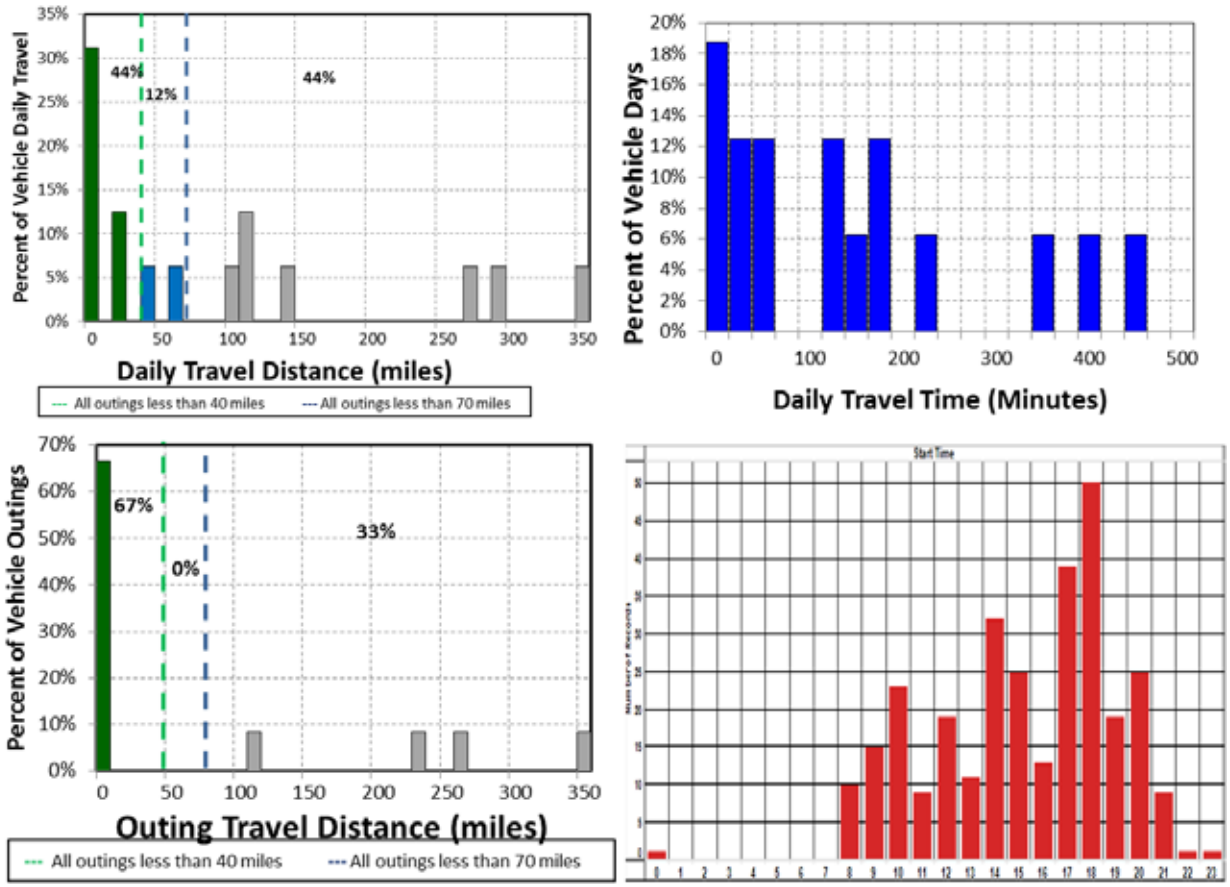

Figure B-9. Vehicle G10-3576L travel and time-of-day graphs. Note: The highest outing of 601 miles is not shown for clarity of scale.

Vehicle G10-3576L Observations

Logger 16 collected data on this vehicle for a period of 16 days of the 47-day study period. Validation occurred on 99.5% of the input data. Data indicate that this vehicle has a support mission for the hospital. This vehicle's data indicate it parks near the hospital (Building 993) on Franklin Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 1,720 miles at the start of this study and its average annual mileage is 9,000 miles. The vehicle was used on 34% of the available days, with an average daily usage of 2.6 hours and a peak daily usage of 7.6 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening of the day.

Figure B-9 shows that 56% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 67% of the outings were also within this range. Further, 44% of daily travel and 67% of outings were within the typically advertised CD mode of 40 miles for PHEVs. The peak outing of 601 miles occurred over a several day period when the vehicle was frequently offsite.

A BEV could not meet all daily travel, but a significant portion of this vehicle's travel was within the CD range of a PHEV. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 4

Make/Model/Year	Dodge Avenger – 2008
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 386, Charles Porter Ave
Fleet Vehicle ID	G10-7547F
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	19/27/22 13/20/16
EPA GHG Emissions (Grams CO_2/Mi)	404/388
Study Logger ID	19
Total Vehicle Days/Total Study Days	11/47

Vehicle G10-7547F Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	2.2/5.2	2.7/12.0	0.8/3.5	24
Travel Time (Minutes)	18.5/80.0	22.6/117.0	6.8/67.0	203
Idle Time (Minutes)	0.3/NA	10.2/NA	3.1/NA	92

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	19	100%	Less than 2	6
10 to 20	0	0	2 to 4	1
20 to 40	0	0	4 to 8	2
40 to 60	0	0	Greater than 8	10

Figure B-10. Vehicle G10-7547F stops.

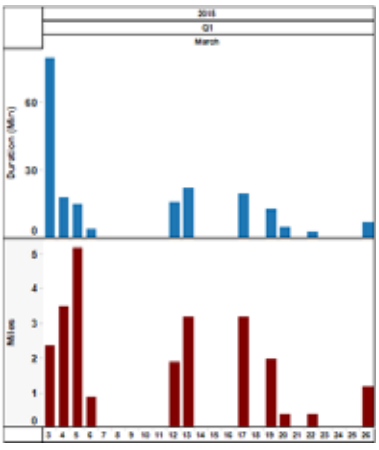

Figure B-11. Vehicle G10-7547F history.

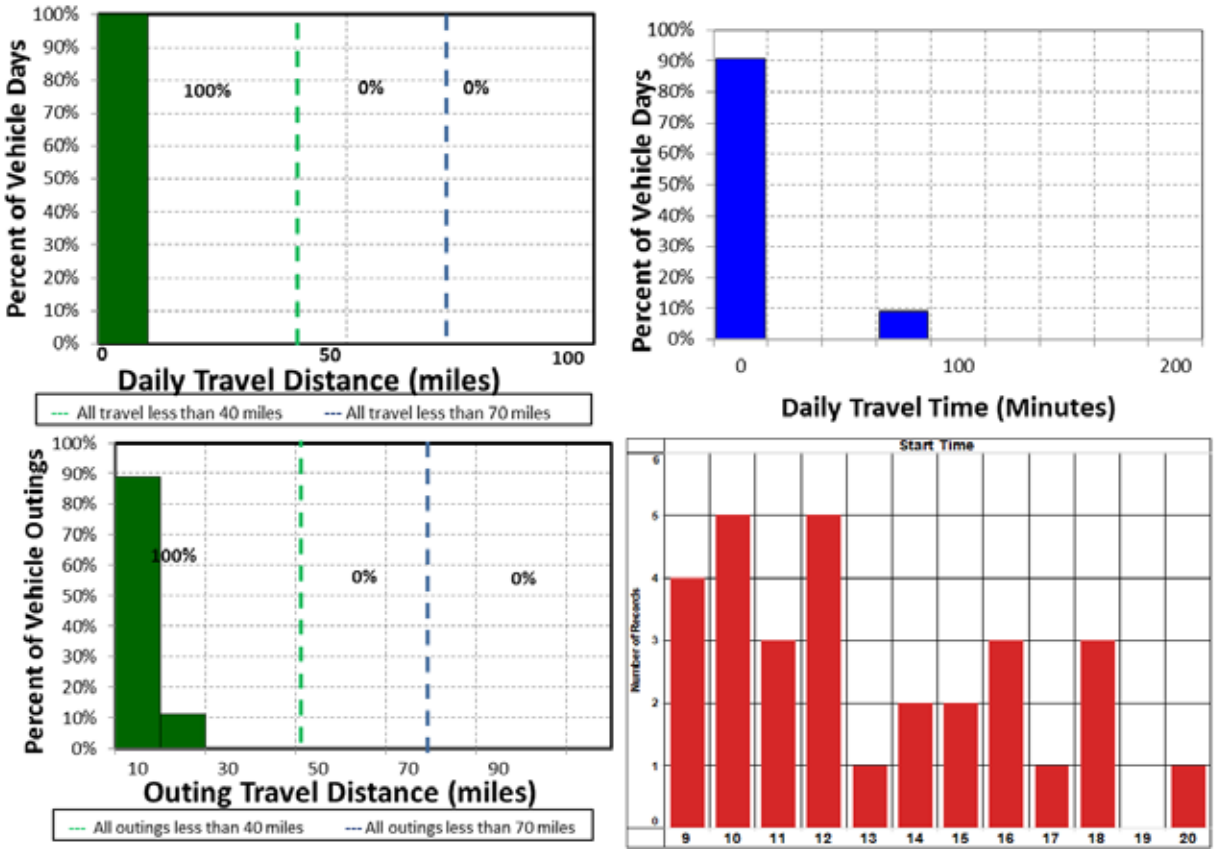

Figure B-12. Vehicle G10-7547F travel and time-of-day graphs.

Vehicle G10-7547F Observations

Logger 19 collected data on this vehicle for a period of 11 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for the VAQ. This vehicle's data indicate it parks near Building 386 on Charles Porter Ave (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 17,566 miles at the start of this study and its average annual mileage is 2,464 miles. The vehicle was used on 23% of the available days, with an average daily usage of 0.3 hours and a peak daily usage of 1.3 hours on the days it was used. The vehicle was used primarily during normal day-shift hours.

Figure B-12 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles and all outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was assigned a home base.

Sheet 5

Make/Model/Year	Dodge Grand Caravan - 2010
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2547, Essex Rd
Fleet Vehicle ID	G41-1136K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/477
Study Logger ID	38
Total Vehicle Days/Total Study Days	23/47

Vehicle G41-1136K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	28.8/56.8	2.5/11.4	2.0/10.8	661
Travel Time (Minutes)	176.0/310.0	15.5/53.0	12.4/53.0	4,048
Idle Time (Minutes)	39.9/NA	3.5/NA	2.8/NA	917

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	307	100%	Less than 2	214
10 to 20	0	0	2 to 4	77
20 to 40	0	0	4 to 8	15
40 to 60	0	0	Greater than 8	1

Figure B-13. Vehicle G41-1136K stops.

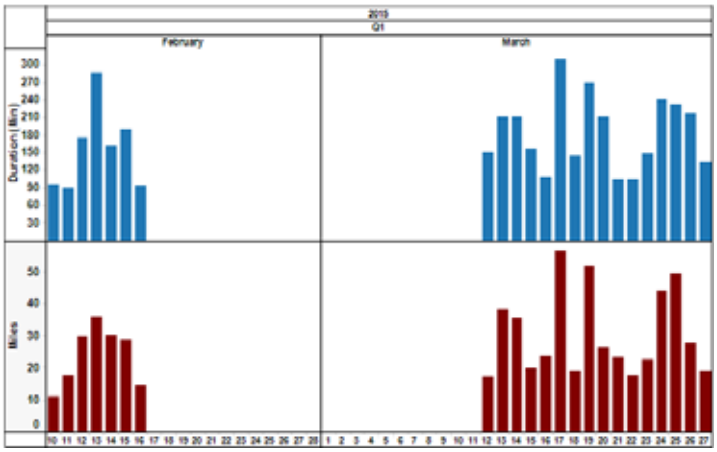

Figure B-14. Vehicle G41-1136K history.

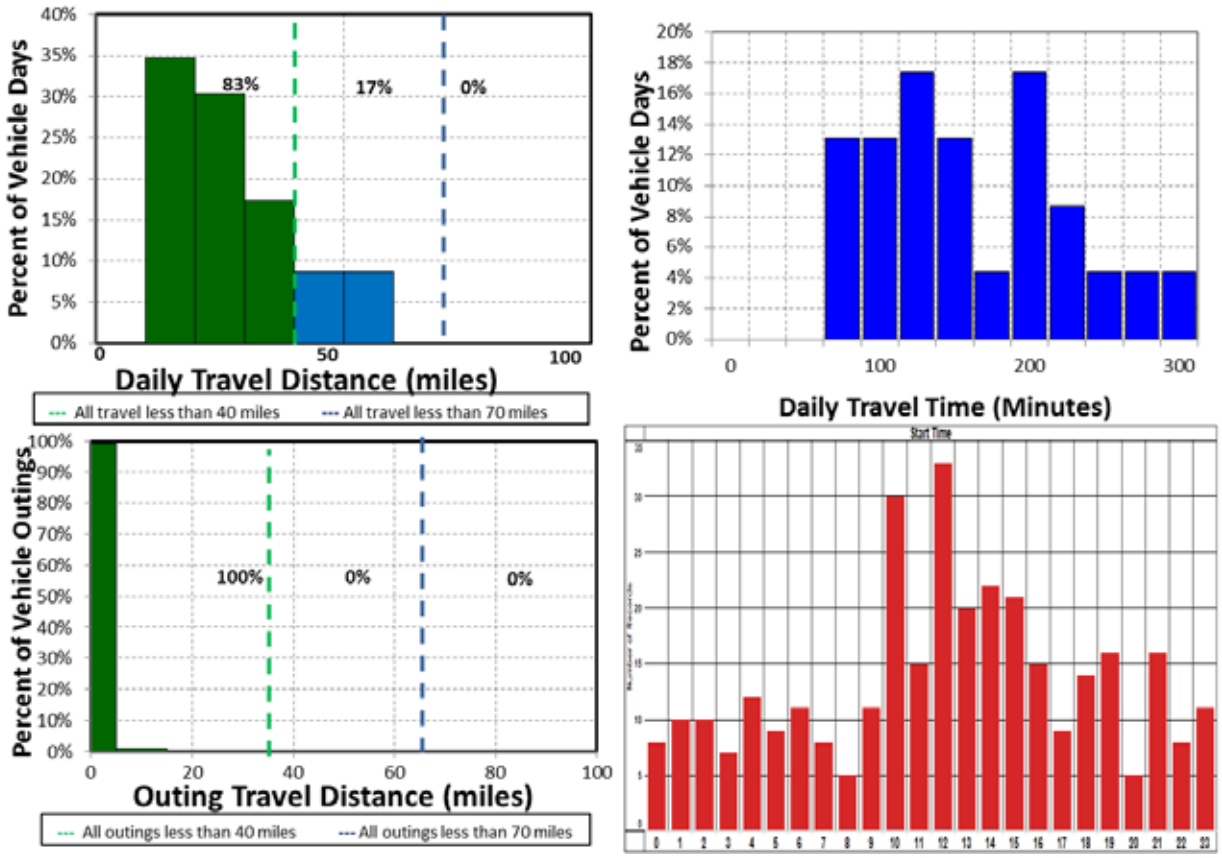

Figure B-15. Vehicle G41-1136K travel and time-of-day graphs.

Vehicle G41-1136K Observations

Logger 38 collected data on this vehicle for a period of 23 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for FRC. This vehicle's data indicate it parks near Building 2547 near Essex Road (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 68,516 miles at the start of this study and its average annual mileage is 13,004 miles. The vehicle was used on 83% of the available days, with an average daily usage of 2.9 hours and a peak daily usage of 5.2 hours on the days it was used. The vehicle was used during all hours of the day.

Figure B-15 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles and all outings were also within this range. Further, 83% of daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was assigned a home base.

Sheet 6

Make/Model/Year	Dodge Grand Caravan - 2010
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 410, Charles Porter Ave
Fleet Vehicle ID	G41-1139K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/477
Study Logger ID	40
Total Vehicle Days/Total Study Days	35/47

Vehicle G41-1139K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	12.5/215.7	3.3/216.7	1.8/106.6	438
Travel Time (Minutes)	48.8/319.0	12.8/297.0	6.9/143.0	1,709
Idle Time (Minutes)	9.2/NA	2.4/NA	1.3/NA	321

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	204	99.5%	Less than 2	143
10 to 20	0	0	2 to 4	17
20 to 40	0	0	4 to 8	12
40 to 60	1	0.5%	Greater than 8	33

Figure B-16. Vehicle G41-1139K stops.

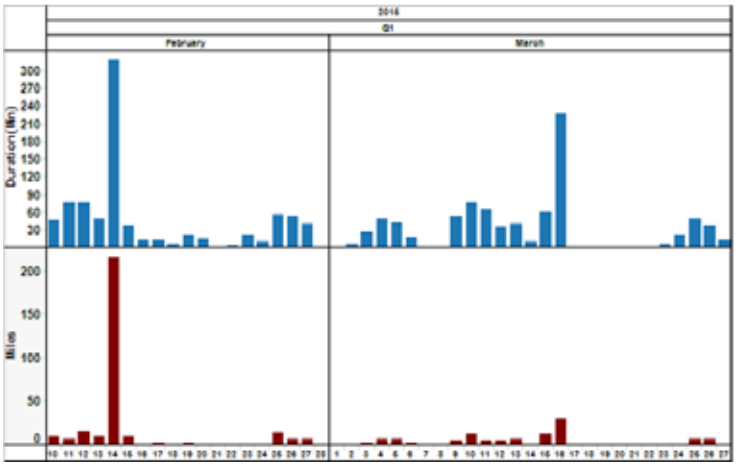

Figure B-17. Vehicle G41-1139K history.

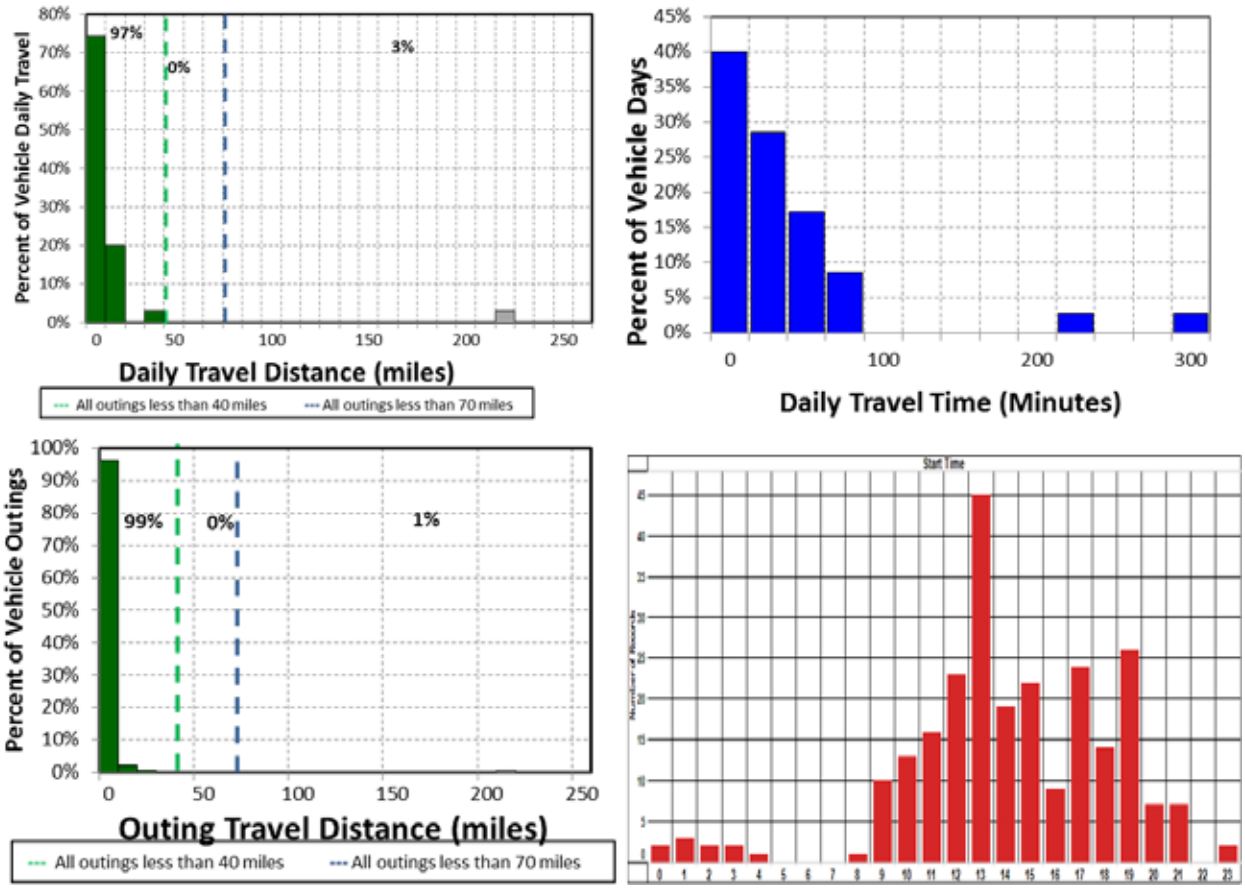

Figure B-18. Vehicle G41-1139K travel and time-of-day graphs.

Vehicle G41-1139K Observations

Logger 40 collected data on this vehicle for a period of 35days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for VP1. This vehicle's data indicate it parks near Building 410 near N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 54,551 miles at the start of this study and its average annual mileage is 10,781 miles. The vehicle was used on 74% of the available days, with an average daily usage of 0.8 hours and a peak daily usage of 5.3 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening of the day.

Figure B-18 shows that 97% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 99% of the outings were also within this range. Further, 97% of daily travel and 99% of outings were within the typically advertised CD mode of 40 miles for PHEVs. A single excursion off-base to SEATAC airport and other locations accounted for the long outing.

A BEV could meet most of the daily travel without additional charging opportunities, assuming the vehicle was charged at a home base. A PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 7

Make/Model/Year	Dodge Grand Caravan - 2010
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 410, Charles Porter Ave
Fleet Vehicle ID	G41-1140K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/477
Study Logger ID	41
Total Vehicle Days/Total Study Days	23/47

Vehicle G41-1140K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	6.2/27.4	3.3/27.4	1.3/26.1	142
Travel Time (Minutes)	28.8/81.0	15.4/84.0	6.3/47.0	663
Idle Time (Minutes)	4.7/NA	2.5/NA	1.0/NA	108

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	84	100%	Less than 2	48
10 to 20	0	0	2 to 4	6
20 to 40	0	0	4 to 8	9
40 to 60	0	0	Greater than 8	21

Figure B-19. Vehicle G41-1140K stops.

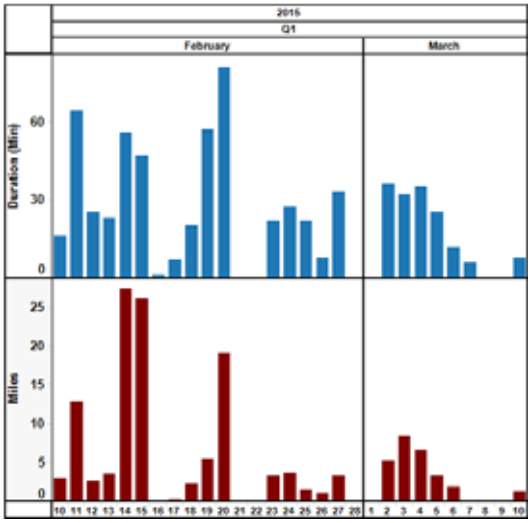

Figure B-20. Vehicle G41-1140K history.

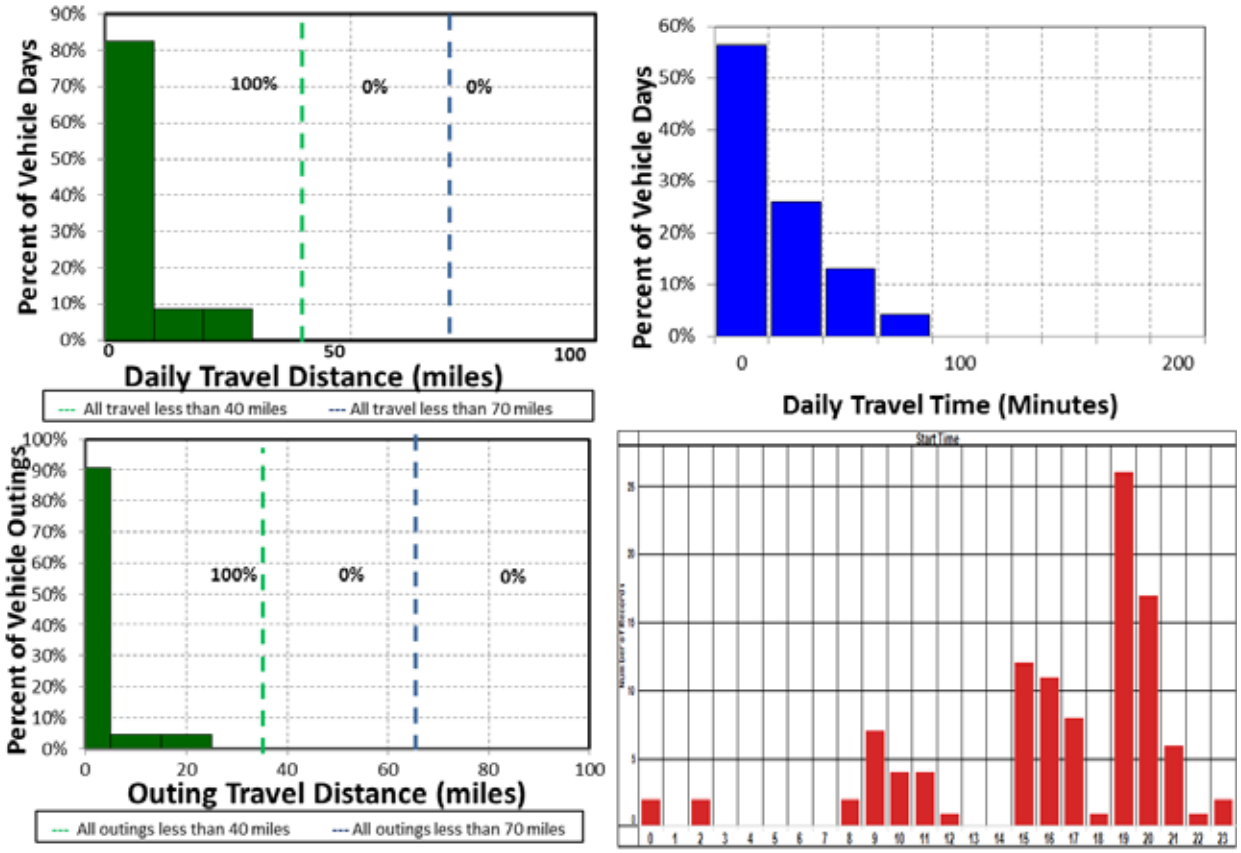

Figure B-21. Vehicle G41-1140K travel and time-of-day graphs.

Vehicle G41-1140K Observations

Logger 41 collected data on this vehicle for a period of 23 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for VQ1. This vehicle's data indicate it parks near Building 410 near N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 9,773 miles at the start of this study and its average annual mileage is 1,635 miles. The vehicle was used on 49% of the available days, with an average daily usage of 0.5 hours and a peak daily usage of 1.4 hours on the days it was used. The vehicle was used primarily during the evening hours of the day.

Figure B-21 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 8

Make/Model/Year	Dodge Grand Caravan - 2010
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 993, E Franklin St
Fleet Vehicle ID	G41-1155K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/477
Study Logger ID	43
Total Vehicle Days/Total Study Days	20/47

Vehicle G41-1155K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	28.7/134.8	17.9/134.8	7.8/44.9	574
Travel Time (Minutes)	68.4/256.0	42.7/256.0	18.5/77.0	1,367
Idle Time (Minutes)	8.5/NA	5.3/NA	2.3/NA	169

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	58	93.5%	Less than 2	38
10 to 20	2	3.2%	2 to 4	4
20 to 40	0	0	4 to 8	2
40 to 60	2	3.2%	Greater than 8	18

Figure B-22. Vehicle G41-1155K stops.

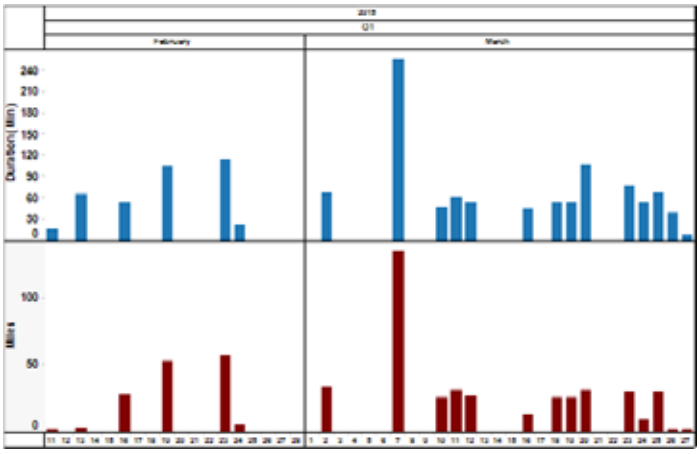

Figure B-23. Vehicle G41-1155K history.

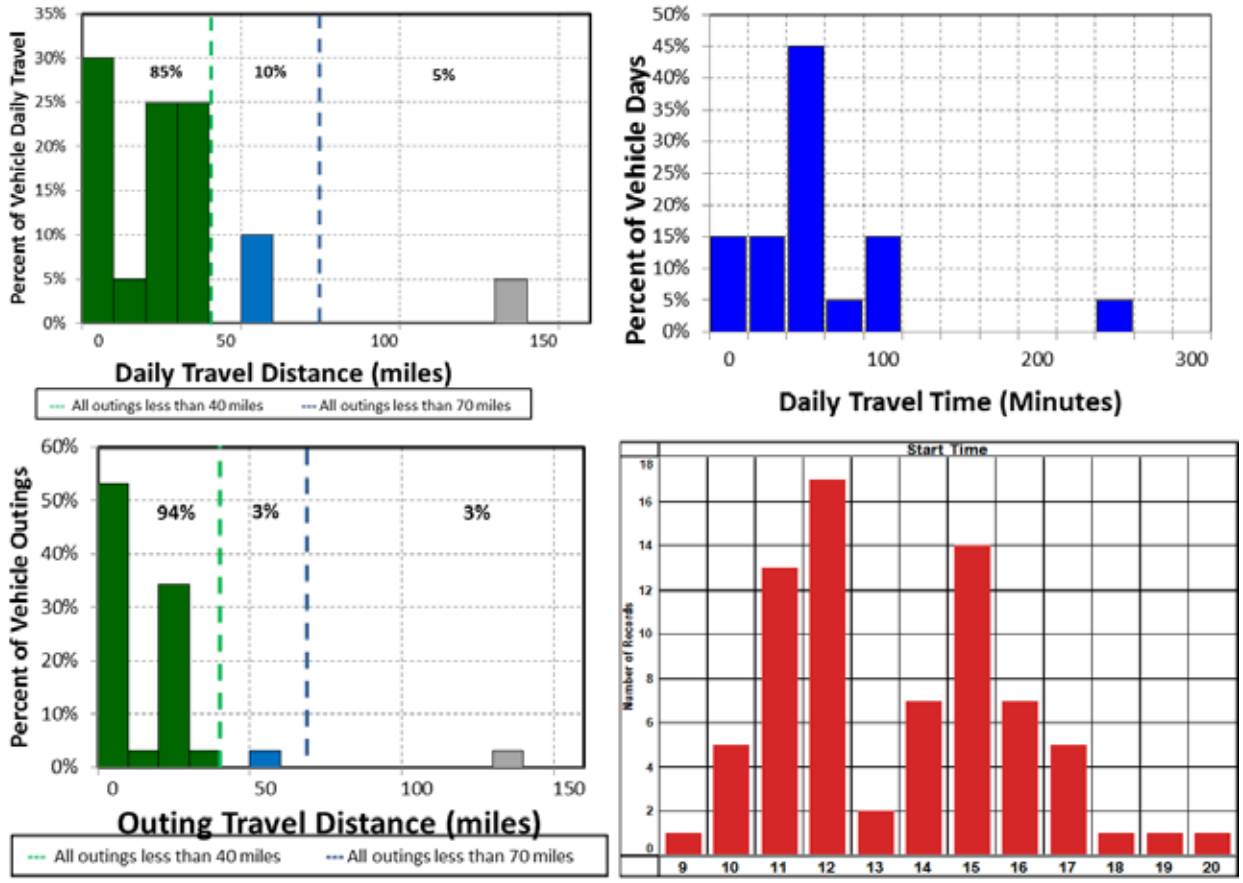

Figure B-24. Vehicle G41-1155K travel and time-of-day graphs.

Vehicle G41-1155K Observations

Logger 43 collected data on this vehicle for a period of 20 days of the47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for NHOH. This vehicle's data indicate it parks near the hospital (Building 993) near E. Franklin Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 23,361 miles at the start of this study and its average annual mileage is 4,995 miles. The vehicle was used on 43% of the available days, with an average daily usage of 1.1 hours and a peak daily usage of 4.3 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure B-24 shows that 95% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 97% of the outings were also within this range. Further, 85% of daily travel and 94% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 9

Make/Model/Year	Dodge Dakota - 2008
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2544, Prowler St
Fleet Vehicle ID	G41-1351G
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/19/15 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)	592/620
Study Logger ID	47
Total Vehicle Days/Total Study Days	32/47

Vehicle G41-1351G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	7.0/20.9	1.0/12.1	0.5/12.1	223
Travel Time (Minutes)	62.6/153.0	9.0/77.0	4.5/43.0	2,002
Idle Time (Minutes)	11.8/NA	1.7/NA	0.9/NA	379

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	387	100%	Less than 2	321
10 to 20	0	0	2 to 4	23
20 to 40	0	0	4 to 8	14
40 to 60	0	0	Greater than 8	26

Figure B-25. Vehicle G41-1351G stops.

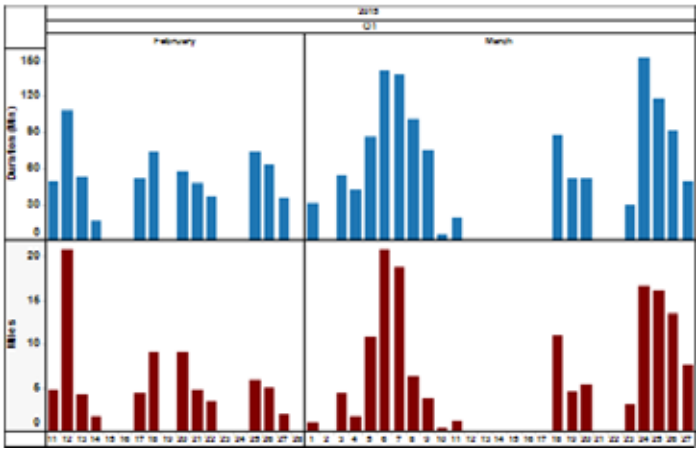

Figure B-26 Vehicle G41-1351G history.

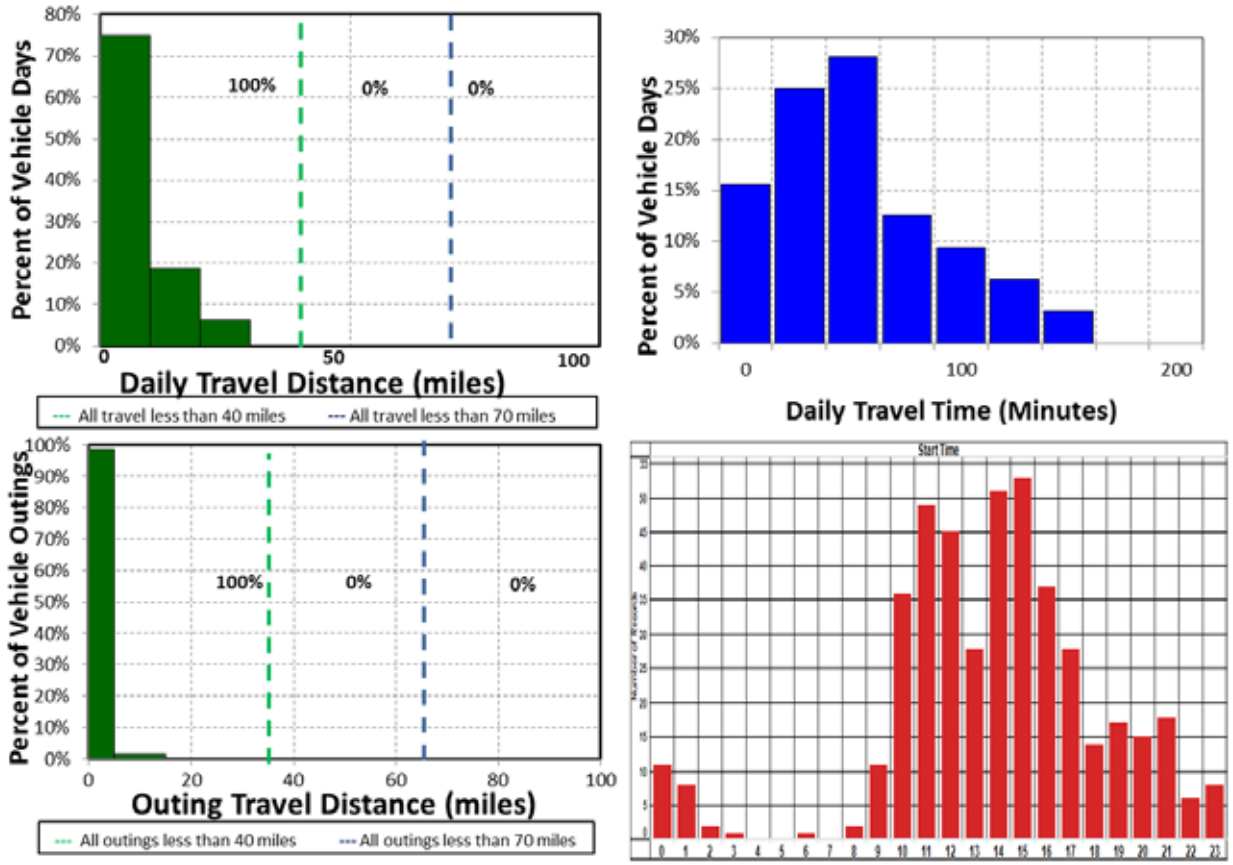

Figure B-27. Vehicle G41-1351G travel and time-of-day graphs.

Vehicle G41-1351G Observations

Logger 47 collected data on this vehicle for a period of 32 days of the47-day study period. Validation occurred on 99.8% of the input data. Data indicate that this vehicle has a support mission for VP69. This vehicle's data indicate it parks near Building 2544 near Prowler Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 26,112 miles at the start of this study and its average annual mileage is 3,634 miles. The vehicle was used on 68% of the available days, with an average daily usage of 1.0 hours and a peak daily usage of 2.6 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure B-27 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 10

Make/Model/Year	Chevrolet Colorado – 2012
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 975, Midway St
Fleet Vehicle ID	G41-2911M
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	18/25/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	74
Total Vehicle Days/Total Study Days	25/47

Vehicle G41-2911M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	32.3/124.3	12.0/124.2	5.8/51.4	805
Travel Time (Minutes)	71.3/213.0	26.6/181.0	12.8/74.0	1,783
Idle Time (Minutes)	14.6/NA	5.5/NA	2.6/NA	366

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	116	92.1%	Less than 2	89
10 to 20	1	0.8%	2 to 4	8
20 to 40	9	7.1%	4 to 8	5
40 to 60	0	0	Greater than 8	24

Figure B-28. Vehicle G41-2911M stops.

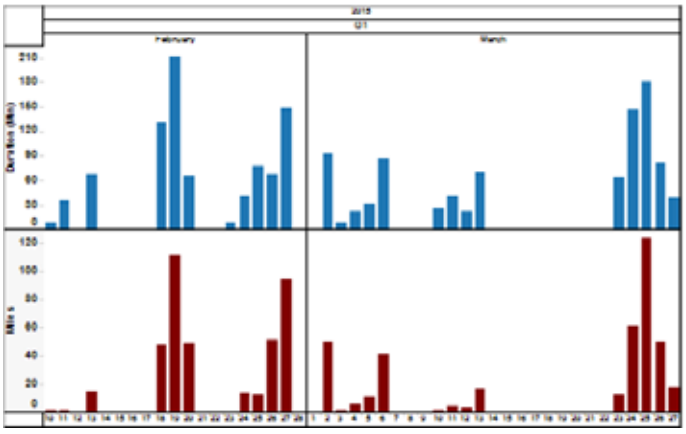

Figure B-29. Vehicle G41-2911M history.

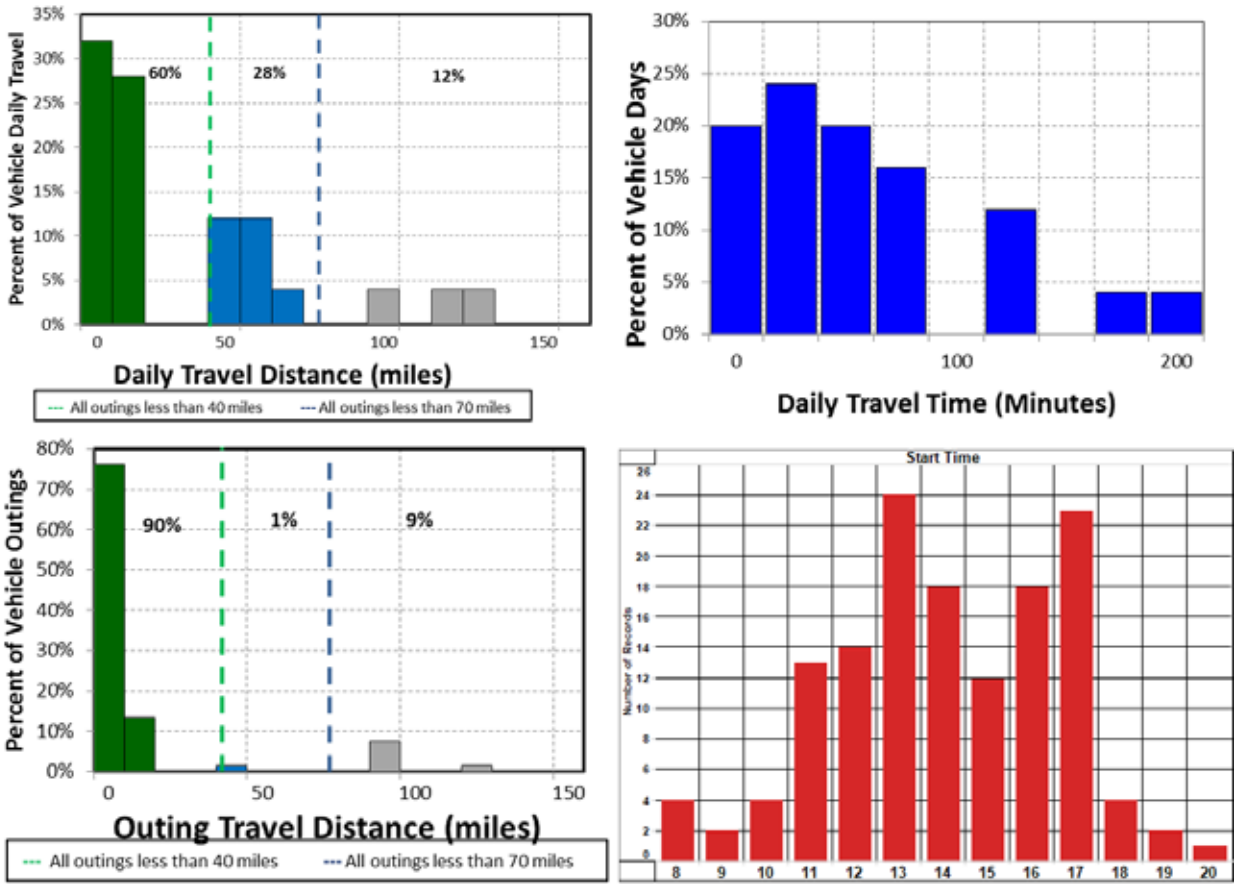

Figure B-30. Vehicle G41-2911M travel and time-of-day graphs.

Vehicle G41-2911M Observations

Logger 74 collected data on this vehicle for a period of 25 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for VP69. This vehicle's data indicate it parks near Building 975 near Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 4,925 miles at the start of this study and its average annual mileage is 1,184 miles. The vehicle was used on 53% of the available days, with an average daily usage of 1.2 hours and a peak daily usage of 3.6 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure B-30 shows that 88% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 91% of the outings were also within this range. Further, 60% of daily travel and 90% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at a home base. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 11

Make/Model/Year	Dodge Grand Caravan- 2014
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 385, Charles Porter Ave
Fleet Vehicle ID	G41-3153P
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/25/20 12/18/14
EPA GHG Emissions (Grams CO_2/Mi)	444/434
Study Logger ID	75
Total Vehicle Days/Total Study Days	6/47

Vehicle G41-3153P Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	1.5/2.0	1.0/1.8	0.5/0.9	9
Travel Time (Minutes)	9.8/14.0	6.6/9.0	3.3/7.0	59
Idle Time (Minutes)	0.5/NA	0.3/NA	0.2/NA	3

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	17	100%	Less than 2	11
10 to 20	0	0	2 to 4	0
20 to 40	0	0	4 to 8	0
40 to 60	0	0	Greater than 8	6

Figure B-31. Vehicle G41-3153P stops.

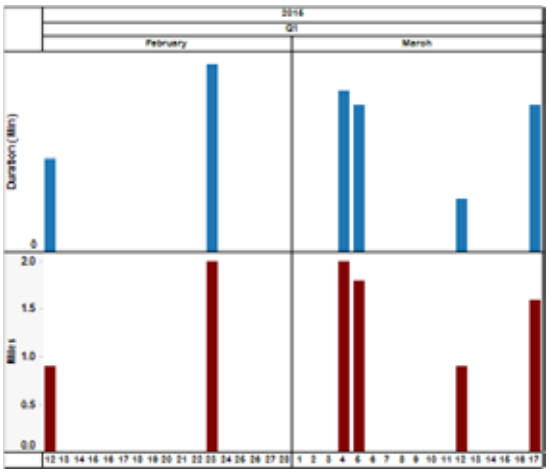

Figure B-32. Vehicle G41-3153P history.

