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Electric Vehicle Preparedness Utilization Task 3: Detailed Assessment of Target Electrification Vehicles at Joint Base Lewis McChord

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August 2014

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Task 3: Detailed Assessment of Target Electrification Vehicles at Joint Base Lewis McChord

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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 U.S. Department of Energy 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 and Joint Base Lewis McChord fleet managers and personnel for participation in this study.

Intertek is pleased to provide this report and is encouraged by enthusiasm and support from Joint Base Lewis McChord 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 in the 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 Joint Base Lewis McChord (JBLM) 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 to identify vehicles that may be replaced with PEVs, with emphasis on BEVs that provide maximum benefit.

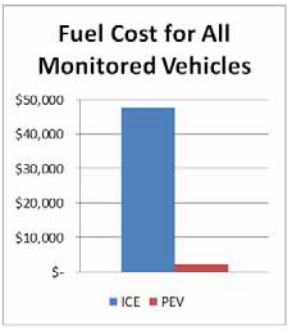
JBLM has a sub-installation in the Yakima Training Center. The joint base is 647 m^2, with 142 m^2 for the main base and 505 m^2 for the Yakima Training Center. The geographic size of JBLM creates significant travel demands on its vehicle fleet and provides opportunities for conversion of some vehicles to PEVs. JBLM identified 1,595 vehicles in its fleet; four JBLM fleet managers selected 60 vehicles to be representative of their fleets for participation in this study. Fleet vehicle mission categories are defined in Section 4 and, while the JBLM vehicles conduct many different missions, three (i.e., pool, support, and transport missions) were selected by fleet management to be part of this fleet evaluation. The selected vehicles included many vehicle types.

This report actually provides five reports: one for each of the fleets participating in the monitoring 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 transport vehicles, because while some vehicles travel long distances, the group could support some

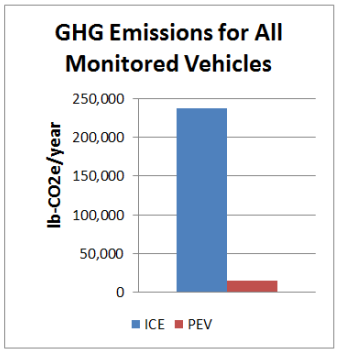
[a] Energy Policy act of 1992, Energy Policy Act of 2005, Executive Order 13423, and Energy Independence and Security Act of 2007.

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, passenger vans, and specialty usage vehicles), some of which were included in this study. However, based on data collected for the monitored vehicles, the 60-vehicle fleet subset could possibly consist of two conventional heavy-duty trucks, 11 conventional passenger vans, 28 BEVs, and 19 PHEVs. Additional replacement may be possible as more PEVs of different types become commercially available.



Tacoma Power provides the electric power for JBLM and its generation capacity consists mostly of hydroelectricity. Hydroelectricity generally provides lower electrical costs and lower generation GHG emissions than the national averages. The replacement of the 47 internal combustion vehicles with PEVs potentially results in an annual fuel savings of over **$47,000 (95% reduction)** and GHG savings of over **223,000 lb-CO_2e (94% reduction)**.



The monitored vehicles represent 60 vehicles of 1,382 on-road-rated vehicles in these represented fleets. Assuming that the balance of these fleets operate 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 111 conventional heavy-duty trucks, 263 conventional passenger vans, 57 conventional buses, five conventional specialty vehicles, 573 BEVs, and 373 PHEVs. This replacement of ICE vehicles with PEVs could result in an annual fuel savings of over **$1 million (95% reduction)** and annual GHG savings of over **740,000 lb-CO_2e (76% reduction)**.

The entire non-tactical fleet of vehicles at JBLM includes 190 vehicles not counted in the above figures because they were not part of the monitored vehicles. Additional evaluation of these vehicles likely will result in more potential PEV replacements and added savings. The average vehicle monitored travels approximately 4,500 miles per year. This is an average of 375 miles per month or 94 miles per week. This may reflect the opportunity to increase the percentage of BEVs over that analyzed in Section 5. Intertek suggests JBLM may wish to move forward in the near future with the replacement of pool, support, and transport 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
BEA	Battelle Energy Alliance, LLC
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
GVWR	gross vehicle weight rating
GSA	General Services Administration
ICE	internal combustion engine
INL	Idaho National Laboratory
Intertek	Intertek Testing Services, North America
JBLM	Joint Base Lewis McChord
LSV	Low speed vehicle
MOU	memorandum of understanding
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
VIN	vehicle identification number

Electric Vehicle Preparedness Utilization Task 3: Detailed Assessment of Target Electrification Vehicles at Joint Base Lewis McChord

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 fleet and infrastructure assessment
- Task 2: Develop target electrification vehicles
- Task 3: Perform detailed assessment of target electrification vehicles and charging infrastructure
- Task 4: Perform economic analysis of target electrification.

Assessment of the potential for replacing Joint Base Lewis McChord (JBLM; in Tacoma, Washington) fleet vehicles with PEVs starts with assessment of the fleet vehicles' missions and vehicle characteristics. This assessment was conducted through a written survey, instrumentation of vehicles, and field interviews. The Task 1 report provided a summary and assessment of General Services Administration (GSA) data and survey results.

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 by an onboard battery that 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. Task 2 selected a number of 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 details of that data collection. At the same time, the electrical distribution system at JBLM was reviewed as input for the charging infrastructure assessment. The charging infrastructure assessment is the subject of a separate report.

2. METHODS

2.1 Fleet Vehicle Survey

JBLM identified 60 vehicles for further study, as identified in the Task 2 report. This subset of vehicles contains eight sedans, seven minivans, four sports utility vehicles (SUV), 20 pickup trucks,

seven cargo vans, 11 passenger vans, and three heavy-duty trucks. 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).

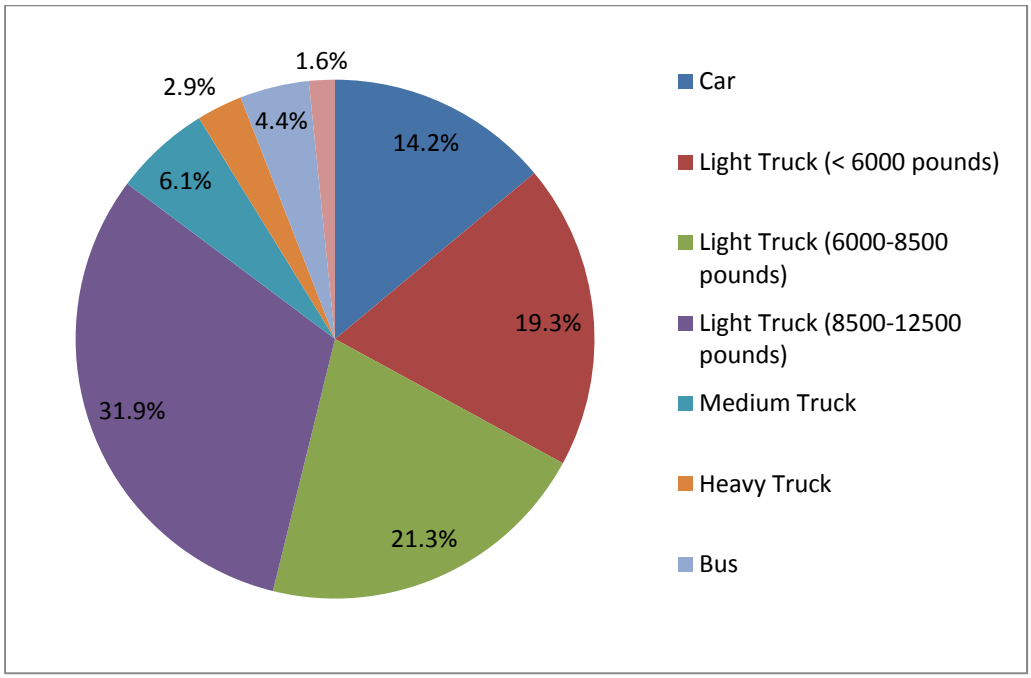


Figure 1. Vehicle type distribution for all vehicles.