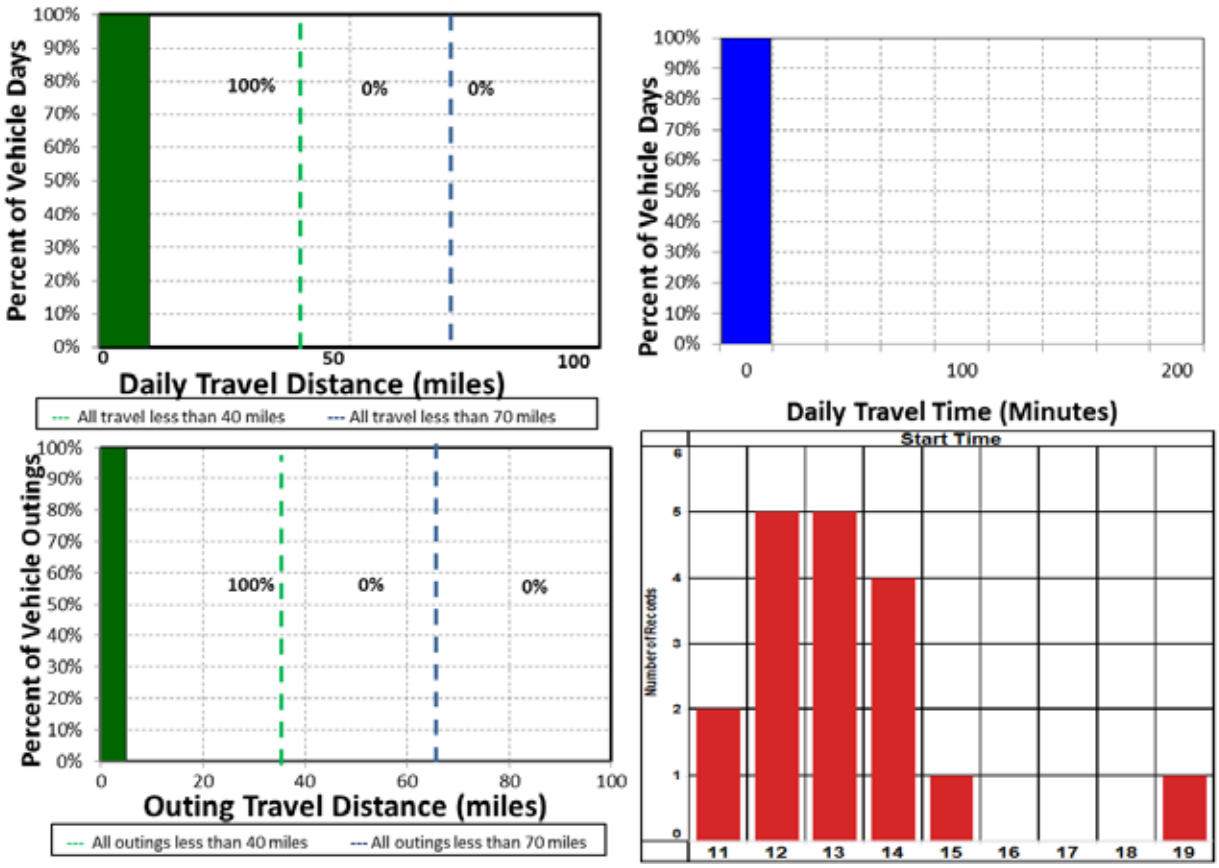

Figure B-33. Vehicle G41-3153P travel and time-of-day graphs.

Vehicle G41-3153P Observations

Logger 75 collected data on this vehicle for a period of 6 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for CMS. This vehicle's data indicate it parks near Building 385 on Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 683 miles at the start of this study and its average annual mileage is 744 miles. The vehicle was used on 13% of the available days, with an average daily usage of 0.2 hours and a peak daily usage of 0.2 hours on the days it was used. The vehicle was used during day-shift hours.

Figure B-33 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 12

Make/Model/Year	Dodge Grand Caravan- 2014
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 976, Princeton St
Fleet Vehicle ID	G41-3159P
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/25/20 12/18/14
EPA GHG Emissions (Grams CO_2/Mi)	444/434
Study Logger ID	76
Total Vehicle Days/Total Study Days	1/47

Vehicle G41-3159P Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Travel Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Idle Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	Insufficient data	Insufficient data	Less than 2	Insufficient data
10 to 20	Insufficient data	Insufficient data	2 to 4	Insufficient data
20 to 60	Insufficient data	Insufficient data	4 to 8	Insufficient data
Greater than 60	Insufficient data	Insufficient data	Greater than 8	Insufficient data

Insufficient Data

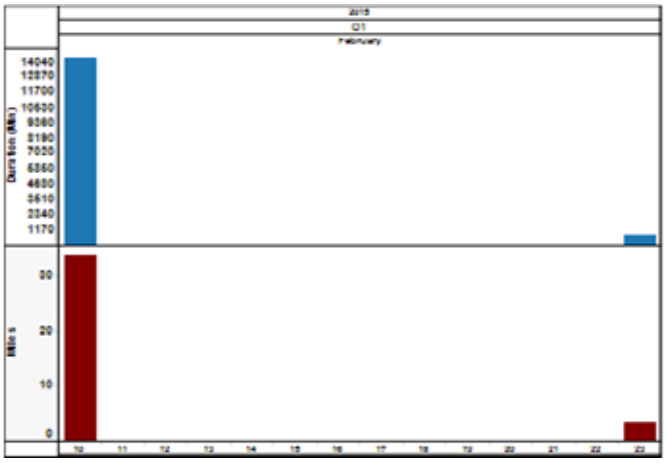

Figure B-34. Vehicle G41-3159P stops.

Figure B-35. Vehicle G41-3159P history.

Insufficient Data

Figure B-36. Vehicle G41-3159P travel and time-of-day graphs.

Vehicle G41-3159P Observations

Insufficient data were collected by Logger 76 on this vehicle. Although this was recognized early in the study period, it could not be resolved.

NASWI reports that the vehicle odometer indicated 2,245 miles at the start of this study and its average annual mileage is 1,921 miles.

Sheet 13

Make/Model/Year	Chevrolet Silverado – 2010
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	No data
Fleet Vehicle ID	G42-0587K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	15/22/18 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	494/477
Study Logger ID	80
Total Vehicle Days/Total Study Days	

Vehicle G42-0587K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Travel Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Idle Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	Insufficient data	Insufficient data	Less than 2	Insufficient data
10 to 20	Insufficient data	Insufficient data	2 to 4	Insufficient data
20 to 40	Insufficient data	Insufficient data	4 to 8	Insufficient data
40 to 60	Insufficient data	Insufficient data	Greater than 8	Insufficient data

Insufficient Data

Figure B-37. Vehicle G42-0587K stops.

Insufficient Data

Figure B-38. Vehicle G42-0587K history.

Insufficient data

Figure B-39. Vehicle G42-0587K travel and time-of-day graphs.

Vehicle G42-0587K Observations

Insufficient data were collected by Logger 76 on this vehicle. Although this was recognized early in the study period, it could not be resolved.

NASWI reports that the vehicle odometer indicated 14,415 miles at the start of this study and its average annual mileage is 2,798 miles.

Sheet 14

Make/Model/Year	Chevrolet Silverado – 2010
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 385, Lexington St
Fleet Vehicle ID	G42-0590K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	15/22/18 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	494/477
Study Logger ID	82
Total Vehicle Days/Total Study Days	32/47

Vehicle G42-0590K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	15.8/46.5	8.7/33.4	2.6/32.8	505
Travel Time (Minutes)	82.4/246.0	45.5/157.0	13.3/131.0	2.637
Idle Time (Minutes)	12.6/NA	6.9/NA	2.0/NA	402

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	205	100%	Less than 2	171
10 to 20	0	0	2 to 4	7
20 to 40	0	0	4 to 8	1
40 to 60	0	0	Greater than 8	26

Figure B-40. Vehicle G42-0590K stops.

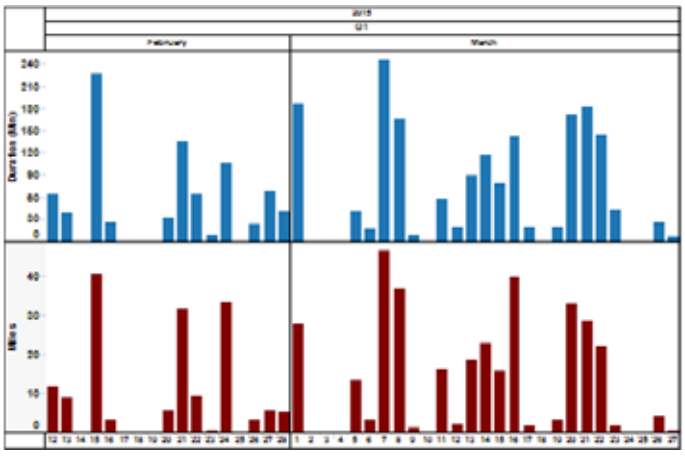

Figure B-41. Vehicle G42-0590K history.

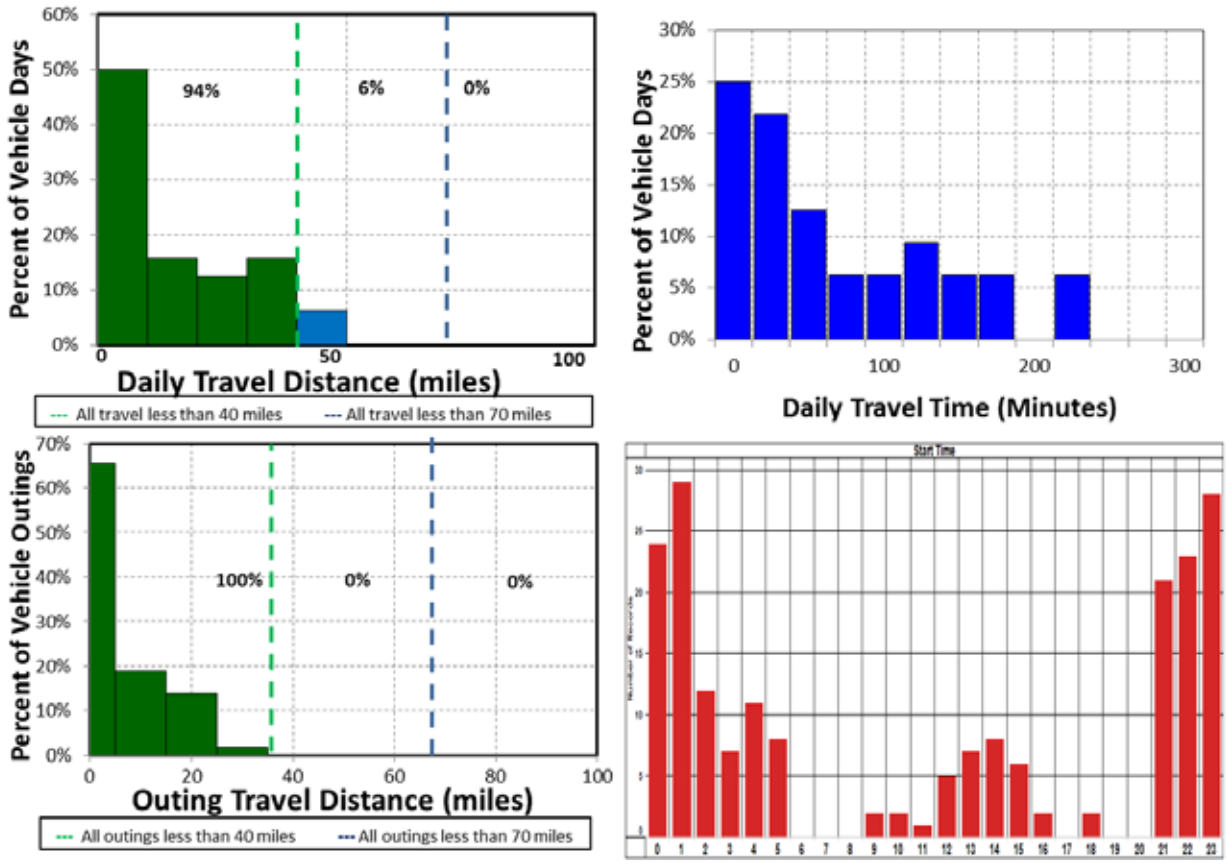

Figure B-42. Vehicle G42-0590K travel and time-of-day graphs.

Vehicle G42-0590K Observations

Logger 82 collected data on this vehicle for a period of 32 days of the47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for CDO. This vehicle's data indicate it parks near Building 385 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 21,557 miles at the start of this study and its average annual mileage is 4,260 miles. The vehicle was used on 68% of the available days, with an average daily usage of 1.4 hours and a peak daily usage of 4.1 hours on the days it was used. The vehicle was used during late night and early morning hours.

Figure B-42 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, 94% of daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 15

Make/Model/Year	Ford F150 – 2012
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2737, Lexington St
Fleet Vehicle ID	G42-1232M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/23/19 12/17/14
EPA GHG Emissions (Grams CO_2/Mi)	468/443
Study Logger ID	90
Total Vehicle Days/Total Study Days	31/47

Vehicle G42-1232M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	5.0/11.5	1.3/4.1	0.6/2.3	155
Travel Time (Minutes)	46.2/92.0	11.6/52.0	5.1/25.0	1,431
Idle Time (Minutes)	5.0/NA	1.3/NA	0.5/NA	154

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	243	100%	Less than 2	187
10 to 20	0	0	2 to 4	18
20 to 40	0	0	4 to 8	7
40 to 60	0	0	Greater than 8	31

Figure B-43. Vehicle G42-1232M stops.

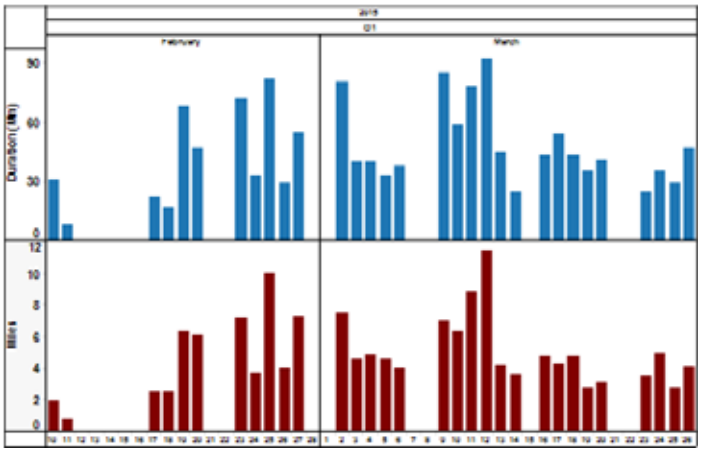

Figure B-44. Vehicle G42-1232M history.

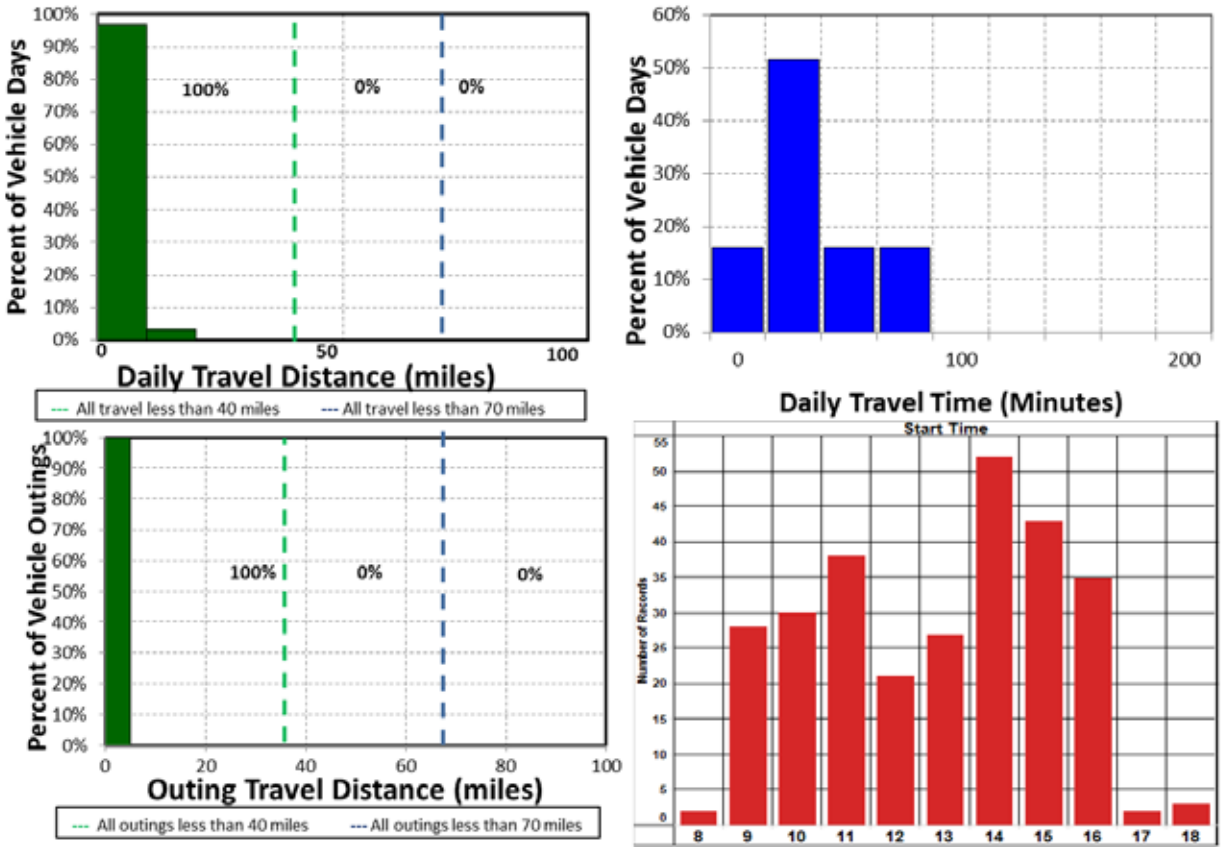

Figure B-45. Vehicle G42-1232M travel and time-of-day graphs.

Vehicle G42-1232M Observations

Logger 90 collected data on this vehicle for a period of 31 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for NADEP. This vehicle's data indicate it parks near Building 2737 near N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 4,892 miles at the start of this study and its average annual mileage is 1,479 miles. The vehicle was used on 66% of the available days, with an average daily usage of 0.8 hours and a peak daily usage of 1.5 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure B-45 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 16

Make/Model/Year	Ford E350 – 2013
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2737,Charles Porter Ave
Fleet Vehicle ID	G42-1281M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	12/16/13 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)	671/625
Study Logger ID	91
Total Vehicle Days/Total Study Days	42/47

Vehicle G42-1281M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/10.0/Peak	Total
Travel Distance (Miles)	43.9/268.4	7.4/213.0	4.6/209.3	1,845
Travel Time (Minutes)	136.8/427.0	23.2/340.0	14.3/264.0	5,747
Idle Time (Minutes)	45.2/NA	7.6/NA	4.7/NA	1,897

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	364	98.6%	Less than 2	264
10 to 20	2	0.5%	2 to 4	54
20 to 40	1	0.3%	4 to 8	23
40 to 60	2	0.5%	Greater than 8	28

Figure B-46. Vehicle G42-1281M stops.

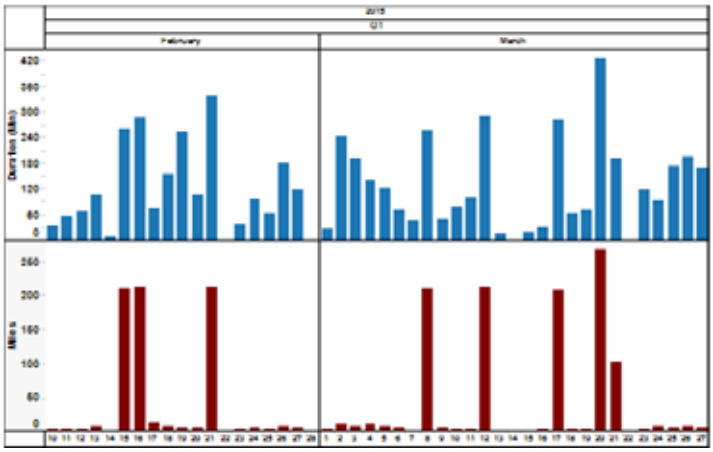

Figure B-47. Vehicle G42-1281M history.

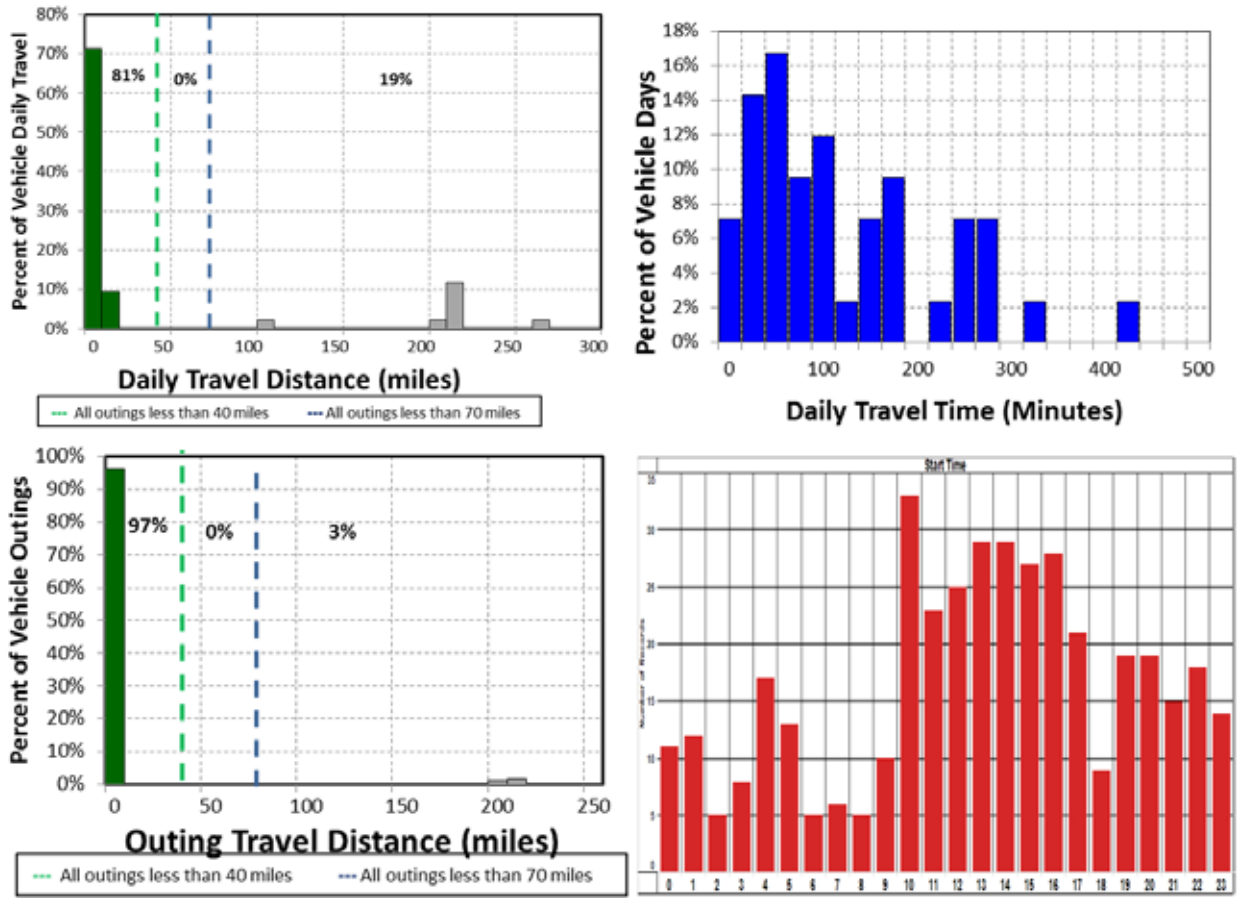

Figure B-48. Vehicle G42-1281M travel and time-of-day graphs.

Vehicle G42-1281M Observations

Logger 91 collected data on this vehicle for a period of 42 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Q129. This vehicle's data indicate it parks near Building 2737/112 near N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 28,079 miles at the start of this study and its average annual mileage is 12,725 miles. The vehicle was used on 89% of the available days, with an average daily usage of 2.3 hours and a peak daily usage of 7.1 hours on the days it was used. The vehicle was used during all hours of the day.

Figure B-48 shows that 81% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 97% of the outings were also within this range. Further, 81% of daily travel and 97% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 17

Make/Model/Year	Ford E350 - 2006
EPA Class Size	Van – Cargo
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2642, Essex Rd
Fleet Vehicle ID	G43-3437B
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	13/17/15
EPA GHG Emissions (Grams CO_2/Mi)*	592
Study Logger ID	100
Total Vehicle Days/Total Study Days	25/47

Vehicle G43-3437B Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	4.6/16.4	1.7/13.1	0.6/3.8	114
Travel Time (Minutes)	47.9/149.0	17.9/90.0	6.1/64.0	1,197
Idle Time (Minutes)	12.3/NA	4.6/NA	1.6/NA	307

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	193	100%	Less than 2	158
10 to 20	0	0	2 to 4	8
20 to 40	0	0	4 to 8	1
40 to 60	0	0	Greater than 8	26

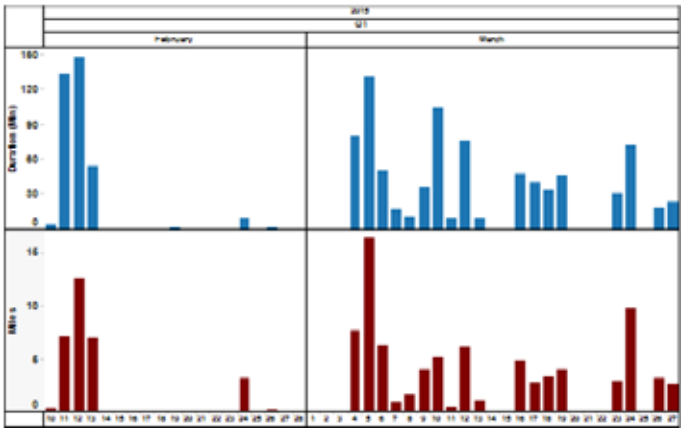

Figure B-49. Vehicle G43-3437B stops. Figure B-50. Vehicle G43-3437B history.

*Fuel economy for 2006 E350 is unavailable. Information is for 2006 E150 van.

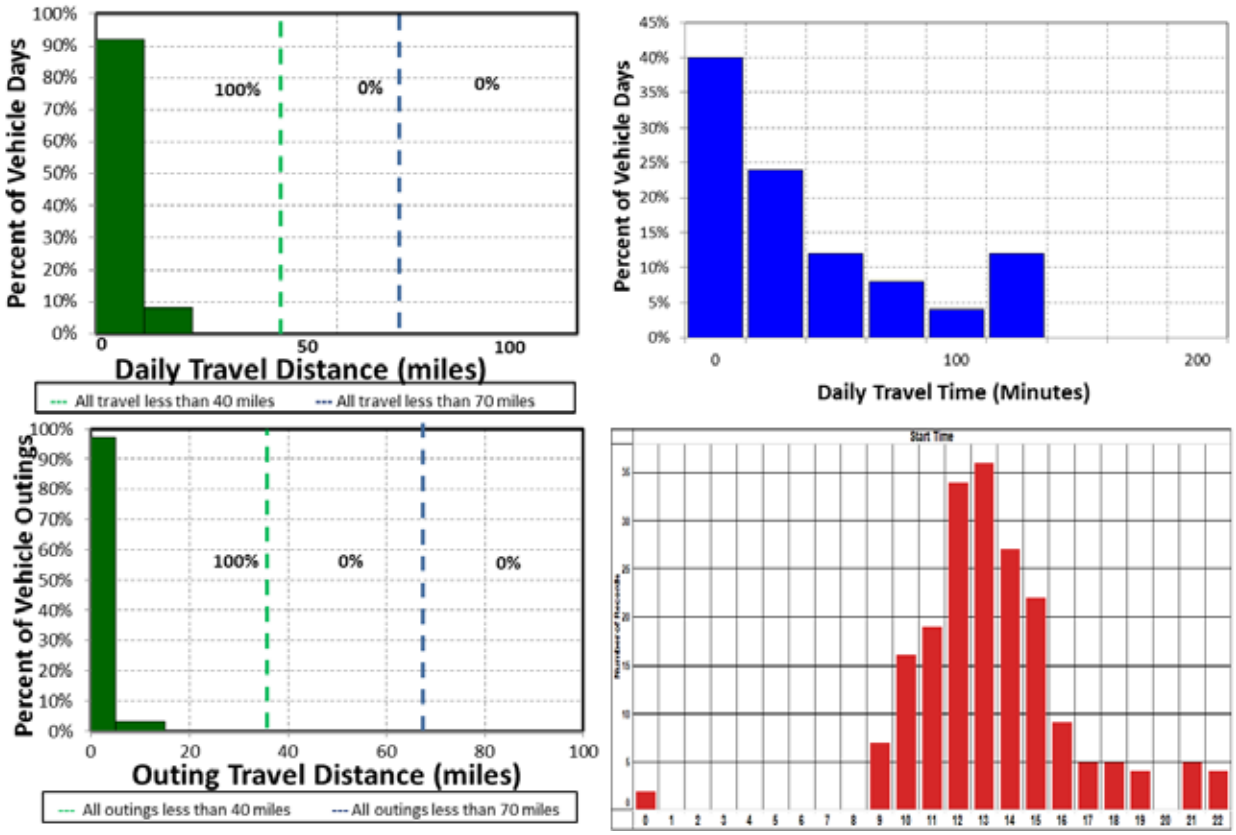

Figure B-51. Vehicle G43-3437B travel and time-of-day graphs.

Vehicle G43-3437B Observations

Logger 100 collected data on this vehicle for a period of 25 days of the 47-day study period. Validation occurred on 99.8% of the input data. Data indicate that this vehicle has a support mission for Q209. This vehicle's data indicate it parks near Building 2642 on Essex Road (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 9,095 miles at the start of this study and its average annual mileage is 986 miles. The vehicle was used on 53% of the available days, with an average daily usage of 0.8 hours and a peak daily usage of 2.5 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure B-51 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 18

Make/Model/Year	Ford Explorer – 2010
EPA Class Size	SUV
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2897, Ranger St
Fleet Vehicle ID	G61-0513K
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	15/21/17
EPA GHG Emissions (Grams CO_2/Mi)	523
Study Logger ID	103
Total Vehicle Days/Total Study Days	28/47

Vehicle G61-0513K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	43.2/261.9	22.8/305.5	8.9/89.8	1,209
Travel Time (Minutes)	83.8/402.0	44.2/441.0	17.2/117.0	2,345
Idle Time (Minutes)	14.2/NA	7.5/NA	2.9/NA	397

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	84	71.8%	Less than 2	73
10 to 20	6	5.1%	2 to 4	6
20 to 40	25	21.4%	4 to 8	12
40 to 60	2	1.7%	Greater than 8	26

Figure B-52. Vehicle G61-0513K stops.

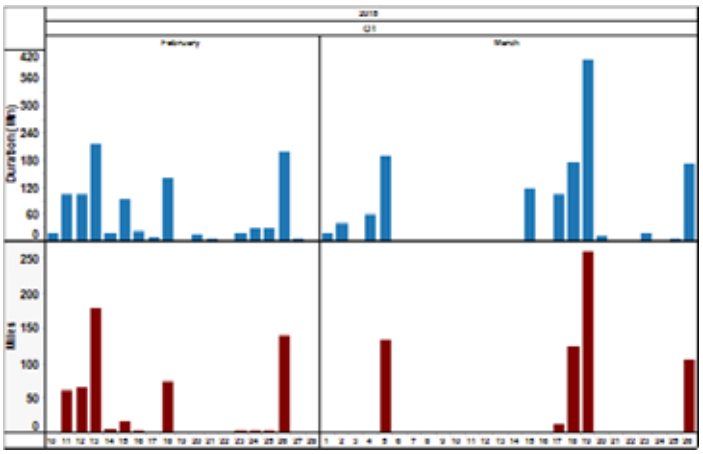

Figure B-53. Vehicle G61-0513K history.

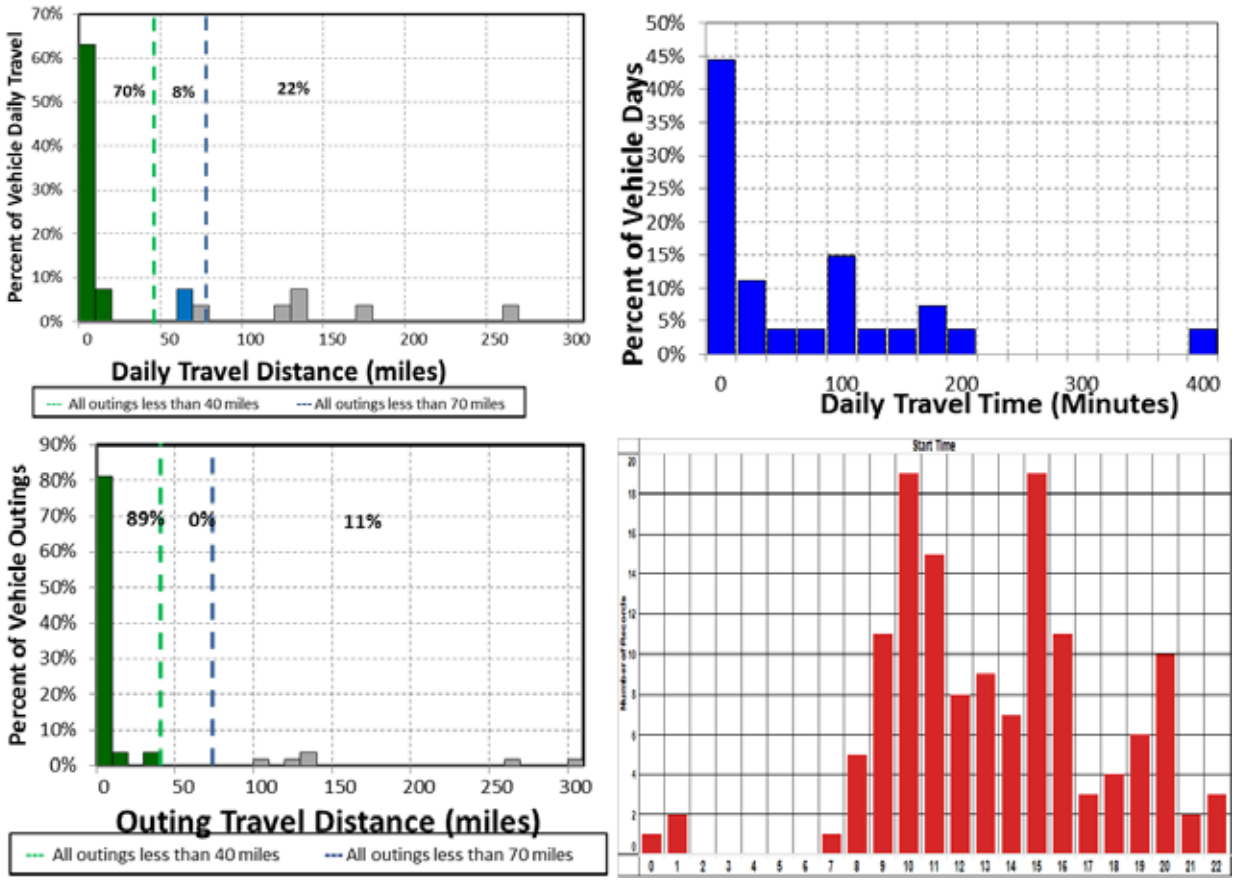

Figure B-54. Vehicle G61-0513K travel and time-of-day graphs.

Vehicle G61-0513K Observations

Logger 103 collected data on this vehicle for a period of 28 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Fire. This vehicle's data indicate it parks near Building 2897 on Ranger Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 38,881 miles at the start of this study and its average annual mileage is 7,229 miles. The vehicle was used on 60% of the available days, with an average daily usage of 1.4 hours and a peak daily usage of 6.7 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure B-54 shows that 78% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 89% of the outings were also within this range. Further, 70% of daily travel and 89% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Appendix C

NASWI Departments Vehicle Data Sheets

Table C-1. NASWI Departments group vehicle index.

Vehicle Index							
Sheet	Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
19	2	G10-0984N	Dodge	Avenger	2008	Sedan - Compact	Support
20	3	G10-1137M	Chevrolet	Malibu	2012	Sedan - Midsize	Support
21	5	G10-1139M	Chevrolet	Malibu	2012	Sedan - Midsize	Support
22	8	G10-1141M	Chevrolet	Malibu	2012	Sedan - Midsize	Support
23	9	G10-2844L	Chevrolet	Malibu	2011	Sedan - Midsize	Pool
24	10	G10-3590P	Chevrolet	Malibu	2015	Sedan - Midsize	Support
25	13	G10-2848L	Chevrolet	Malibu	2011	Sedan - Midsize	Pool
26	14	G10-2850L	Chevrolet	Malibu	2011	Sedan - Midsize	Pool
27	15	G10-2968L	Chevrolet	Malibu	2011	Sedan - Midsize	Pool
28	17	G10-5286H	Pontiac	G6	2009	Sedan - Compact	Support
29	18	G42-1940N	Chevrolet	G1300	2014	Van – Pass	Pool
30	20	G61-0245G	Ford	Escape	2008	SUV	Pool
31	35	G11-0472L	Chevrolet	Impala	2011	Sedan – Large	Enforcement
32	36	G11-1424L	Chevrolet	Impala	2012	Sedan - Large	Enforcement
33	37	G11-2898K	Chevrolet	Impala	2014	Sedan - Large	Enforcement
34	39	G41-1137K	Dodge	Grd Caravan SE	2010	Minivan	Support
35	42	G41-1142K	Dodge	Grd Caravan SE	2010	Minivan	Pool
36	45	G41-1349G	Dodge	Dakota	2008	Pickup	Support
37	46	G41-1350G	Dodge	Dakota	2008	Pickup	Support
38	59	G41-1536L	Dodge	Grd Caravan Exp	2011	Minivan	Support
39	68	G41-1597L	Dodge	Dakota	2011	Pickup	Support
40	69	G41-1763H	Ford	Ranger	2009	Pickup	Support
41	70	G41-1765H	Ford	Ranger	2009	Pickup	Support
42	71	G41-1767H	Ford	Ranger	2009	Pickup	Support
43	73	G41-1768H	Ford	Ranger	2009	Pickup	Support
44	77	G41-4334M	Chevrolet	Colorado	2012	Pickup	Support
45	78	G42-0334G	Chevrolet	G1300	2008	Van - Pass	Pool
46	79	G42-0335G	Chevrolet	G1300	2008	Van - Pass	Support
47	83	G42-0656K	Chevrolet	Silverado	2010	Pickup	Support
48	84	G42-0766L	Chevrolet	C1500	2011	Pickup	Support
49	86	G42-0881H	Ford	F150	2009	Pickup	Pool
50	87	G42-1222M	Chevrolet	G1300 Express	2012	Van - Pass	Support
51	88	G42-1223M	Chevrolet	G1300 Express	2012	Van - Pass	Support
52	92	G42-2035L	Chevrolet	Tahoe	2012	SUV	Enforcement
53	94	G43-0895K	Ford	E-350	2010	Van - Pass	Support
54	95	G43-0896K	Ford	E-350	2010	Van - Pass	Support
55	96	G43-0936K	Chevrolet	C2500HD	2011	Van - Cargo	Enforcement
56	98	G43-2287M	Chevrolet	G2300	2012	Van - Pass	Support

Vehicle Index							
Sheet	Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
57	99	G43-2288M	Chevrolet	G2300 Express	2012	Van - Pass	Support
58	104	G62-0203H	Ford	F150	2009	Pickup	Support
59	108	G62-0871K	Ford	Expedition	2010	SUV	Enforcement
60	110	G62-2420P	Ford	FI50 SSV	2014	Pickup	Enforcement

Table C-2. Departments total fleet characterization.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	Mini-Van	SUV	Cargo Van	Pass. Van	Pickup Truck	Total
Pool	2	4		1			1	1	9
Support	2	4		2			7	11	26
Enforcement			3		2	1		1	7
Total	4	8	3	3	2	1	8	13	42

Sheet 19

Make/Model/ ear	Dodge Avenger – 2008
EPA Class Size	Sedan – Compact
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 382, Charles Porter Ave
Fleet Vehicle ID	G10-0984N
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	19/27/22 13/20/16
EPA GHG Emissions (Grams CO_2/Mi)	404/388
Study Logger ID	2
Total Vehicle Days/Total Study Days	26/47

Vehicle G10-0984N Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	9.3/261.9	3.9/305.5	1.6/89.8	243
Travel Time (Minutes)	48.0/402.0	19.8/441.0	8.4/117.0	1,247
Idle Time (Minutes)	16.9/NA	7.0/NA	3.0/NA	440

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	131	100%	Less than 2	94
10 to 20	0	0	2 to 4	10
20 to 40	0	0	4 to 8	2
40 to 60	0	0	Greater than 8	25

Figure C-1. Vehicle G10-0984N stops.

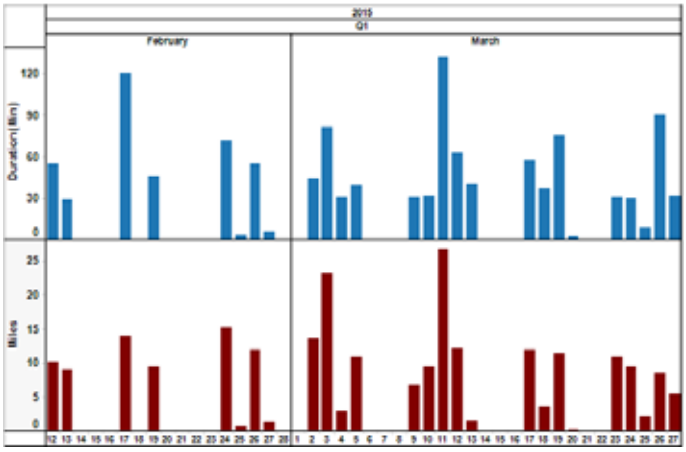

Figure C-2. Vehicle G10-0984N history.

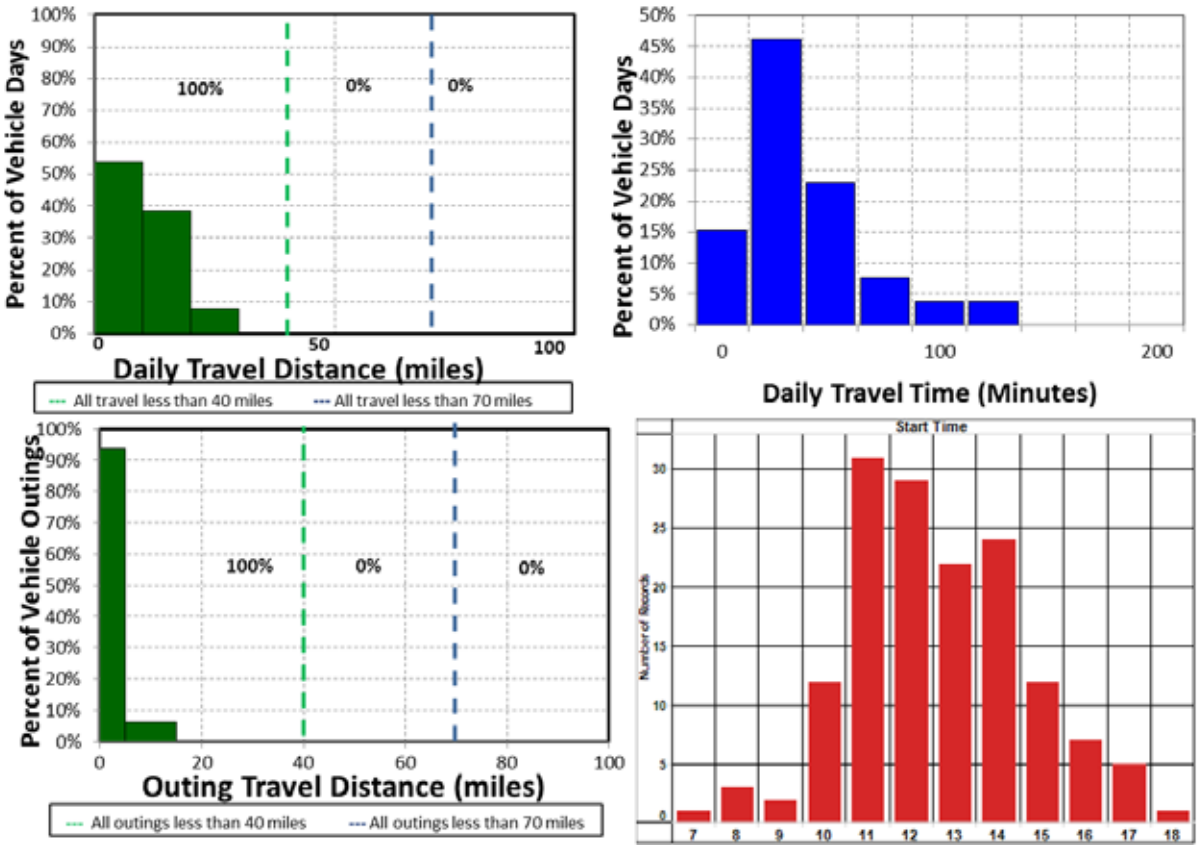

Figure C-3. Vehicle G10-0984N travel and time-of-day graphs.