Figures 2 through 6 present distributions for model year, gross vehicle weight rating (GVWR), cumulative distance driven, and monthly distance driven. The figures show that the selected vehicles are representative of a wide range of vehicle and mission types.

Additionally, the fleet vehicles are used for a variety of purposes by several different divisions on base. These include Public Works, Motor Transport Branch, Directorate of Community Activities, and 6th MP Group, Directorate of Family Morale, Welfare and Recreation, Madigan Army Medical Center, Criminal Investigation Division, Directorate of Logistics, and the Department of Emergency Services.

Figures 7 through 9 present survey results for the selected vehicles. Respondents have completed surveys for 23 of the selected vehicles. As can be seen in the figures, the responses vary widely; however, the responses match reasonably well with the fleet composition.

JBLM identified 1,593 fleet vehicles in its non-tactical, onroad fleet. The four fleet managers involved in the selection of vehicles for monitoring manage 1,405 of these vehicles. Table 1 identifies these vehicles by mission type. (Note that Section 3 provides descriptions of the vehicle mission types.) Subtracting the low-speed vehicles, 1,382 vehicles are potentially considered for replacement by PEVs.

Intertek coordinated with the JBLM fleet managers to identify the specific vehicles for inclusion in the study. The four fleet managers assessed their wide range of vehicles and made selections of high-interest vehicles based on vehicle missions and vehicle type/class. Selection also favored vehicles used at least twice a week. 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 JBLM.

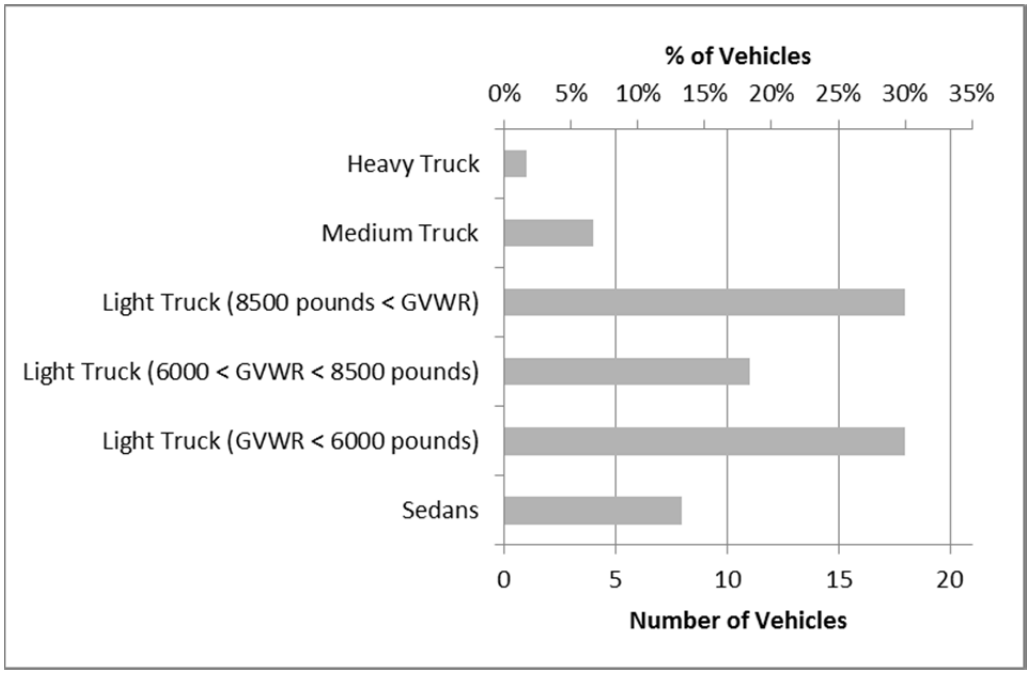


Figure 2. Vehicle type distribution for vehicles with data loggers.

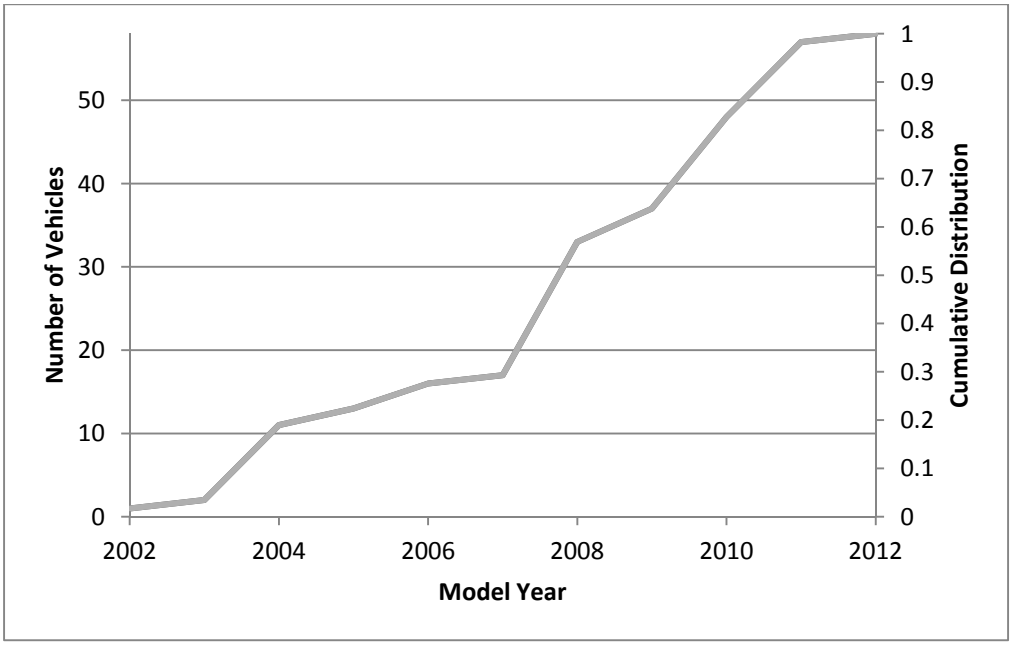


Figure 3. Model year distribution for vehicles with data loggers.