Vehicle G10-0984N Observations

Logger 2 collected data on this vehicle for a period of 26 days of the 47-day study period. Validation occurred on 99.7% of the input data. Data indicate that this vehicle has a support mission for Galley. This vehicle's data indicate it parks near Building 382 near N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 29,008 miles at the start of this study and its average annual mileage is 4,015 miles. The vehicle was used on 55% of the available days, with an average daily usage of 0.8 hours and a peak daily usage of 2.2 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-3 shows all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 20

Make/Model/Year	Chevrolet Malibu – 2012
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 243, Midway St
Fleet Vehicle ID	G10-1137M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	3
Total Vehicle Days/Total Study Days	30/47

Vehicle G10-1137M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	6.7/25.0	4.4/19.1	2.0/11.8	200
Travel Time (Minutes)	81.8/198.0	53.4/198.0	24.1/192.0	2,455
Idle Time (Minutes)	49.2/NA	32.1/NA	14.5/NA	1,477

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	85	100%	Less than 2	54
10 to 20	0	0	2 to 4	5
20 to 40	0	0	4 to 8	2
40 to 60	0	0	Greater than 8	24

Figure C-4. Vehicle G10-1137M stops.

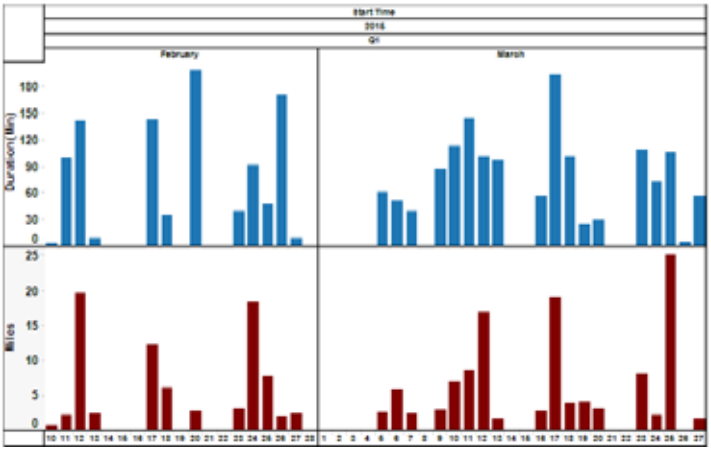

Figure C-5. Vehicle G10-1137M history.

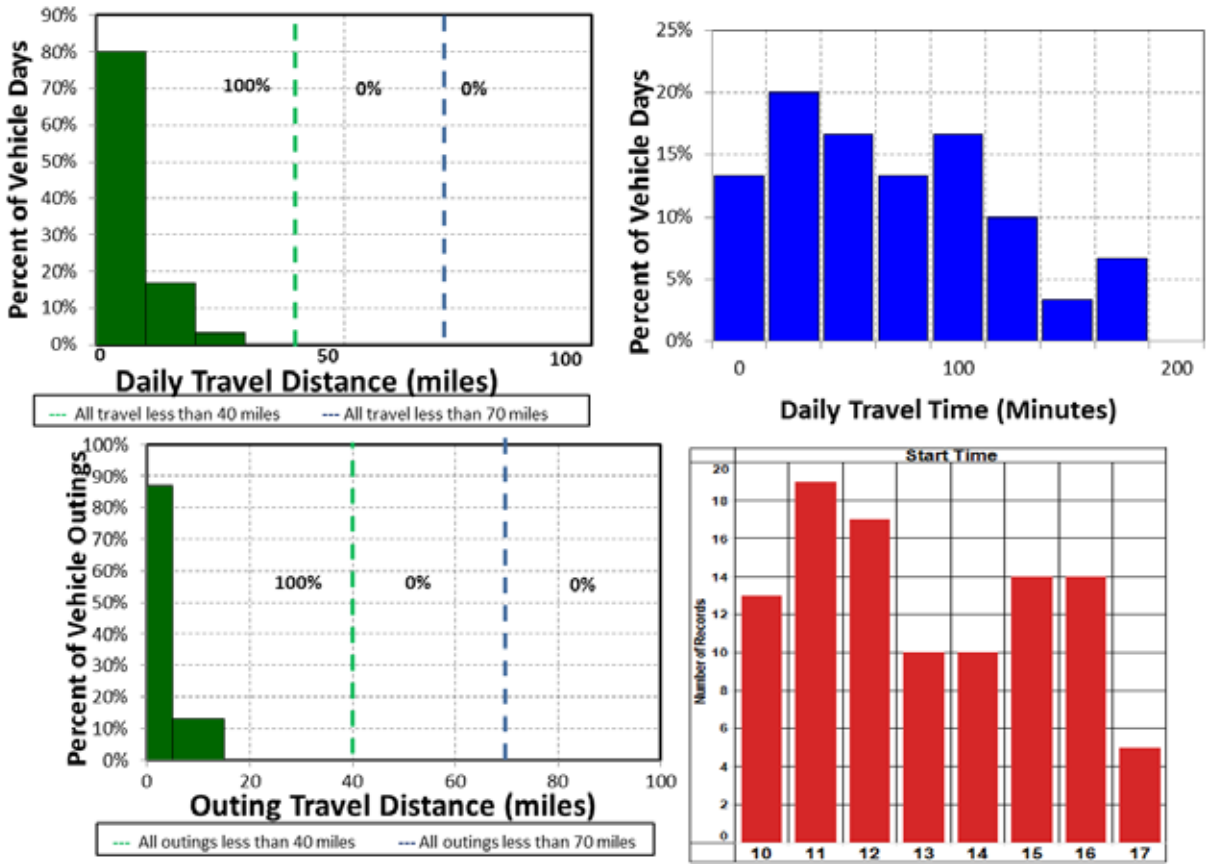

Figure C- 6. Vehicle G10-1137M travel and time-of-day graphs.

Vehicle G10-1137M Observations

Logger 3 collected data on this vehicle for a period of 30 days of the 47-day study period. Validation occurred on 82.6% of the input data. Data indicate that this vehicle has a support mission for Fuels. This vehicle's data indicate it parks near Building 243 near Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 11,215 miles at the start of this study and its average annual mileage is 3,434 miles. The vehicle was used on 64% of the available days, with an average daily usage of 1.4 hours and a peak daily usage of 3.3 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-6 shows all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 21

Make/Model/Year	Chevrolet Malibu – 2012
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 103, Eisenhower St
Fleet Vehicle ID	G10-1139M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	5
Total Vehicle Days/Total Study Days	31/47

Vehicle G10-1139M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	34.2/145.7	12.5/130.5	4.6/63.5	1,059
Travel Time (Minutes)	87.0/240.0	31.7/197.0	11.8/107.0	2,696
Idle Time (Minutes)	13.7/NA	5.0/NA	1.9/NA	426

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	196	91.6%	Less than 2	171
10 to 20	2	0.9%	2 to 4	12
20 to 40	16	7.5%	4 to 8	1
40 to 60	0	0	Greater than 8	30

Figure C-7. Vehicle G10-1139M stops.

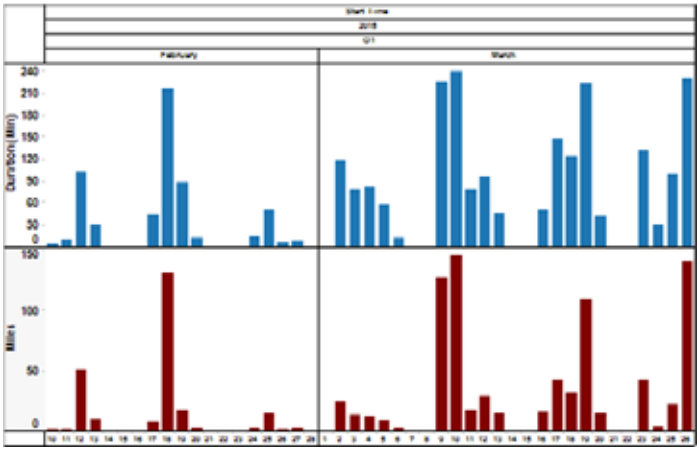

Figure C-8. Vehicle G10-1139M history.

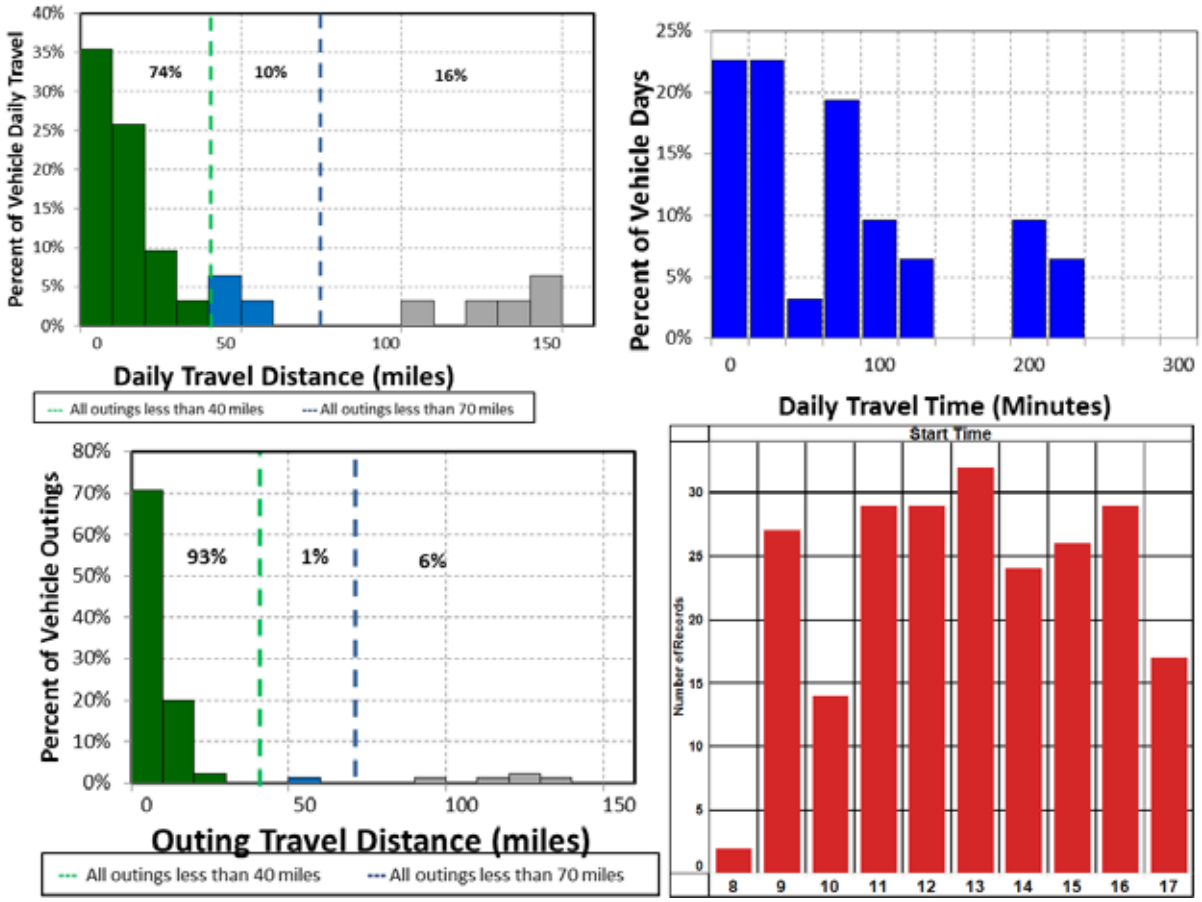

Figure C-9. Vehicle G10-1139M travel and time-of-day graphs.

Vehicle G10-1139M Observations

Logger 5 collected data on this vehicle for a period of 31 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Public Works. This vehicle's data indicate it parks near Building 103 near Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 16,019 miles at the start of this study and its average annual mileage is 5,200 miles. The vehicle was used on 66% of the available days, with an average daily usage of 1.4 hours and a peak daily usage of 1.8 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-9 shows that 84% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 94% of the outings were also within this range. Further, 74% of daily travel and 93% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 22

Make/Model/Year	Chevrolet Malibu – 2012
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 103, Eisenhower St
Fleet Vehicle ID	G10-1141M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	8
Total Vehicle Days/Total Study Days	31/47

Vehicle G10-1141M Travel Summary

	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	38.0/143.0	16.3/128.9	4.9/73.4	1,025
Travel Time (Minutes)	90.0/239.0	38.6/231.0	11.6/140.0	2,430
Idle Time (Minutes)	11.9/NA	5.1/NA	1.5/NA	320

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	174	91.6%	Less than 2	154
10 to 20	6	3.2%	2 to 4	9
20 to 40	7	3.7%	4 to 8	1
40 to 60	3	1.6%	Greater than 8	26

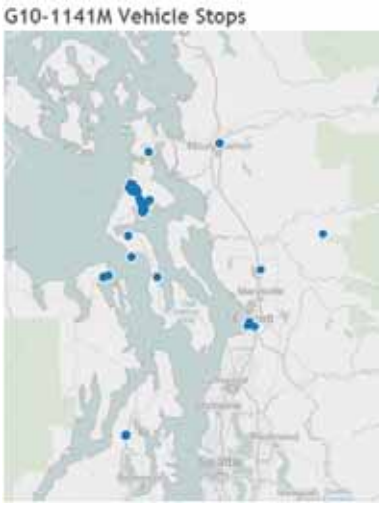

Figure C-10. Vehicle G10-1141M stops.

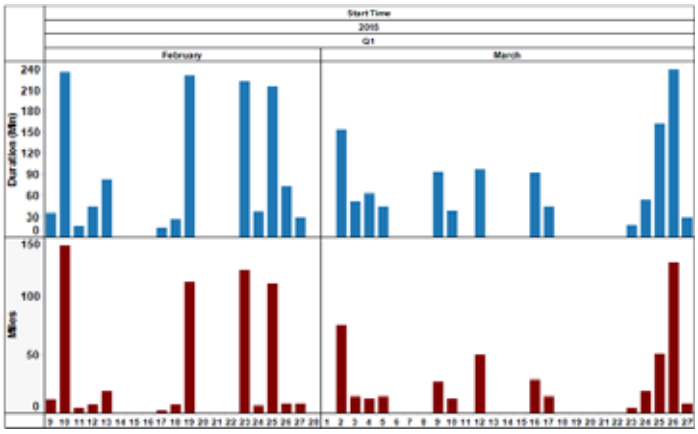

Figure C-11. Vehicle G10-1141M history.

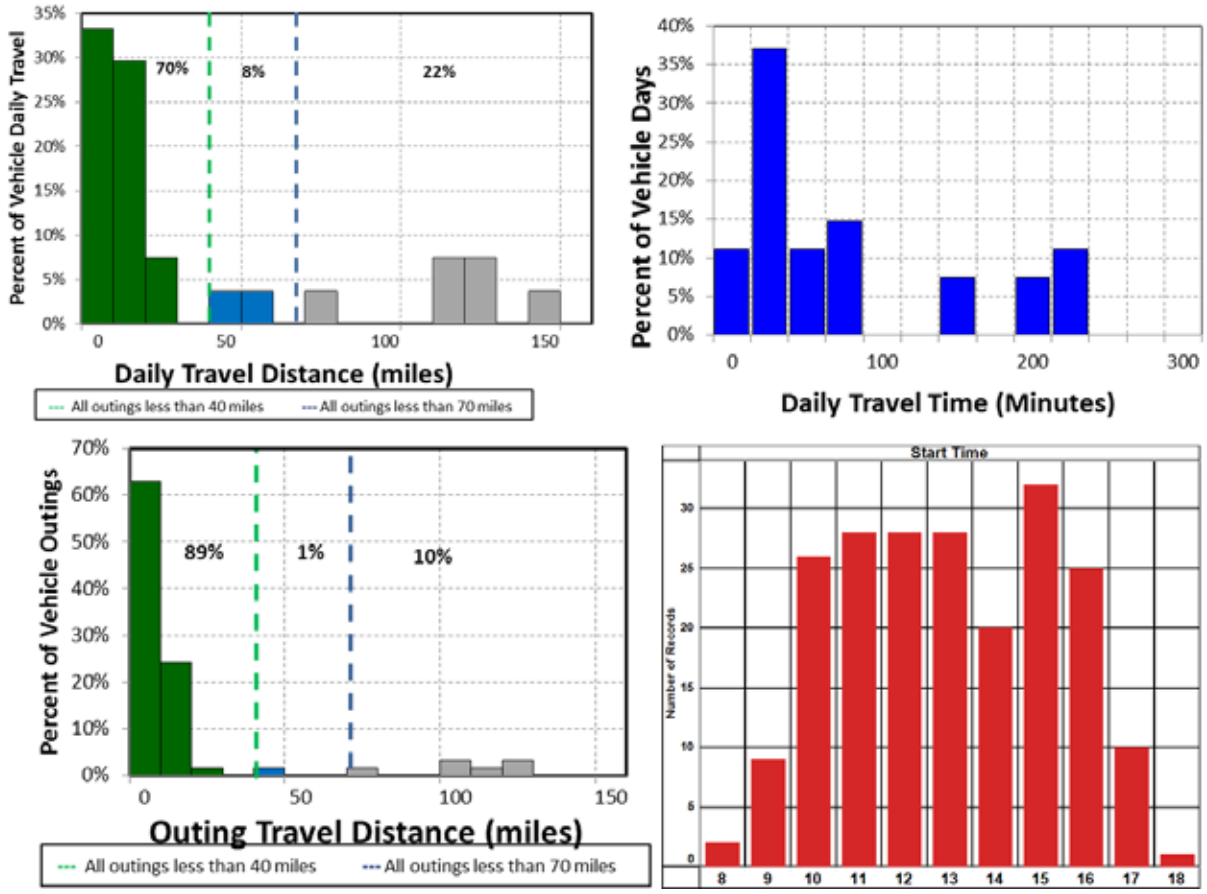

Figure C-12. Vehicle G10-1141M travel and time-of-day graphs.

Vehicle G10-1141M Observations

Logger 8 collected data on this vehicle for a period of 27 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Public Works. This vehicle's data indicate it parks near Building 103 near Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 24,026 miles at the start of this study and its average annual mileage is 7,061 miles. The vehicle was used on 57% of the available days, with an average daily usage of 1.5 hours and a peak daily usage of 2.3 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-12 shows that 78% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 90% of outings were also within this range. Further, 70% of daily travel and 89% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 23

Make/Model/Year	Chevrolet Malibu – 2011
EPA Class Size	Sedan – Midsize
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G10-2844L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	9
Total Vehicle Days/Total Study Days	12/47

Vehicle G10-2844L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	120.0/264.5	130.9/264.5	22.5/130.3	1,439
Travel Time (Minutes)	181.2/352.0	197.6/390.0	34.0/174.0	2,174
Idle Time (Minutes)	11.8/NA	12.8/NA	2.2/NA	141

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	24	41.4%	Less than 2	39
10 to 20	10	17.2%	2 to 4	5
20 to 40	13	22.4%	4 to 8	2
Greater than 40	11	19.0%	Greater than 8	12

Figure C-13. Vehicle G10-2844L stops.

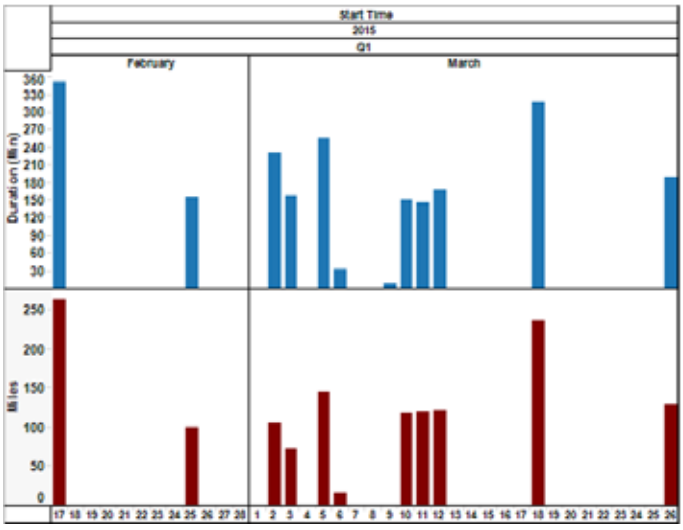

Figure C-14. Vehicle G10-2844L history.

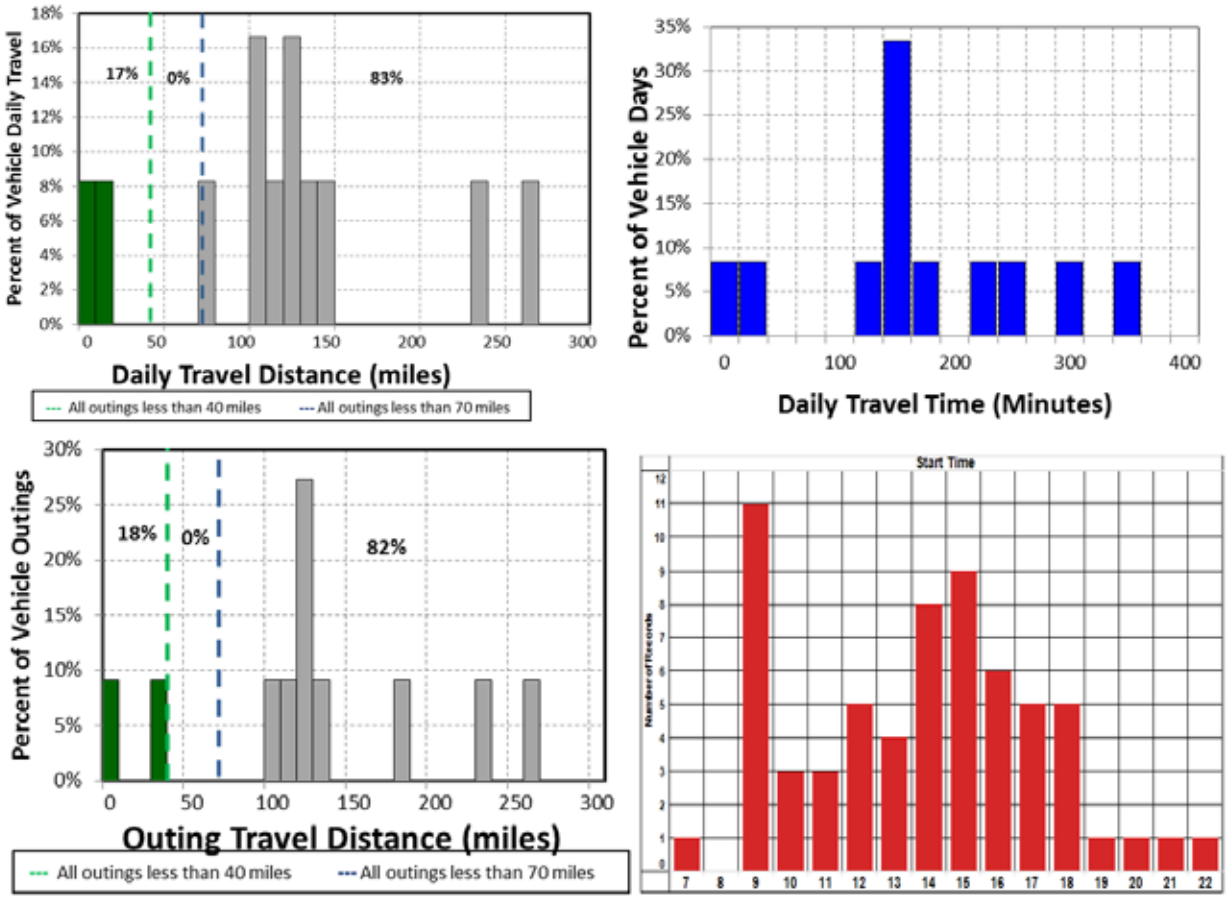

Figure C-15. Vehicle G10-2844L travel and time-of-day graphs.

Vehicle G10-2844L Observations

Logger 9 collected data on this vehicle for a period of 12 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 53,998 miles at the start of this study and its average annual mileage is 12,943 miles. The vehicle was used on 26% of the available days, with an average daily usage of 3.0 hours and a peak daily usage of 5.9 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-15 shows that 17% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 18% of the outings were also within this range. Further, 17% of daily travel and 18% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel because of the frequent long distances. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of enforcement vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 24

Make/Model/Year	Chevrolet Malibu – 2015
EPA Class Size	Sedan – Midsize
Mission	Support
Contact	NAVFAC NW
Parking Location	Building LDG 243, Midway St
Fleet Vehicle ID	G10-3590P
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	25/36/29
EPA GHG Emissions (Grams CO_2/Mi)	307
Study Logger ID	10
Total Vehicle Days/Total Study Days	14/47

Vehicle G10-3590P Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	6.7/14.8	5.2/14.3	1.6/8.8	94
Travel Time (Minutes)	21.9/46.0	17.1/46.0	5.1/27.0	307
Idle Time (Minutes)	0.4/NA	0.3/NA	0.1/NA	6

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	42	100%	Less than 2	25
10 to 20	0	0	2 to 4	3
20 to 40	0	0	4 to 8	0
40 to 60	0	0	Greater than 8	14

Figure C-16. Vehicle G10-3590P stops.

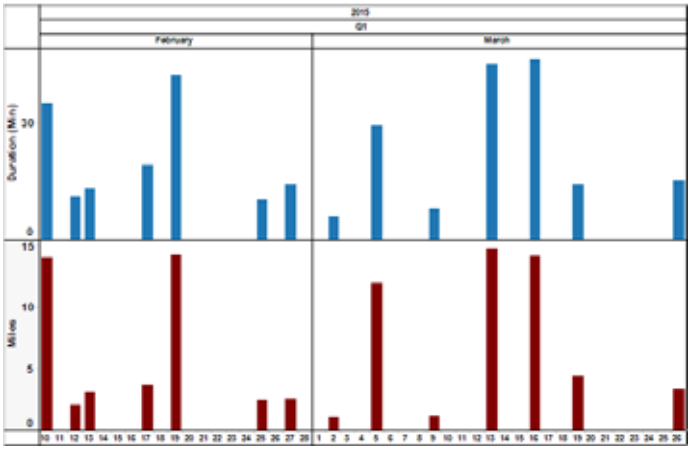

Figure C-17. Vehicle G10-3590P history.

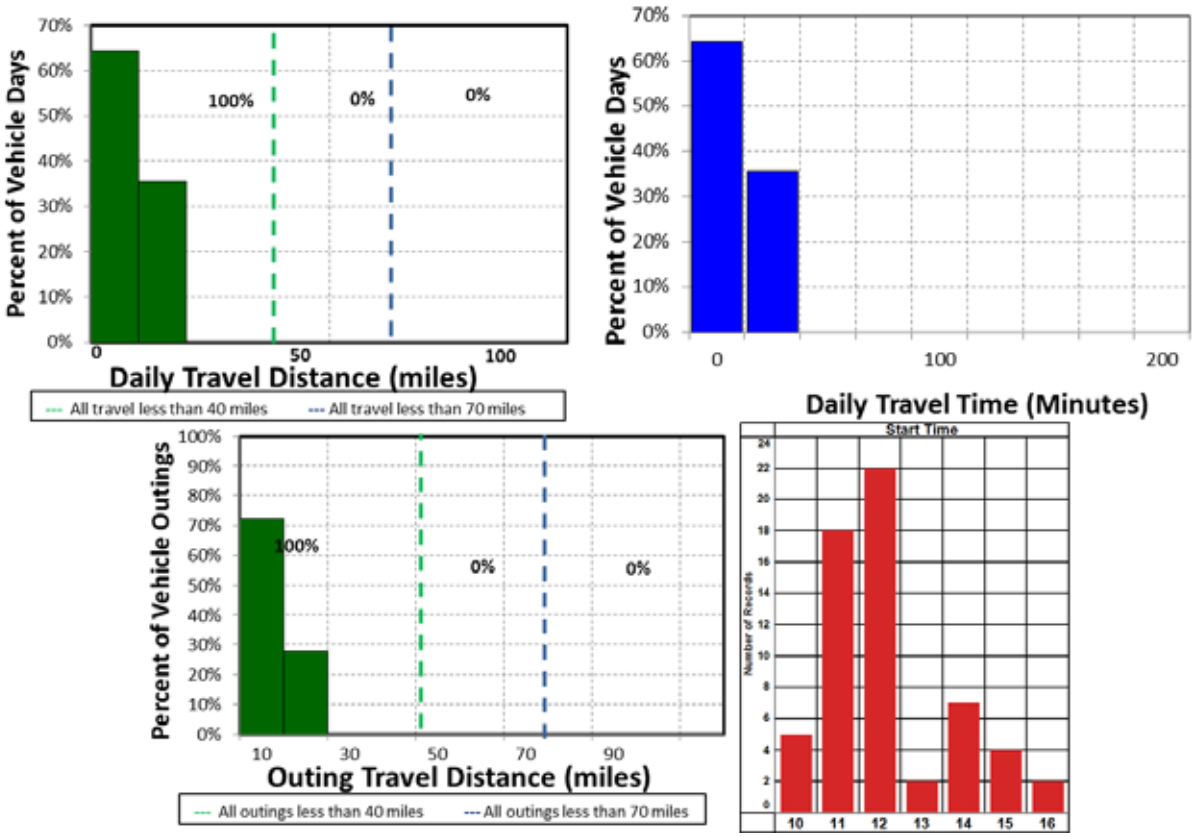

Figure C-18. Vehicle G10-3590P travel and time-of-day graphs.

Vehicle G10-3590P Observations

Logger 10 collected data on this vehicle for a period of 14 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Safety. This vehicle's data indicate it parks near Building 243 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 1,215 miles at the start of this study and its average annual mileage is 9,708 miles. The vehicle was used on 30% of the available days, with an average daily usage of 0.4 hours and a peak daily usage of 0.8 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-18 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 25

Make/Model/Year	Chevrolet Malibu – 2011
EPA Class Size	Sedan – Midsize
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G10-2848L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	13
Total Vehicle Days/Total Study Days	15/47

Vehicle G10-2848L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	76.5/268.0	76.5/263.8	11.8/133.9	1,148
Travel Time (Minutes)	140.3/374.0	140.3/377.0	21.7/178.0	2,104
Idle Time (Minutes)	15.2/NA	15.2/NA	2.4/NA	228

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	60	70.6%	Less than 2	67
10 to 20	9	10.6%	2 to 4	2
20 to 40	1	1.2%	4 to 8	2
Greater than 40	15	17.7%	Greater than 8	14

Figure C-19. Vehicle G10-2848L stops.

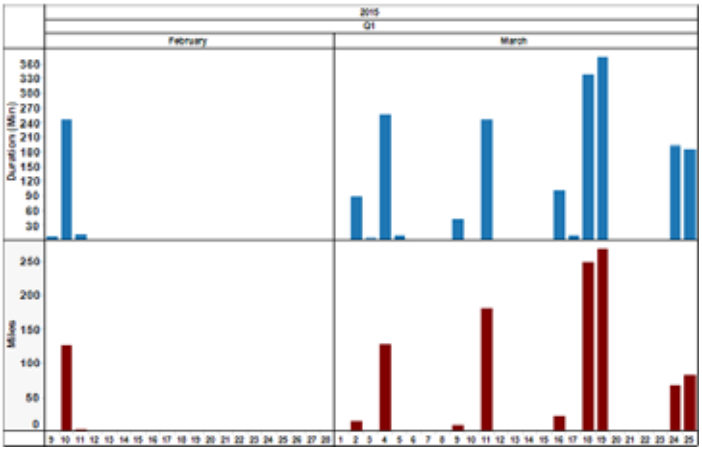

Figure C-20. Vehicle G10-2848L history.

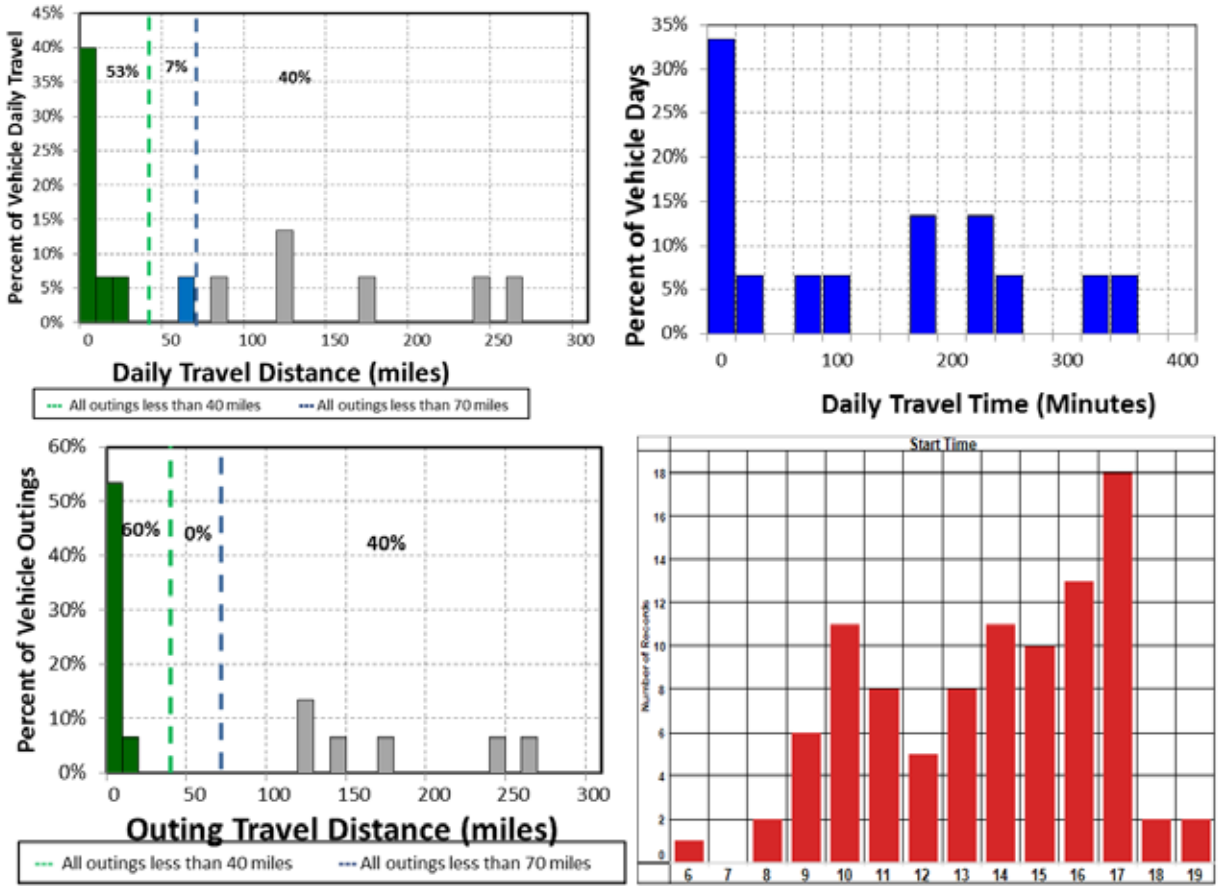

Figure C-21. Vehicle G10-2848L travel and time-of-day graphs.

Vehicle G10-2848L Observations

Logger 13 collected data on this vehicle for a period of 15 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 50,134 miles at the start of this study and its average annual mileage is 12,118 miles. The vehicle was used on 30% of the available days, with an average daily usage of 2.3 hours and a peak daily usage of 6.2 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-21 shows that 60% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 60% of the outings were also within this range. Further, 53% of daily travel and 60% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel because of frequent long distances. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 26

Make/Model/Year	Chevrolet Malibu – 2011
EPA Class Size	Sedan – Midsize
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G10-2850L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	14
Total Vehicle Days/Total Study Days	16/47

Vehicle G10-2850L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	82.7/267.7	120.3/267.7	21.0/133.9	1,323
Travel Time (Minutes)	121.3/316.0	176.5/316.0	30.8/157.0	1,941
Idle Time (Minutes)	7.6/NA	11.0/NA	1.9/NA	121

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	26	45.6%	Less than 2	37
10 to 20	12	21.1%	2 to 4	1
20 to 40	10	17.5%	4 to 8	2
Greater than 40	9	15.8%	Greater than 8	17

Figure C-22. Vehicle G10-2850L stops.

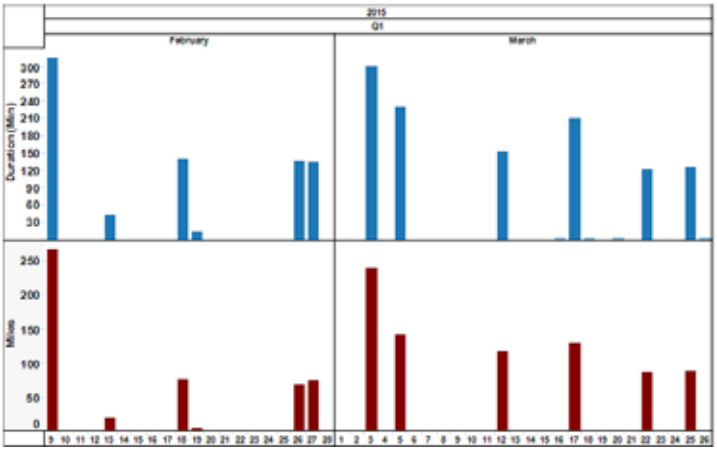

Figure C-23. Vehicle G10-2850L history.

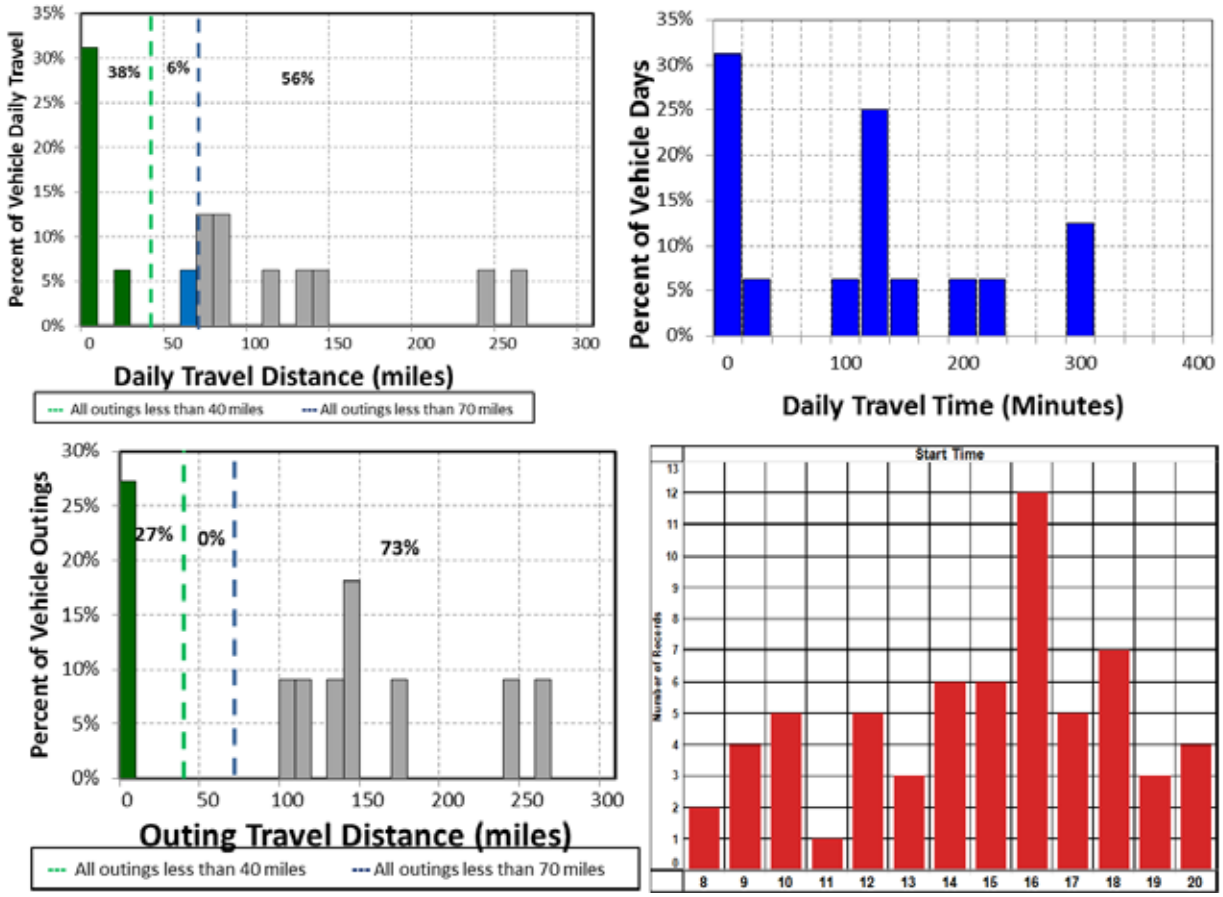

Figure C-24. Vehicle G10-2850L travel and time-of-day graphs.

Vehicle G10-2850L Observations

Logger 14 collected data on this vehicle for a period of 16 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 51,272 miles at the start of this study and its average annual mileage is 12,371 miles. The vehicle was used on 34% of the available days, with an average daily usage of 2.0 hours and a peak daily usage of 5.3 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-24 shows that 44% of daily travel as within the typically advertised range of a BEV of approximately 70 miles and 27% of the outings were also within this range. Further, 38% of daily travel and 27% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel because of the frequent long distances traveled. However, a PHEV provides benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 27

Make/Model/Year	Chevrolet Malibu – 2011
EPA Class Size	Sedan – Midsize
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G10-2968L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)	342/345
Study Logger ID	15
Total Vehicle Days/Total Study Days	14/47

Vehicle G10-2968L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	77.4/128.3	60.2/244.5	17.8/86.6	1,083
Travel Time (Minutes)	112.4/180.0	87.4/326.0	25.8/98.0	1,573
Idle Time (Minutes)	5.1/NA	4.0/NA	1.2/NA	72

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	34	63.0%	Less than 2	35
10 to 20	2	3.7%	2 to 4	0
20 to 40	17	31.5%	4 to 8	4
40 to 60	1	1.9%	Greater than 8	15

Figure C-25. Vehicle G10-2968K stops.

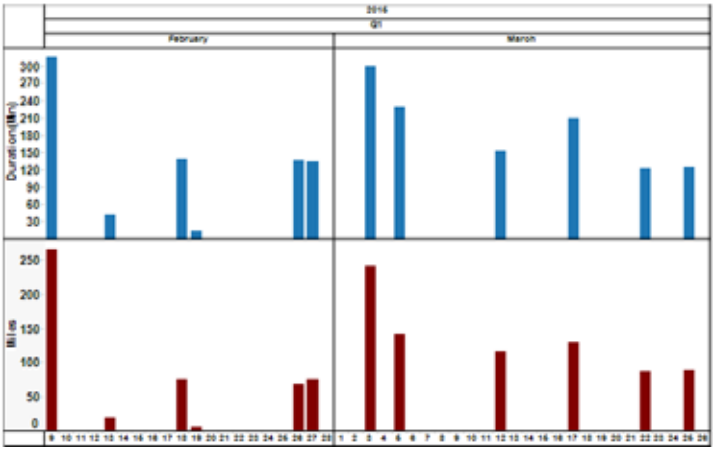

Figure C-26. Vehicle G10-2968K history.

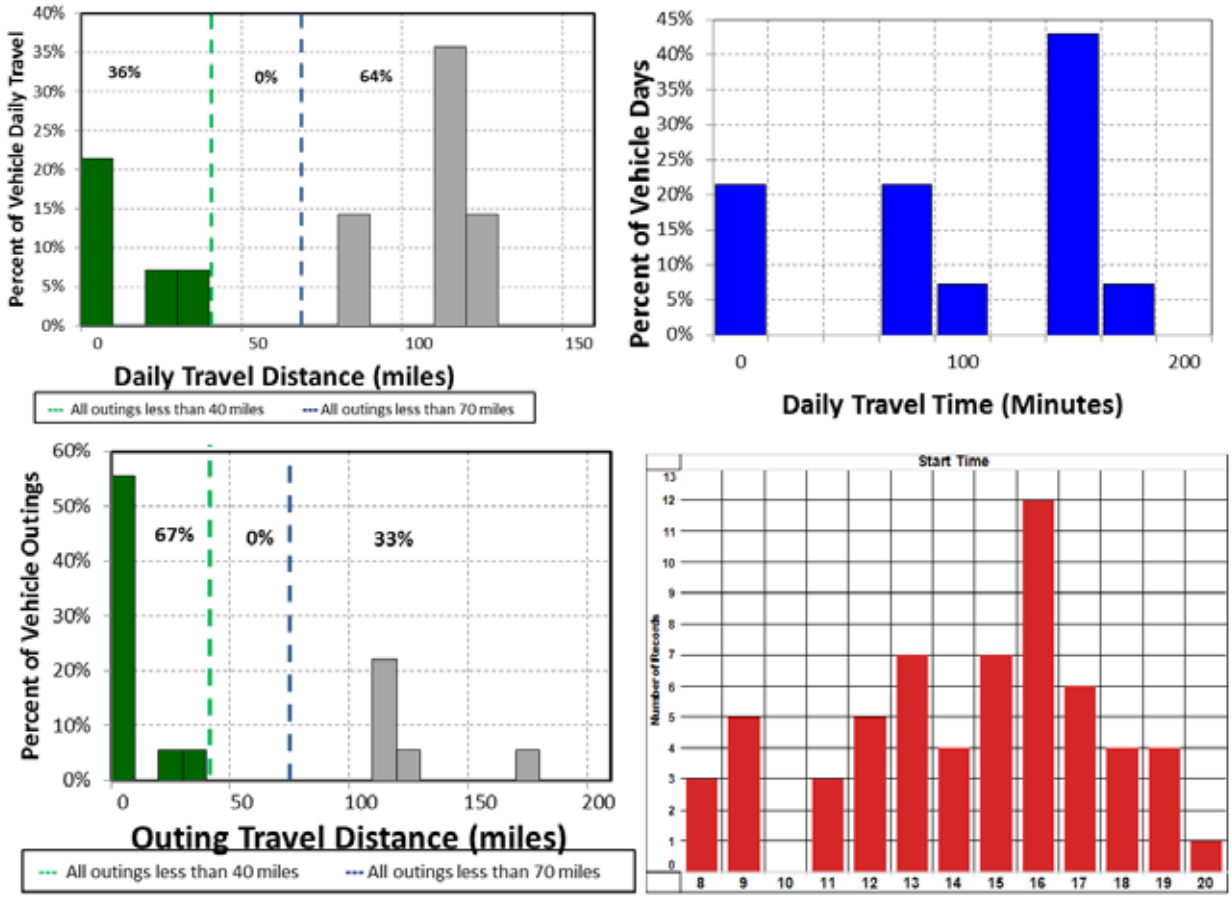

Figure C-27. Vehicle G10-2968L travel and time-of-day graphs.