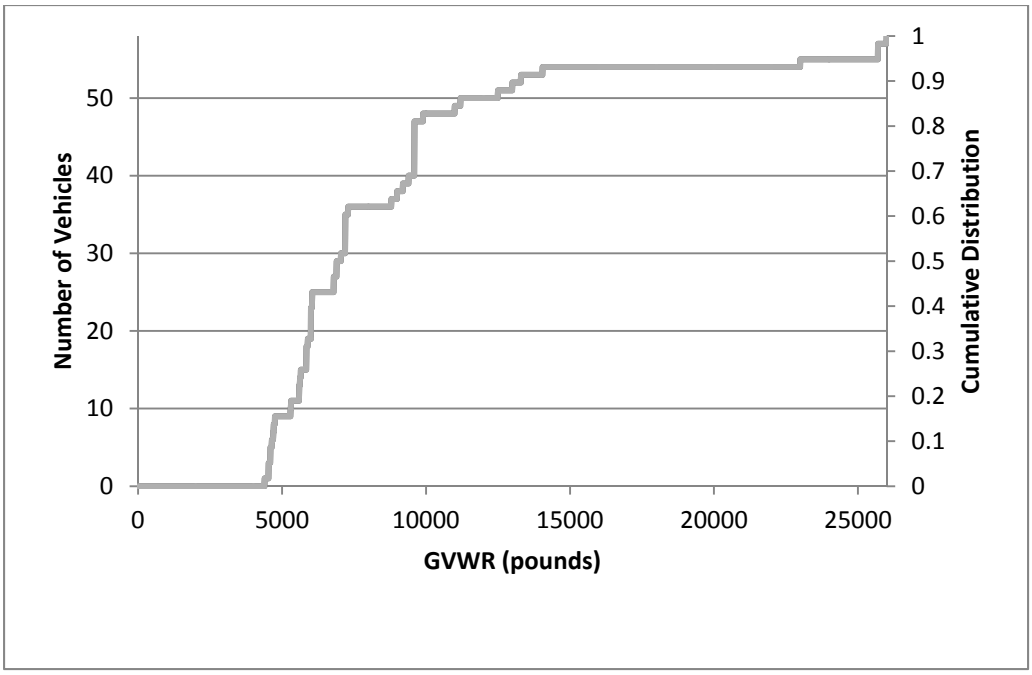


Figure 4. GVWR distribution for vehicles with data loggers.

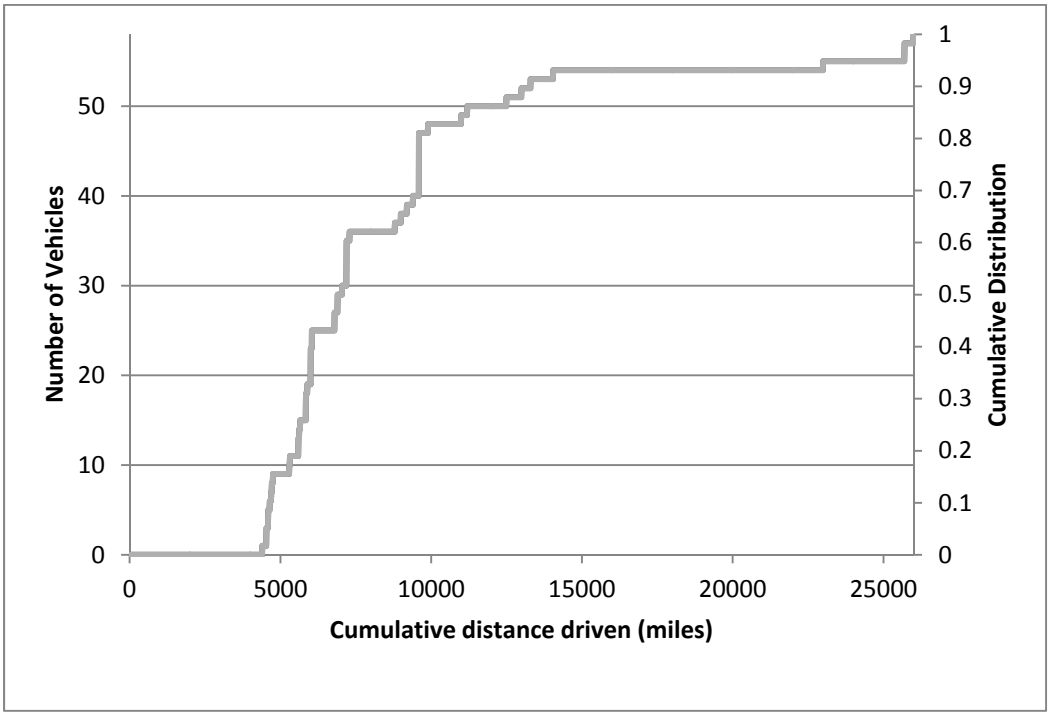


Figure 5. Distribution of cumulative distance driven for vehicles with data loggers.

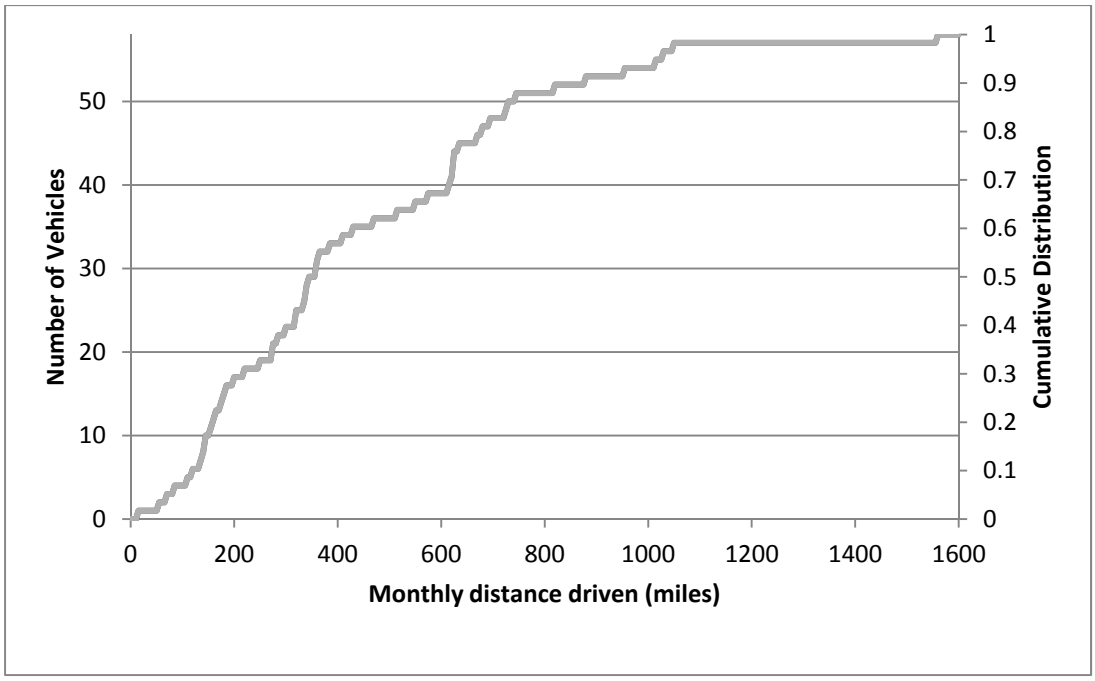


Figure 6. Distribution of monthly distance driven for vehicles with data loggers.

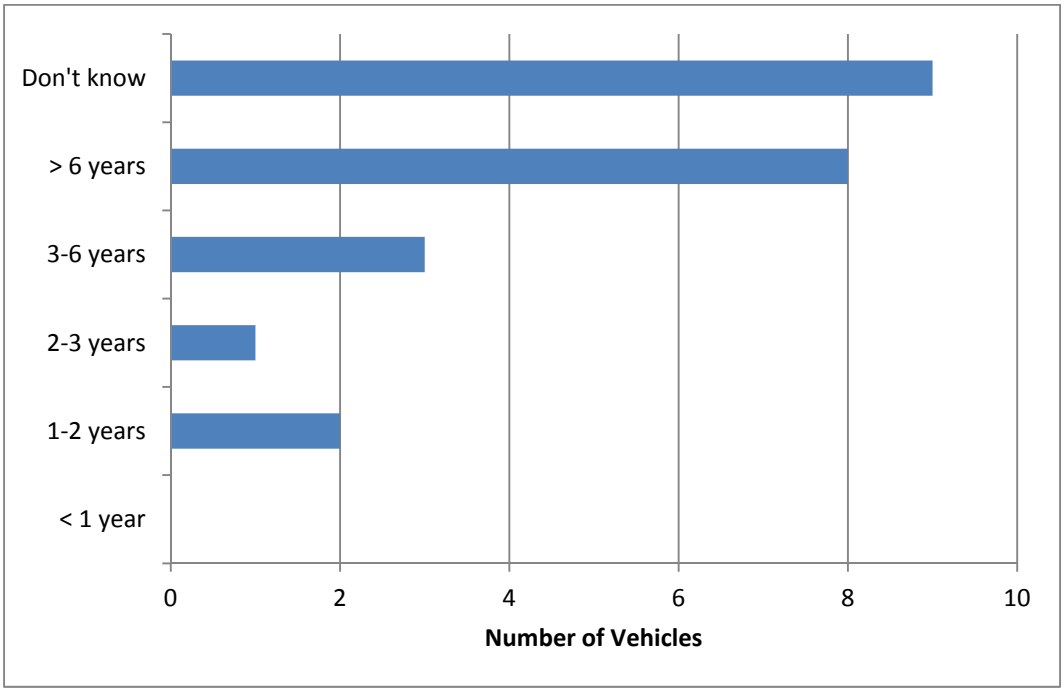


Figure 7. Survey results for vehicles with data loggers: How much longer do you expect to keep the vehicle in your fleet?

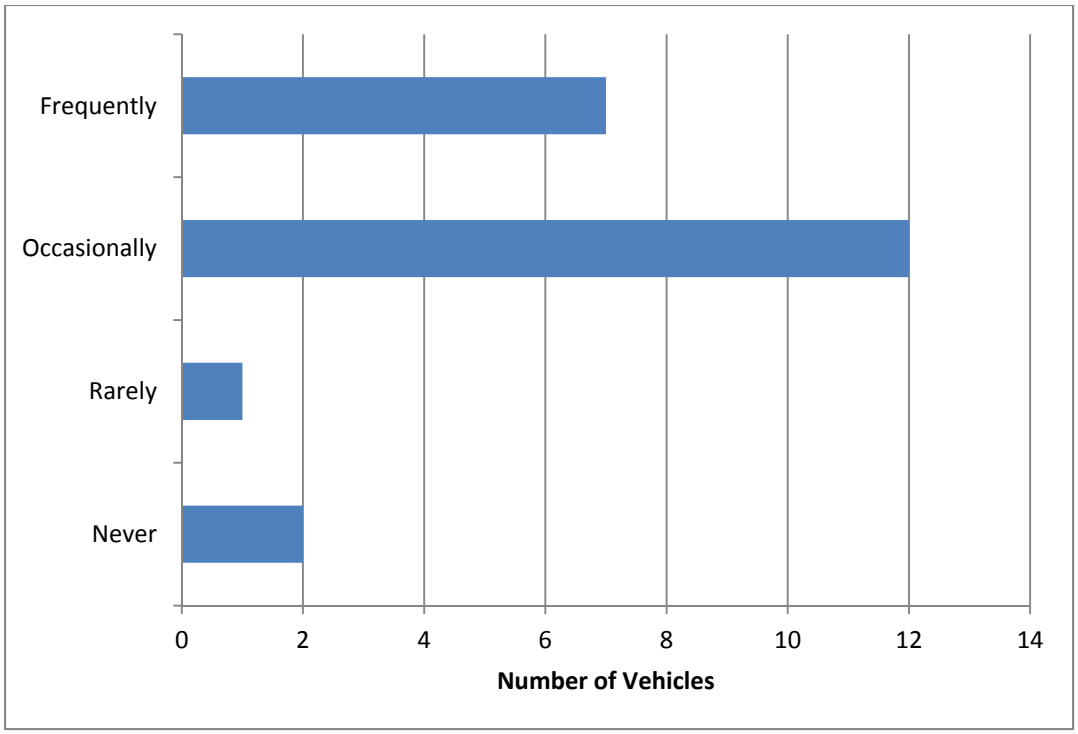


Figure 8. Survey results for vehicles with data loggers: Is this vehicle used off-base?

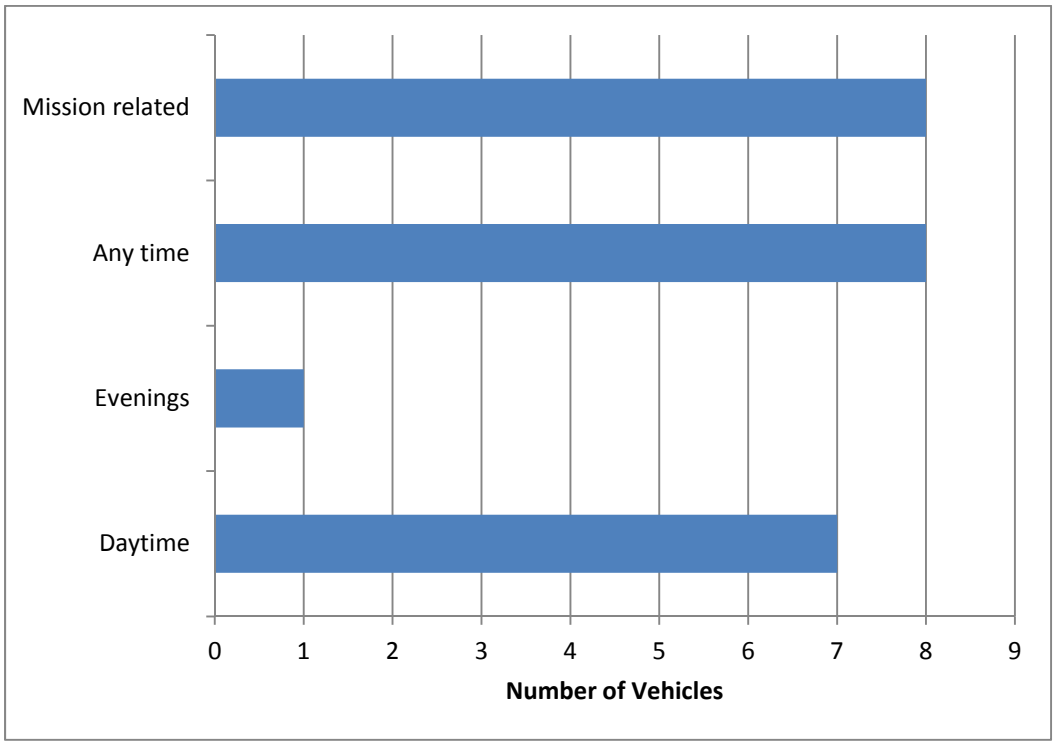


Figure 9. Survey results for vehicles with data loggers: Are the vehicles used during specific hours or at any time during the day?

Table 1. Fleet evaluation.

Vehicle Mission	Study Vehicles	Total Fleet Reported	Percentage Studied
Pool Vehicles	35	633	5.5%
Enforcement Vehicles			0%
Support Vehicles	19	458	4.2%
Transport Vehicles	6	229	2.6%
Specialty Vehicles		5	0%
Shuttle/Bus		57	0%
Low Speed Vehicles		23	0%
Total Fleet Vehicles	60	1,405	4.3%

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 vehicle identification number (VIN) or 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[2] and depicted in Figure 10 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 10. InTouchMVC data logger.[3]

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

[2] www.intouchmvc.com [accessed July 30, 2014].

[3] ibid.

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.

JBLM requested and installed 60 data loggers into their fleet vehicles (i.e., 35 pool vehicles, six transport vehicles, and19 support vehicles). JBLM 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 11 illustrates a vehicle outing, which is comprised of trips, stops, and idle events, that may occur over one 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.