Vehicle G10-2968L Observations

Logger 15 collected data on this vehicle for a period of 14 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 48,057 miles at the start of this study and its average annual mileage is 11,509 miles. The vehicle was used on 30% of the available days, with an average daily usage of 1.9 hours and a peak daily usage of 3.0 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-27 shows that 36% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 67% of the outings were also within this range. Further, 36% of daily travel and 67% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. One overnight trip was also encountered. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 28

Make/Model/Year	Pontiac G6 – 2009
EPA Class Size	Sedan – Compact
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 960, Intruder St
Fleet Vehicle ID	G10-5286H
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	19/29/23 14/22/17
EPA GHG Emissions (Grams CO_2/Mi)	386/365
Study Logger ID	17
Total Vehicle Days/Total Study Days	22/47

Vehicle G10-5286H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	10.6/112.1	5.8/112.1	1.9/38.5	232
Travel Time (Minutes)	35.2/266.0	19.4/266.0	6.5/76.0	775
Idle Time (Minutes)	4.2/NA	2.3/NA	0.8/NA	93

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	101	94.4%	Less than 2	76
10 to 20	4	3.7%	2 to 4	8
20 to 40	0	0	4 to 8	1
40 to 60	2	1.9%	Greater than 8	22

Figure C-28. Vehicle G10-5286H stops.

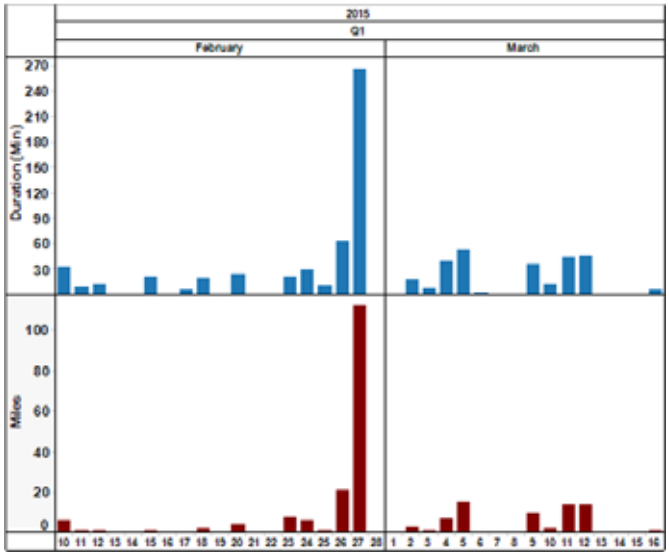

Figure C-29. Vehicle G10-5286H history.

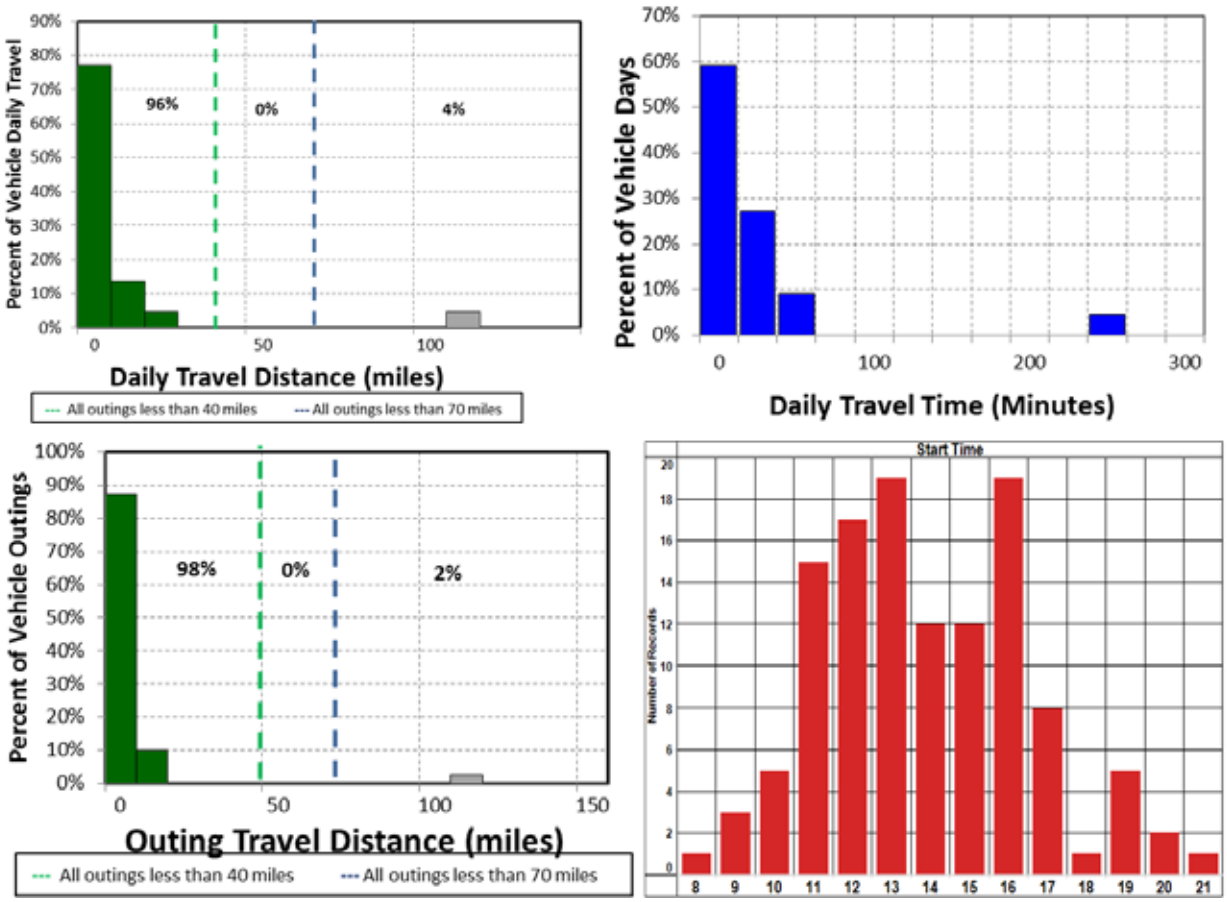

Figure C-30. Vehicle G10-5286H travel and time-of-day graphs.

Vehicle G10-5286H Observations

Logger 17 collected data on this vehicle for a period of 22 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for the Chapel. This vehicle's data indicate it parks near Building 960 near Intruder Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 31,548 miles at the start of this study and its average annual mileage is 5,103 miles. The vehicle was used on 47% of the available days, with an average daily usage of 0.6 hours and a peak daily usage of 4.4 hours on the days it was used. The vehicle was used primarily during day-shift hours day and into the evening.

Figure C-30 shows that 96% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 98% of the outings were also within this range. Further, 96% of daily travel and 98% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at a home base. However, PHEVs provide benefit for the first 40 miles of a trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 29

Make/Model/Year	Chevrolet G1300 – 2014
EPA Class Size	Van – Passenger
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G42-1940N
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)	622/580
Study Logger ID	18
Total Vehicle Days/Total Study Days	10/47

Vehicle G42-1940N Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	176.2/396.6	220.3/1,008.4	28.0/162.1	1,762
Travel Time (Minutes)	234.9/486.0	293.6/1,202.0	37.3/149.0	2,349
Idle Time (Minutes)	13.8/NA	17.3/NA	2.2/NA	138

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	23	39.0%	Less than 2	46
10 to 20	3	5.1%	2 to 4	3
20 to 40	15	25.4%	4 to 8	0
Greater than 40	18	30.5%	Greater than 8	10

Figure C-31. Vehicle G42-1940N stops.

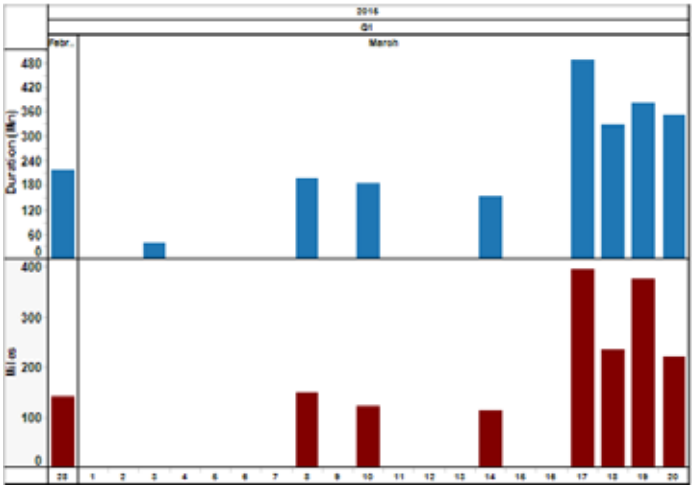

Figure C-32. Vehicle G42-1940N history.

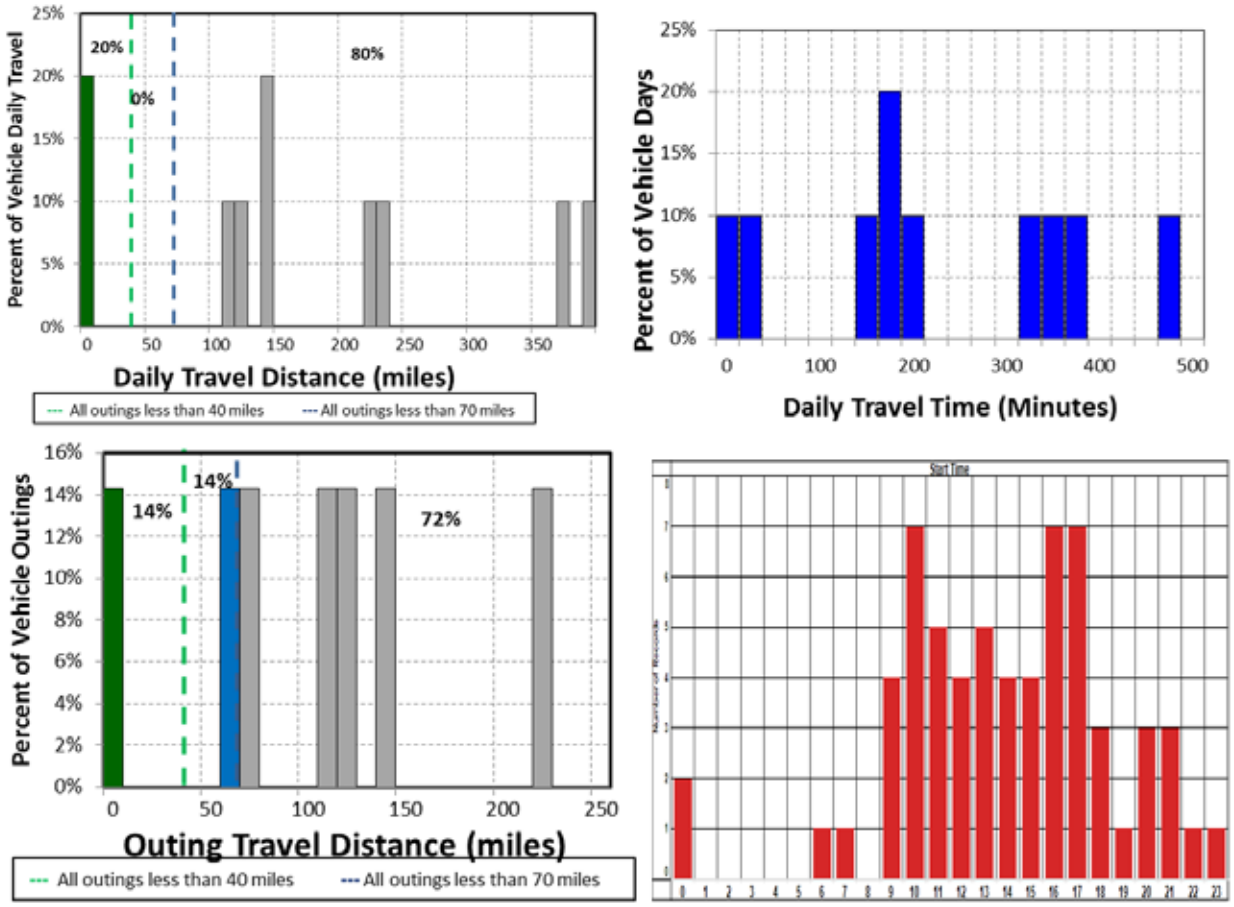

Figure C-33. Vehicle G42-1940N travel and time-of-day graphs.

Vehicle G42-1940N Observations

Logger 18 collected data on this vehicle for a period of 10 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 3,732 miles at the start of this study and its average annual mileage is 7,464 miles. The vehicle was used on 21% of the available days, with an average daily usage of 3.9 hours and a peak daily usage of 8.1 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-33 shows that 20% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 28% of the outings were also within this range. Further, 20% of daily travel and 14% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet daily travel because of the frequent long distance trips. However, PHEVs provide benefits for the first 40 miles of a trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 30

Make/Model/Year	Ford Escape - 2008
EPA Class Size	SUV
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G61-0245G
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	19/24/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	20
Total Vehicle Days/Total Study Days	3/47

Vehicle G61-0245G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	84.6/100.3	126.9/153.4	10.6/50.7	254
Travel Time (Minutes)	150.0/152.0	225.0/298.0	18.8/79.0	450
Idle Time (Minutes)	9.0/NA	13.5/NA	1.1/NA	27

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	6	30.0%	Less than 2	16
10 to 20	5	25.0%	2 to 4	0
20 to 40	3	15.0%	4 to 8	1
40 to 60	6	30.0%	Greater than 8	3

Figure C-34. Vehicle G61-0245G stops.

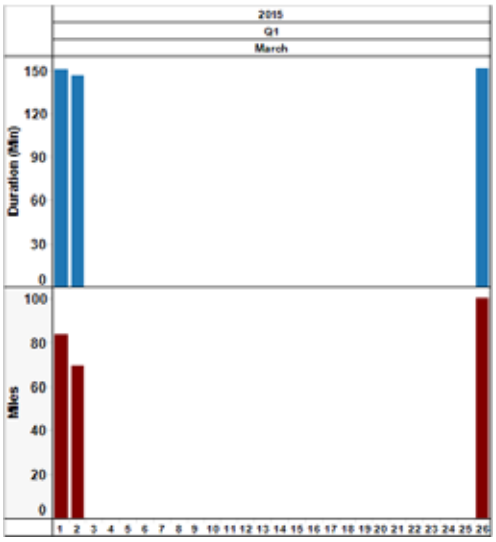

Figure C-35. Vehicle G61-0245G history.

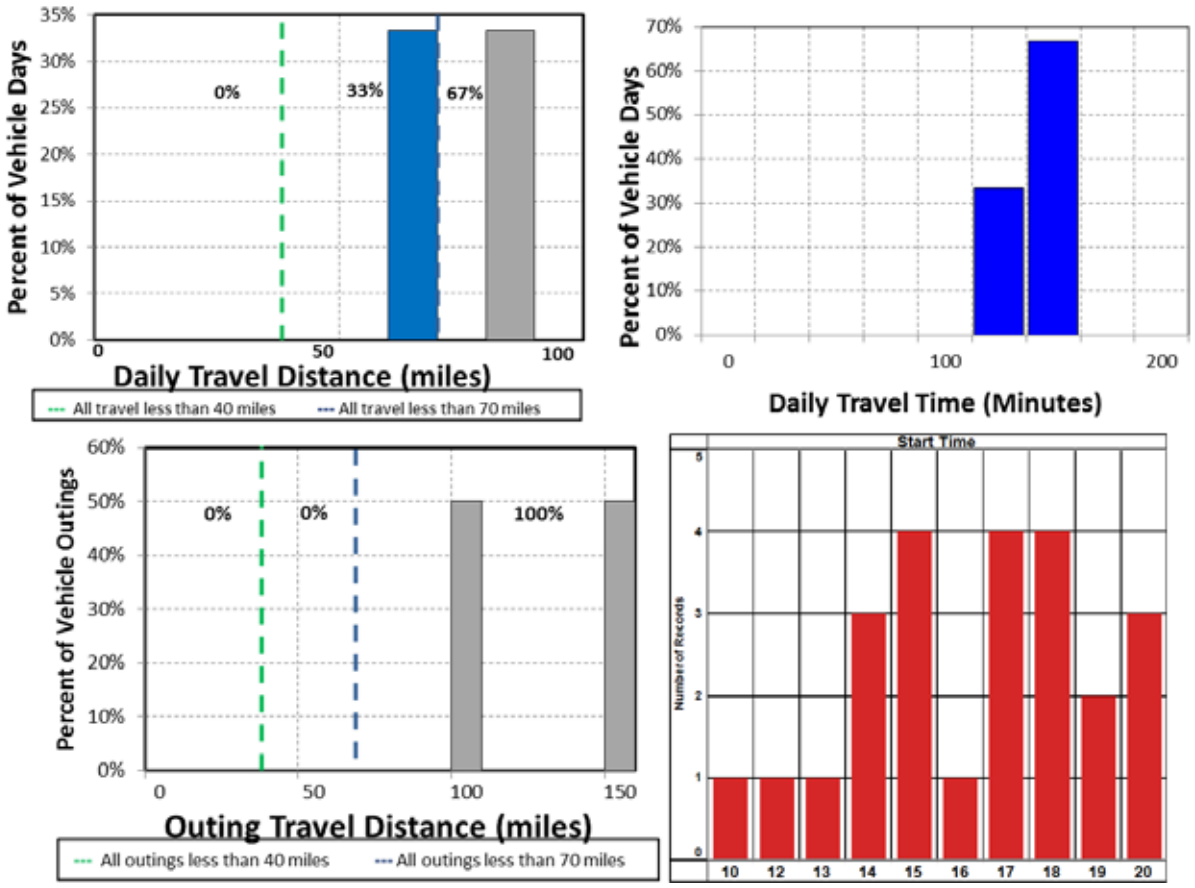

Figure C-36. Vehicle G61-0245G travel and time-of-day graphs.

Vehicle G61-0245G Observations

Logger 20 collected data on this vehicle for a period of 3 days of the 47-day study period. Validation occurred on 94.3% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 60,585 miles at the start of this study and its average annual mileage is 8,655 miles. The vehicle was used on 6% of the available days, with an average daily usage of 2.5 hours and a peak daily usage of 2.5 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-36 shows that none of the daily travel as within the typically advertised range of a BEV of approximately 70 miles. None of the outings were within this range. Further, none of daily travel and none of outings were within the typically advertised CD mode of 40 miles for PHEVs. Only 3 days of travel were included in the study, but it was assumed that these 3 days were typical for this vehicle.

A BEV could not meet all daily travel, but PHEVs would provide benefit for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 31

Make/Model/Year	Chevrolet Impala – 2011
EPA Class Size	Sedan – Large
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 994, Charles Porter Ave
Fleet Vehicle ID	G11-0472L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	19/29/23 14/22/17
EPA GHG Emissions (Grams CO_2/Mi)	386/365
Study Logger ID	35
Total Vehicle Days/Total Study Days	39/47

Vehicle G11-0472L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	34.5/137.0	19.2/137.0	4.7/49.9	1,347
Travel Time (Minutes)	169.5/494.0	94.4/592.0	23.0/218.0	6,610
Idle Time (Minutes)	75.6/NA	42.1/NA	10.2/NA	2,949

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	258	98.5%	Less than 2	197
10 to 20	4	1.5%	2 to 4	18
20 to 40	0	0	4 to 8	10
40 to 60	0	0	Greater than 8	37

Figure C-37. Vehicle G11-0472L stops.

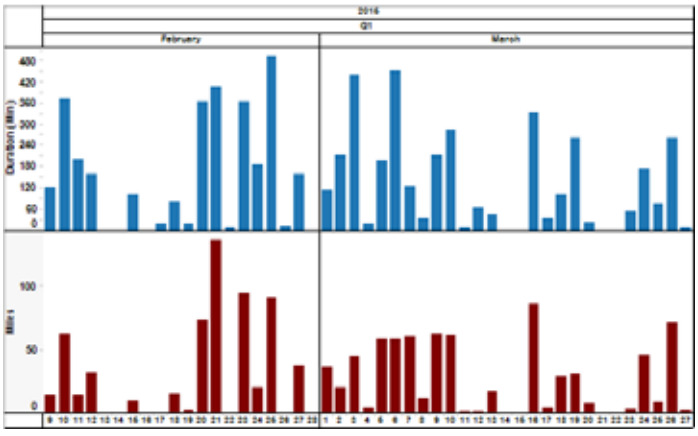

Figure C-38. Vehicle G11-0472L history.

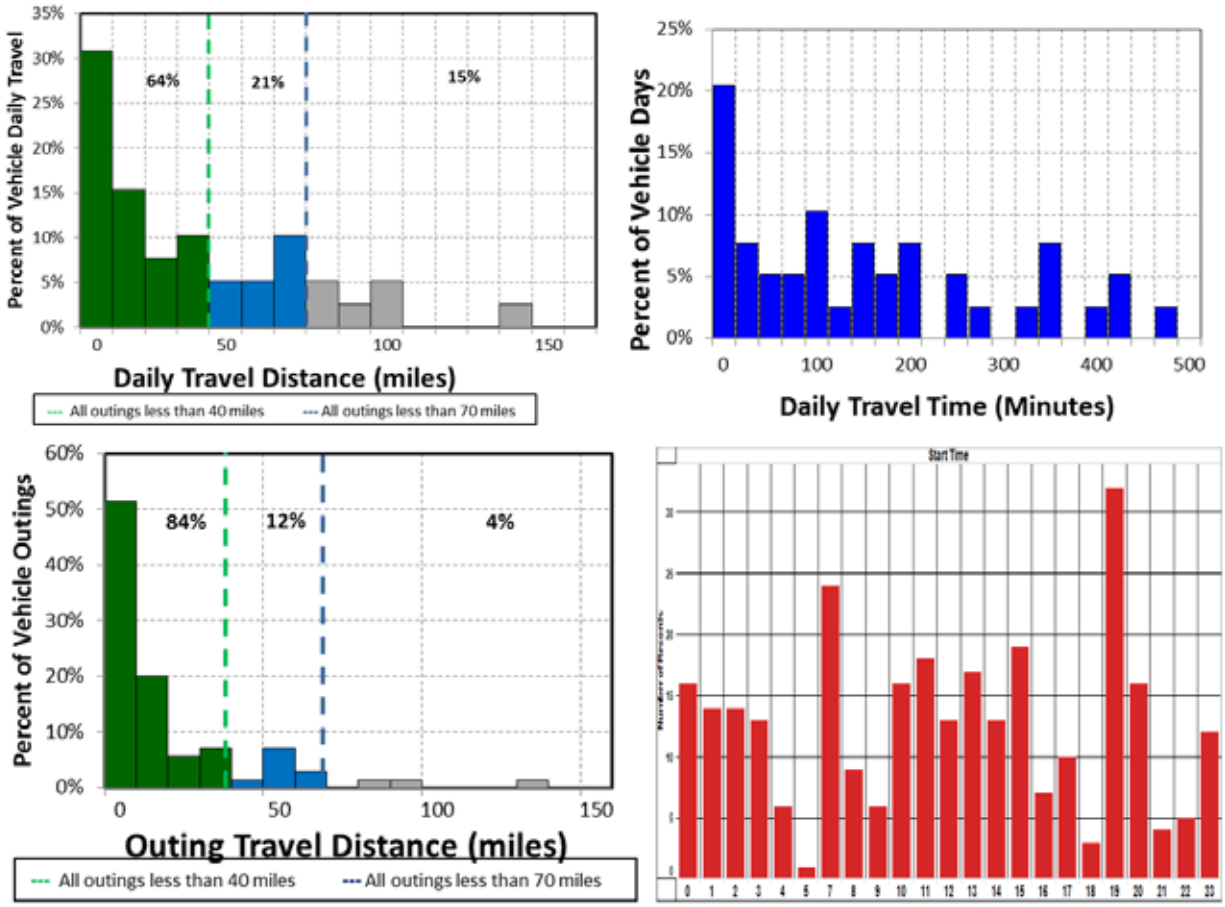

Figure C-39. Vehicle G11-0472L travel and time-of-day graphs.

Vehicle G11-0472L Observations

Logger 35 collected data on this vehicle for a period of 39 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 994 near Langley/N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 84,620 miles at the start of this study and its average annual mileage is 1,712 miles. The vehicle was used on 83% of the available days, with an average daily usage of 2.8 hours and a peak daily usage of 8.2 hours on the days it was used. The vehicle was used during all hours of the day.

Figure C-39 shows that 85% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 96% of the outings were also within this range. Further, 64% of daily travel and 84% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, fleet managers typically do not prefer enforcement vehicles that contain range limitations. Thus, a fleet of enforcement vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 32

Make/Model/Year	Chevrolet Impala – 2012
EPA Class Size	Sedan – Large
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 994, Charles Porter Ave
Fleet Vehicle ID	G11-1424L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	18/30/22 13/22/16
EPA GHG Emissions (Grams CO_2/Mi)	404/388
Study Logger ID	36
Total Vehicle Days/Total Study Days	42/47

Vehicle G11-1424L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	47.4/183.9	13.9/117.2	4.3/44.2	1,989
Travel Time (Minutes)	244.0/1,093.0	71.7/949.0	22.2/491.0	10,248
Idle Time (Minutes)	99.5/NA	29.2/NA	9.1/NA	4,179

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	423	99.5%	Less than 2	351
10 to 20	2	0.5%	2 to 4	27
20 to 40	0	0	4 to 8	17
40 to 60	0	0	Greater than 8	30

Figure C-40. Vehicle G11-1424L stops.

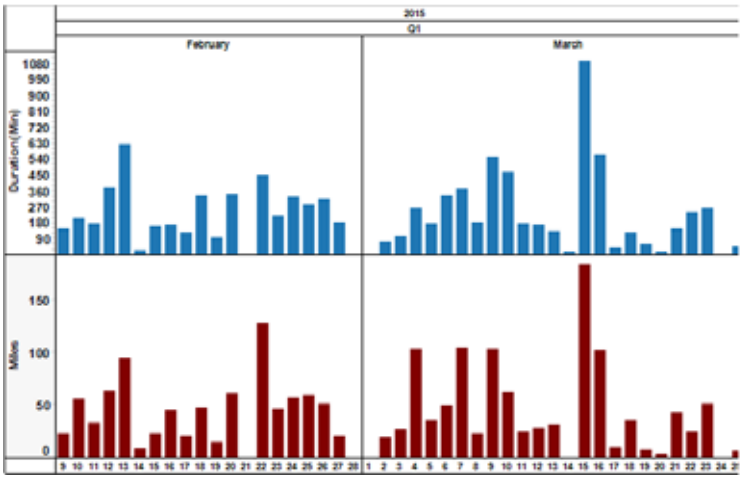

Figure C-41. Vehicle G11-1424L history.

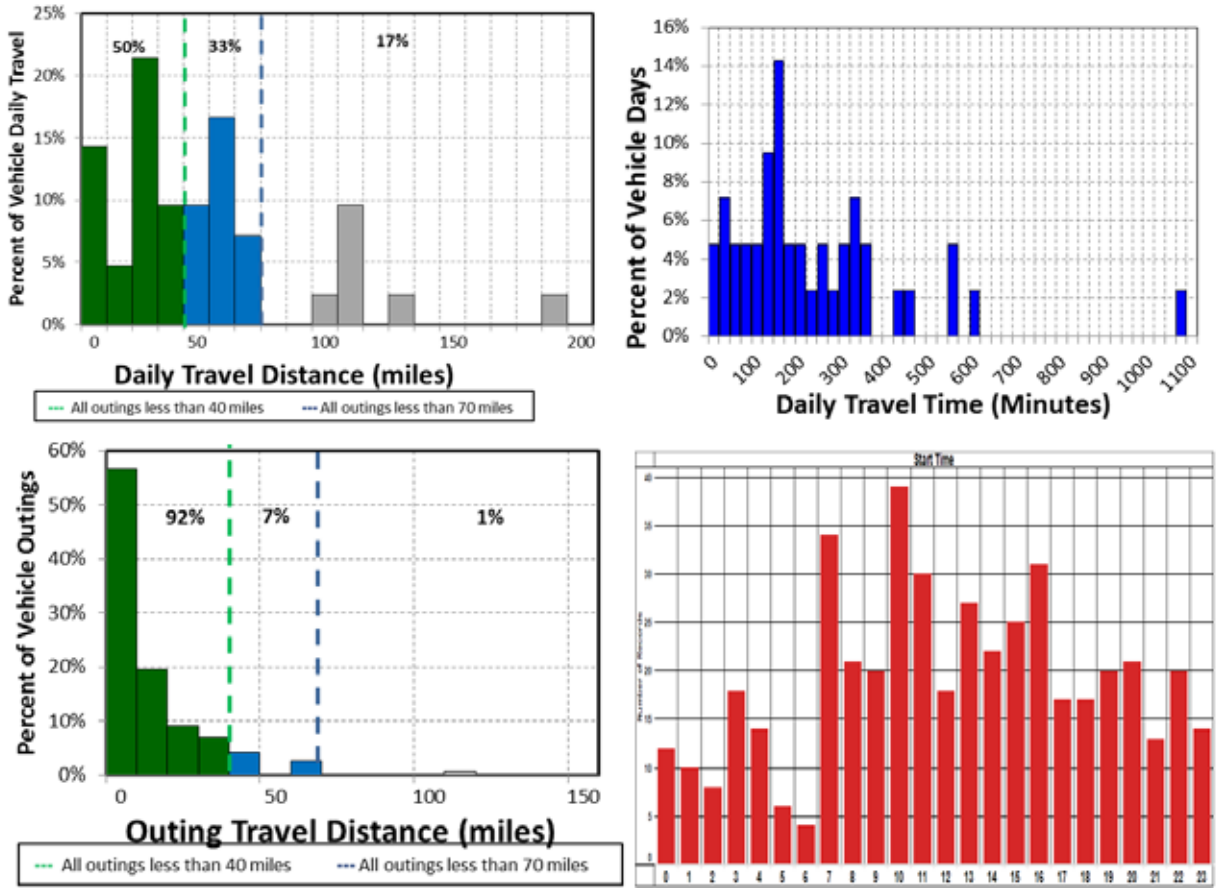

Figure C-42. Vehicle G11-1424L travel and time-of-day graphs.

Vehicle G11-1424L Observations

Logger 36 collected data on this vehicle for a period of 42 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 994 near Langley/N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 72,580 miles at the start of this study and its average annual mileage is 20,109 miles. The vehicle was used on 89% of the available days, with an average daily usage of 4.1 hours and a peak daily usage of 18.2 hours on the days it was used. The vehicle was used during all hours of the day.

Figure C-42 shows that 83% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 99% of the outings were also within this range. Further, 50% of daily travel and 92% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. In addition, fleet managers typically do not prefer enforcement vehicles that contain range limitations. Thus, a fleet of enforcement vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 33

Make/Model/Year	Chevrolet Impala – 2014
EPA Class Size	Sedan – Large
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 994, Charles Porter Ave
Fleet Vehicle ID	G11-2898K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	19/29/22 14/20/16
EPA GHG Emissions (Grams CO_2/Mi)	399/384
Study Logger ID	37
Total Vehicle Days/Total Study Days	40/47

Vehicle G11-2898K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	35.2/128.5	11.2/68.2	4.1/47.8	1,406
Travel Time (Minutes)	186.0/748.0	59.0/575.0	21.5/555.0	7,439
Idle Time (Minutes)	76.1/NA	24.2/NA	8.8/NA	3,043

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	326	99.7%	Less than 2	248
10 to 20	1	0.3%	2 to 4	29
20 to 40	0	0	4 to 8	1634
40 to 60	0	0	Greater than 8	

Figure C-43. Vehicle G11-2898K stops.

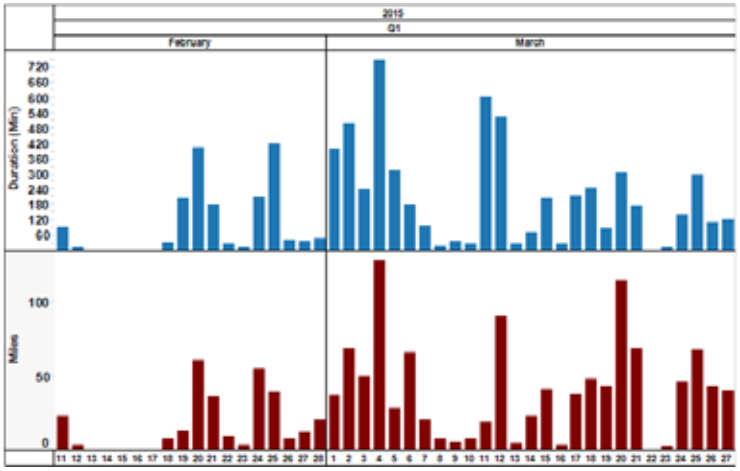

Figure C-44. Vehicle G11-2898K history.

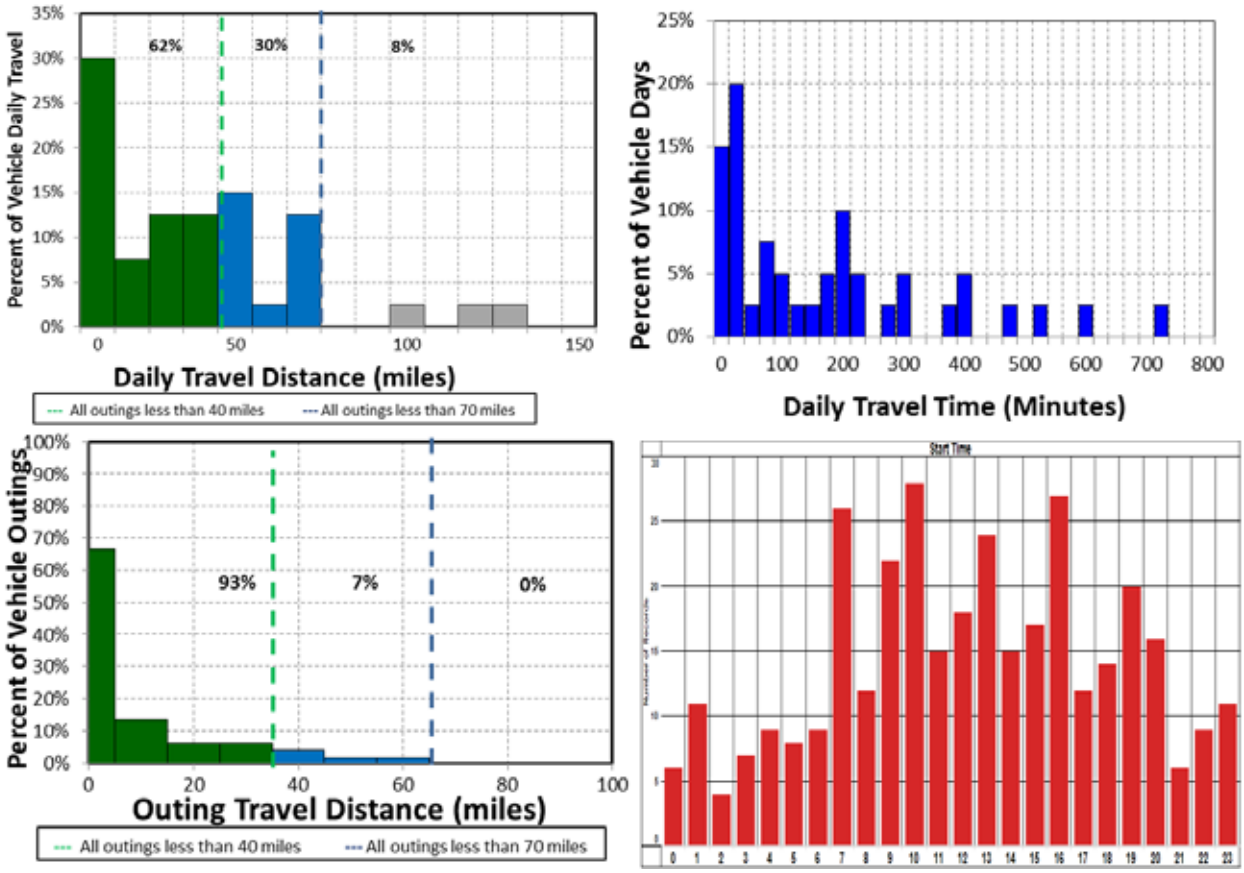

Figure C-45. Vehicle G11-2898K travel and time-of-day graphs.

Vehicle G11-2898K Observations

Logger 37 collected data on this vehicle for a period of 40 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 994 near Langley/N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 170 miles at the start of this study and its average annual mileage is 20,230 miles. The vehicle was used on 85% of the available days, with an average daily usage of 3.1 hours and a peak daily usage of 12.5 hours on the days it was used. The vehicle was used during all hours of the day.

Figure C-45 shows that 92% of daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, 62% of daily travel and 93% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, fleet managers typically do not prefer enforcement vehicles that contain range limitations. Thus, a fleet of enforcement vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 34

Make/Model/Year	Dodge Grand Caravan - 2010
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2556, Lexington St
Fleet Vehicle ID	G41-1137K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/477
Study Logger ID	39
Total Vehicle Days/Total Study Days	10/47

Vehicle G41-1137K travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	12.0/15.7	9.2/15.7	3.8/7.3	120
Travel Time (Minutes)	36.5/52.0	28.1/46.0	11.4/28.0	365
Idle Time (Minutes)	3.3/NA	2.5/NA	1.0/NA	33

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	31	100%	Less than 2	20
10 to 20	0	0	2 to 4	1
20 to 40	0	0	4 to 8	0
40 to 60	0	0	Greater than 8	10

Figure C-46. Vehicle G41-1137K stops.

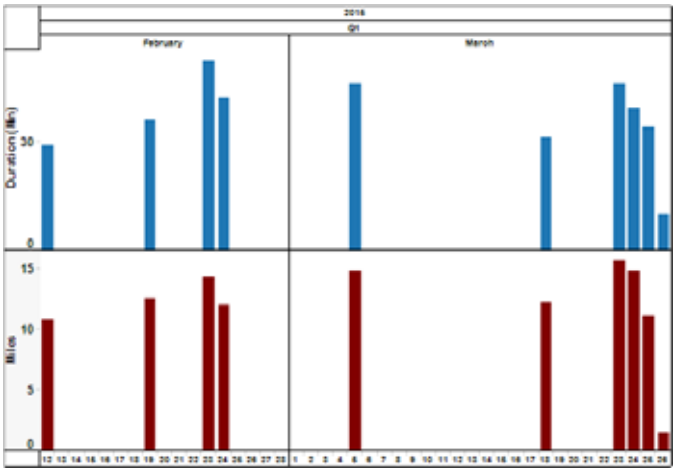

Figure C-47. Vehicle G41-1137K history.

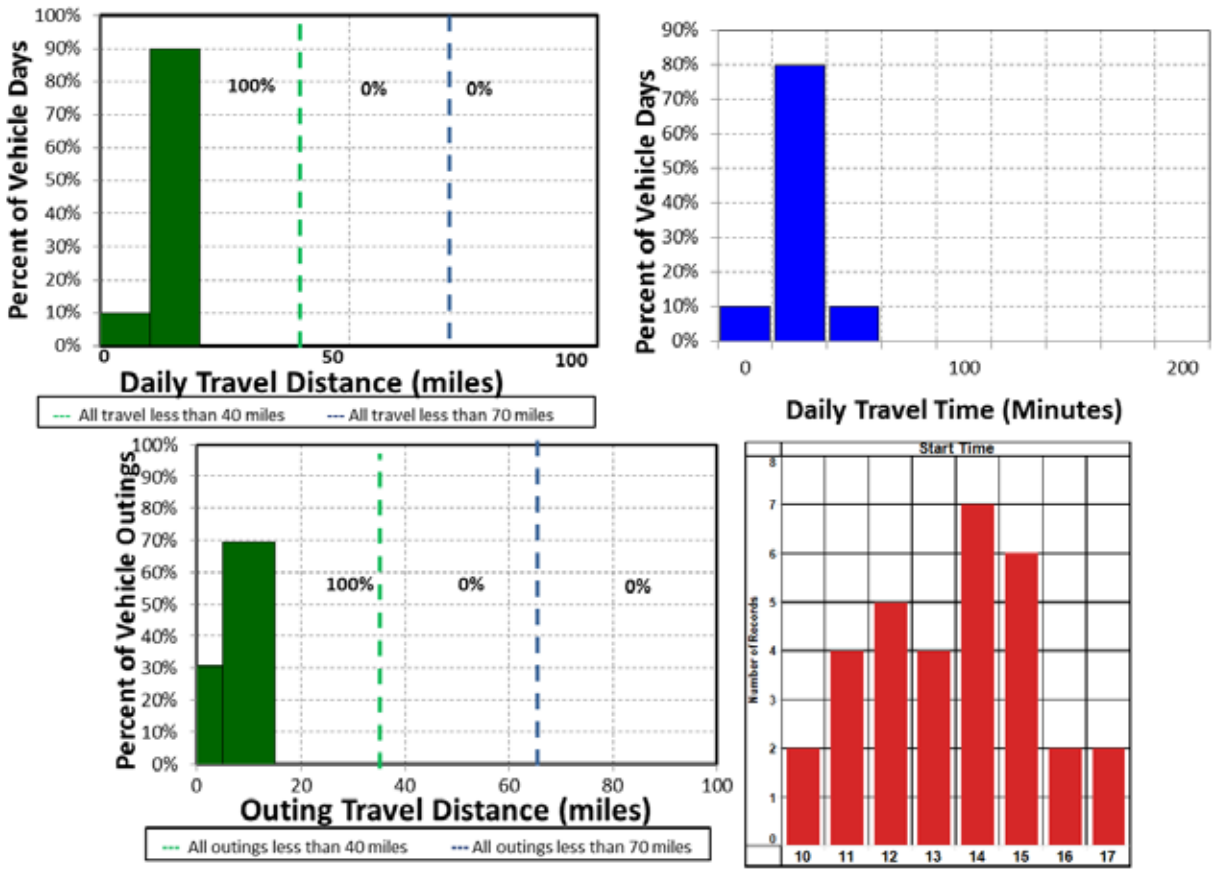

Figure C-48. Vehicle G41-1137K travel and time-of-day graphs.

Vehicle G41-1137K Observations

Logger 39 collected data on this vehicle for a period of 10 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Housing. This vehicle's data indicate it parks near Building 2556 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 9,309 miles at the start of this study and its average annual mileage is 1,783 miles. The vehicle was used on 21% of the available days, with an average daily usage of 0.6 hours and a peak daily usage of 0.9 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-48 shows that all travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 35

Make/Model/Year	Dodge Grand Caravan – 2010
EPA Class Size	Minivan
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 385, Lexington St
Fleet Vehicle ID	G41-1142K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/477
Study Logger ID	42
Total Vehicle Days/Total Study Days	21/47

Vehicle G41-1142K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	40.6/246.2	40.6/559.4	9.7/130.1	853
Travel Time (Minutes)	71.0/275.0	71.0/891.0	17.0/146.0	1,492
Idle Time (Minutes)	7.6/NA	7.6/NA	1.8/NA	160

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	57	67.9%	Less than 2	49
10 to 20	1	1.2%	2 to 4	10
20 to 40	6	7.1%	4 to 8	4
Greater than 40	20	23.8%	Greater than 8	21

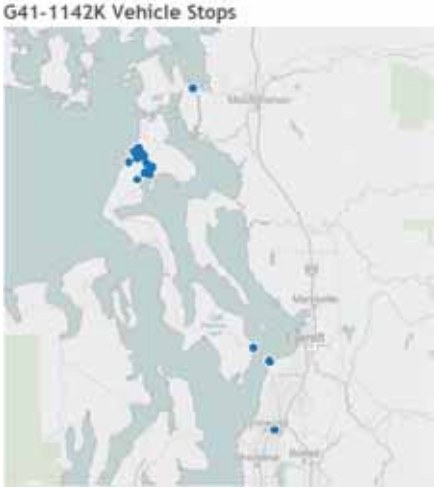

Figure C-49. Vehicle G41-1142K stops.

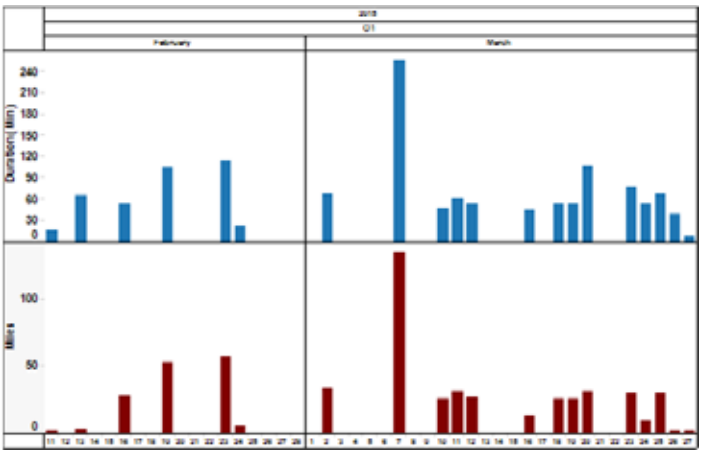

Figure C-50. Vehicle G41-1142K history.