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.

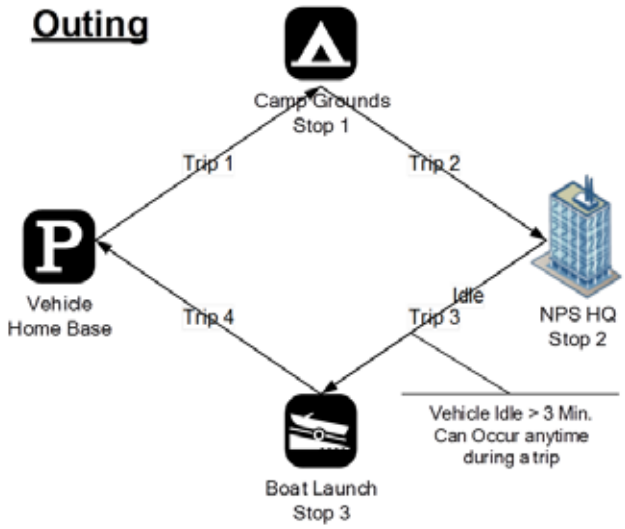


Figure 11. Vehicle outing.

Statistical data analysis uses Python 2.7 with the Matlab Plotting Library graphics environment (Matplotlib) and spatial display with ESRI ArcGIS.[4] 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 12:

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).

[4] www.esri.com [accessed January 10, 2014].

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 12. Vehicle missions.

3.2 Alternative Fuel Vehicles

As the operating agency, JBLM has a unique opportunity to plan for the adoption of BEVs and PHEVs, along with planning for supporting infrastructure. The adoption of PHEVs and BEVs is a primary goal of 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

[5] http://www.gsa.gov/graphics/fas/VehicleReplacementStandardsJune2011Redux.pdf [accessed January 10, 2014].

GSA Vehicle Replacement Requirements[5]			
	Fuel Type	Years	Miles
Light trucks 4 x 2	Non-diesel	7	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

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, 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.

[6] http://www.fueleconomy.gov/feg/evtech.shtml [accessed December 27, 2013]

- **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.
- **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 the 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 3and 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.

[7] http://www.fueleconomy.gov/feg/phevtech.shtml [accessed July 19, 2013].

[8] http://www.gsa.gov/portal/content/104211 [accessed August 1, 2014].

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

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.

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	100/38 mpg	$14,899.52
Ford Fusion Energi	Sedan, Compact	PHEV	100/38 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	Model	Model Year/Estimated Year for Commercialization
Chevrolet	Volt	2011
Ford	C-MAX Energi	2013
Ford	Fusion Energi	2013
Toyota	Prius PHEV	2012
Honda	Accord PHEV	2014
BMW	i3 w Range Extender	2014
BMW	i8	2015 (estimate)
Audi	A3 eTron PHEV	2015 (estimate)
Volvo	V60 Plug-in	2016 (estimate)

Table 6. OEM BEV cars and availability.

Make	Model	Model Year/Estimated Year for Commercialization
Nissan	Leaf	2011
Ford	Focus Electric	2012
Tesla	Model S	2012
Fiat	500e	2013
Honda	Fit EV	2013
BMW	i3	2014

[9] http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=34130 [accessed August 1, 2014]

Make	Model	Model Year/Estimated Year for Commercialization
Chevrolet	Spark EV	2014
smart	ED	2014
Kia	Soul EV	2014 (estimate)
Mercedes-Benz	B-Class ED	2015 (estimate)
Tesla	Model X	2015 (estimate)
Volkswagen	Golf e-Golf	2015 (estimate)
Volvo	C30 Electric	2016 (estimate)

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

Make	Model	Model Year/Estimated Date for Commercialization
Via	VTRUX VR300	2013
Mitsubishi	Outlander PHEV	2015 (estimate)
Land Rover	Range Rover Sport	2016 (estimate)

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

Make	Model	Model Year/Estimated Date for Commercialization
Toyota	RAV4 EV	2013 (California only – elsewhere 2015 estimate)
Nissan	eNV200	2015 (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] Options such as this company's conversions might be of benefit to the passenger vans identified in the JBLM 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.

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 13 illustrates the primary components of a typical alternating current (AC) Level 2 EVSE.

[10] http://www.echoautomotive.com/index.php?option=com_content&view=article&id=8 [accessed July 14, 2014].

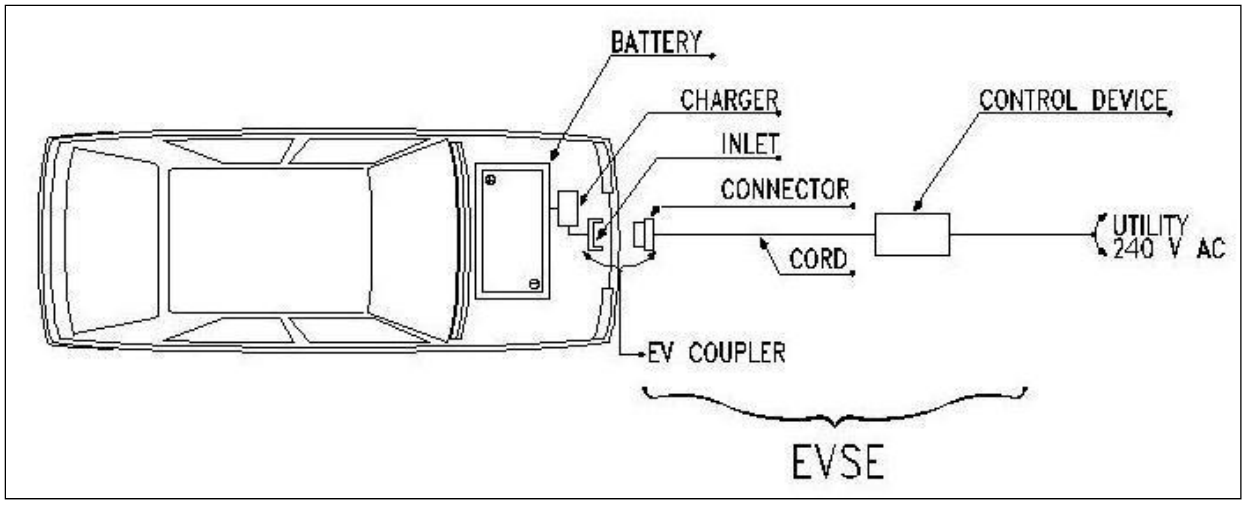


Figure 13. AC Level 2 charging diagram.[11]

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 on board 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 14 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 15 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 SAE approved a single connector and inlet design. Figure 16 shows this connector, which is colloquially known as the J1772 "combo connector."

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 17 shows this connector. EVSE units that are either J1772-compliant or CHAdeMO-compliant are both known as DC fast chargers (DCFCs).

[11] http://www.theevproject.com/downloads/documents/Electric%20Vehicle%20Charging%20Infrastructure%20Deployment%20Guidelines%20for%20the%20Greater%20Phoenix%20Area%20Ver%203.2.pdf [accessed January 15, 2014].

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 10. Society of Automotive Engineers charging configurations and ratings terminology.[12]

Figure 11. J1772 connector and inlet.[13]

[12] http://www.sae.org/smartgrid/chargingspeeds.pdf [accessed January 15, 2014].

[13] http://carstations.com/types/j09 [accessed January 15, 2014].

Figure 12. J1772-compliant combo connector.[14]

Figure 13. CHAdeMO-compliant connector.[15]

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

[14] http://www.zemotoring.com/news/2012/10/sae-standardizes-j1772-fast-dc-charging-up-to-100-kw [accessed January 15, 2014].

[15] https://radio.azpm.org/p/azspot/2012/5/10/1632-electric-cars/ [accessed January 15, 2014].

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 18 provides an example of a public AC Level 2 EVSE unit.[16]

Figure 14. Public AC Level 2 unit.

DCFCs also are available from several manufacturers. Figure 19 illustrates one such charger.[17] This particular unit uses the CHAdeMO connector standard.

Figure 15. Public DCFC unit.

[16] www.eaton.com/ [accessed January 29, 2014].

[17] http://evsolutions.avinc.com/products/public_charging/public_charging_b [Accessed April 16, 2014].

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.

4. JOINT BASE LEWIS McCHORD ANALYSIS

Sixty vehicles belonging to four different fleet managers were included in the study at JBLM. The specific requirements of each fleet manager necessitate that first these data be analyzed by fleet then followed by aggregating across all vehicles.

4.1 Analysis Results – 6th MP Group

This section summarizes and aggregates data collection for the 6th MP Group. The details of each vehicle monitored are included in Appendix B. Appendix F presents the full detailed analysis.

The 6th MP Group fleet contains 20 vehicles. Table 9 provides a summary of all vehicles in this fleet by mission type and vehicle type. Three vehicles were monitored as part of this study, including one SUV, one minivan, and one pickup truck.

Table 9. 6th MP Group total fleet summary.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	SUV	Mini -van	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Total
Pool	3	3	5	2	2		1	4		20
Other										0
Total	3	3	5	2	2		1	4		20

4.1.1 6th MP Group Pool 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 6th MP Group are pool vehicles.

Pool vehicles are typically light-duty motor vehicles for use in passenger transportation, with not more than 10 passengers. Pool 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.

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.

4.1.1.1 Summary for 6th MP Group Pool Vehicles. Appendix B provides the vehicle data sheets for each of the three pool vehicles monitored and Appendix F provides the detailed analysis that is summarized in this section. Table 10 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0900 and 1900 hours daily. The vehicles monitored traveled 2,052 miles, logged 108 hours, and idled for 21 hours during the 63-day study period.

Table 10. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	22.1/224	11.3/156	4.5/83	2,050
Travel Time (Minutes)	69.6/361	35.6/443	14.2/181	6,477
Idle Time (Minutes)	13.6/NA	7.0/NA	2.8/NA	1,269

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 is 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). That is, 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 20 shows the daily travel summary for the monitored vehicles. As an example, the figure shows that almost 50% of daily travel was less than 10 miles per day.

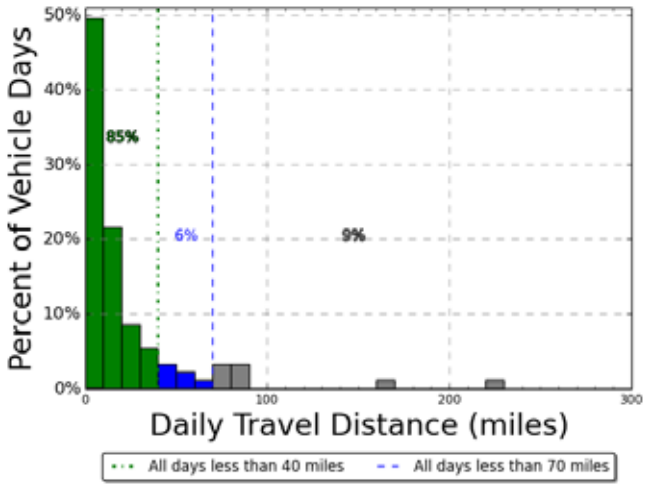


Figure 16. Pool vehicle daily travel miles (all vehicles).

The average travel distance per day when driven for pool vehicles was 22.1 miles. On 91% of these vehicle days, the daily travel was less than the 70 miles and within the BEV safe range. Meanwhile, only 9% percent of pool daily travel was greater than 70 miles, with 85% of vehicle travel days less than 40 miles. A very basic look might suggest that considering only daily travel, a fleet consisting of 91% BEVs and 9% PHEVs would meet vehicle travel needs. However, other considerations will apply.

Figure 21 shows the outings for all vehicles. The figure notes that 75% of all vehicle outings travel was less than 10 miles.

The average travel outing when driven for pool vehicles was 11.3 miles. On 95% of these vehicle outings, the distance traveled was less than the 70 miles and considered to be within the BEV safe range. Meanwhile, only 5% of pool outing travel was greater than 70 miles, with 93% of vehicle travel outings less than the 40 miles considered to be within the CD range of a PHEV.

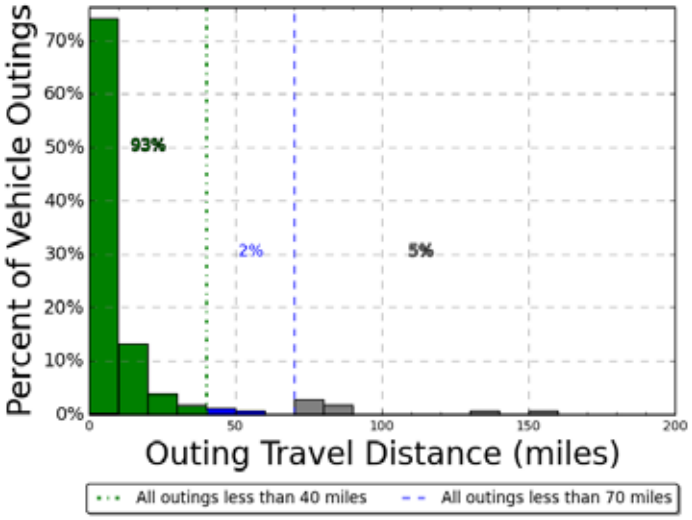


Figure 17. Pool vehicle combined outings.

4.1.1.2 6th MP Group Pool Vehicle Observations/Summary. In 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 GHG. A conservative approach to the vehicle usage suggests one PHEV with two BEVs would meet the needs of the pool vehicles.

Considering a full complement of 20 pool vehicles in the 6th MP Group fleet, Intertek suggests that a mixed fleet may be possible. While one of the vehicles is a passenger van and there are currently no PEVs in this class, the remaining vehicles could be replaced. These remaining vehicles were not monitored, but using the data collected for the three that were, Intertek suggests a fleet of 12 BEVs and seven PHEVs conservatively meets vehicle travel requirements.

4.1.1.3 6th MP Group Pool 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 pool vehicles, two BEVs require two AC Level 2 EVSE units for overnight charging and one PHEV requires one AC Level 1 outlet 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 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 benefit from using public charging infrastructure. Figure 22 displays the availability of public charging at the time of this writing for the JBLM area. The green-colored sites are AC sites, indicating AC Level 1 and Level 2 public locations and the orange-colored sites are DCFCs.

There is significant development in public charging infrastructure in the JBLM area due to the great public interest in PEV adoption and earlier emphasis on infrastructure through DOE-granted programs and EVSE supplier interests. For the 6th MP Group fleet that was monitored, all travel was within the JBLM base, but this may not be the case for all 6th MP Group vehicles.