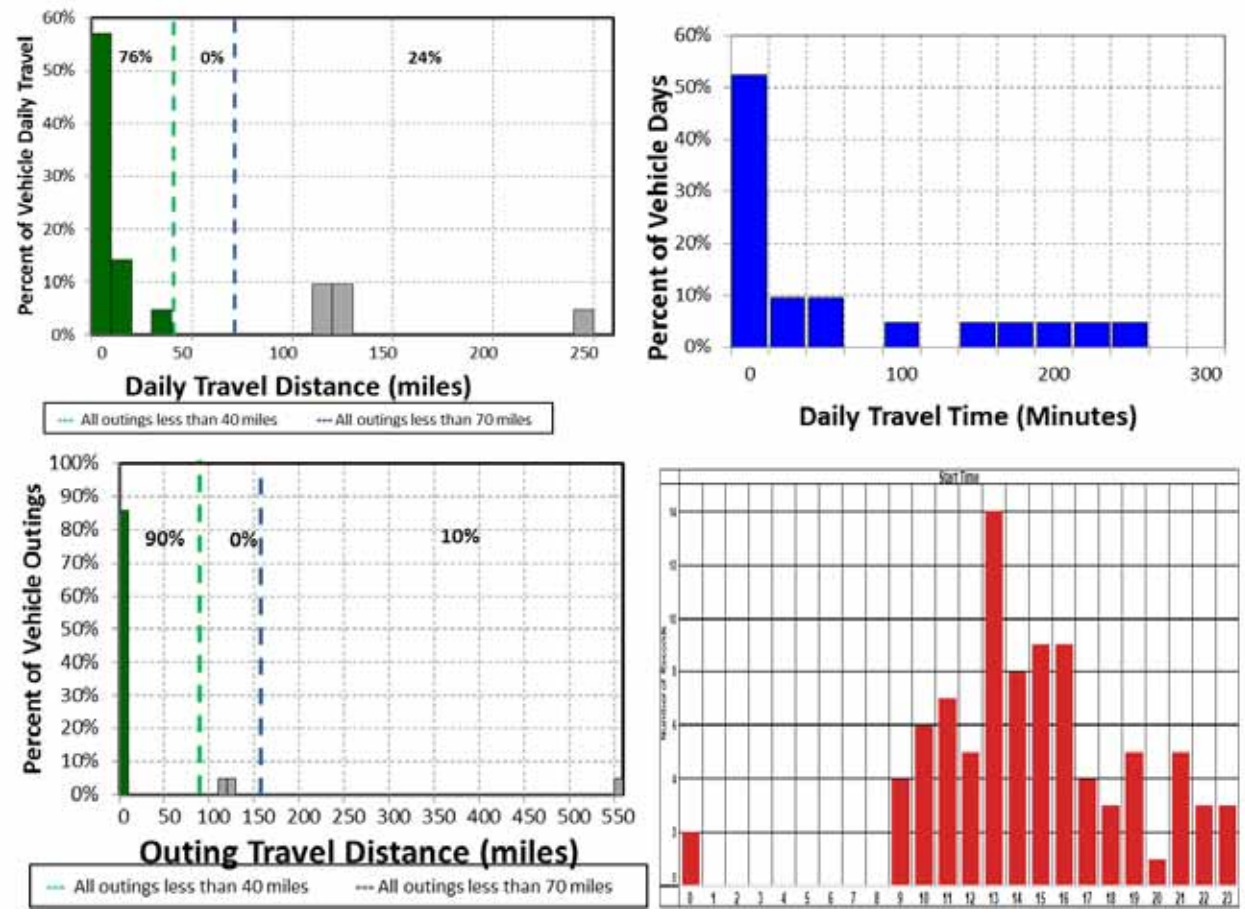

Figure C-51. Vehicle G41-1142K travel and time-of-day graphs.

Vehicle G41-1142K Observations

Logger 42 collected data on this vehicle for a period of 21 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 385 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 36,101 miles at the start of this study and its average annual mileage is 7,011 miles. The vehicle was used on 45% of the available days, with an average daily usage of 1.2 hours and a peak daily usage of 4.6 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-51 shows that 76% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 90% of the outings were also within this range. Further, 76% of daily travel and 90% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel because of the longer excursions. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 36

Make/Model/Year	Dodge Dakota – 2008
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 378, Intruder St
Fleet Vehicle ID	G41-1349G
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/19/15 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)	592/620
Study Logger ID	45
Total Vehicle Days/Total Study Days	20/47

Vehicle G41-1349G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	5.7/12.8	1.1/11.0	0.6/5.0	114
Travel Time (Minutes)	60.9/142.0	11.7/45.0	6.1/45.0	1,217
Idle Time (Minutes)	24.0/NA	4.6/NA	2.4/NA	480

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	169	100%	Less than 2	126
10 to 20	0	0	2 to 4	17
20 to 40	0	0	4 to 8	14
40 to 60	0	0	Greater than 8	12

Figure C-52. Vehicle G41-1349G stops.

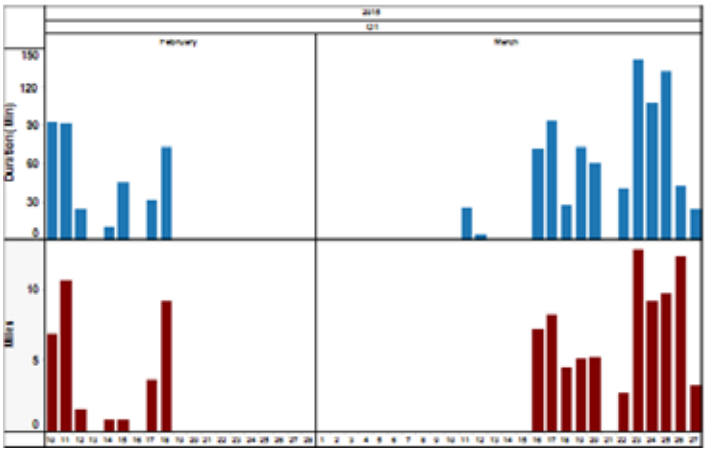

Figure C-53. Vehicle G41-1349G history.

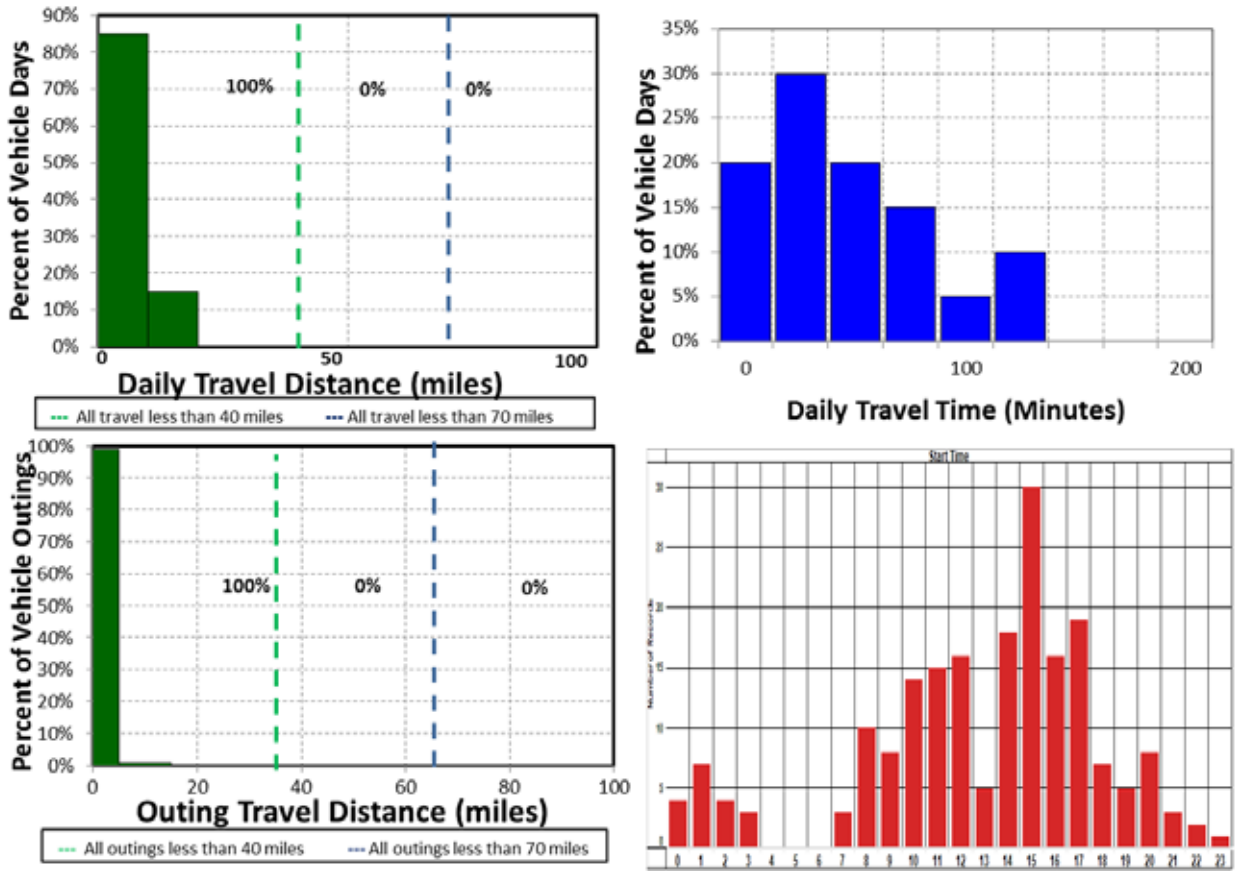

Figure C-54. Vehicle G41-1349G travel and time-of-day graphs.

Vehicle G41-1349G Observations

Logger 45 collected data on this vehicle for a period of 20 days of the 47-day study period. Validation occurred on 99.5% of the input data. Data indicate that this vehicle has a support mission for CBQ. This vehicle's data indicate it parks near Building 378 near Intruder Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 16,956 miles at the start of this study and its average annual mileage is 2,337 miles. The vehicle was used on 43% of the available days, with an average daily usage of 1.0 hours and a peak daily usage of 2.4 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-54 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 37

Make/Model/Year	Dodge Dakota – 2008
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 385, Lexington St
Fleet Vehicle ID	G41-1350G
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/19/25 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)	592/620
Study Logger ID	46
Total Vehicle Days/Total Study Days	16/47

Vehicle G41-1350G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	3.4/12.7	2.0/10.3	1.0/5.4	54
Travel Time (Minutes)	15.5/40.0	9.2/34.0	4.6/15.0	248
Idle Time (Minutes)	2.6/NA	1.6/NA	0.8/NA	42

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	44	100%	Less than 2	24
10 to 20	0	0	2 to 4	3
20 to 40	0	0	4 to 8	3
40 to 60	0	0	Greater than 8	14

Figure B-55. Vehicle G41-1350G stops.

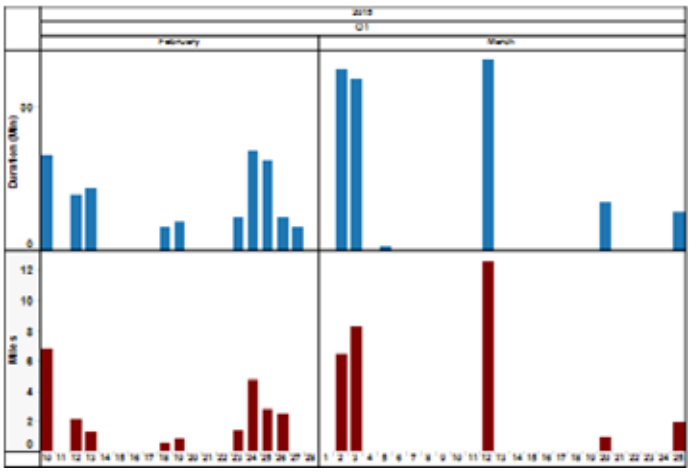

Figure B-56. Vehicle G41-1350G history.

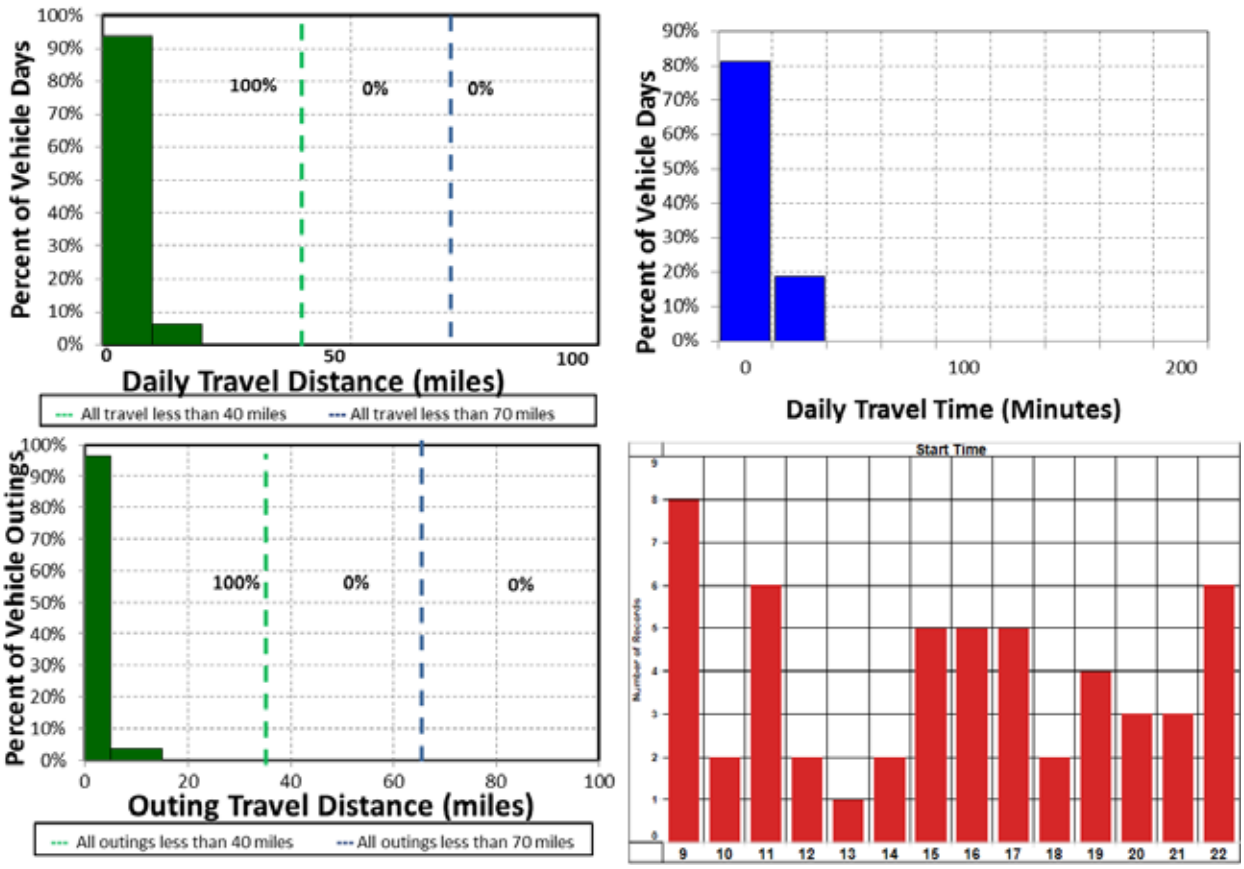

Figure C-57. Vehicle G41-1350G travel and time-of-day graphs.

Vehicle G41-1350G Observations

Logger 46 collected data on this vehicle for a period of 16 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for FAC. This vehicle's data indicate it parks near Building 385 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 7,238 miles at the start of this study and its average annual mileage is 926 miles. The vehicle was used on 34% of the available days, with an average daily usage of 0.3 hours and a peak daily usage of 0.7 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-57 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 38

Make/Model/Year	Dodge Grand Caravan – 2011
EPA Class Size	Minivan
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 103, Eisenhower St
Fleet Vehicle ID	G41-1536L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/25/20 12/18/14
EPA GHG Emissions (Grams CO_2/Mi)	444/443
Study Logger ID	59
Total Vehicle Days/Total Study Days	27/47

Vehicle G41-1536L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	7.0/19.2	4.8/19.2	1.4/7.0	190
Travel Time (Minutes)	28.7/91.0	19.4/91.0	5.5/29.0	774
Idle Time (Minutes)	2.5/NA	1.7/NA	0.5/NA	68

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	121	100%	Less than 2	87
10 to 20	0	0	2 to 4	6
20 to 40	0	0	4 to 8	1
40 to 60	0	0	Greater than 8	27

Figure C-58. Vehicle G41-1536L stops.

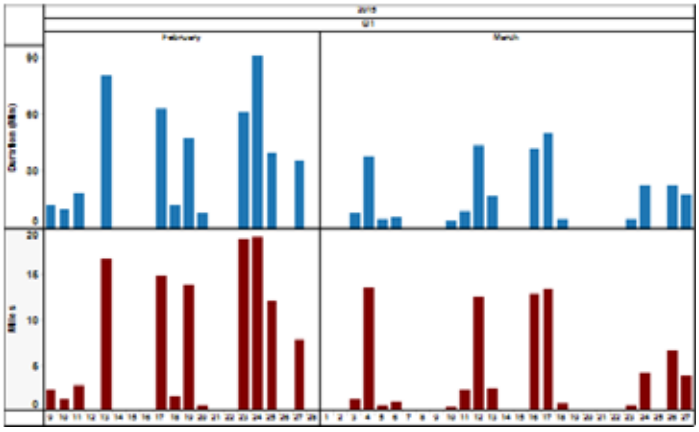

Figure C-59. Vehicle G41-1536L history.

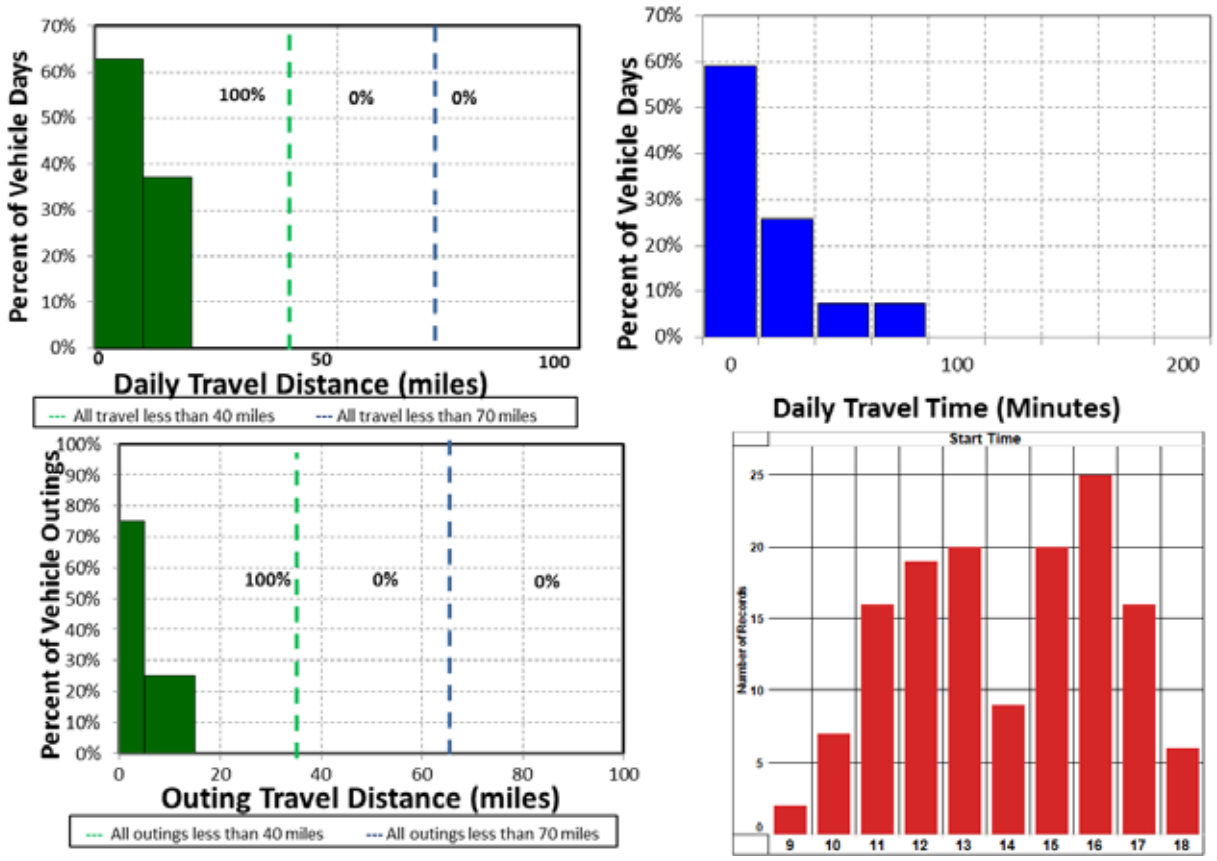

Figure C-60. Vehicle G41-1536L travel and time-of-day graphs.

Vehicle G41-1536L Observations

Logger 59 collected data on this vehicle for a period of 27 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Public Works. This vehicle's data indicate it parks near Building 103 near Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 6,901 miles at the start of this study and its average annual mileage is 1,364 miles. The vehicle was used on 57% of the available days, with an average daily usage of 0.5 hours and a peak daily usage of 1.5 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-60 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 39

Make/Model/Year	Dodge Dakota – 2011
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 103, Eisenhower St
Fleet Vehicle ID	G41-1597L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/19/16 9/13/10
EPA GHG Emissions (Grams CO_2/Mi)	555/620
Study Logger ID	68
Total Vehicle Days/Total Study Days	30/47

Vehicle G41-1597L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	6.8/17.4	3.6/17.3	1.4/16.2	203
Travel Time (Minutes)	37.5/122.0	19.7/122.0	7.9/120.0	1,125
Idle Time (Minutes)	10.0/NA	5.3/NA	2.1/NA	300

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	136	100%	Less than 2	94
10 to 20	0	0	2 to 4	9
20 to 40	0	0	4 to 8	4
40 to 60	0	0	Greater than 8	29

Figure C-61. Vehicle G41-1597L stops.

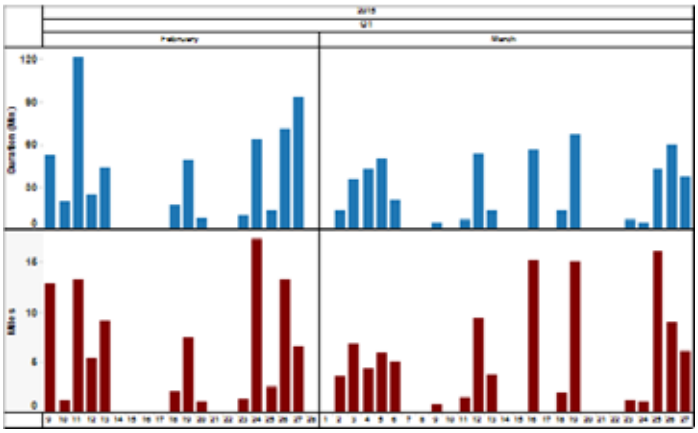

Figure C-62. Vehicle G41-1597L history.

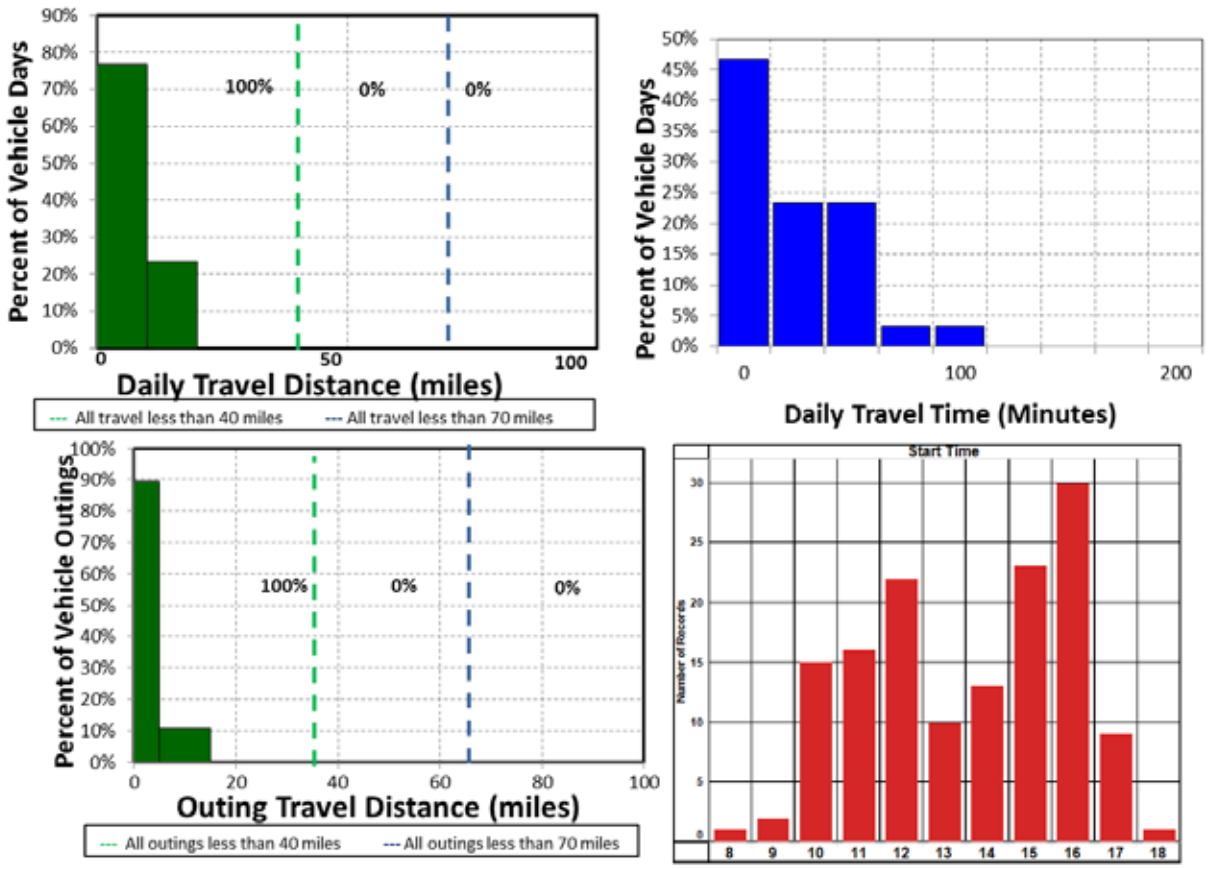

Figure C-63. Vehicle G41-1597L travel and time-of-day graphs.

Vehicle G41-1597L Observations

Logger 68 collected data on this vehicle for a period of 30 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Public Works. This vehicle's data indicate it parks near Building 103 near Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 16,980 miles at the start of this study and its average annual mileage is 4,065 miles. The vehicle was used on 64% of the available days, with an average daily usage of 0.6 hours and a peak daily usage of 2.0 hours on the days it was used. The vehicle was used during day-shift hours.

Figure C-63 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 40

Make/Model/Year	Ford Ranger – 2009
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2734, Lexington St
Fleet Vehicle ID	G41-1763H
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	19/24/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	69
Total Vehicle Days/Total Study Days	42/47

Vehicle G41-1763H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	3.9/12.1	0.7/12.1	0.6/6.5	165
Travel Time (Minutes)	72.8/192.0	12.9/109.0	11.5/109.0	3,056
Idle Time (Minutes)	50.0/NA	8.9/NA	7.9/NA	2,099

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	174	100%	Less than 2	91
10 to 20	0	0	2 to 4	31
20 to 40	0	0	4 to 8	12
40 to 60	0	0	Greater than 8	40

Figure C-64. Vehicle G41-1763H stops.

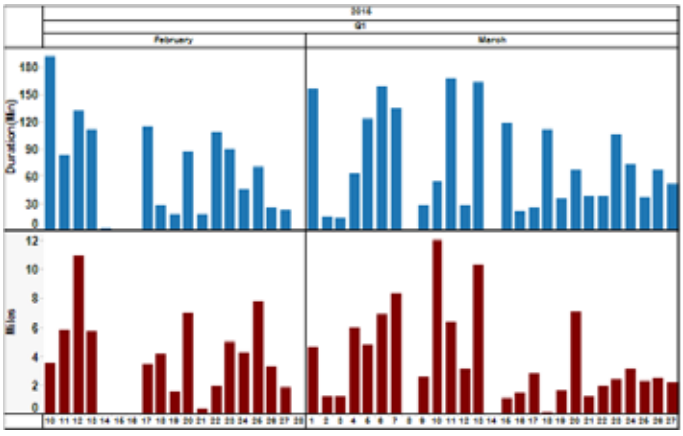

Figure C-64. Vehicle G41-1763H history.

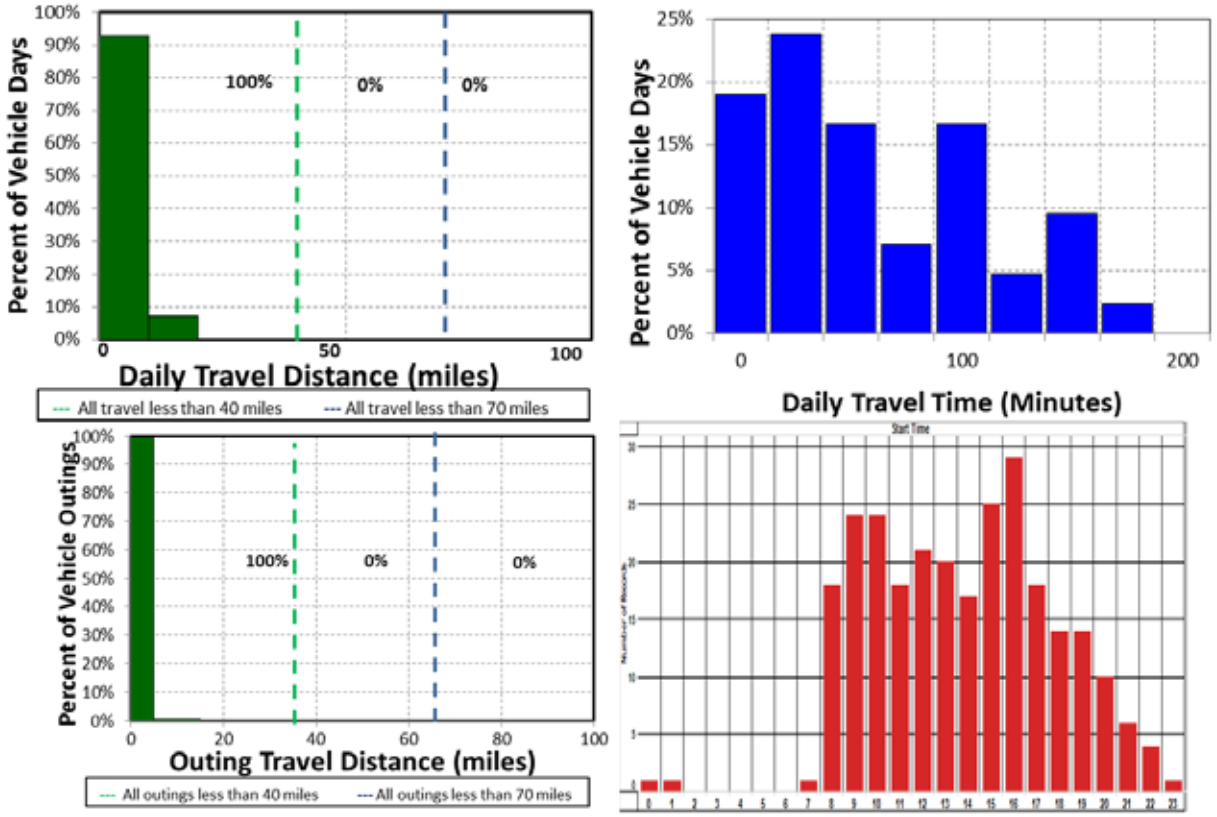

Figure C-66. Vehicle G41-1763H travel and time-of-day graphs.

Vehicle G41-1763H Observations

Logger 69 collected data on this vehicle for a period of 42 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Air Terminal. This vehicle's data indicate it parks near Building 103 near Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 13,857 miles at the start of this study and its average annual mileage is 2,246 miles. The vehicle was used on 89% of the available days, with an average daily usage of 1.2 hours and a peak daily usage of 3.2 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-66 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 41

Make/Model/Year	Ford Ranger – 2009
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	No data
Fleet Vehicle ID	G41-1765H
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	19/24/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	70
Total Vehicle Days/Total Study Days	Insufficient data

Vehicle G41-1765H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Travel Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Idle Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	Insufficient data	Insufficient data	Less than 2	Insufficient data
10 to 20	Insufficient data	Insufficient data	2 to 4	Insufficient data
20 to 40	Insufficient data	Insufficient data	4 to 8	Insufficient data
40 to 60	Insufficient data	Insufficient data	Greater than 8	Insufficient data

Insufficient data

Figure C-67. Vehicle G41-1765H stops.

Insufficient data

Figure C-68. Vehicle G41-1765H history.

Insufficient data

Figure C-69. Vehicle G41-1765H travel and time-of-day graphs.

Vehicle G41-1765H Observations

Logger 76 collected insufficient data on this vehicle. Although this was recognized early in the study period, it could not be resolved.

NASWI reports the vehicle odometer indicated 19,085 miles at the start of this study and its average annual mileage is 3,073 miles.

Sheet 42

Make/Model/Year	Ford Ranger – 2009
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 103, Eisenhower St
Fleet Vehicle ID	G41-1767H
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	19/24/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	71
Total Vehicle Days/Total Study Days	21/47

Vehicle G41-1767H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	11.2/28.8	6.0/22.9	2.4/21.0	236
Travel Time (Minutes)	39.2/95.0	21.1/63.0	8.6/53.0	824
Idle Time (Minutes)	2.5/NA	1.3/NA	0.5/NA	52

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	89	100%	Less than 2	63
10 to 20	0	0	2 to 4	4
20 to 40	0	0	4 to 8	2
40 to 60	0	0	Greater than 8	20

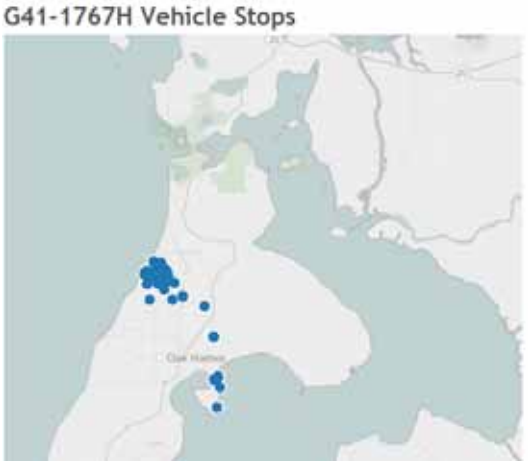

Figure C-70. Vehicle G41-1767H stops.

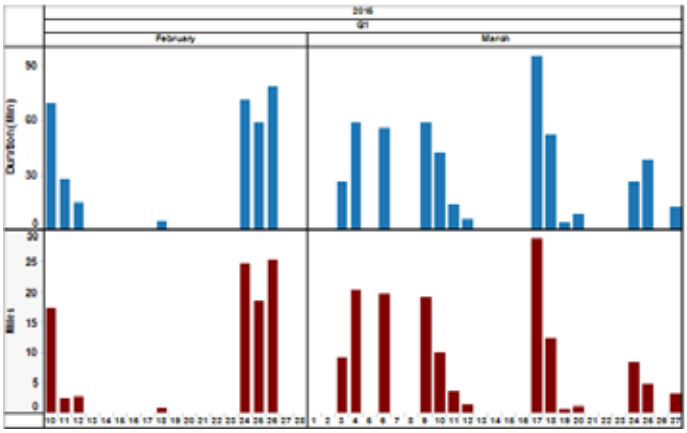

Figure C-71. Vehicle G41-1767H history.

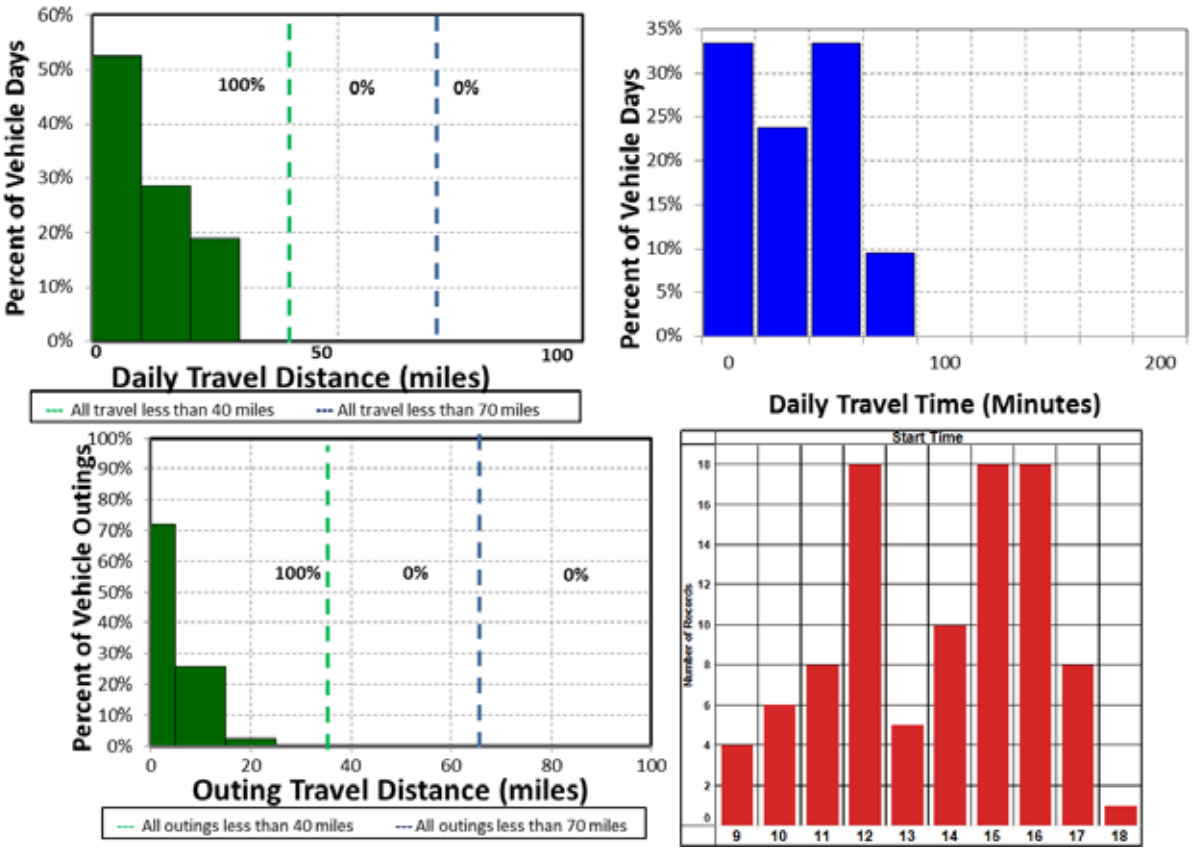

Figure C-72. Vehicle G41-1767H travel and time-of-day graphs.

Vehicle G41-1767H Observations

Logger 71 collected data on this vehicle for a period of 21 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Public Works. This vehicle's data indicate it parks near Building 103 on Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 19,354 miles at the start of this study and its average annual mileage is 3,072 miles. The vehicle was used on 45% of the available days, with an average daily usage of 0.7 hours and a peak daily usage of 1.6 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-72 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 43

Make/Model/Year	Ford Ranger – 2009
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	No data
Fleet Vehicle ID	G41-1768H
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	19/24/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	73
Total Vehicle Days/Total Study Days	Insufficient data

Vehicle G41-1768H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Travel Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Idle Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	Insufficient data	Insufficient data	Less than 2	Insufficient data
10 to 20	Insufficient data	Insufficient data	2 to 4	Insufficient data
20 to 40	Insufficient data	Insufficient data	4 to 8	Insufficient data
40 to 60	Insufficient data	Insufficient data	Greater than 8	Insufficient data

Insufficient data

Figure C-73. Vehicle G41-1768H stops.

Insufficient data

Figure C-74. Vehicle G41-1768H history.

Insufficient Data

Figure C-75. Vehicle G41-1768H travel and time-of-day graphs.

Vehicle G41-1768H Observations

Logger 73 collected insufficient data on this vehicle. Although this was recognized early in the study period, it could not be resolved.

NASWI reports that the vehicle odometer indicated 11,571 miles at the start of this study and its average annual mileage is 1,896 miles.

Sheet 44

Make/Model/Year	Chevrolet Colorado – 2012
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2699, Ranger St
Fleet Vehicle ID	G41-4334M
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	18/25/21
EPA GHG Emissions (Grams CO_2/Mi)	423
Study Logger ID	77
Total Vehicle Days/Total Study Days	28/47

Vehicle G41-4334M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	7.3/137.3	3.3/138.5	1.2/48.3	205
Travel Time (Minutes)	34.1/304.0	15.4/315.0	5.7/81.0	954
Idle Time (Minutes)	10.2/NA	4.6/NA	1.7/NA	286

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	123	95.3%	Less than 2	92
10 to 20	4	3.1%	2 to 4	6
20 to 40	0	0	4 to 8	4
40 to 60	2	1.6%	Greater than 8	27

Figure C-76. Vehicle G41-4334M stops.

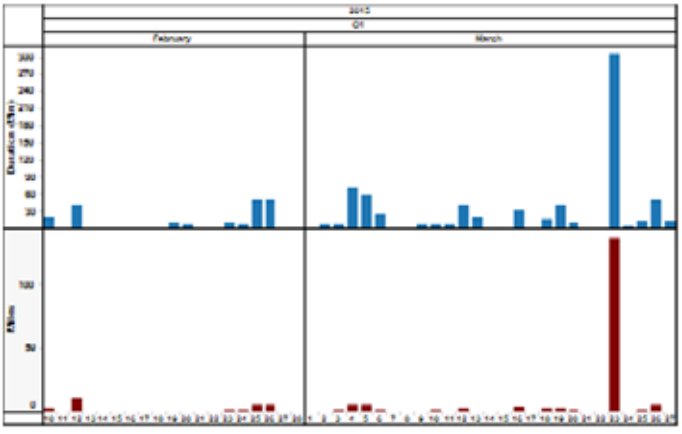

Figure C-77. Vehicle G41-4334M history.

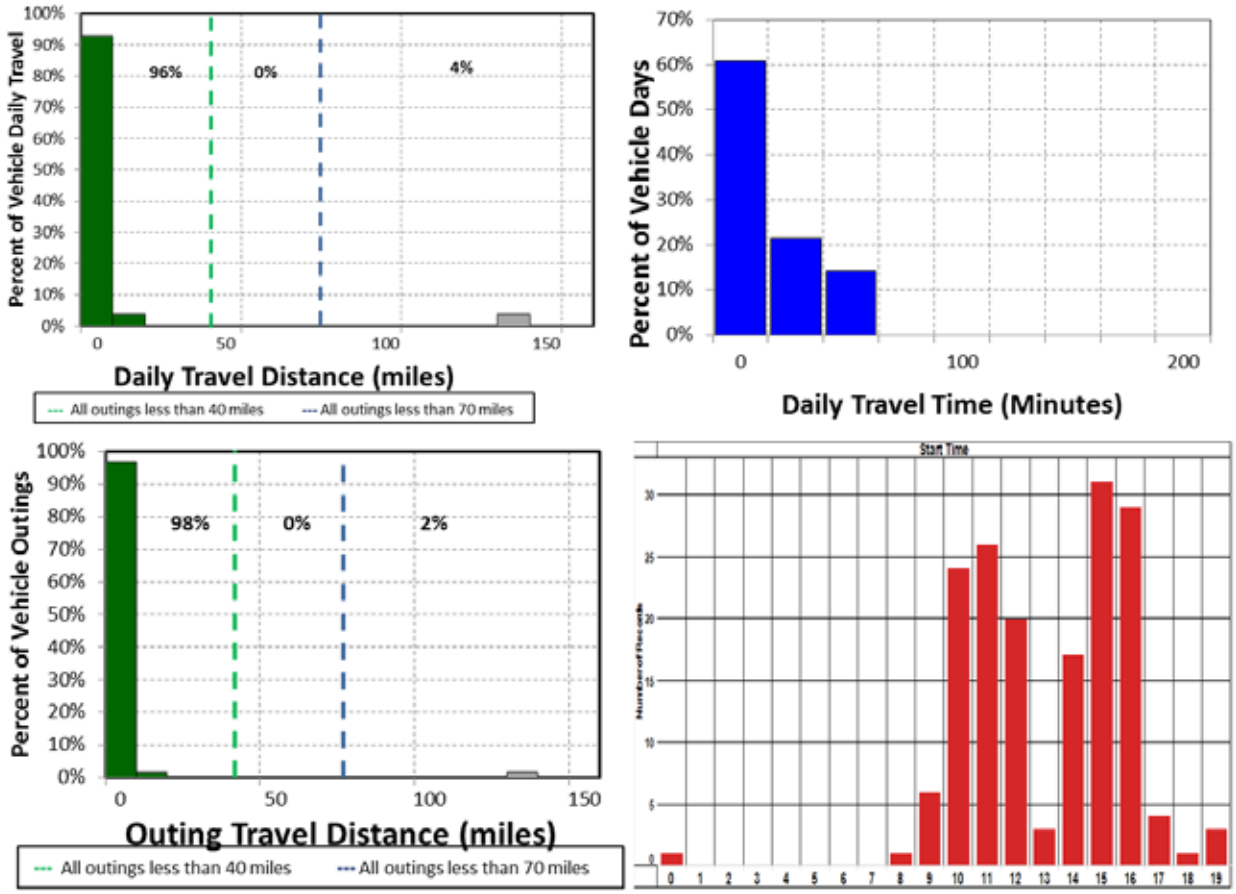

Figure C-78. Vehicle G41-4334M travel and time-of-day graphs.