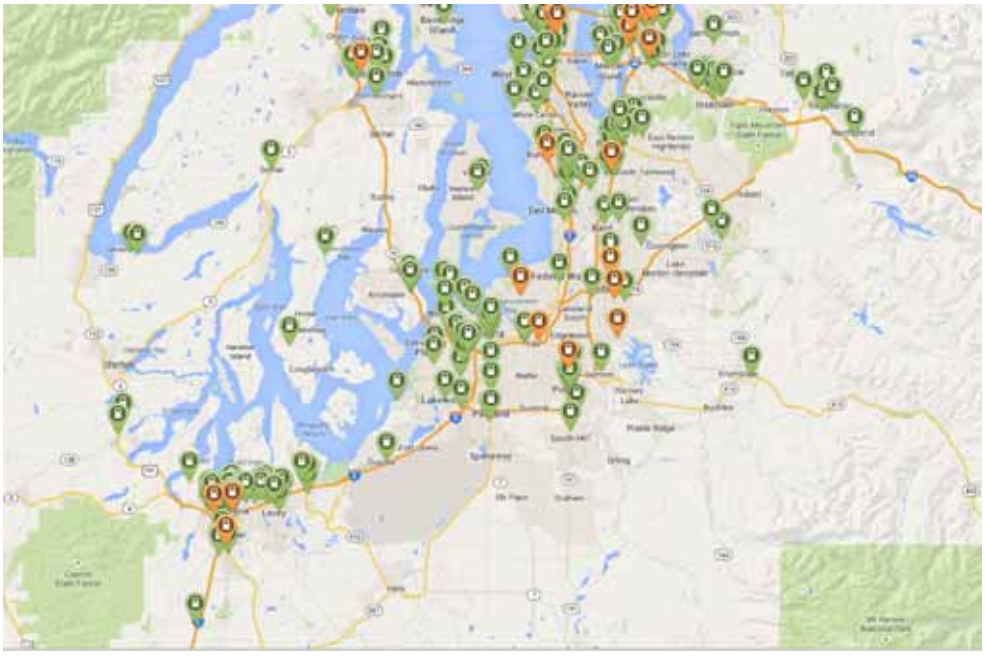


Figure 18. Public EVSE in JBLM region.[18]

4.1.2 6th MP Group Vehicles Mileage

The vehicle's annual miles factored into the calculations for replacement of vehicles as noted in Section 5 and Appendix F. The actual miles measured during the study were extrapolated to identify calculated annual miles in the study. JBLM has also provided vehicle information that identified the average monthly miles and vehicle mileage in April 2012.

For the entire 6th MP Group fleet, the average monthly miles traveled was 509 miles for an average annual travel total of 6,114 miles. On an average basis, this reflects positively on the use of BEVs in the fleet.

4.1.3 6th MP Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the 6th MP Group. The study indicates that PEVs offer alternatives to vehicles in the existing fleet, provided that any specific cargo requirements may be met by the PEV. In general, a mixed fleet of BEVs and PHEVs is suggested.

The fleet of pool vehicles in this study included one SUV, one minivan, and one pickup truck. 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 these vehicles. Appendix F provides the details of the observations and summary and, based on these travel data, Intertek suggests that replacing these three vehicles with two BEVs and one PHEV would meet current mission requirements.

The vehicles studied were utilized on 69% 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.

[18] http://www.plugshare.com/ [accessed June 19, 2014].

Considering a full complement of 20 pool vehicles in the 6th MP Group fleet, Intertek suggests that a mixed fleet may be possible. While one of the vehicles is a passenger van and there currently are no PEVs in this class, the remaining vehicles may be replaced. These remaining vehicles were not monitored, but using the data collected for the three that were, Intertek suggests a fleet of 12 BEVs and seven PHEVs conservatively meets vehicle travel requirements.

With potential replacement by PEVs established, Section 5 and Appendix J 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 6th MP Group. Those observations will be addressed in Task 4 of this project.

4.2 Analysis Results – Directorate of Community Activities Group

The Directorate of Community Activities (DCA) support group fleet contains 52 vehicles. Table 10 provides a summary of the all vehicles in the DCA Support Group fleet by mission and vehicle type. Four vehicles were monitored as part of this study, including one pickup truck, one heavy-duty truck, one cargo van, and one passenger van. This section summarizes and aggregates data collection for the DCA Support Group. The details of each vehicle monitored are included in Appendix C. Appendix G presents the full detailed analysis for the vehicles monitored and for the group as a whole.

Table 10. DCA group total fleet summary.

Mission	Sedan Compact/ Subcompact	Sedan Midsize	Sedan Large	SUV	Mini -van	Cargo Van	Pass Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool					1	2	2	3	3	1	12
Support	8	2				6	6	16	2		40
Total	8	2			1	8	8	19	5	1	52

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 Directorate of Community Activities Pool Vehicles Analysis

Pool vehicles are typically 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 DCA Support Group, the pool vehicles include a cargo van and a heavy-duty truck. Although there currently are no PEVs available to replace the heavy-duty truck, it is assumed that the usage of these pool vehicles can be of value in considering the remaining pool vehicles in the larger DCA fleet. PEVs are currently available to replace the balance of the vehicles.

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 Directorate of Community Activities Pool Vehicles. Appendix C provides the vehicle data sheets for each of the pool vehicles monitored. This section aggregates data for both pool vehicles. Table 11 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0800 and 1500 hours daily. The vehicles traveled 409 miles, logged 32 hours, and idled for 7 hours during the 63-day study period.

Table 11. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.5/53.5	6.1/53.5	1.8/20.2	408.7
Travel Time (Minutes)	40.1/123.0	28.7/133.0	8.3/55.0	1,926.0
Idle Time (Minutes)	9.1/NA	6.5/NA	1.9/NA	435.0

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 23 shows the daily travel summary for pool vehicles.

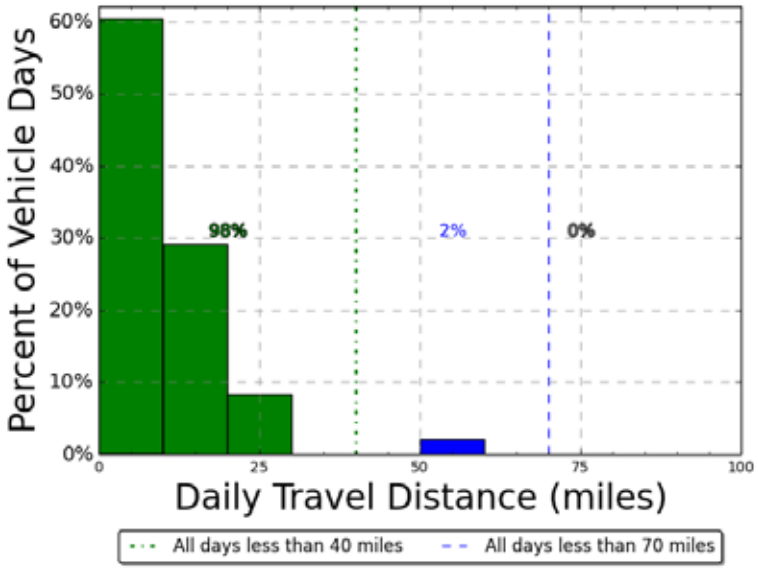


Figure 23. Pool vehicle daily travel miles (all vehicles).

The average travel distance per day when driven for pool vehicles was 8.5 miles. On all 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 23). Meanwhile, 98% of vehicle travel days were less than 40 miles considered to be within the CD mode of a PHEV (green bars of Figure 23). Figure 24 shows the outings for all pool vehicles.

Appendix C provides the details of each of the pool vehicle's outings. Neither vehicle exceeded 70 miles in a single outing.

The average travel outing when driven for pool vehicles was 6.1 miles. All outings were less than the 70 miles considered to be within the BEV safe range. Furthermore, 99% percent of pool outings were less than 40 miles considered to be within the CD mode range of a PHEV.