Vehicle G41-4334M Observations

Logger 77 collected data on this vehicle for a period of 28 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for SAR. This vehicle's data indicate it parks near Building 2699 near Ranger Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 11,782 miles at the start of this study and its average annual mileage is 2,016 miles. The vehicle was used on 60% of the available days, with an average daily usage of 0.6 hours and a peak daily usage of 5.1 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-78 shows that 96% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 98% of the outings were also within this range. Further, 96% of daily travel and 98% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 45

Make/Model/Year	Chevrolet G1300 - 2008
EPA Class Size	Van – Passenger
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G42-0334G
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/564
Study Logger ID	78
Total Vehicle Days/Total Study Days	16/47

Vehicle G42-0334G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	72.8/320.8	145.6/424.8	25.9/128.8	1,165
Travel Time (Minutes)	114.1/450.0	228.1/584.0	40.6/237.0	1,825
Idle Time (Minutes)	16.7/NA	33.4/NA	5.9/NA	267

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	30	75.0%	Less than 2	20
10 to 20	0	0	2 to 4	1
20 to 40	3	7.5%	4 to 8	3
Greater than 40	10	17.5%	Greater than 8	16

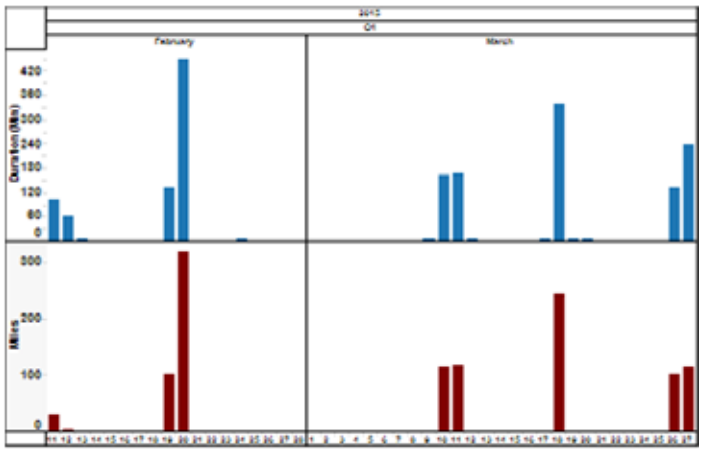

Figure C-79. Vehicle G42-0334G stops. Figure C-80. Vehicle G42-0334G history.

*Fuel economy for G1300 is unavailable. Economy for G1500 is used.

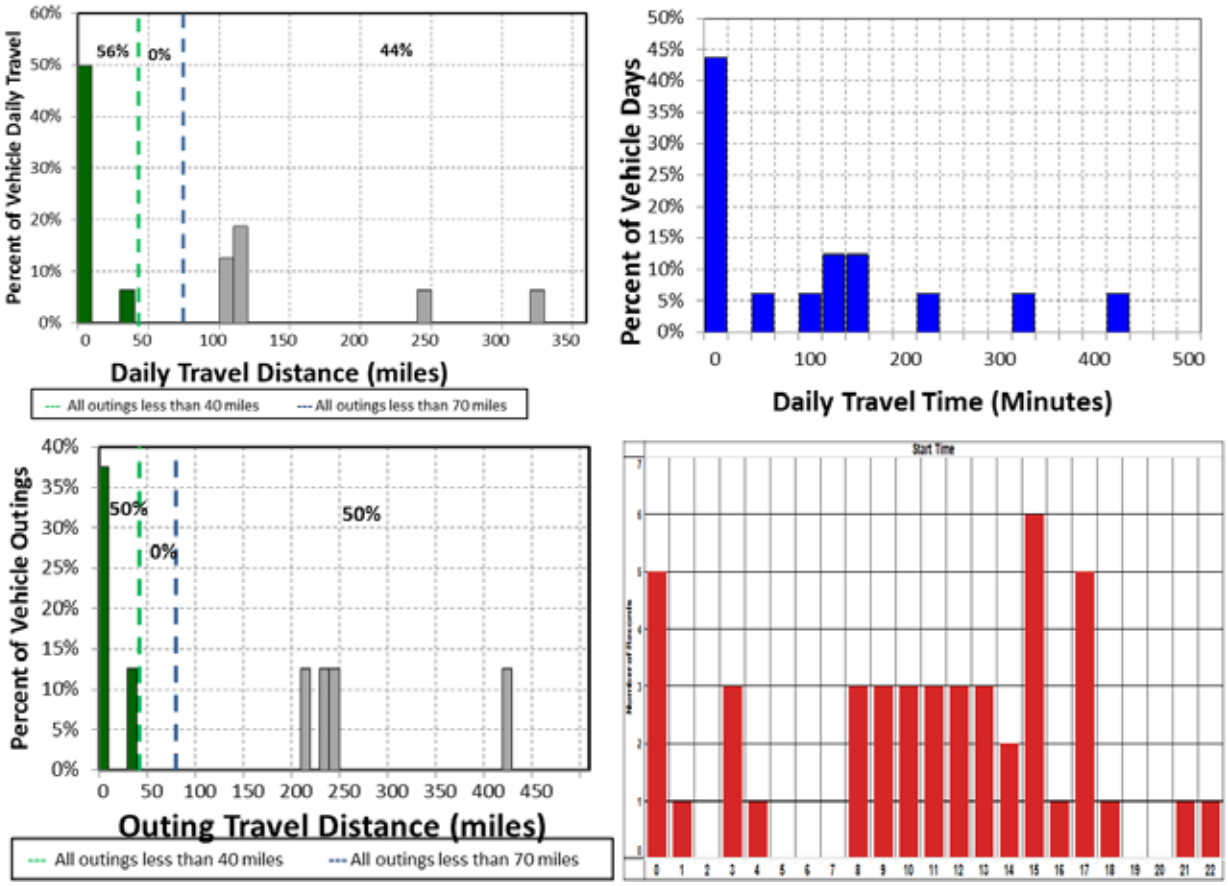

Figure C-81. Vehicle G42-0334G travel and time-of-day graphs.

Vehicle G42-0334G Observations

Logger 78 collected data on this vehicle for a period of 16 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 51,997 miles at the start of this study and its average annual mileage is 7,170 miles. The vehicle was used on 34% of the available days, with an average daily usage of 1.9 hours and a peak daily usage of 7.5 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-81 shows that 56% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 50% of the outings were also within this range. Further, 56% of daily travel and 50% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 46

Make/Model/Year	Chevrolet G1300 - 2008
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2704, Prowler St
Fleet Vehicle ID	G42-0335G
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/564
Study Logger ID	79
Total Vehicle Days/Total Study Days	8/47

Vehicle G42-0335G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)				
Travel Time (Minutes)				
Idle Time (Minutes)				

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10			Less than 2	
10 to 20			2 to 4	
20 to 40			4 to 8	
40 to 60			Greater than 8	

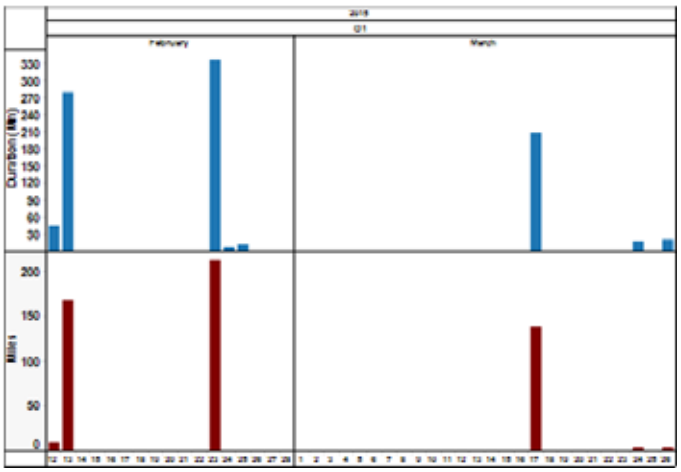

Figure C-82. Vehicle G42-0335G stops. Figure C-83. Vehicle G42-0335G history.

*Fuel economy for G1300 is unavailable. Economy for G1500 is used.

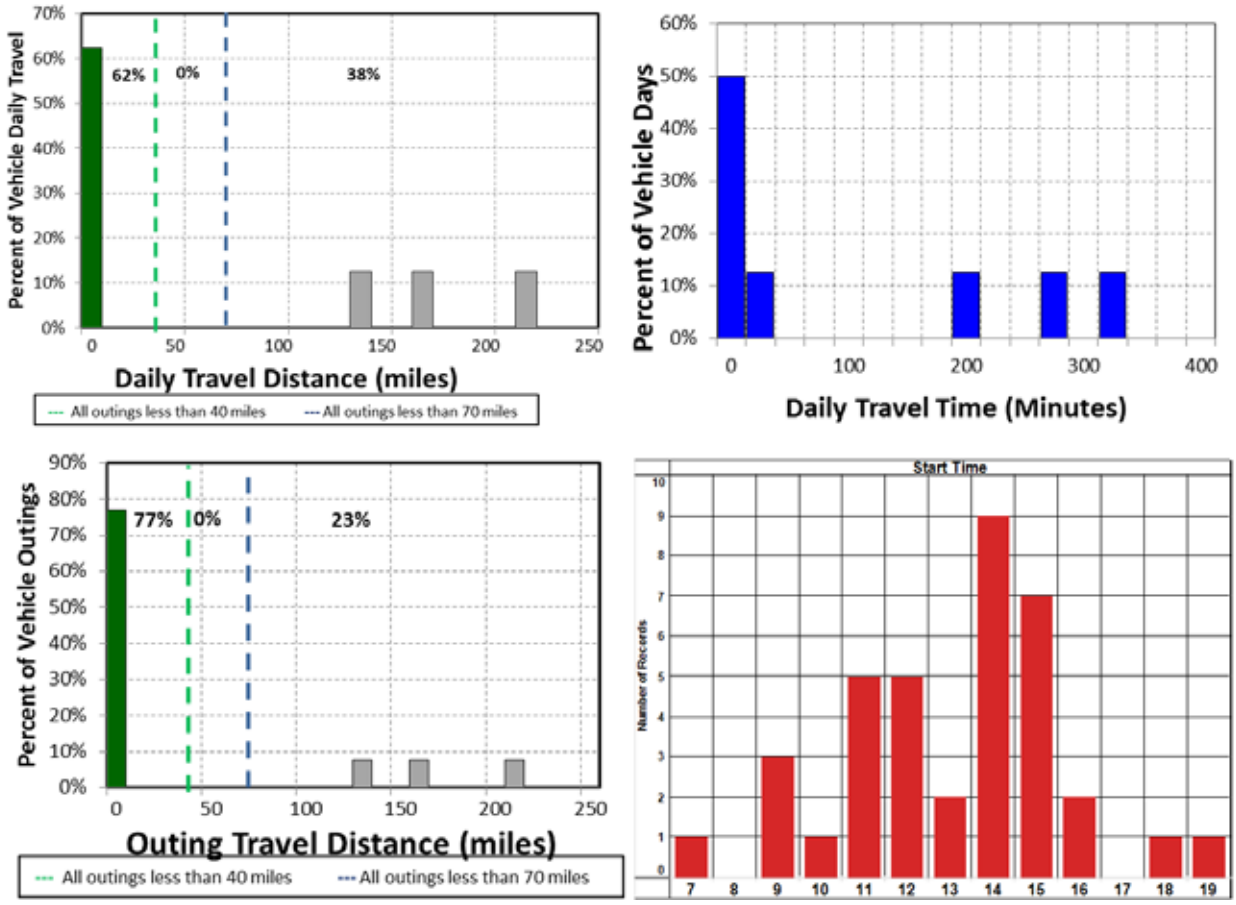

Figure C-84. Vehicle G42-0335G travel and time-of-day graphs.

Vehicle G42-0335G Observations

Logger 79 collected data on this vehicle for a period of 8 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for TSCOMM. This vehicle's data indicate it parks near Building 2704 on Prowler Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 44,318 miles at the start of this study and its average annual mileage is 5,759 miles. The vehicle was used on 17% of the available days, with an average daily usage of 1.9 hours and a peak daily usage of 5.6 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-84 shows that 62% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 77% of the outings were also within this range. Further, 62% of daily travel and 77% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 47

Make/Model/Year	Chevrolet Silverado – 2010
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 103, Eisenhower St
Fleet Vehicle ID	G42-0656K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	15/22/18 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	494/477
Study Logger ID	83
Total Vehicle Days/Total Study Days	29/47

Vehicle G42-0656K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	4.1/16.6	2.4/15.3	1.1/7.5	119
Travel Time (Minutes)	32.7/95.0	19.4/68.0	8.7/66.0	949
Idle Time (Minutes)	12.9/NA	7.6/NA	3.4/NA	374

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	105	100%	Less than 2	66
10 to 20	0	0	2 to 4	5
20 to 40	0	0	4 to 8	5
40 to 60	0	0	Greater than 8	29

Figure C-85. Vehicle G42-0656K stops.

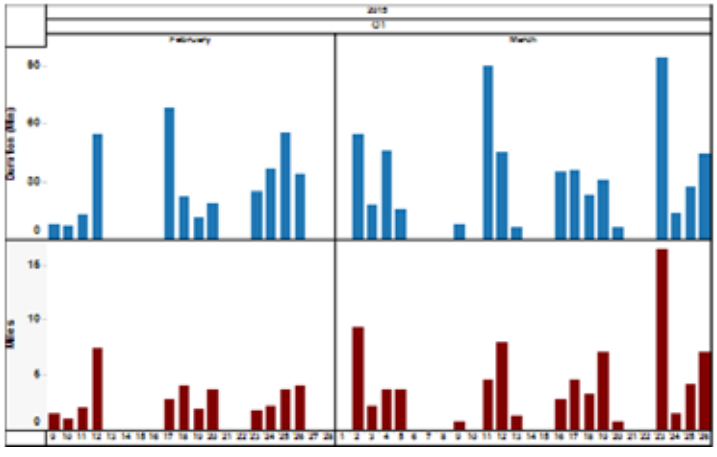

Figure C-86. Vehicle G42-0656K history.

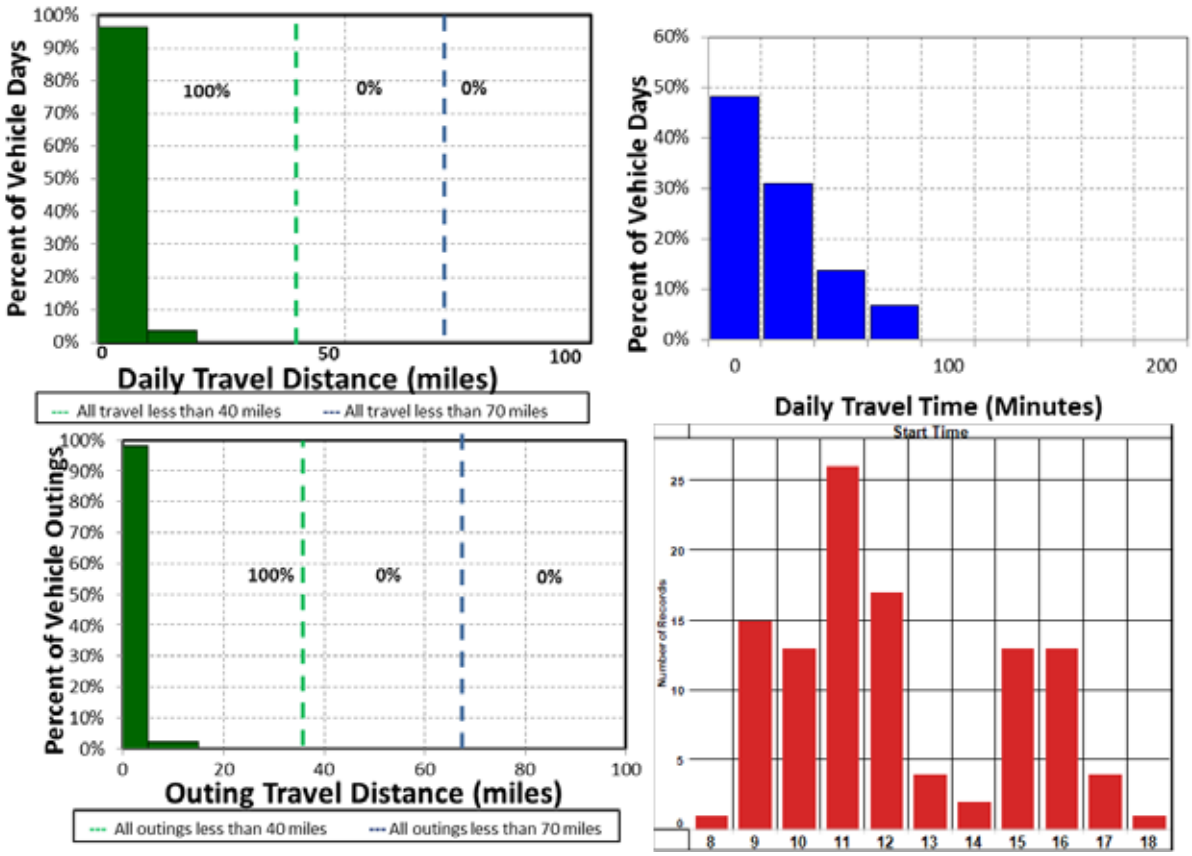

Figure C-87. Vehicle G42-0656K travel and time-of-day graphs.

Vehicle G42-0656K Observations

Logger 83 collected data on this vehicle for a period of 29 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Public Works. This vehicle's data indicate it parks near Building 103 near Eisenhower Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 10,695 miles at the start of this study and its average annual mileage is 2,074 miles. The vehicle was used on 62% of the available days, with an average daily usage of 0.5 hours and a peak daily usage of 1.6 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-87 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 48

Make/Model/Year	Chevrolet C1500 – 2011
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2555, Langley Blvd
Fleet Vehicle ID	G42-0766L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	15/18/22 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	494/477
Study Logger ID	84
Total Vehicle Days/Total Study Days	34/47

Vehicle G42-0766L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.2/122.1	7.1/121.9	3.7/61.6	688
Travel Time (Minutes)	51.9/168.0	18.2/164.0	9.4/87.0	1,765
Idle Time (Minutes)	5.8/NA	2.0/NA	1.0/NA	196

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	178	97.8%	Less than 2	131
10 to 20	1	0.5%	2 to 4	14
20 to 40	3	1.6%	4 to 8	1
40 to 60	0	0	Greater than 8	36

Figure C-88. Vehicle G42-0766L stops.

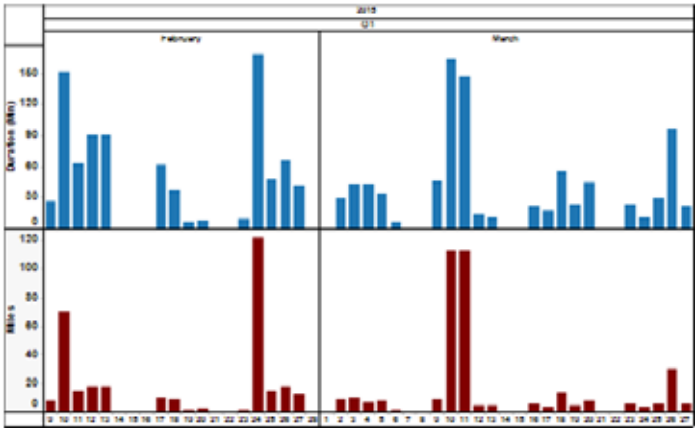

Figure C-89. Vehicle G42-0766L history.

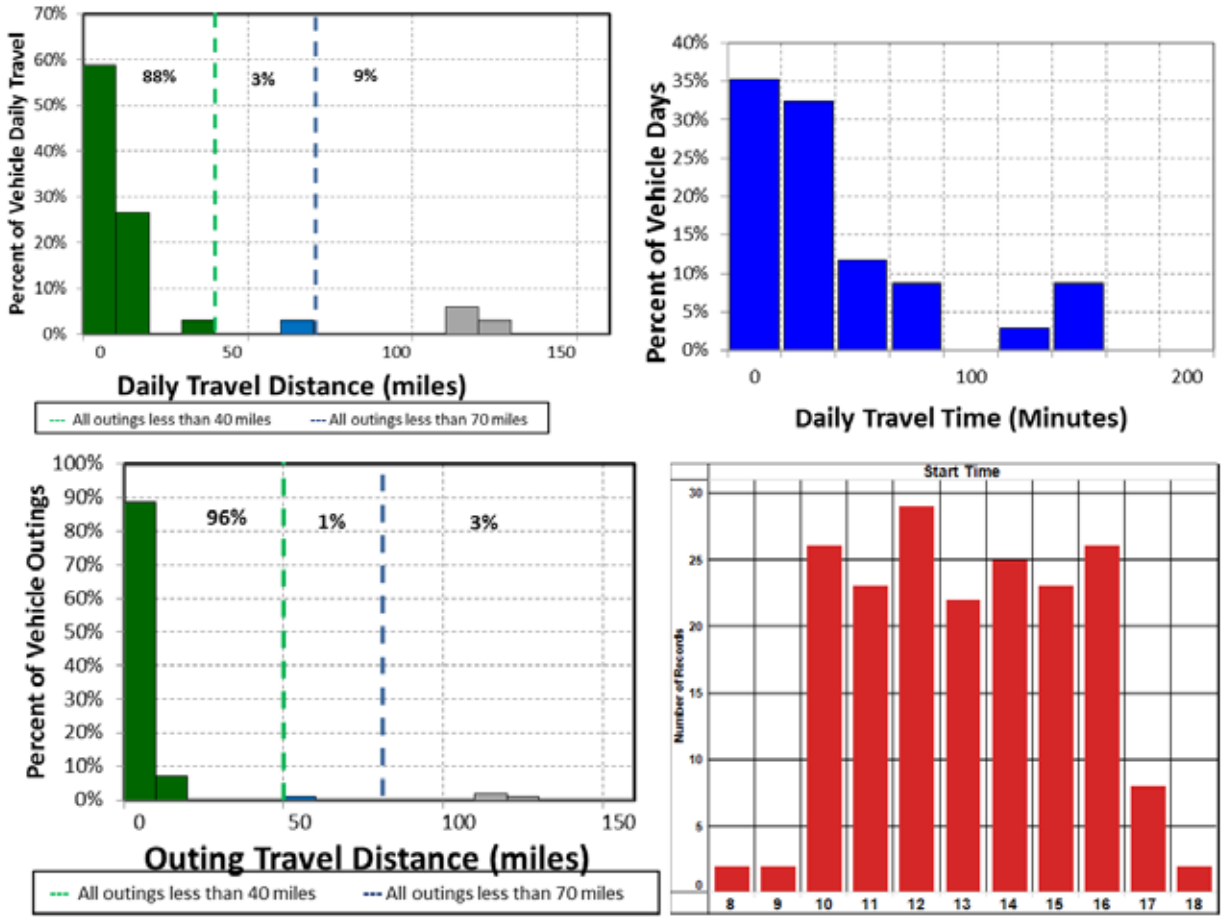

Figure C-90. Vehicle G42-0766L travel and time-of-day graphs.

Vehicle G42-0766L Observations

Logger 84 collected data on this vehicle for a period of 34 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Recycle. This vehicle's data indicate it parks near Building 2555 near Langley Boulevard (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 11,582 miles at the start of this study and its average annual mileage is 2,766 miles. The vehicle was used on 72% of the available days, with an average daily usage of 0.9 hours and a peak daily usage of 2.8hours on the days it was used. The vehicle was used during day-shift hours.

Figure C-90 shows that 91% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 97% of the outings were also within this range. Further, 88% of daily travel and 96% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, PHEVs provide benefit for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 49

Make/Model/Year	Ford F150 – 2009
EPA Class Size	Pickup
Mission	Pool
Contact	NAVFAC NW
Parking Location	Building 124, Midway St
Fleet Vehicle ID	G42-0881H
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/20/16 10/14/12
EPA GHG Emissions (Grams CO_2/Mi)	555/517
Study Logger ID	86
Total Vehicle Days/Total Study Days	11/47

Vehicle G42-0881H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	45.2/235.5	55.2/239.5	8.2/133.1	497
Travel Time (Minutes)	81.3/415.0	99.3/409.0	14.7/166.0	894
Idle Time (Minutes)	9.2/NA	11.2/NA	1.7/NA	101

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	40	60.6%	Less than 2	51
10 to 20	2	3.0%	2 to 4	4
20 to 40	5	7.6%	4 to 8	1
Greater than 40	19	28.8%	Greater than 8	10

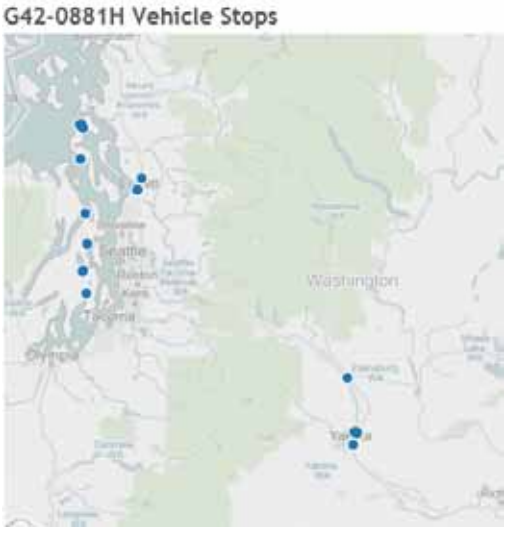

Figure C-91. Vehicle G42-0881H stops.

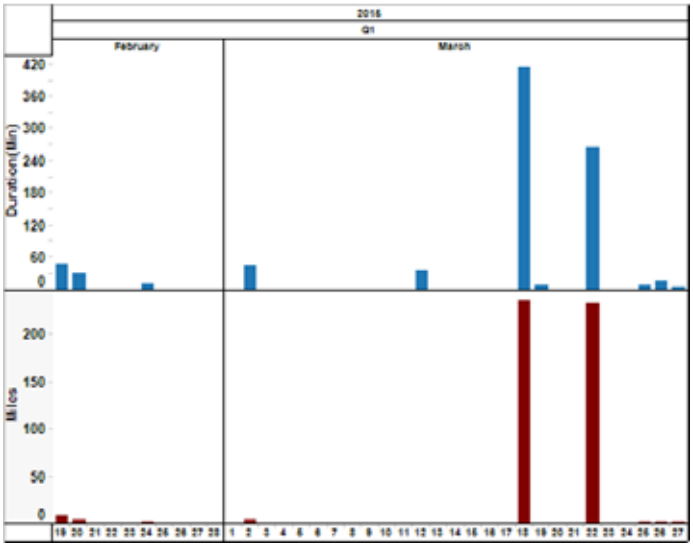

Figure C-92. Vehicle G42-0881H history.

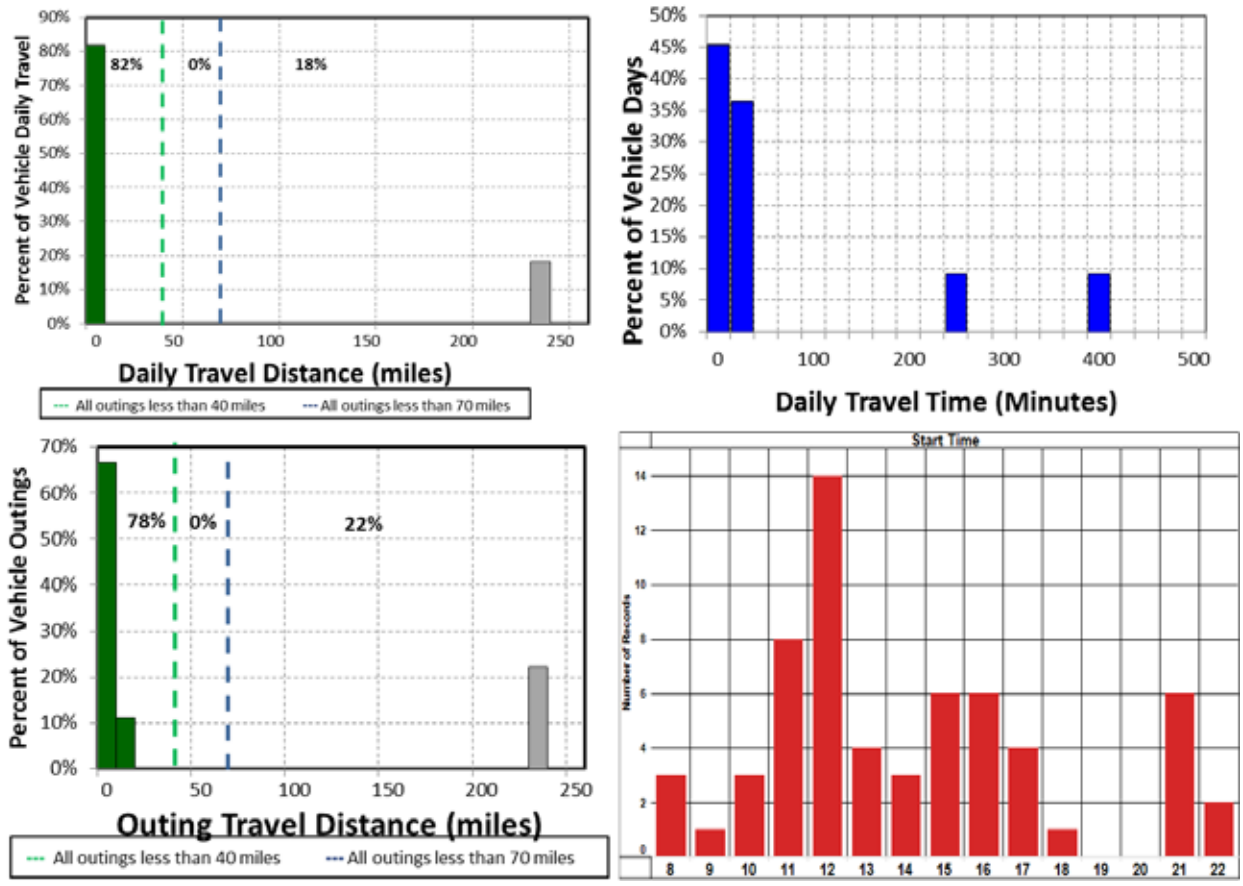

Figure C-93. Vehicle G42-0881H travel and time-of-day graphs.

Vehicle G42-0881H Observations

Logger 86 collected data on this vehicle for a period of 11 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 124 on Midway Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 50,830 miles at the start of this study and its average annual mileage is 8,243 miles. The vehicle was used on 23% of the available days, with an average daily usage of 1.4 hours and a peak daily usage of 6.9 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-93 shows that 82% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 78% of the outings were also within this range. Further, 82% of daily travel and 78% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 50

Make/Model/Year	Chevrolet G1300 Exp - 2012
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 385, Lexington St
Fleet Vehicle ID	G42-1222M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/564
Study Logger ID	87
Total Vehicle Days/Total Study Days	26/47

Vehicle G42-1222M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	15.1/140.8	7.3/137.2	2.3/49.3	393
Travel Time (Minutes)	60.5/235.0	29.1/216.0	9.1/112.0	1,573
Idle Time (Minutes)	13.5/NA	6.5/NA	2.0/NA	350

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	116	95.1%	Less than 2	84
10 to 20	5	4.1%	2 to 4	9
20 to 40	0	0	4 to 8	3
Greater than 40	1	0.8%	Greater than 8	26

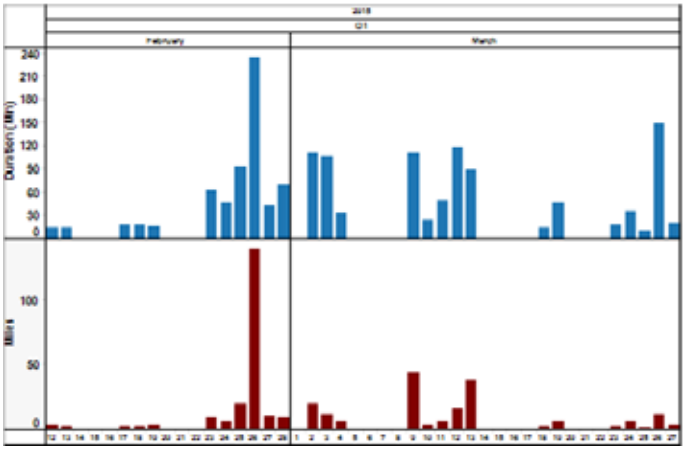

Figure C-94. Vehicle G42-1222M stops. Figure C-95. Vehicle G42-1222M history.

*Fuel Economy for G1300 is unavailable. Economy for G1500 is used.

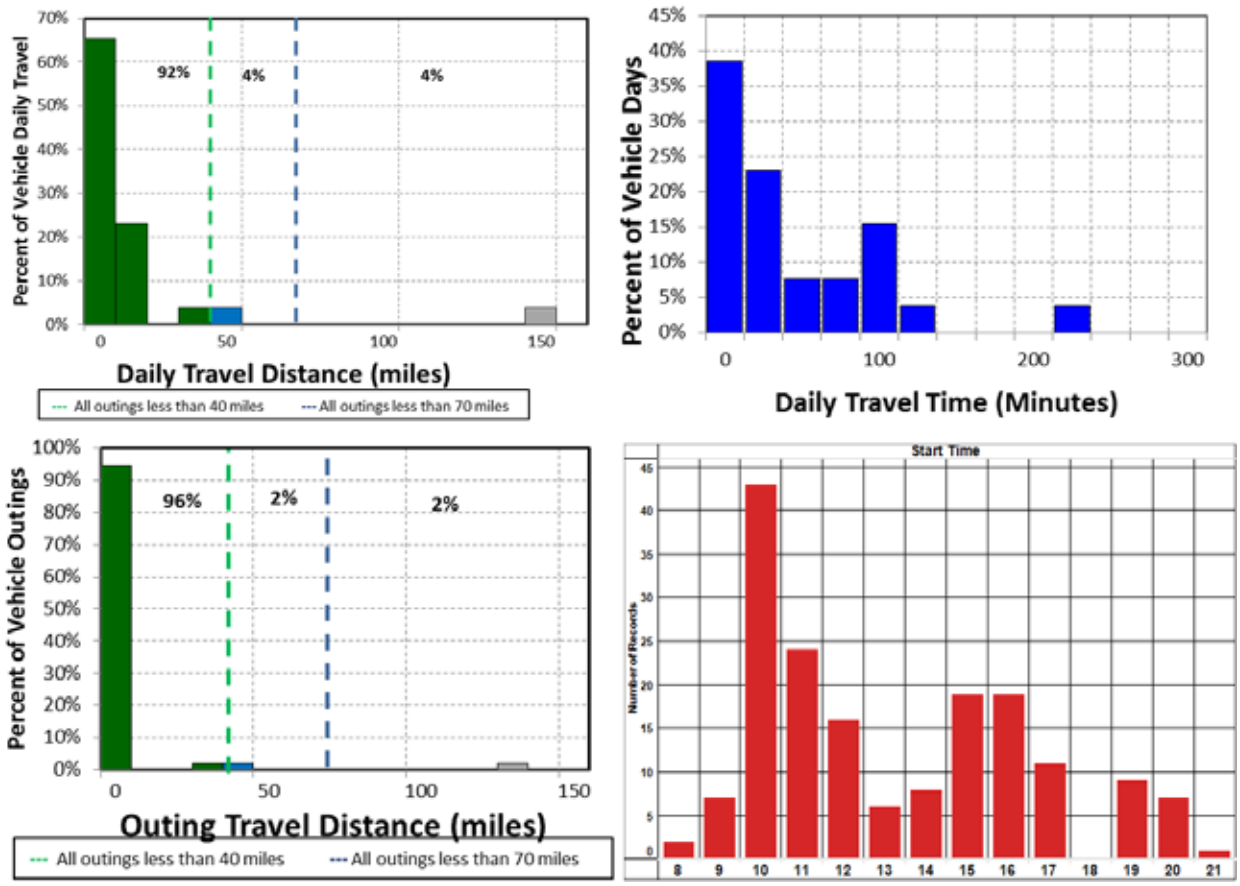

Figure C-96. Vehicle G42-1222M travel and time-of-day graphs.

Vehicle G42-1222M Observations

Logger 87 collected data on this vehicle for a period of 26 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a pool mission. This vehicle's data indicate it parks near Building 385 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 10,894 miles at the start of this study and its average annual mileage is 3,215 miles. The vehicle was used on 55% of the available days, with an average daily usage of 1.0 hours and a peak daily usage of 3.9 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-96 shows that 96%of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 98% of the outings were also within this range. Further, 92% of daily travel and 96% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base. However, PHEVs provide benefits for the first 40 miles of each trip. Thus, a fleet of vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 51

Make/Model/Year	Chevrolet G1300 Exp - 2012
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2734, Lexington St
Fleet Vehicle ID	G42-1223M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/564
Study Logger ID	88
Total Vehicle Days/Total Study Days	40/47

Vehicle G42-1223M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	2.6/17.9	1.3/37.4	0.8/17.6	105
Travel Time (Minutes)	15.2/85.0	7.7/139.0	4.8/57.0	608
Idle Time (Minutes)	4.7/NA	2.4/NA	1.5/NA	187

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	65	100%	Less than 2	34
10 to 20	0	0	2 to 4	7
20 to 40	0	0	4 to 8	4
Greater than 40	0	0	Greater than 8	20

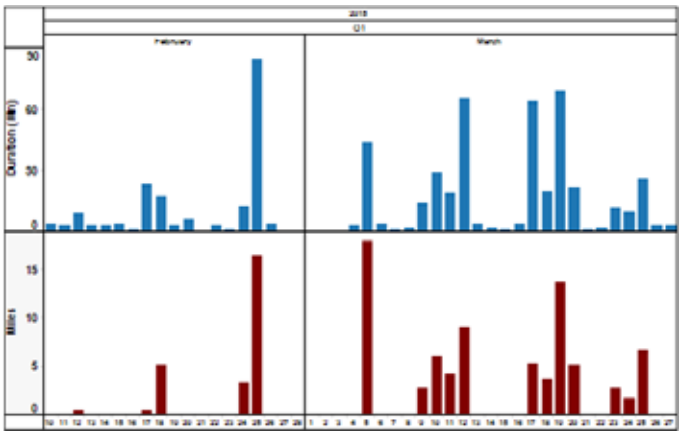

Figure C-97. Vehicle G42-1223M stops. Figure C-98. Vehicle G42-1223M history.

*Fuel Economy for G1300 is unavailable. Economy for G1500 is used.

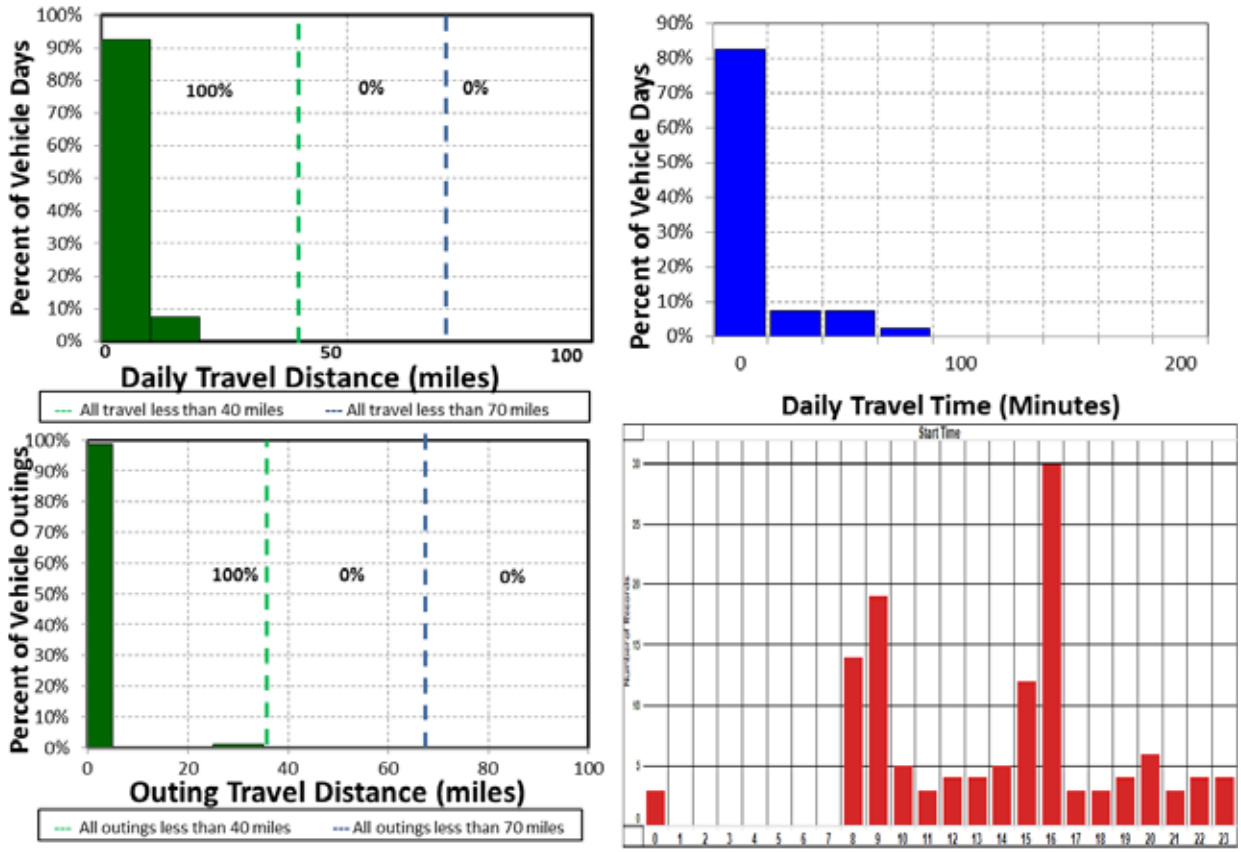

Figure C-99. Vehicle G42-1223M travel and time-of-day graphs.

Vehicle G42-1223M Observations

Logger 88 collected data on this vehicle for a period of 40 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for ODO. This vehicle's data indicate it parks near Building 2734 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 3,179 miles at the start of this study and its average annual mileage is 988 miles. The vehicle was used on 85% of the available days, with an average daily usage of 0.3 hours and a peak daily usage of 1.4 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-99 shows all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 52

Make/Model/Year	Chevrolet Tahoe – 2012
EPA Class Size	SUV
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 994, Charles Porter Ave
Fleet Vehicle ID	G42-2035L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	15/21/17 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	523/477
Study Logger ID	92
Total Vehicle Days/Total Study Days	29/47

Vehicle G42-2035L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	5.2/27.4	3.0/26.2	1.5/23.4	150
Travel Time (Minutes)	22.0/119.0	12.8/110.0	6.2/74.0	638
Idle Time (Minutes)	2.1/NA	1.2/NA	0.6/NA	61

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	99	100%	Less than 2	58
10 to 20	0	0	2 to 4	11
20 to 40	0	0	4 to 8	2
40 to 60	0	0	Greater than 8	28

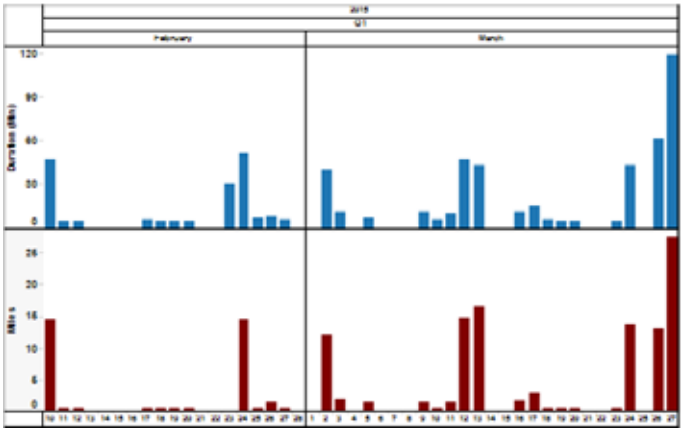

Figure C-100. Vehicle G42-2035L stops. Figure C-101. Vehicle G42-2035L history.

*2004 Ford F150 information. EPA data for 2004 Ford 350 not available.

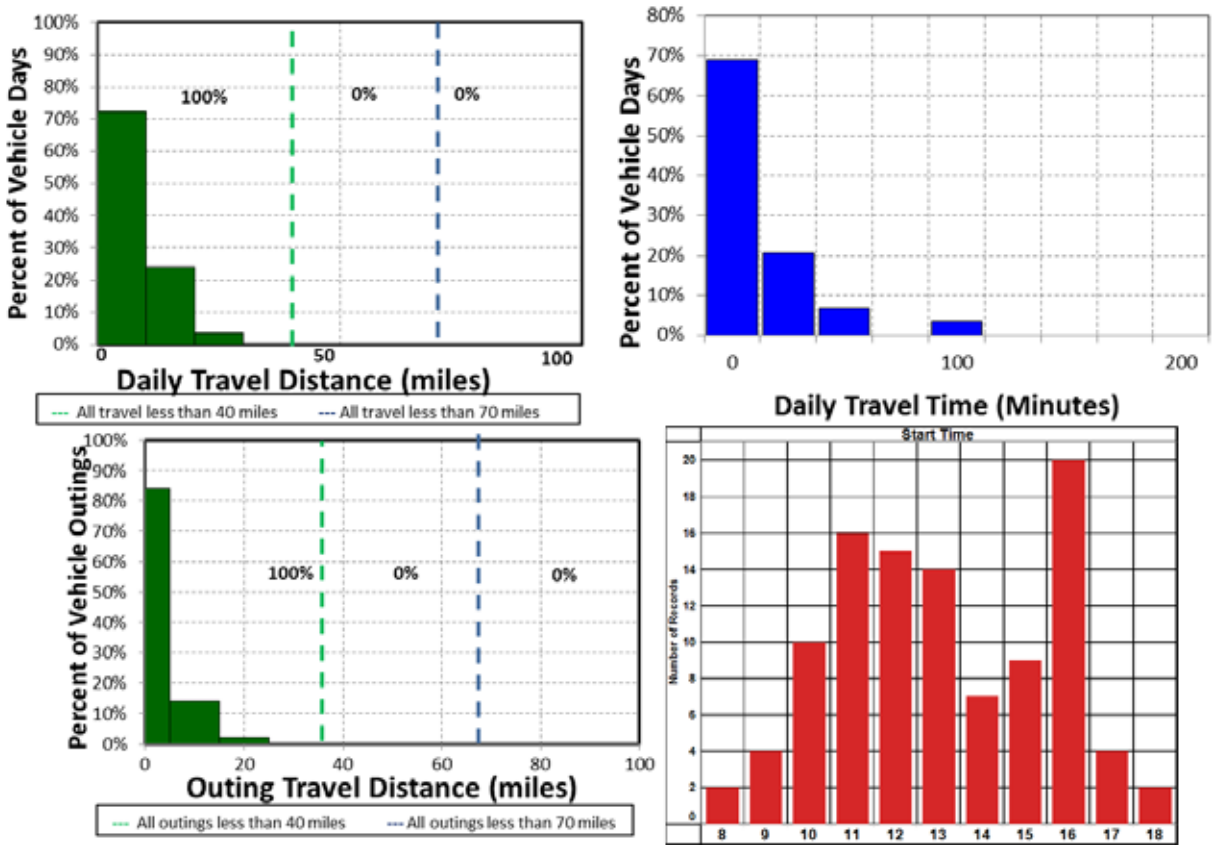

Figure C-102. Vehicle G42-2035L travel and time-of-day graphs.

Vehicle G42-2035L Observations

Logger 92 collected data on this vehicle for a period of 29 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 994near Langley/N. Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 11,329 miles at the start of this study and its average annual mileage is 3,680 miles. The vehicle was used on 62% of the available days, with an average daily usage of 0.4 hours and a peak daily usage of 2.0 hours on the days it was used. The vehicle was used during day-shift hours.

Figure C-102 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 53

Make/Model/Year	Ford E350 - 2010
EPA Class Size	Van - Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2734, Lexington St
Fleet Vehicle ID	G43-0895K
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	10/14/12
EPA GHG Emissions (Grams CO_2/Mi)*	741
Study Logger ID	94
Total Vehicle Days/Total Study Days	39/47

Vehicle G43-0895K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	3.4/13.7	1.1/11.7	0.8/10.1	132
Travel Time (Minutes)	37.0/186.0	11.6/133.0	8.5/71.0	1,444
Idle Time (Minutes)	16.5/NA	5.2/NA	3.8/NA	644

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	124	100%	Less than 2	77
10 to 20	0	0	2 to 4	7
20 to 40	0	0	4 to 8	5
Greater than 40	0	0	Greater than 8	35

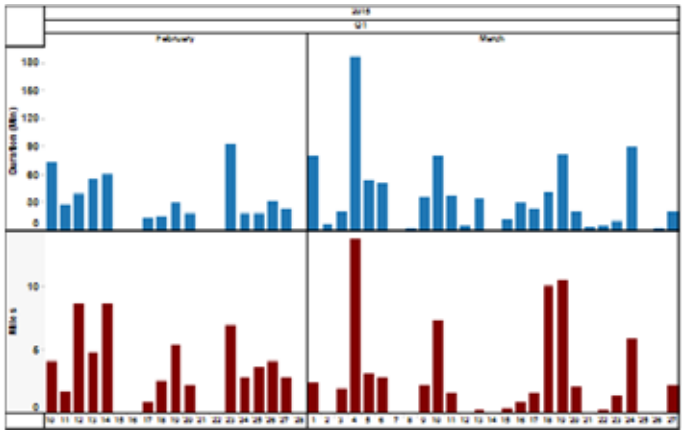

Figure C-103. Vehicle G43-0895K stops. Figure C-104. Vehicle G43-0895K history.

*Fuel Economy for 2010 E350 is unavailable. 2011 E350 information is used.

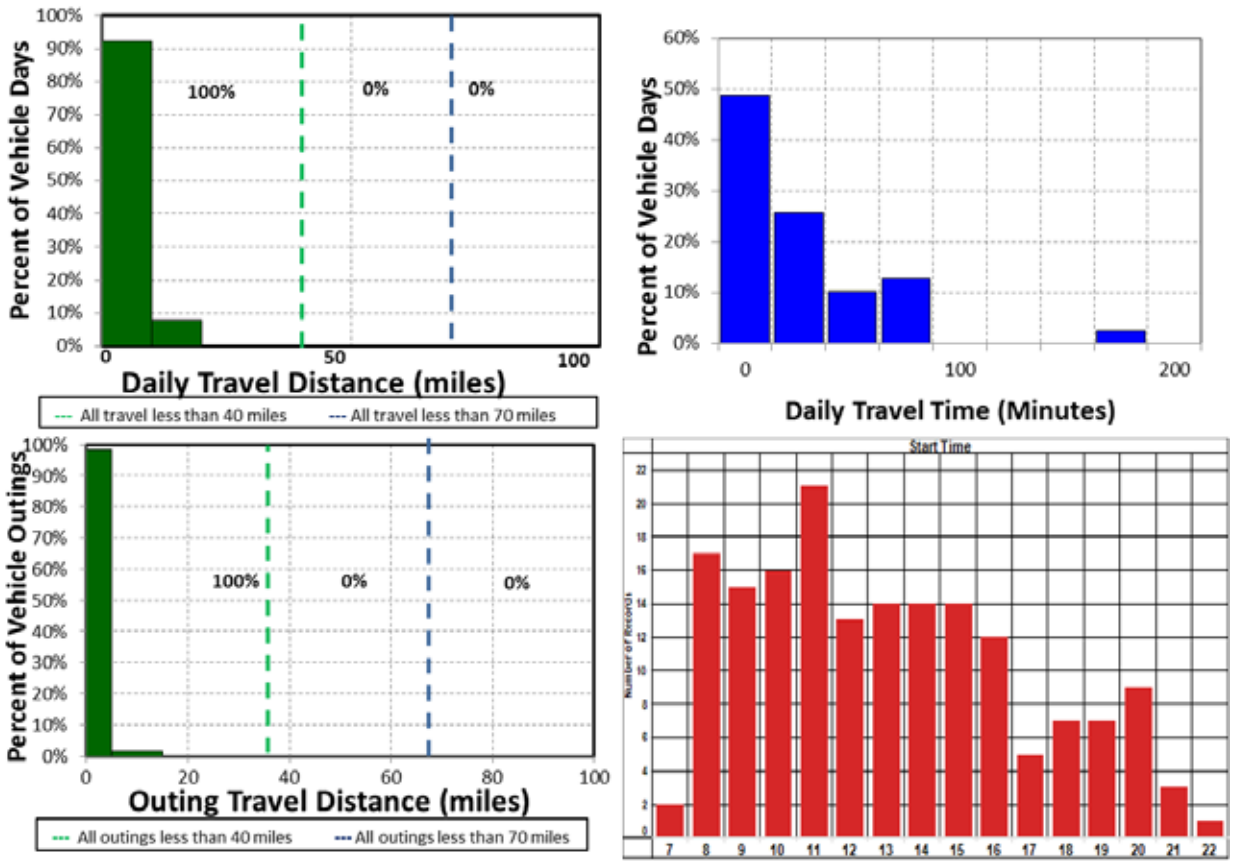

Figure C-105. Vehicle G43-0895K travel and time-of-day graphs.

Vehicle G43-0895K Observations

Logger 94 collected data on this vehicle for a period of 39 days of the 41-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for the Air Terminal. This vehicle's data indicate it parks near Building 2734 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 24,610 miles at the start of this study and its average annual mileage is 4,842 miles. The vehicle was used on 83% of the available days, with an average daily usage of 0.6 hours and a peak daily usage of 3.1 hours on the days it was used. The vehicle was used primarily during day-shift hours and into the evening.

Figure C-105 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 54

Make/Model/Year	Ford E350 – 2010
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2734, Lexington St
Fleet Vehicle ID	G43-0896K
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	10/14/12
EPA GHG Emissions (Grams CO_2/Mi)*	741
Study Logger ID	95
Total Vehicle Days/Total Study Days	40/47

Vehicle G43-0896K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	3.7/21.7	1.1/15.5	0.8/11.2	150
Travel Time (Minutes)	35.1/149.0	10.0/132.0	7.2/67.0	1,402
Idle Time (Minutes)	14.1/NA	4.0/NA	2.9/NA	564

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	150	100%	Less than 2	97
10 to 20	0	0	2 to 4	12
20 to 40	0	0	4 to 8	4
Greater than 40	0	0	Greater than 8	37

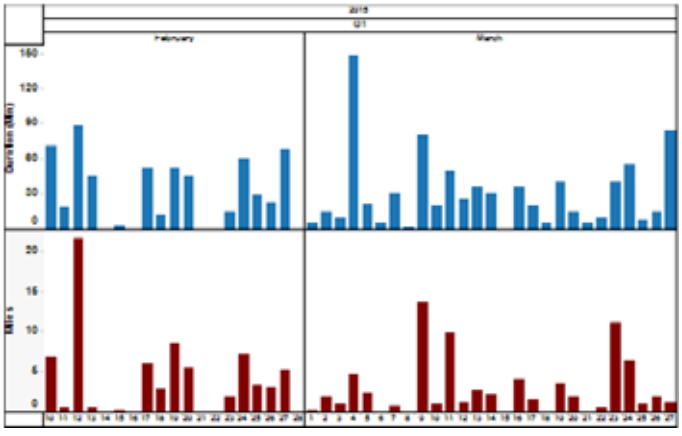

Figure C-106. Vehicle G43-0896K stops. Figure C-107. Vehicle G43-0896K history.

*Fuel Economy for 2010 E350 is unavailable. 2011 E350 information is used.

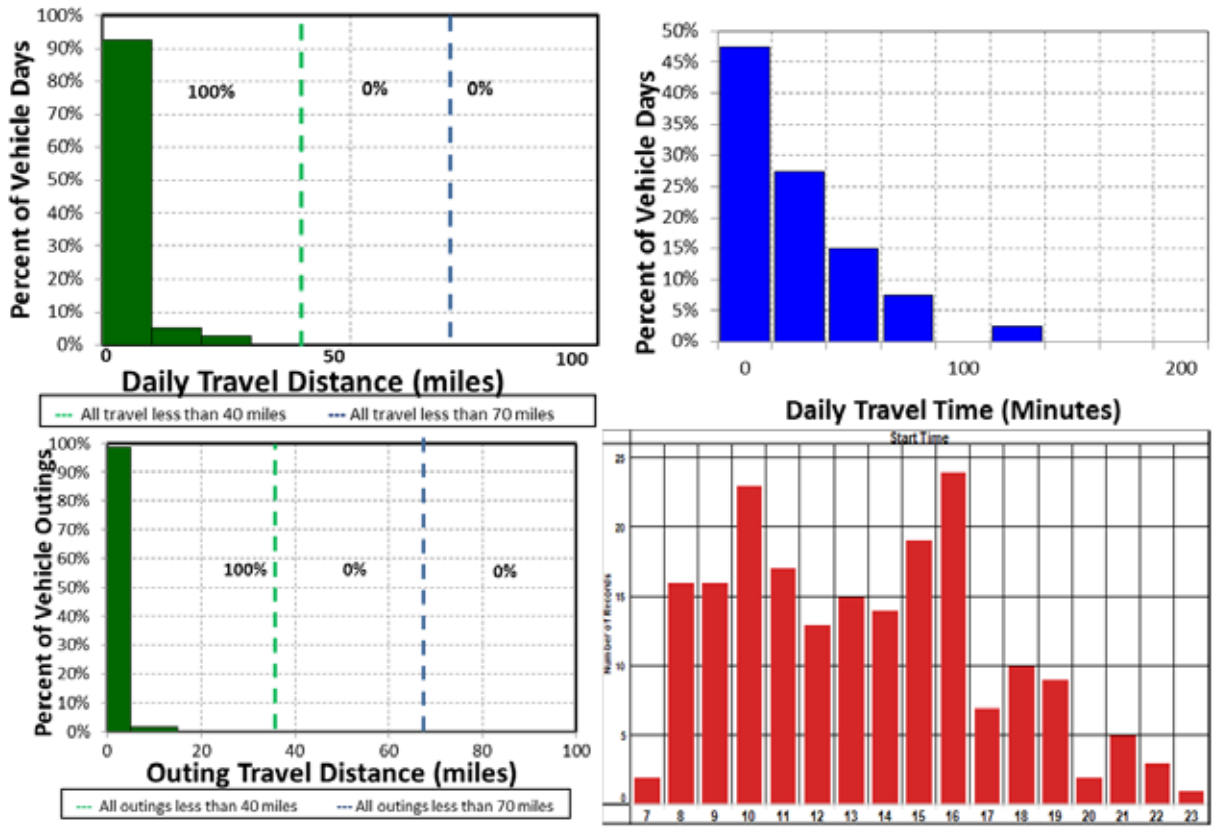

Figure C-108. Vehicle G43-0896K travel and time-of-day graphs.

Vehicle G43-0896K Observations

Logger 95 collected data on this vehicle for a period of 40 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for the Air Terminal. This vehicle's data indicate it parks near Building 2734 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 7,212 miles at the start of this study and its average annual mileage is 1,401 miles. The vehicle was used on 85% of the available days, with an average daily usage of 0.6 hours and a peak daily usage of 2.5 hours on the days it was used. The vehicle was used during day-shift hours.

Figure C-108 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 55

Make/Model/Year	Chevrolet C2500HD – 2011
EPA Class Size	Van – Cargo
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 2815, Langley Blvd
Fleet Vehicle ID	G43-0936K
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	10/16/12
EPA GHG Emissions (Grams CO_2/Mi)	741
Study Logger ID	96
Total Vehicle Days/Total Study Days	25/47

Vehicle G43-0936K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	4.6/35.2	1.7/35.2	0.6/11.6	114
Travel Time (Minutes)	47.9/174.0	17.9/133.0	6.1/70.0	1,197
Idle Time (Minutes)	12.3/NA	4.6/NA	1.6/NA	307

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	193	100%	Less than 2	158
10 to 20	0	0	2 to 4	8
20 to 40	0	0	4 to 8	1
40 to 60	0	0	Greater than 8	26

Figure C-109. Vehicle G43-0936K stops.

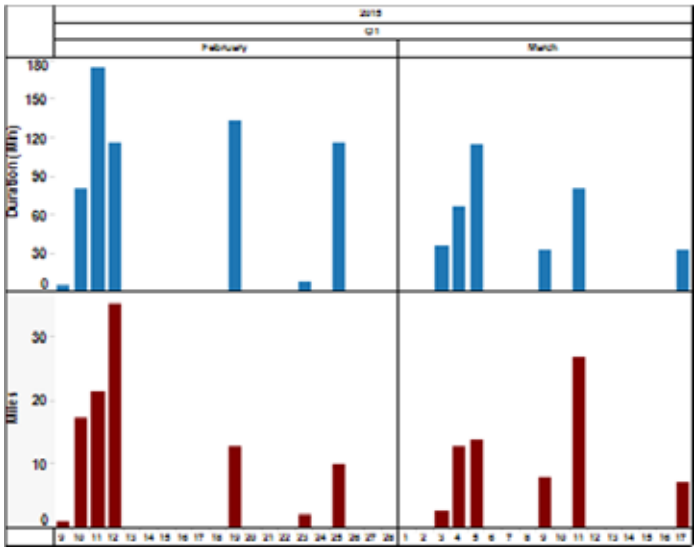

Figure C-110. Vehicle G43-0936K history.

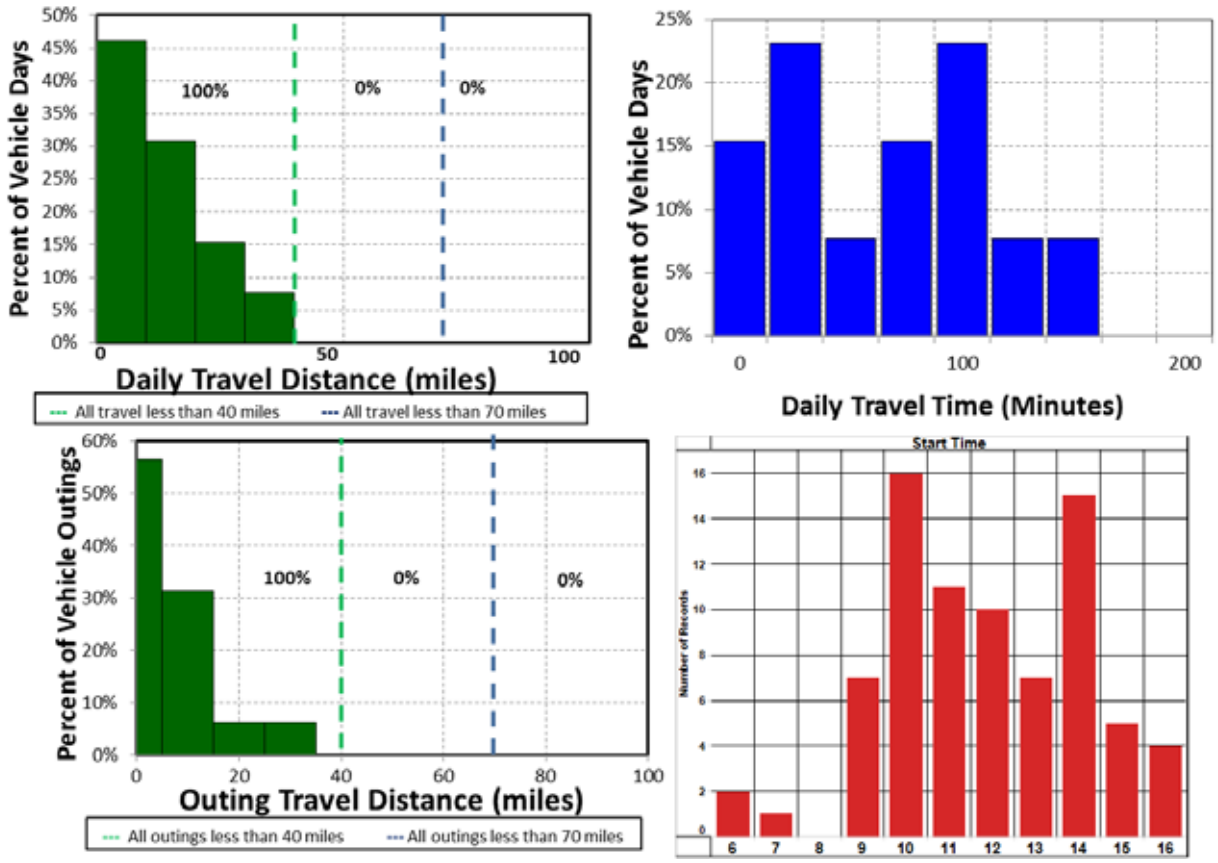

Figure C-111. Vehicle G43-0936K travel and time-of-day graphs.

Vehicle G43-0936K Observations

Logger 96 collected data on this vehicle for a period of 25 days of the 47-day study period. Validation occurred on 99.8% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 2815 on Langley Boulevard (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 9,996 miles at the start of this study and its average annual mileage is 2,307 miles. The vehicle was used on 38% of the available days, with an average daily usage of 0.8 hours and a peak daily usage of 2.9 hours on the days it was used. The vehicle was used during day-shift hour.

Figure C-111 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, all daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 56

Make/Model/Year	Chevrolet G2300 – 2012
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 2737, Lexington St
Fleet Vehicle ID	G43-2287M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	11/16/13 9/8/11
EPA GHG Emissions (Grams CO_2/Mi)	684/689
Study Logger ID	98
Total Vehicle Days/Total Study Days	34/47

Vehicle G43-2287M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.9/55.3	4.2/44.1	1.6/23.1	301
Travel Time (Minutes)	48.1/179.0	22.7/108.0	8.7/59.0	1,636
Idle Time (Minutes)	10.3/NA	4.9/NA	1.9/NA	351

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	148	98.7%	Less than 2	95
10 to 20	2	1.3%	2 to 4	12
20 to 40	0	0	4 to 8	7
40 to 60	0	0	Greater than 8	36

Figure C-112. Vehicle G43-2287M stops.

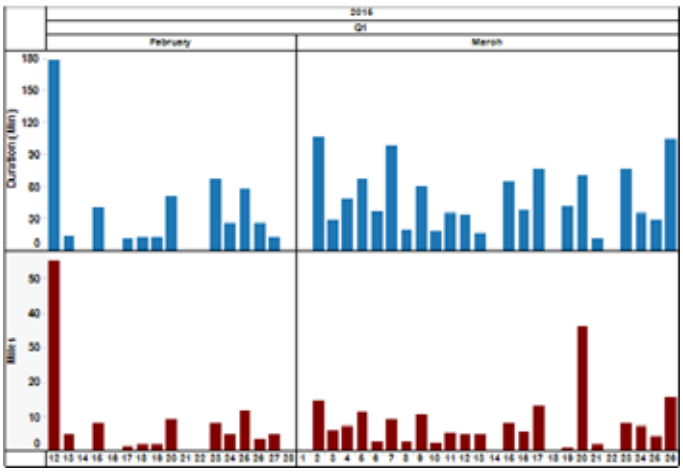

Figure C-113. Vehicle G43-2287M history.

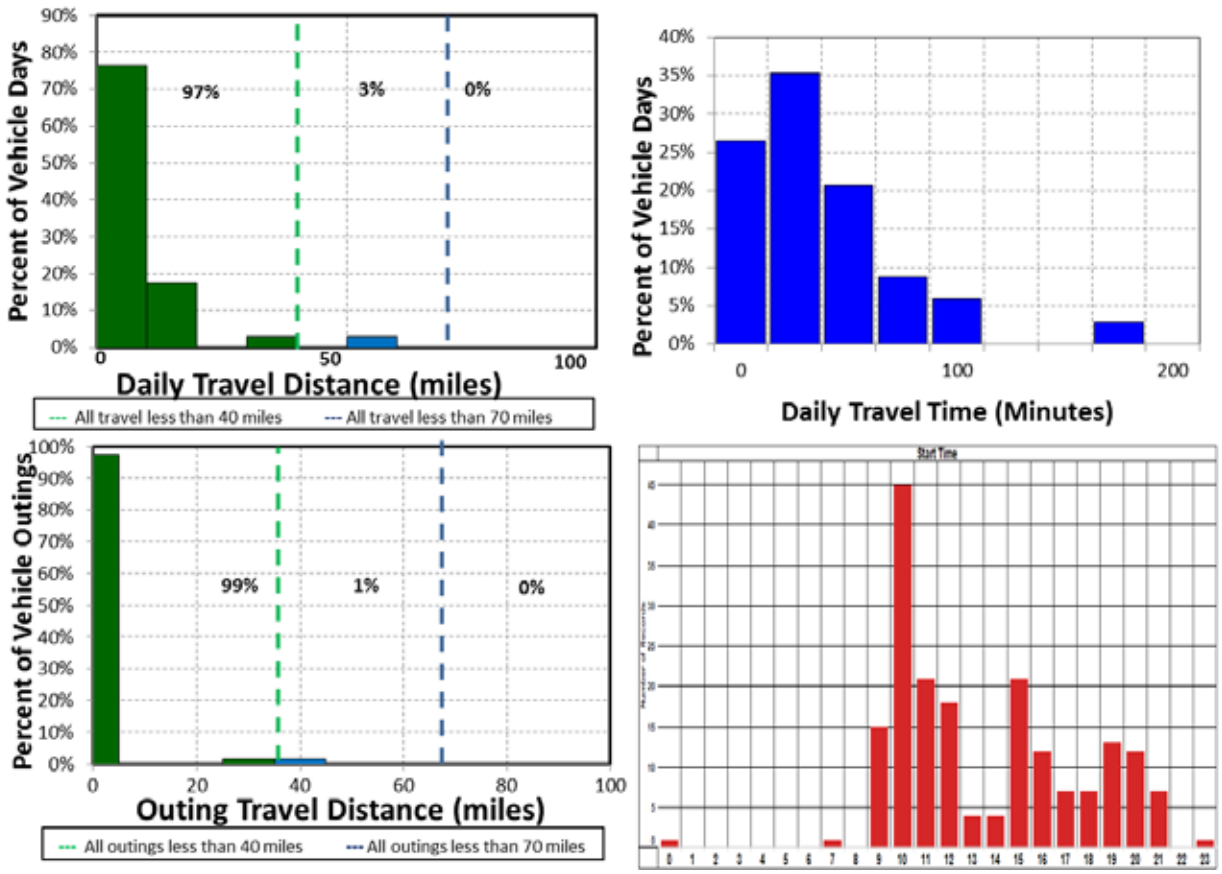

Figure C-114. Vehicle G43-2287M travel and time-of-day graphs.

Vehicle G43-2287M Observations

Logger 98 collected data on this vehicle for a period of 34 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Gnd Elec. This vehicle's data indicate it parks near Building 2737 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 4,896 miles at the start of this study and its average annual mileage is 1,441 miles. The vehicle was used on 72% of the available days, with an average daily usage of 0.8 hours and a peak daily usage of 3.0 hours on the days it was used. The vehicle was used during day-shift hours.

Figure C-114 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, 97% of daily travel and 99% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 57

Make/Model/Year	Chevrolet G2300 Exp – 2012
EPA Class Size	Van – Passenger
Mission	Support
Contact	NAVFAC NW
Parking Location	Building 385, Lexington St
Fleet Vehicle ID	G43-2288M
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	11/16/13 9/8/11
EPA GHG Emissions (Grams CO_2/Mi)	684/689
Study Logger ID	99
Total Vehicle Days/Total Study Days	38/47

Vehicle G43-2288M Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	9.7/46.0	4.8/36.7	1.9/18.6	370
Travel Time (Minutes)	57.8/139.0	28.5/137.0	11.0/76.0	2,197
Idle Time (Minutes)	13.4/NA	6.6/NA	2.6/NA	508

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	130	97.7%	Less than 2	79
10 to 20	3	2.3%	2 to 4	5
20 to 40	0	0	4 to 8	10
40 to 60	0	0	Greater than 8	39

Figure C-115. Vehicle G43-2288M stops.

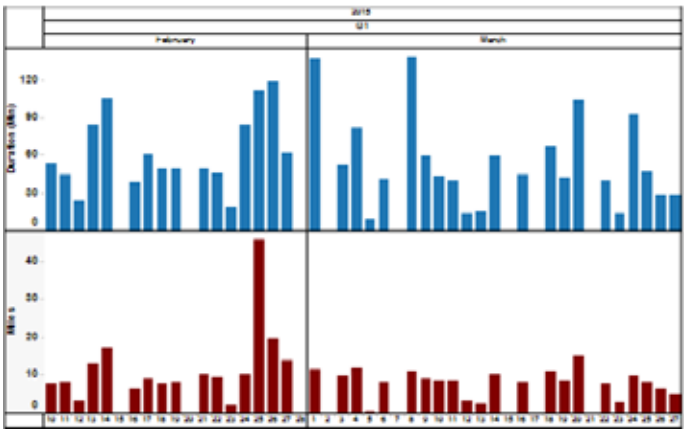

Figure C-116. Vehicle G43-2288M history.

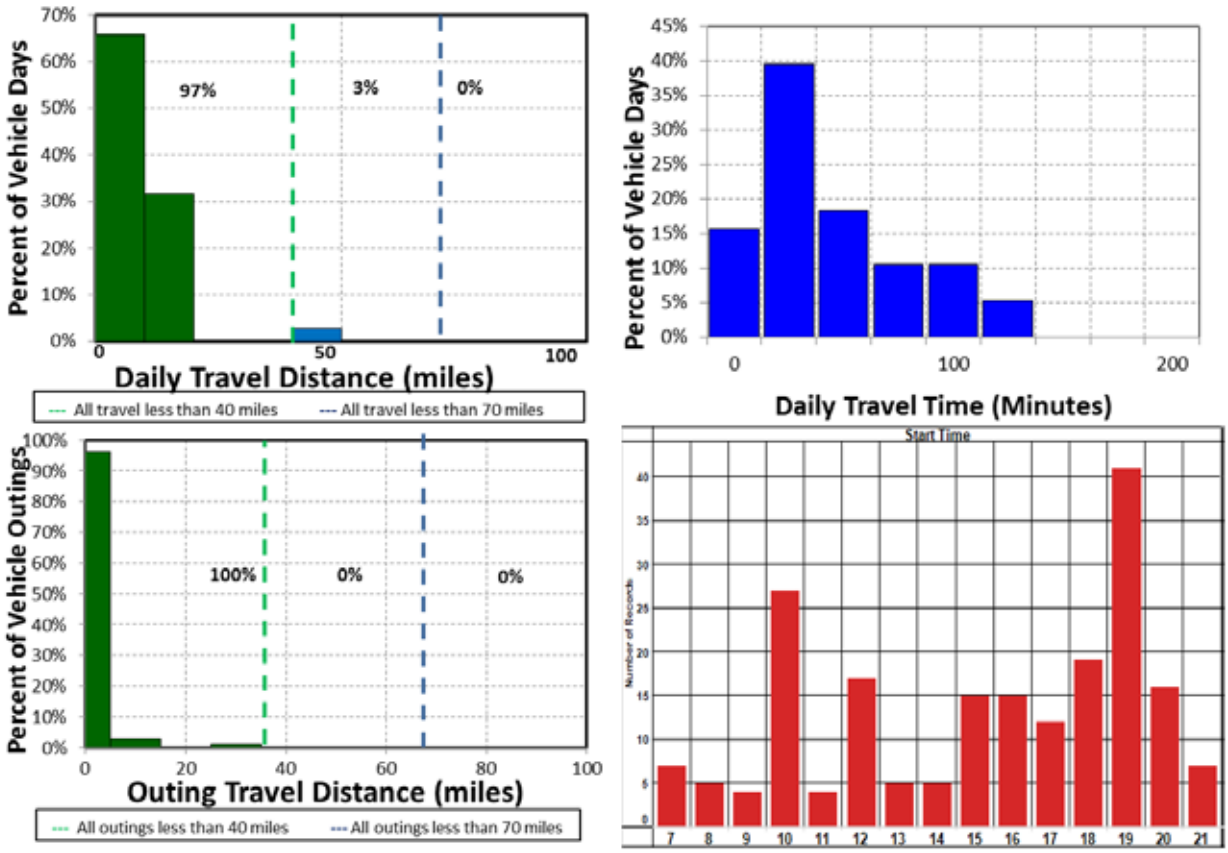

Figure C-117. Vehicle G43-2288M travel and time-of-day graphs.

Vehicle G43-2288M Observations

Logger 99 collected data on this vehicle for a period of 38 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has a support mission for Gnd Elec. This vehicle's data indicate it parks near Building 385 near Lexington Street (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 3,797 miles at the start of this study and its average annual mileage is 977 miles. The vehicle was used on 81% of the available days, with an average daily usage of 1.0 hours and a peak daily usage of 2.3 hours on the days it was used. The vehicle was used primarily during day-shift hours.

Figure C-117 shows that all daily travel was within the typically advertised range of a BEV of approximately 70 miles. All outings were also within this range. Further, 97% of daily travel and all outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could meet all daily travel without additional charging opportunities, assuming the vehicle was charged at its home base.

Sheet 58

Make/Model/Year	Ford F150 – 2009
EPA Class Size	Pickup
Mission	Support
Contact	NAVFAC NW
Parking Location	No data
Fleet Vehicle ID	G62-0203H
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/20/16 10/14/12
EPA GHG Emissions (Grams CO_2/Mi)	555/517
Study Logger ID	104
Total Vehicle Days/Total Study Days	Insufficient data

Vehicle G62-0203H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Travel Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data
Idle Time (Minutes)	Insufficient data	Insufficient data	Insufficient data	Insufficient data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	Insufficient data	Insufficient data	Less than 2	Insufficient data
10 to 20	Insufficient data	Insufficient data	2 to 4	Insufficient data
20 to 40	Insufficient data	Insufficient data	4 to 8	Insufficient data
40 to 60	Insufficient data	Insufficient data	Greater than 8	Insufficient data

Insufficient data

Figure C-118. Vehicle G62-0203H stops.

Insufficient data

Figure C-119. Vehicle G62-0203H history.

Insufficient data

Figure C-120. Vehicle G62-0203H travel and time-of-day graphs.

Vehicle G62-0203H Observations

Logger 104 collected insufficient information to analyze. Although it was identified early in the study, it was not resolved.

NASWI reports that the vehicle odometer indicated 69,473 miles at the start of this study and its average annual mileage is 11,252 miles.

Sheet 59

Make/Model/Year	Ford Expedition – 2010
EPA Class Size	SUV
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 994, Charles Porter Ave
Fleet Vehicle ID	G62-0871K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	14/20/16 9/13/11
EPA GHG Emissions (Grams CO_2/Mi)	555/564
Study Logger ID	108
Total Vehicle Days/Total Study Days	43/47

Vehicle G62-0871K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	92.0/278.6	14.5/114.9	6.2/71.5	3,955
Travel Time (Minutes)	428.2/1,000.0	67.5/777.0	28.8/269.0	18,414
Idle Time (Minutes)	155.3/NA	24.5/NA	10.4/NA	6,680

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	590	99.8%	Less than 2	509
10 to 20	1	0.2%	2 to 4	39
20 to 40	0	0	4 to 8	25
40 to 60	0	0	Greater than 8	18

Figure C-121. Vehicle G62-0871K stops.

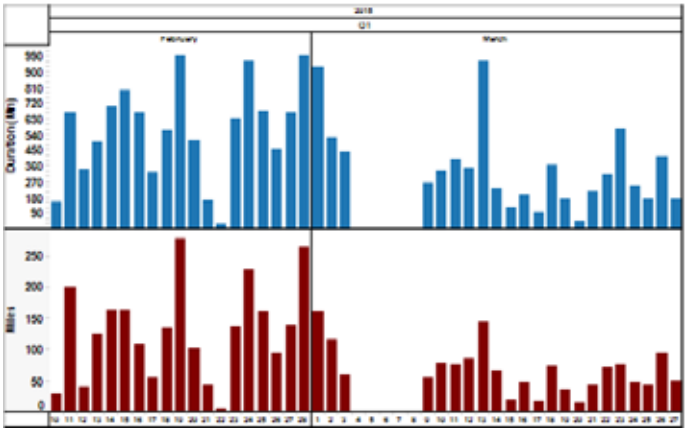

Figure C-122. Vehicle G62-0871K history.

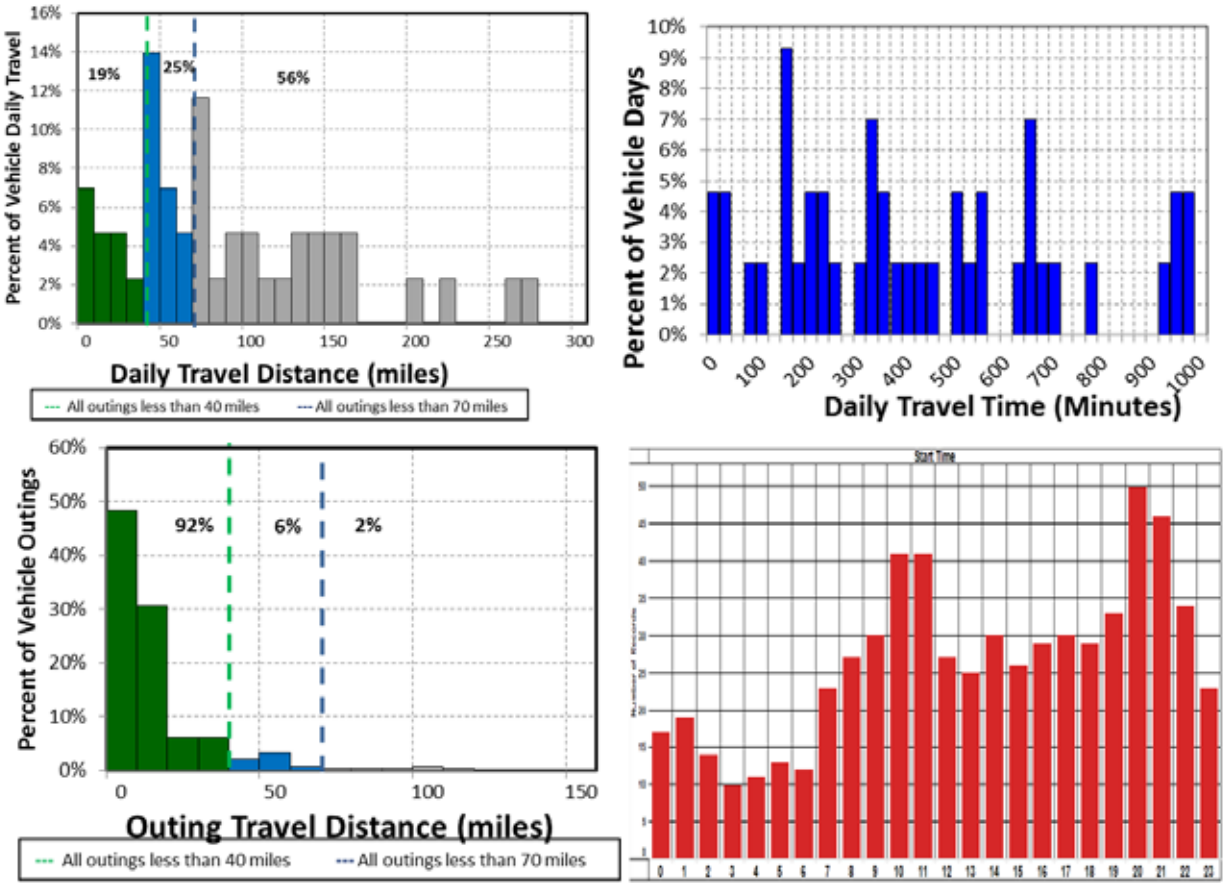

Figure C-123. Vehicle G62-0871K travel and time-of-day graphs.

Vehicle G62-0871K Observations

Logger 108 collected data on this vehicle for a period of 43 days of the 47-day study period. Validation occurred on 99.8% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 994 on Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 101,291 miles at the start of this study and its average annual mileage is 18,874 miles. The vehicle was used on 91% of the available days, with an average daily usage of 7.1 hours and a peak daily usage of 16.7 hours on the days it was used. The vehicle was used during all hours of the day.

Figure C-123 shows that 44% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 98% of the outings were also within this range. Further, 19% of daily travel and 92% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel. However, PHEVs provide benefit for the first 40 miles of all trips. Thus, a fleet of enforcement vehicles would likely contain a mix of BEVs and PHEVs.

Sheet 60

Make/Model/Year	Ford F150 SSV – 2014
EPA Class Size	Pickup
Mission	Enforcement
Contact	NAVFAC NW
Parking Location	Building 994, Charles Porter Ave
Fleet Vehicle ID	G62-2420P
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)	17/23/19 12/17/14
EPA GHG Emissions (Grams CO_2/Mi)	464/442
Study Logger ID	110
Total Vehicle Days/Total Study Days	47/47

Vehicle G62-2420P Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	131.9/294.5	25.4/232.5	5.2/86.7	6,201
Travel Time (Minutes)	744.0/1,232.0	143.3/1,072.0	29.4/515.0	34,968
Idle Time (Minutes)	302.9/NA	58.3/NA	12.0/NA	14,235

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	1,064	99.9%	Less than 2	1,019
10 to 20	1	0.1%	2 to 4	27
20 to 40	0	0	4 to 8	11
40 to 60	0	0	Greater than 8	8

Figure C-124. Vehicle G62-2420P stops.

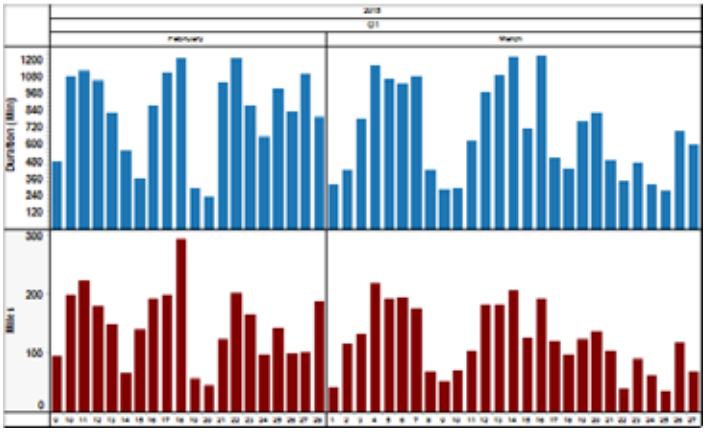

Figure C-125. Vehicle G62-2420P history.

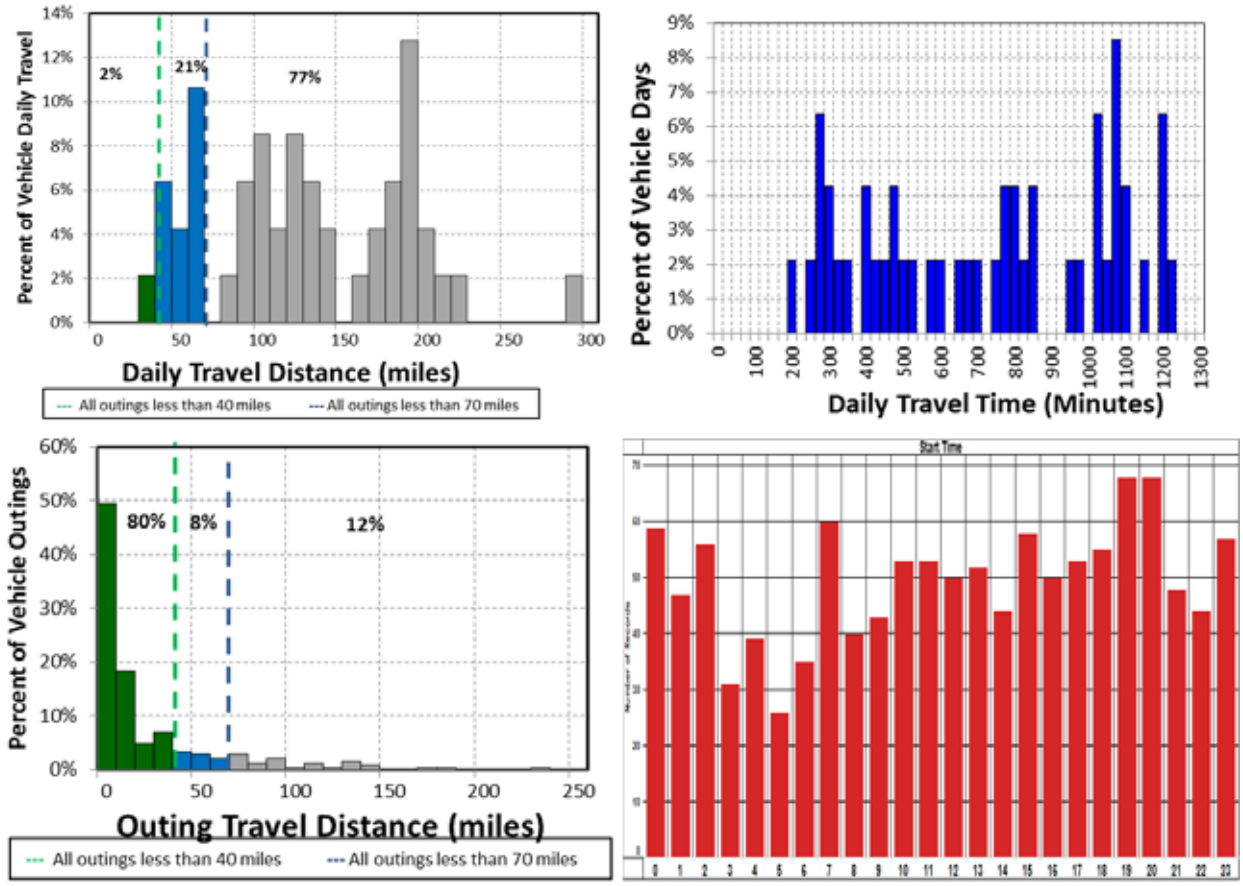

Figure C-126. Vehicle G62-2420P travel and time-of-day graphs.

Vehicle G62-2420P Observations

Logger 110 collected data on this vehicle for all 47 days of the 47-day study period. Validation occurred on 100% of the input data. Data indicate that this vehicle has an enforcement mission. This vehicle's data indicate it parks near Building 994 on Charles Porter Avenue (see Google Earth figure to the right).

NASWI reports that the vehicle odometer indicated 15,980 miles at the start of this study and its average annual mileage is 4,752 miles. The vehicle was used on 100% of the available days, with an average daily usage of 12.4 hours and a peak daily usage of 20.5 hours on the days it was used. The vehicle was used during all hours of the day.

Figure C-126 shows that 23% of daily travel was within the typically advertised range of a BEV of approximately 70 miles and 88% of the outings were also within this range. Further, 2% of daily travel and 80% of outings were within the typically advertised CD mode of 40 miles for PHEVs.

A BEV could not meet all daily travel requirements due to long trips and infrequent charge opportunities. However, PHEVs provide benefits for the first 40 miles of a trip. In addition, enforcement fleet managers typically do not prefer enforcement vehicles that contain range limitations. Thus, a fleet of enforcement vehicles would likely contain a mix of BEVs and PHEVs.

Appendix D

Greenhouse Gas Emissions Avoided and Fuel Cost Reduction Analysis – Commands Fleet

D.1 Replacement Plug-In Electric Vehicles for the Commands Fleet

Section 4.1 provided analysis results for the Commands fleet vehicles monitored during the study period based on data recorded and reported in the vehicle data sheets found in Appendix B. For the study, PEV replacements were based on vehicle class. The observations of Section 4.1.1.1 suggest that replacing these 18 vehicles with 11 BEVs and seven PHEVs would meet current mission requirements. Specific vehicle cargo requirements have not been specified; therefore, they were not considered in these replacement suggestions.

Table D-1. NASWI Commands fleet PEV replacements.

Vehicle Replacements						
	Current Vehicle			PEV Replacement		
Vehicle ID	Make	Model	EPA Class	PEV Make	PEV Model	Mission
G10-1138M	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Support
G10-1140M	Chevrolet	Malibu	Sedan - Midsize	Nissan	Leaf	Support
G10-3576L	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Support
G10-7547F	Dodge	Avenger	Sedan - Midsize	Nissan	Leaf	Support
G41-1136K	Dodge	Grd Caravan SE	Minivan	Nissan	Leaf	Support
G41-1139K	Dodge	Grd Caravan SE	Minivan	Honda	Fit	Support
G41-1140K	Dodge	Grd Caravan SE	Minivan	Honda	Fit	Support
G41-1155K	Dodge	Grd Caravan SE	Minivan	Mitsubishi	Outlander	Support
G41-1351G	Dodge	Dakota	Pickup	Toyota	Rav4	Support
G41-2911M	Chevrolet	Colorado	Pickup	Via	VTRUX PU	Support
G41-3153P	Dodge	Grd Caravan SE	Minivan	Honda	Fit	Support
G41-3159P	Dodge	Grd Caravan SE	Minivan	Honda	Fit	Support
G42-0587K	Chevrolet	Silverado	Pickup	Via	VTRUX PU	Support
G42-0590K	Chevrolet	Silverado	Pickup	Nissan	eNV200	Support
G42-1232M	Ford	F150	Pickup	Toyota	Rav4	Support
G42-1281M	Ford	E-350	Van - Pass	Via	VTRUX Van	Support
G43-3437B	Ford	E-350	Van - Cargo	Nissan	eNV200	Support
G61-0513K	Ford	Explorer	SUV	Mitsubishi	Outlander	Support

The vehicle data sheets for vehicles G41-3159P and G42-0587K report that insufficient data were collected for detailed analysis. Replacement vehicles were selected based on their reported annual mileage and the ratio of the balance of vehicles. In addition, the average of all daily distance traveled less than 40 miles was used for analysis.

Section 5 provides the methodology and assumptions for calculating the reduction in GHG and fuel costs. NASWI provided the recorded annual miles for each vehicle. If the PEV replacing the monitored vehicle is a BEV, all annual miles occur in CD mode. If the PEV is a PHEV, the percentage of miles that are less than 40 miles per day recorded by the monitored vehicles (Appendix B) is multiplied by the annual miles to identify miles in CD mode. Only these miles are used in the reduction calculations. This is conservative because the replacement PHEV is likely more fuel efficient than the monitored vehicle when powered by ICE.

D.2 Monitored Vehicle Fuel Cost Reduction

Tables D-2 and D-3 identify the calculated miles in CD mode for each replacement vehicle and the projected fuel cost reductions in Washington State and nationally. As noted in Section 5, both the local cost of fuel and the national average were used for comparisons.

Because Washington State fuel costs are higher than the national average, local gasoline costs are greater than the national figures. Also, because Puget Sound Energy relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

The following is an example calculation for Vehicle G10-1138M. The NASWI reported annual miles for this vehicle as 4,164 miles. The suggested replacement PEV is a PHEV. The Appendix B daily travel percentage for this vehicle less than 40 miles was 74%; therefore, annual miles in CD mode were 3,081 miles. EPA fuel economy for the vehicle replaced is 26 mpg, implying 118.5 gallons of gasoline are unused. The Washington State cost for gasoline is $2.83/gallon for an annual cost of $335. The replacement PEV requires 370 Wh/mi; therefore, 1,140 kWh are required for recharging the battery. Local power cost is $0.057138/kWh, resulting in annual electric cost of $65. The savings are $270 for an 81% reduction in fuel cost.

Table D-2. Monitored vehicle replacement fuel cost reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Wash.	Elect Cost Wash.	Fuel Savings Wash.	Fuel Reduction Wash. %
G10-1138M	Fusion	74%	3,081	119	$335	$65	$270	81%
G10-1140M	Leaf	100%	5,724	220	$623	$98	$525	84%
G10-3576L	Fusion	44%	3,342	115	$326	$71	$255	78%
G10-7547F	Leaf	100%	23,110	1,050	$2,973	$396	$2,577	87%
G41-1136K	Leaf	100%	5,232	275	$779	$90	$690	88%
G41-1139K	Fit	100%	7,392	389	$1,101	$122	$979	89%
G41-1140K	Fit	100%	3,000	158	$447	$50	$397	89%
G41-1155K	Outlander	85%	3,356	177	$500	$84	$415	83%
G41-1351G	Rav4	100%	2,580	172	$487	$65	$422	87%
G41-2911M	VTRUX PU	60%	3,722	177	$502	$101	$401	80%
G41-3153P	Fit	100%	22,522	1,126	$3,187	$373	$2,814	88%
G41-3159P	Fit	100%	4,044	202	$572	$67	$505	88%
G42-0587K	VTRUX PU	87%	10,054	559	$1,581	$273	$1,308	83%
G42-0590K	eNV200	100%	10,776	599	$1,694	$246	$1,448	85%
G42-1232M	Rav4	100%	1,272	67	$189	$32	$157	83%
G42-1281M	VTRUX Van	81%	6,629	510	$1,443	$180	$1,263	88%
G43-3437B	eNV200	100%	1,716	114	$324	$39	$285	88%
G61-0513K	Outlander	70%	6,829	402	$1,137	$172	$965	85%
Total			124,382	6,431	$18,200	$2,524	$15,676	86%

In summary, over $15,000 in fuel costs in Washington State can be saved by using PEVs as replacement vehicles. This represents an 86% reduction in costs.

Table D-3. Monitored vehicle replacement fuel cost reduction (national comparisons).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost National	Elect Cost National	Fuel Savings National	Fuel Red. National %
G10-1138M	Fusion	74%	3,081	119	$292	$148	$143	49%
G10-1140M	Leaf	100%	5,724	220	$542	$223	$318	59%
G10-3576L	Fusion	44%	3,342	115	$284	$161	$123	43%
G10-7547F	Leaf	100%	23,110	1,050	$2,584	$901	$1,683	65%
G41-1136K	Leaf	100%	5,232	275	$677	$204	$473	70%
G41-1139K	Fit	100%	7,392	389	$957	$279	$678	71%
G41-1140K	Fit	100%	3,000	158	$388	$113	$275	71%
G41-1155K	Outlander	85%	3,356	177	$434	$192	$243	56%
G41-1351G	Rav4	100%	2,580	172	$423	$148	$276	65%
G41-2911M	VTRUX PU	60%	3,722	177	$436	$230	$206	47%
G41-3153P	Fit	100%	22,522	1,126	$2,770	$849	$1,921	69%
G41-3159P	Fit	100%	4,044	202	$497	$152	$345	69%
G42-0587K	VTRUX PU	87%	10,054	559	$1,374	$621	$753	55%
G42-0590K	eNV200	100%	10,776	599	$1,473	$560	$912	62%
G42-1232M	Rav4	100%	1,272	67	$165	$73	$92	56%
G42-1281M	VTRUX Van	81%	6,629	510	$1,254	$409	$845	67%
G43-3437B	eNV200	100%	1,716	114	$281	$89	$192	68%
G61-0513K	Outlander	70%	6,829	402	$988	$391	$598	60%
Total			124,382	6,431	$15,820	$5,743	$10,077	64%

For national comparisons, replacement of these vehicles with PEVs could save over $10,000 per year in fuel costs.

D.3 Monitored Vehicle Greenhouse Gas Reduction

Tables D-4 and D-5 identify the reduction in GHGs projected in Washington State when replacing the current vehicles with PEVs. The calculated miles in CD mode were also used in the calculation of GHG reduction. As noted in Section 5, the emissions from burning gasoline are known and the emissions from the use of electricity are dependent on the power generation mix that is used to recharge the PEV battery. As before, both the local power production emissions figures and the national average are used for comparisons.

Because Puget Sound Energy relies more on cleaner hydroelectric power than the average of all national power providers, electrical emissions in Washington State are lower. Electrical emissions are significantly lower than gasoline emissions.

The following is an example calculation for vehicle G10-1138M. The annual miles in CD mode are 3,081 miles and 118.5 gallons of gasoline are unused. ICE vehicles produce 20.1 lb-CO_2e/gallon; therefore, the annual emissions for the monitored vehicle are 2,382 lb-CO_2e. Puget Sound Energy produces 0.8700 lb-CO_2e/kWh. As above, 1,140 kWh are required for recharging the battery, resulting in 992 lb-CO_2e. The savings are 1,390 lb-CO_2e for a 58% reduction in GHG emissions.

Table D-4. GHG reduction of monitored vehicle replacement (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Wash.	PEV GHG Sav Wash.	GHG Savings Wash. %
G10-1138M	Fusion	74%	3,081	119	2,382	992	1,390	58%
G10-1140M	Leaf	100%	5,724	220	4,425	1,494	2,931	66%

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Wash.	PEV GHG Sav Wash.	GHG Savings Wash. %
G10-3576L	Fusion	44%	3,342	115	2,317	1,076	1,241	54%
G10-7547F	Leaf	100%	23,110	1,050	21,114	6,032	15,082	71%
G41-1136K	Leaf	100%	5,232	275	5,535	1,366	4,169	75%
G41-1139K	Fit	100%	7,392	389	7,820	1,865	5,955	76%
G41-1140K	Fit	100%	3,000	158	3,174	757	2,417	76%
G41-1155K	Outlander	85%	3,356	177	3,550	1,285	2,265	64%
G41-1351G	Rav4	100%	2,580	172	3,457	988	2,470	71%
G41-2911M	VTRUX PU	60%	3,722	177	3,563	1,538	2,025	57%
G41-3153P	Fit	100%	22,522	1,126	22,635	5,682	16,952	75%
G41-3159P	Fit	100%	4,044	202	4,064	1,020	3,044	75%
G42-0587K	VTRUX PU	87%	10,054	559	11,227	4,155	7,072	63%
G42-0590K	eNV200	100%	10,776	599	12,033	3,750	8,283	69%
G42-1232M	Rav4	100%	1,272	67	1,346	487	859	64%
G42-1281M	VTRUX Van	81%	6,629	510	10,250	2,739	7,510	73%
G43-3437B	eNV200	100%	1,716	114	2,299	597	1,702	74%
G61-0513K	Outlander	70%	6,829	402	8,075	2,614	5,460	68%
Total			124,382	6,431	129,264	38,436	90,828	70%

In summary, with the monitored vehicles replaced with PEVs, over 90,000lb-CO_2e are avoided each year using Washington State statistics.

Table D-5. GHG reduction of monitored vehicle replacement (national comparison).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Nat.	PEV GHG Sav Nat.	GHG Savings Nat. %
G10-1138M	Fusion	74%	3,081	119	2,382	1,744	638	27%
G10-1140M	Leaf	100%	5,724	220	4,425	2,627	1,798	41%
G10-3576L	Fusion	44%	3,342	115	2,317	1,892	424	18%
G10-7547F	Leaf	100%	23,110	1,050	21,114	10,607	10,507	50%
G41-1136K	Leaf	100%	5,232	275	5,535	2,401	3,133	57%
G41-1139K	Fit	100%	7,392	389	7,820	3,280	4,540	58%
G41-1140K	Fit	100%	3,000	158	3,174	1,331	1,843	58%
G41-1155K	Outlander	85%	3,356	177	3,550	2,259	1,291	36%
G41-1351G	Rav4	100%	2,580	172	3,457	1,737	1,720	50%
G41-2911M	VTRUX PU	60%	3,722	177	3,563	2,705	858	24%
G41-3153P	Fit	100%	22,522	1,126	22,635	9,993	12,642	56%
G41-3159P	Fit	100%	4,044	202	4,064	1,794	2,270	56%
G42-0587K	VTRUX PU	87%	10,054	559	11,227	7,307	3,920	35%
G42-0590K	eNV200	100%	10,776	599	12,033	6,595	5,438	45%
G42-1232M	Rav4	100%	1,272	67	1,346	856	489	36%
G42-1281M	VTRUX Van	81%	6,629	510	10,250	4,818	5,432	53%
G43-3437B	eNV200	100%	1,716	114	2,299	1,050	1,249	54%
G61-0513K	Outlander	70%	6,829	402	8,075	4,597	3,477	43%
Total			124,382	6,431	129,264	67,595	61,669	48%

D.4 Commands Group Support Fleet Evaluation

Section 4.1.1.1 provided the Intertek suggestion that a fleet of 34 BEVs and 22 PHEVs conservatively meet the full Commands group support fleet vehicle travel requirements.

The replacement vehicles follow the suggestions of Table 17 in Section 5.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Tables D-6 and D-7 (these reductions are summarized in Section 5).

Table D-6. Commands group full support fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
325,976	18,473	$ 52,279	$ 7,440	$ 44,839	86%	371,310	113,279	258,030	69%

Table D-7. Commands group full support fleet PEV replacement reductions (national statistics).

Annual Miles CD	Gas Gallons Saved	Gas Cost National	Elect Fuel Cost Nat	Fuel Savings Nat	Fuel Reds Nat%	GHG Emission ICE	PEV GHG Nat	PEV GHG Sav Nat	GHG Saving % Nat
325,976	18,473	$ 45,444	$ 16,927	$ 28,517	63%	371,310	199,215	172,094	46%

D.5 Commands Group Transport Fleet Evaluation

Section 4.1 identifies 13 cargo vans in the Commands fleet with a transport mission. One cargo van with a support mission was monitored in this study and all of its daily travel and outings were less than 40 miles, suggesting that all vans could be replaced with BEVs. However, a more conservative approach would be to use eight BEVs and five PHEVS. The Commands fleet averages were applied to these vehicles. The projected reductions for transport vehicles are shown in Tables D-8 and D-9.

Table D-8. Commands group full transport fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
83,631	5,118	$ 14,483	$ 2,056	$ 12,428	86%	102,869	31,300	71,568	70%

Table D-9. Commands group full transport fleet PEV replacement reductions (national statistics).

Annual Miles CD	Gas Gallons Saved	Gas Cost National	Elect Fuel Cost Nat	Fuel Savings Nat	Fuel Reds Nat%	GHG Emission ICE	PEV GHG Nat	PEV GHG Sav Nat	GHG Saving % Nat
83,631	5,118	$ 12,590	$ 4,677	$ 7,913	63%	102,869	55,045	47,823	46%

D.5 Commands Group Full Fleet Evaluation

Section 4.1.1.1 provided the Intertek suggestion that a fleet of 42 BEVs and 27 PHEVs conservatively meet the full Commands group fleet vehicle travel requirements.

The replacement vehicles follow the suggestions of Table 17 in Section 5.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Tables D-10 and D-11 (these reductions are summarized in Section 5).

Table D-10. Commands group full fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
409,608	23,591	$ 66,762	$ 9,495	$ 57,267	86%	474,178	144,579	329,599	70%

Table D-11. Commands group full fleet PEV replacement reductions (national statistics).

Annual Miles CD	Gas Gallons Saved	Gas Cost National	Elect Fuel Cost Nat	Fuel Savings Nat	Fuel Reds Nat%	GHG Emission ICE	PEV GHG Nat	PEV GHG Sav Nat	GHG Saving % Nat
409,608	23,591	$ 58,034	$ 21,604	$ 36,430	63%	474,178	254,260	219,918	46%

D.6 Commands Fleet Summary

Table D-12 provides average values for all monitored vehicles belonging to the Commands group.

Table D-12. Commands group monitored vehicles average values.

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%
6,910	357	$ 1,011	$ 140	$ 871	86%

GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
7,181	2,135	5,046	70%

Table D-12 shows that there is a significant opportunity for savings not only in fuel costs but in GHG emissions with the deployment of PEVs in this fleet.

Appendix E

Greenhouse Gas Emissions Avoided and Fuel Cost Reduction Analysis – Departments Fleet

E.1 Replacement Plug-In Electric Vehicle for Departments Fleet

Section 4.2 provided analysis results for the Departments fleet vehicles monitored during the study period based on the data recorded and reported in the vehicle data sheets found in Appendix C. Pool, support, and enforcement missions were identified for these vehicles. For the study, PEV replacements were based on vehicle class. The observations of Section 4.2 suggest that replacing these 42 monitored vehicles with 21 BEVs and 21 PHEVs would meet current mission requirements. Specific vehicle cargo requirements have not been specified; therefore, they were not considered in these replacement suggestions.

Table E-1. NASWI Departments group PEV replacements.

Vehicle Replacements						
Current Vehicles				PEV Replacements		
Vehicle Id	Make	Model	EPA Class	PEV Make	PEV Model	Mission
G10-0984N	Dodge	Avenger	Sedan - Compact	Ford	Focus	Support
G10-1137M	Chevrolet	Malibu	Sedan - Midsize	Nissan	Leaf	Support
G10-1139M	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Support
G10-1141M	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Support
G10-2844L	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Pool
G10-3590P	Chevrolet	Malibu	Sedan - Midsize	Nissan	Leaf	Support
G10-2848L	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Pool
G10-2850L	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Pool
G10-2968L	Chevrolet	Malibu	Sedan - Midsize	Ford	Fusion	Pool
G10-5286H	Pontiac	G6	Sedan - Compact	Chevrolet	Volt	Support
G42-1940N	Chevrolet	G1300	Van - Pass	Via	VTRUX Van	Pool
G61-0245G	Ford	Escape	SUV	Mitsubishi	Outlander	Pool
G11-0472L	Chevrolet	Impala	Sedan - Large	Ford	Fusion	Enforce
G11-1424L	Chevrolet	Impala	Sedan - Large	Ford	Fusion	Enforce
G11-2898K	Chevrolet	Impala	Sedan - Large	Ford	Fusion	Enforce
G41-1137K	Dodge	Grd Caravan SE	Minivan	Honda	Fit	Support
G41-1142K	Dodge	Grd Caravan SE	Minivan	Mitsubishi	Outlander	Pool
G41-1349G	Dodge	Dakota	Pickup	Toyota	Rav4	Support
G41-1350G	Dodge	Dakota	Pickup	Nissan	eNV200	Support
G41-1536L	Dodge	Grd Caravan Exp	Minivan	Honda	Fit	Support
G41-1597L	Dodge	Dakota	Pickup	Nissan	eNV200	Support
G41-1763H	Ford	Ranger	Pickup	Toyota	Rav4	Support
G41-1765H	Ford	Ranger	Pickup	Via	VTRUX PU	Support
G41-1767H	Ford	Ranger	Pickup	Nissan	eNV200	Support
G41-1768H	Ford	Ranger	Pickup	Nissan	eNV200	Support
G41-4334M	Chevrolet	Colorado	Pickup	Via	VTRUX PU	Support
G42-0334G	Chevrolet	G1300	Van - Pass	Via	VTRUX Van	Pool
G42-0335G	Chevrolet	G1300	Van - Pass	Via	VTRUX Van	Support
G42-0656K	Chevrolet	Silverado	Pickup	Nissan	eNV200	Support

Vehicle Replacements						
Current Vehicles				PEV Replacements		
Vehicle Id	Make	Model	EPA Class	PEV Make	PEV Model	Mission
G42-0766L	Chevrolet	C1500	Pickup	Via	VTRUX PU	Support
G42-0881H	Ford	F150	Pickup	Nissan	eNV200	Pool
G42-1222M	Chevrolet	G1300 Express	Van - Pass	Via	VTRUX Van	Support
G42-1223M	Chevrolet	G1300 Express	Van - Pass	Nissan	eNV200	Support
G42-2035L	Chevrolet	Tahoe	SUV	Honda	Fit	Enforce
G43-0895K	Ford	E-350	Van - Pass	Nissan	eNV200	Support
G43-0896K	Ford	E-350	Van - Pass	Nissan	eNV200	Support
G43-0936K	Chevrolet	C2500HD	Van - Cargo	Nissan	eNV200	Enforce
G43-2287M	Chevrolet	G2300	Van - Pass	Nissan	eNV200	Support
G43-2288M	Chevrolet	G2300 Express	Van - Pass	Nissan	eNV200	Support
G62-0203H	Ford	F150	Pickup	Toyota	Rav4	Support
G62-0871K	Ford	Expedition	SUV	Mitsubishi	Outlander	Enforce
G62-2420P	Ford	FI50 SSV	Pickup	Via	VTRUX Van	Enforce

The vehicle data sheets for vehicles G41-1765H, G41-1768H, and G62-0203H report that insufficient data were collected for detailed analysis. The replacement vehicles were selected based on the vehicles' reported annual mileage and the ratio of the balance of vehicles. In addition, the average of all daily distance traveled less than 40 miles was used for analysis.

Section 5 provides the methodology and assumptions for reduction in GHG and fuel costs calculations. The miles recorded by vehicles during the 47-day study were extrapolated into annual miles. If the PEV replacing the monitored vehicle is a BEV, all annual miles can potentially occur in CD mode. If the PEV is a PHEV, the percentage of miles that were less than 40 miles per day recorded by the monitored vehicles (Appendix C) was multiplied by the annual miles to identify miles in CD mode. Only these miles were used in the reduction calculations. This is conservative because the replacement PHEV is likely more fuel efficient than the monitored vehicle when powered by the ICE.

Vehicle G62-2420P showed just 2% of days were less than 40 miles. While the methodology identified in the above paragraph is conservative, it is overly so for cases like this because all PHEV trips include at least the first 40 miles in CD mode. This vehicle was used daily; therefore, the percent of miles in CD mode was determined by the ratio of 40 miles to the average total miles per day = 30%.

The fuel cost savings and GHG emissions reductions are presented by mission category.

E.2 Monitored Pool Mission Vehicle Reductions

E.2.1 Monitored Pool Mission Vehicle Fuel Cost Reduction

Tables E-2 and E-3 identify the calculated miles in CD mode for each replacement vehicle and the projected fuel cost reductions for the pool vehicles using Washington State and national data. As noted in Section 5, both the local cost of fuel and the national average were used for comparisons.

Because Washington State fuel costs are higher than the national average, local gasoline costs are greater than national figures. Also, because Puget Sound Energy relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

The following is an example calculation for Vehicle G10-2848L. The NASWI reported annual miles for this vehicle are 1,416 miles. The suggested replacement PEV is a PHEV. The Appendix C daily travel percentage for this vehicle less than 40 miles was 53%; therefore, annual miles in CD mode is 750 miles. EPA fuel economy for the vehicle replaced is 26 mpg, implying 28.8 gallons of gasoline are unused. Washington State cost for gasoline is $2.83/gallon for an annual cost of $82. The replacement PEV

requires 370 Wh/mi, with 277.7 kWh required for recharging the battery. Local power cost is $0.057138/kWh, resulting in annual electric cost of $16. The savings are $66 for an 81% reduction in fuel cost.

Table E-2. Monitored pool vehicle replacement fuel cost reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Wash.	Elect Cost Wash.	Fuel Savings Wash.	Fuel Red. Wash. %
G10-2844L	Fusion	17%	116	4	$13	$2	$10	81%
G10-2848L	Fusion	53%	750	29	$82	$16	$66	81%
G10-2850L	Fusion	38%	2,818	108	$307	$60	$247	81%
G10-2968L	Fusion	36%	2,769	107	$301	$59	$243	81%
G42-1940N	VTRUX Van	20%	2,405	172	$486	$65	$421	87%
G61-0245G	Outlander	79%	11,073	527	$1,492	$278	$1,214	81%
G41-1142K	Outlander	76%	2,523	133	$376	$63	$312	83%
G42-0334G	VTRUX Van	56%	1,028	73	$208	$28	$180	87%
G42-0881H	eNV200	100%	9,720	608	$1,719	$222	$1,497	87%
Total			33,203	1,761	$4,984	$794	$4,190	84%

In summary, over $4,000 in fuel costs in Washington State can be saved for these pool vehicles by using PEVs as replacement vehicles. This represents an 84% reduction in fuel costs.

Table E-3 identifies the projected fuel cost reductions for the pool vehicles using national statistics.

Table E-3. Monitored vehicle replacement fuel cost reduction (national comparisons).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Nat.	Electricity Cost Nat.	Fuel Savings Nat.	Fuel Red. Nat. %
G10-2844L	Fusion	17%	116	4	$11	$6	$5	49%
G10-2848L	Fusion	53%	750	29	$71	$36	$35	49%
G10-2850L	Fusion	38%	2,818	108	$267	$136	$131	49%
G10-2968L	Fusion	36%	2,769	107	$262	$133	$129	49%
G42-1940N	VTRUX Van	20%	2,405	172	$423	$148	$274	65%
G61-0245G	Outlander	79%	11,073	527	$1,297	$633	$664	51%
G41-1142K	Outlander	76%	2,523	133	$327	$144	$182	56%
G42-0334G	VTRUX Van	56%	1,028	73	$181	$63	$117	65%
G42-0881H	eNV200	100%	9,720	608	$1,494	$505	$989	66%
Total			33,203	1,761	$4,332	$1,806	$2,527	58%

E.2.2 Monitored Pool Mission Vehicle Greenhouse Gas Reduction

Tables E-4 and E-5 identify the reduction in GHG projected in Washington State and nationally when replacing the current pool vehicles with PEVs. The calculated miles in CD mode were also used in the calculation of GHG reduction. As noted in Section 5, emissions from burning gasoline are known and emissions from the use of electricity are dependent on the power generation mix that is used to recharge the PEV battery.

Because Puget Sound Energy relies more on cleaner hydroelectric power than the average of all national power providers, electrical emissions in Washington State are lower. Electrical emissions are significantly lower than gasoline emissions.

The following is example calculation for Vehicle G10-2848L. As shown above, annual miles in CD mode is 750 miles and 28.8 gallons of gasoline are unused. ICE vehicles produce 20.1 lb-CO_2e/gallon; therefore, annual emissions for the monitored vehicle are 580 lb-CO_2e. Puget Sound Energy produces 0.8700 lb-CO_2e/kWh. As above, 277.7 kWh are required for recharging the battery, resulting in 242-lb-CO_2e, with savings of 339 lb-CO_2e for a 58% reduction in GHG emissions.

Table E-4. Monitored pool vehicle replacement GHG reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Wash.	PEV GHG Savings Wash.	GHG Savings Wash. %
G10-2844L	Fusion	17%	116	4	90	37	52	58%
G10-2848L	Fusion	53%	750	29	580	242	339	58%
G10-2850L	Fusion	38%	2,818	108	2,179	907	1,271	58%
G10-2968L	Fusion	36%	2,769	107	2,141	891	1,249	58%
G42-1940N	VTRUX Van	20%	2,405	172	3,453	994	2,459	71%
G61-0245G	Outlander	79%	11,073	527	10,598	4,239	6,359	60%
G41-1142K	Outlander	76%	2,523	133	2,669	966	1,703	64%
G42-0334G	VTRUX Van	56%	1,028	73	1,476	425	1,051	71%
G42-0881H	eNV200	100%	9,720	608	12,211	3,383	8,828	72%
Total			33,203	1,761	35,396	12,083	23,313	66%

In summary, over 23,000 lb-CO_2e can be avoided for these pool vehicles by using PEVs as replacement vehicles. This represents a 66% reduction in emissions in Washington State.

Table E-5 presents the reductions using national statistics.

Table E-5. Monitored pool vehicle replacement GHG reduction (national statistics).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Nat.	PEV GHG Savings Nat.	GHG Savings Nat. %
G10-2844L	Fusion	17%	116	4	90	66	24	27%
G10-2848L	Fusion	53%	750	29	580	425	155	27%
G10-2850L	Fusion	38%	2,818	108	2,179	1,595	583	27%
G10-2968L	Fusion	36%	2,769	107	2,141	1,568	573	27%
G42-1940N	VTRUX Van	20%	2,405	172	3,453	1,748	1,705	49%
G61-0245G	Outlander	79%	11,073	527	10,598	7,454	3,144	30%
G41-1142K	Outlander	76%	2,523	133	2,669	1,699	971	36%
G42-0334G	VTRUX Van	56%	1,028	73	1,476	747	729	49%
G42-0881H	eNV200	100%	9,720	608	12,211	5,949	6,262	51%
Total			33,203	1,761	35,396	21,250	14,146	40%

E.2.3 Departments Group Full Pool Mission Fleet Evaluation

Section 4.2 identifies 20 vehicles in the Departments group pool fleet. Intertek suggests that a fleet of two BEVs and 18 PHEVs conservatively meets the other vehicle travel requirements. The replacement vehicles follow the suggestions of Table 17 in Section 5.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Tables E-6 and E-7.

Table E-6. Departments group pool fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
72,752	3902	$ 11,044	$ 1,741	$ 9,304	84%	78,441	26,503	51,938	66%

Table E-7. Departments group pool fleet PEV replacement reductions (national statistics).

Annual Miles CD	Gas Gallons Saved	Gas Cost National	Elect Fuel Cost Nat	Fuel Savings Nat	Fuel Reds Nat%	GHG Emission ICE	PEV GHG Nat	PEV GHG Sav Nat	GHG Saving % Nat
72,752	3902	$ 9,600	$ 3,960	$ 5,640	59%	78,441	46,610	31,832	41%

E.3 Monitored Support Mission Vehicle Reductions

E.3.1 Monitored Departments Group Support Mission Vehicle Fuel Cost Reduction

Tables E-8 and E-9 identify the calculated miles in CD mode for each replacement vehicle and the projected fuel cost reductions for the support vehicles.

As before, because Washington State fuel costs are higher than the national average, local gasoline costs are greater than national figures. Also, because Puget Sound Energy relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Table E-8. Monitored group support vehicle replacement fuel cost reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Wash.	Elect Cost Wash.	Fuel Savings Wash.	Fuel Red. Wash. %
G10-0984N	Focus	100%	4,668	212	$600	$83	$518	86%
G10-1137M	Leaf	100%	3,130	120	$341	$54	$287	84%
G10-1139M	Fusion	74%	1,314	51	$143	$28	$115	81%
G10-1141M	Fusion	70%	10,676	411	$1,162	$226	$936	81%
G10-3590P	Leaf	100%	3,840	132	$375	$66	$309	82%
G10-5286H	Volt	96%	5,887	256	$724	$118	$607	84%
G41-1137K	Fit	100%	5,808	306	$865	$96	$769	89%
G41-1349G	Rav4	100%	2,388	159	$451	$60	$390	87%
G41-1350G	eNV200	100%	1,956	78	$221	$45	$177	80%
G41-1536L	Fit	100%	4,296	215	$608	$71	$537	88%
G41-1597L	eNV200	100%	3,672	230	$649	$84	$566	87%
G41-1763H	Rav4	100%	4,920	234	$663	$124	$539	81%
G41-1765H	VTRUX PU	79%	3,707	177	$500	$101	$399	80%
G41-1767H	eNV200	100%	11,004	524	$1,483	$251	$1,231	83%
G41-1768H	eNV200	100%	1,440	69	$194	$33	$161	83%
G41-4334M	VTRUX PU	96%	1,705	81	$230	$46	$183	80%
G42-0335G	VTRUX Van	62%	1,949	139	$394	$53	$341	87%
G42-0656K	eNV200	100%	7,476	415	$1,175	$171	$1,005	85%
G42-0766L	VTRUX PU	88%	8,004	364	$1,030	$217	$812	79%
G42-1222M	VTRUX Van	92%	8,059	576	$1,629	$219	$1,410	87%
G42-1223M	eNV200	100%	11,364	812	$2,297	$260	$2,037	89%
G43-0895K	eNV200	100%	3,816	318	$900	$87	$813	90%

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Wash.	Elect Cost Wash.	Fuel Savings Wash.	Fuel Red. Wash. %
G43-0896K	eNV200	100%	6,672	556	$1,573	$152	$1,421	90%
G43-2287M	eNV200	100%	4,812	370	$1,048	$110	$938	90%
G43-2288M	eNV200	100%	3,084	237	$671	$70	$601	90%
G62-0203H	Rav4	100%	9,160	573	$1,620	$230	$1,390	86%
Total			134,808	7,614	$21,547	$3,054	$18,493	86%

In summary, over $18,000 in fuel costs in Washington State can be saved by using PEVs as replacement vehicles. This represents an 86% reduction in costs.

Table E-9. Monitored support vehicle replacement fuel cost reduction (national statistics).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Nat.	Electricity Cost Nat.	Fuel Savings Nat.	Fuel Red. Nat. %
G10-0984N	Focus	100%	4,668	212	$522	$188	$334	64%
G10-1137M	Leaf	100%	3,130	120	$296	$122	$174	59%
G10-1139M	Fusion	74%	1,314	51	$124	$63	$61	49%
G10-1141M	Fusion	70%	10,676	411	$1,010	$514	$497	49%
G10-3590P	Leaf	100%	3,840	132	$326	$150	$176	54%
G10-5286H	Volt	96%	5,887	256	$630	$268	$362	57%
G41-1137K	Fit	100%	5,808	306	$752	$219	$533	71%
G41-1349G	Rav4	100%	2,388	159	$392	$137	$255	65%
G41-1350G	eNV200	100%	1,956	78	$192	$102	$91	47%
G41-1536L	Fit	100%	4,296	215	$528	$162	$366	69%
G41-1597L	eNV200	100%	3,672	230	$565	$191	$374	66%
G41-1763H	Rav4	100%	4,920	234	$576	$281	$295	51%
G41-1765H	VTRUX PU	79%	3,707	177	$434	$229	$205	47%
G41-1767H	eNV200	100%	11,004	524	$1,289	$572	$717	56%
G41-1768H	eNV200	100%	1,440	69	$169	$75	$94	56%
G41-4334M	VTRUX PU	96%	1,705	81	$200	$105	$94	47%
G42-0335G	VTRUX Van	62%	1,949	139	$343	$120	$222	65%
G42-0656K	eNV200	100%	7,476	415	$1,022	$389	$633	62%
G42-0766L	VTRUX PU	88%	8,004	364	$895	$494	$401	45%
G42-1222M	VTRUX Van	92%	8,059	576	$1,416	$498	$918	65%
G42-1223M	eNV200	100%	11,364	812	$1,997	$591	$1,406	70%
G43-0895K	eNV200	100%	3,816	318	$782	$198	$584	75%
G43-0896K	eNV200	100%	6,672	556	$1,368	$347	$1,021	75%
G43-2287M	eNV200	100%	4,812	370	$911	$250	$660	73%
G43-2288M	eNV200	100%	3,084	237	$584	$160	$423	73%
G62-0203H	Rav4	100%	9,160	573	$1,408	$524	$884	63%
Total			134,808	7,614	$18,730	$6,949	$11,781	63%

E.3.2 Monitored Support Mission Vehicle Greenhouse Gas Reduction

Tables E-10 and E-11 identify the reduction in GHGs projected when replacing the current support mission vehicles with PEVs.

As before, because Puget Sound Energy relies more on cleaner hydroelectric power than the average of all national power providers, electrical emissions in Washington State are lower. Electrical emissions are significantly lower than gasoline emissions.

Table E-10. Monitored support vehicle replacement GHG reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Wash.	PEV GHG Sav Wash.	GHG Savings Wash. %
G10-0984N	Focus	100%	4,668	212	4,265	1,259	3,006	70%
G10-1137M	Leaf	100%	3,130	120	2,420	817	1,603	66%
G10-1139M	Fusion	74%	1,314	51	1,016	423	593	58%
G10-1141M	Fusion	70%	10,676	411	8,254	3,437	4,817	58%
G10-3590P	Leaf	100%	3,840	132	2,662	1,002	1,659	62%
G10-5286H	Volt	96%	5,887	256	5,144	1,793	3,352	65%
G41-1137K	Fit	100%	5,808	306	6,144	1,465	4,679	76%
G41-1349G	Rav4	100%	2,388	159	3,200	914	2,286	71%
G41-1350G	eNV200	100%	1,956	78	1,573	681	892	57%
G41-1536L	Fit	100%	4,296	215	4,317	1,084	3,234	75%
G41-1597L	eNV200	100%	3,672	230	4,613	1,278	3,335	72%
G41-1763H	Rav4	100%	4,920	234	4,709	1,883	2,826	60%
G41-1765H	VTRUX PU	79%	3,707	177	3,548	1,532	2,016	57%
G41-1767H	eNV200	100%	11,004	524	10,532	3,829	6,703	64%
G41-1768H	eNV200	100%	1,440	69	1,378	501	877	64%
G41-4334M	VTRUX PU	96%	1,705	81	1,632	705	927	57%
G42-0335G	VTRUX Van	62%	1,949	139	2,799	806	1,993	71%
G42-0656K	eNV200	100%	7,476	415	8,348	2,602	5,747	69%
G42-0766L	VTRUX PU	88%	8,004	364	7,313	3,308	4,005	55%
G42-1222M	VTRUX Van	92%	8,059	576	11,571	3,330	8,240	71%
G42-1223M	eNV200	100%	11,364	812	16,315	3,955	12,361	76%
G43-0895K	eNV200	100%	3,816	318	6,392	1,328	5,064	79%
G43-0896K	eNV200	100%	6,672	556	11,176	2,322	8,854	79%
G43-2287M	eNV200	100%	4,812	370	7,440	1,675	5,766	77%
G43-2288M	eNV200	100%	3,084	237	4,768	1,073	3,695	77%
G62-0203H	Rav4	100%	9,160	573	11,507	3,506	8,001	70%
Total			134,808	7,614	153,036	46,507	106,529	70%

In summary, with the monitored vehicles replaced with these PEVs, over 106,000 lb-CO_2e are avoided each year using Washington State statistics.

Table E-11. Monitored support vehicle replacement GHG reduction (national statistics).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Nat.	PEV GHG Sav Nat.	GHG Savings Nat. %
G10-0984N	Focus	100%	4,668	212	4,265	2,214	2,051	48%
G10-1137M	Leaf	100%	3,130	120	2,420	1,437	983	41%
G10-1139M	Fusion	74%	1,314	51	1,016	744	272	27%
G10-1141M	Fusion	70%	10,676	411	8,254	6,044	2,210	27%
G10-3590P	Leaf	100%	3,840	132	2,662	1,763	899	34%
G10-5286H	Volt	96%	5,887	256	5,144	3,152	1,992	39%

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Nat.	PEV GHG Sav Nat.	GHG Savings Nat. %
G41-1137K	Fit	100%	5,808	306	6,144	2,577	3,567	58%
G41-1349G	Rav4	100%	2,388	159	3,200	1,608	1,592	50%
G41-1350G	eNV200	100%	1,956	78	1,573	1,197	376	24%
G41-1536L	Fit	100%	4,296	215	4,317	1,906	2,411	56%
G41-1597L	eNV200	100%	3,672	230	4,613	2,247	2,366	51%
G41-1763H	Rav4	100%	4,920	234	4,709	3,312	1,397	30%
G41-1765H	VTRUX PU	79%	3,707	177	3,548	2,694	854	24%
G41-1767H	eNV200	100%	11,004	524	10,532	6,734	3,798	36%
G41-1768H	eNV200	100%	1,440	69	1,378	881	497	36%
G41-4334M	VTRUX PU	96%	1,705	81	1,632	1,239	393	24%
G42-0335G	VTRUX Van	62%	1,949	139	2,799	1,417	1,382	49%
G42-0656K	eNV200	100%	7,476	415	8,348	4,575	3,773	45%
G42-0766L	VTRUX PU	88%	8,004	364	7,313	5,817	1,496	20%
G42-1222M	VTRUX Van	92%	8,059	576	11,571	5,857	5,714	49%
G42-1223M	eNV200	100%	11,364	812	16,315	6,955	9,361	57%
G43-0895K	eNV200	100%	3,816	318	6,392	2,335	4,056	63%
G43-0896K	eNV200	100%	6,672	556	11,176	4,083	7,092	63%
G43-2287M	eNV200	100%	4,812	370	7,440	2,945	4,495	60%
G43-2288M	eNV200	100%	3,084	237	4,768	1,887	2,881	60%
G62-0203H	Rav4	100%	9,160	573	11,507	6,167	5,341	46%
Total			134,808	7,614	153,036	81,788	71,248	47%

E.3.3 Departments Group Full Support Fleet Evaluation

Section 4.2 identifies 60 vehicles in the Departments group support mission fleet. Intertek suggests that a fleet of 42 BEVs and 18 PHEVs conservatively meet the vehicle travel requirements. The replacement vehicles follow the suggestions of Table 17 in Section 5.

Using averages for these vehicles, potential replacements offer the fuel cost reductions and GHG reductions shown in Tables E-12 and E-13.

Table E-12. Departments full support fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
312,740	18,329	$ 51,871	$ 7,353	$ 44,519	86%	371,314	112,005	259,309	70%

In summary, if all the support fleet were to be replaced by PEVs, a reduction in over $44,000 in fuel costs and nearly 260,000 lbs-CO2e can be avoided.

Table E-13. Departments full support fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost National	Elect Fuel Cost Nat	Fuel Savings Nat	Fuel Reds Nat%	GHG Emission ICE	PEV GHG Nat	PEV GHG Sav Nat	GHG Saving % Nat
312,740	18,329	$ 45,090	$ 16,729	$ 28,360	63%	371,314	196,974	174,340	47%

E.4 Monitored Enforcement Mission Vehicle Reductions

E.4.1 Monitored Departments Enforcement Mission Vehicle Fuel Cost Reduction

Tables E-14 and E-15 identify the calculated miles in CD mode for each replacement vehicle and projected fuel cost reductions for enforcement vehicles.

As before, because Washington State fuel costs are higher than the national average, local gasoline costs are greater than national figures. Also, because Puget Sound Energy relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Table E-14. Monitored enforcement vehicle replacement fuel cost reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Wash.	Elect Cost Wash.	Fuel Savings Wash.	Fuel Red. Wash. %
G11-0472L	Fusion	64%	1,206	52	$148	$25	$123	83%
G11-1424L	Fusion	50%	3,264	148	$420	$69	$351	84%
G11-2898K	Fusion	62%	2,262	103	$291	$48	$243	84%
G42-2035L	Fit	100%	10,700	629	$1,781	$177	$1,604	90%
G43-0936K	eNV200	100%	7,140	595	$1,684	$163	$1,521	90%
G62-0871K	Outlander	19%	1,441	90	$255	$36	$219	86%
G62-2420P	VTRUX Van	30%	968	51	$144	$26	$118	82%
Total			26,981	1,669	$4,723	$545	$4,178	88%

In summary, over $4,000 in fuel costs in Washington State can be saved by using PEVs as replacement vehicles. This represents an 88% reduction in costs.

Table E-15. Monitored enforcement vehicle replacement fuel cost reduction (national statistics).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	Fuel Cost Nat.	Electricity Cost Nat.	Fuel Savings Nat.	Fuel Red. Nat. %
G11-0472L	Fusion	64%	1,206	52	$129	$58	$71	55%
G11-1424L	Fusion	50%	3,264	148	$365	$157	$208	57%
G11-2898K	Fusion	62%	2,262	103	$253	$109	$144	57%
G42-2035L	Fit	100%	10,700	629	$1,548	$403	$1,145	74%
G43-0936K	eNV200	100%	7,140	595	$1,464	$371	$1,092	75%
G62-0871K	Outlander	19%	1,441	90	$222	$82	$139	63%
G62-2420P	VTRUX Van	30%	968	51	$125	$60	$66	52%
Total			26,981	1,669	$4,106	$1,241	$2,865	70%

E.4.2 Monitored Enforcement Mission Vehicle Greenhouse Gas Reduction

Tables E-16 and E-17 identify the reduction in GHGs projected when replacing the current enforcement mission vehicles with PEVs.

Table E-16. Monitored enforcement vehicle replacement GHG reduction (Washington State).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Wash.	PEV GHG Sav Wash.	GHG Savings Wash. %
G11-0472L	Fusion	64%	1,206	52	1,054	388	666	63%
G11-1424L	Fusion	50%	3,264	148	2,982	1,051	1,931	65%

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Wash.	PEV GHG Sav Wash.	GHG Savings Wash. %
G11-2898K	Fusion	62%	2,262	103	2,066	728	1,338	65%
G42-2035L	Fit	100%	10,700	629	12,651	2,700	9,952	79%
G43-0936K	eNV200	100%	7,140	595	11,960	2,485	9,475	79%
G62-0871K	Outlander	19%	1,441	90	1,810	552	1,259	70%
G62-2420P	VTRUX Van	30%	968	51	1,024	400	624	61%
Total			26,981	1,669	33,548	8,303	25,245	75%

In summary, with the monitored enforcement vehicles replaced with these PEVs, over 25,000 lb-CO2e are avoided each year using Washington State statistics.

Table E-17. Monitored enforcement vehicle replacement GHG reduction (National statistics).

Vehicle ID	Replacement PEV	% CD Mode Travel	Annual Miles CD	Gas Gallons Saved	GHG Emission ICE	PEV GHG Nat.	PEV GHG Savings Nat.	GHG Savings Nat. %
G11-0472L	Fusion	64%	1,206	52	1,054	683	371	35%
G11-1424L	Fusion	50%	3,264	148	2,982	1,848	1,134	38%
G11-2898K	Fusion	62%	2,262	103	2,066	1,280	786	38%
G42-2035L	Fit	100%	10,700	629	12,651	4,748	7,904	62%
G43-0936K	eNV200	100%	7,140	595	11,960	4,370	7,590	63%
G62-0871K	Outlander	19%	1,441	90	1,810	970	840	46%
G62-2420P	VTRUX Van	30%	968	51	1,024	704	321	31%
Total			26,981	1,669	33,548	14,602	18,946	56%

E.4.3 Departments Group Full Enforcement Fleet Evaluation

Section 4.2 identifies 25vehicles in the Departments group enforcement mission fleet. Intertek suggests that a fleet of six BEVs and 19 PHEVs conservatively meets the vehicle travel requirements. The replacement vehicles follow the suggestions of Table 17 in Section 5.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Tables E-18 and E-19.

Table E-18. Departments group full enforcement fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
98,014	5,506	$ 15,581	$ 2,062	$ 13,518	87%	110,662	31,402	79,260	72%

In summary, if all of the enforcement fleet were to be replaced by PEVs, a reduction over $67,000 in fuel costs could occur and 390,000 lb-CO_2e can be avoided.

Table E-19. Departments full enforcement fleet PEV replacement reductions (national statistics).

Annual Miles CD	Gas Gallons Saved	Gas Cost National	Elect Fuel Cost Nat	Fuel Savings Nat	Fuel Reds Nat%	GHG Emission ICE	PEV GHG Nat	PEV GHG Sav Nat	GHG Saving % Nat
98,014	5,506	$ 13,544	$ 4,692	$ 8,851	65%	110,662	55,224	55,438	50%

E.4 Transport Mission Vehicle Reductions

Section 4.2 shows that the Departments group has one cargo van with a transport mission. Because it was not monitored, it is suggested that a suitable styled PHEV could provide a replacement (this vehicle is included in the full Departments group summary in Section E.5).

E.5 Full Departments Group Full Fleet Summary

The full Departments group fleet includes support, enforcement, and transport missions. Projected results for all mission groups are shown in Table E-20 and summarized in Section 5.

Table E-20. Departments group full fleet PEV replacement reductions (Washington State).

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%	GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
483,507	27,737	$ 78,496	$ 11,156	$ 67,341	86%	560,417	169,910	390,507	70%

In summary, if all Departments group fleet vehicles are replaced with PEVs, over $67,000 in fuel costs may be saved, along with 390,000 lbs-CO_2e avoided.

E.6 Departments Group Summary

Table E-21 provides the average values for all monitored vehicles belonging to the Departments group.

Table E-21. Departments group monitored vehicles average values.

Annual Miles CD	Gas Gallons Saved	Gas Cost Local	Elect Fuel Cost Local	Fuel Saving Local	Fuel Red Local%
11,512	660	$ 1,869	$ 266	$ 1,603	86%

GHG Emission ICE	PEV GHG Local	PEV GHG Sav Local	GHG Saving % Loc
13,343	4,045	9,298	70%

Table E-21 shows that there is a significant opportunity for savings not only in fuel costs but in GHG emissions with the deployment of PEVs in this fleet.