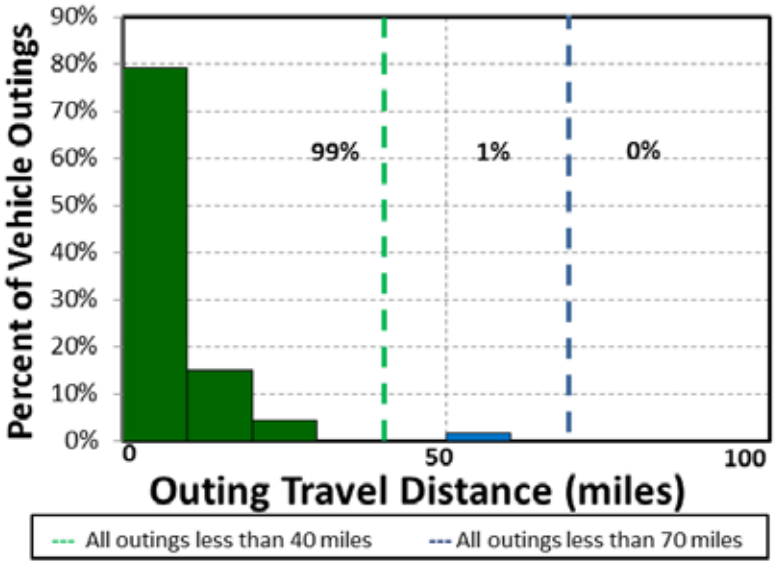


Figure 19. Pool vehicle combined outings.

4.2.1.2 Pool Vehicle Observations/Summary. In 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 GHG.

The fleet of pool vehicles in this study included one heavy-duty truck and one cargo van. While no PEV is currently available to replace heavy-duty trucks, other vehicles in the pool fleet have replacements available. Section 3.4 provides information on PEVs currently or soon to be available in the automotive market.

Considering a full complement of 12 pool vehicles in the DCA Support Group pool fleet, Intertek suggests that in extrapolating the collected data to the entire fleet, a mixed fleet consisting of four BEVs, two PHEVs, two conventional passenger vans, three conventional heavy-duty trucks, and one conventional bus may be possible.

4.2.1.3 Pool Vehicle Charging Needs. As noted previously, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can be accomplished using AC Level 1 charging.

Intertek's experience suggests that each vehicle should 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. For the entire fleet of pool vehicles, four BEVs require four AC Level 2 EVSE units for overnight charging and two PHEVs require two 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 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 benefit from using public charging infrastructure. Figure 22 displays the availability of public charging at the time of this writing for the JBLM area. Because all travel was within the JBLM base, there may be little benefit in using public charging for the DCA Support Group pool vehicles.

4.2.2 Directorate of Community Activities Support Group 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.

4.2.2.1 Summary for Directorate of Community Activities Support Group Support Vehicles. Appendix C provides the vehicle data sheets for each of the pickup truck and passenger van support vehicles monitored. This section aggregates the data for both support vehicles.

Table 12 summarizes support vehicle travel during the study period. Vehicle use occurred primarily between 0800 and 1600 hours daily. Support vehicles traveled 4,677 miles, logged 136 hours, and idled for 14 hours during the study period.

Table 12. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	61.5/354.1	30.6/354.1	12.3/129.4	4,677
Travel Time (Minutes)	108.0/544.0	53.6/544.0	21.7/222.0	8,208
Idle Time (Minutes)	11.5/NA	2.3/NA	2.3/NA	872

Again, daily travel and outings provide the greatest insight into vehicle use for PEV replacement considerations. Figure 25 shows the travel summary for support vehicles.

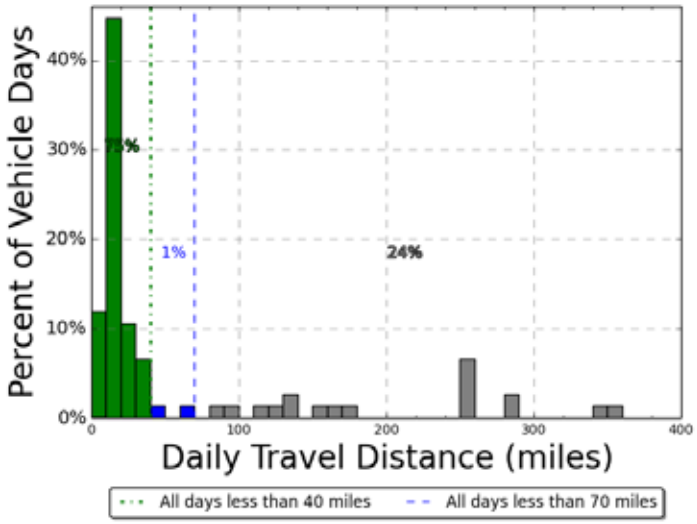


Figure 25. Support vehicle daily travel miles (all vehicles).

The average travel distance per day, when driven for support vehicles, was 61.5 miles. On 76% of these vehicle days, the daily travel was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 24% percent of support vehicle daily travel was greater than 70 miles. Furthermore, 75% of vehicle travel days were less than the 40 miles considered to be within the CD mode range of a PHEV. Figure 20 shows the outings for all support vehicles combined.

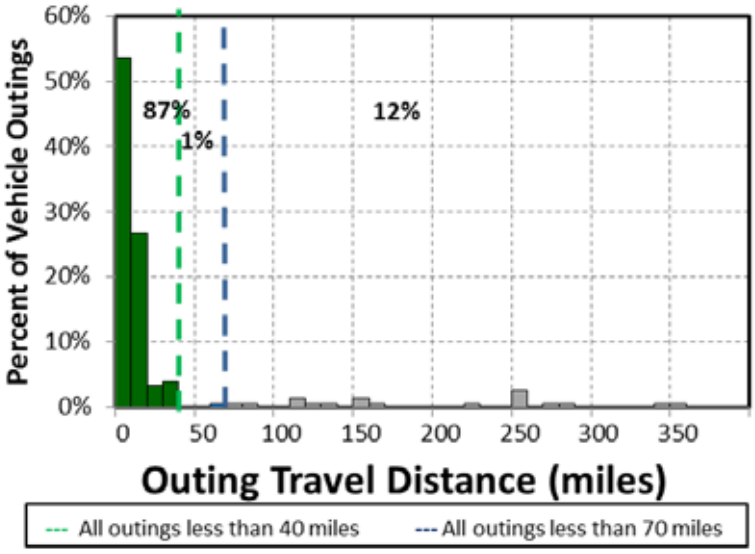


Figure 20. Support vehicle combined outings.

The average travel outing when driven for support vehicles was 30.6 miles. On 88% of these vehicle outings, the distance traveled was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 12% of support outing travel was greater than 70 miles. Furthermore, 87% 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 Directorate of Community Activities Support Group Support Vehicle Observations/Summary.

Again, 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 GHG.

The fleet of support vehicles in this study included one pickup truck and one passenger van. While no PEVs are currently available to replace the passenger van, other vehicles in the entire support fleet have replacements available. Section 3.4 provides information on PEVs currently or soon to be available in the automotive market.

Considering a full complement of 40 support vehicles in the entire DCA Support Group fleet, Intertek suggests that in extrapolating the collected data to the entire fleet, a mixed fleet consisting of 20 BEVs, 12 PHEVs, six conventional passenger vans, and two conventional heavy-duty trucks may be possible.

4.2.2.3 Directorate of Community Activities Support Group Support Vehicle Charging Needs.

For the entire fleet of support vehicles, 20 BEVs require 20 AC Level 2 EVSE units for overnight charging and 12 PHEVs require 12 AC Level 1 outlets for home base.

Greater management attention provides the possibility of reducing the overall number of AC Level 2 EVSE. 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. JBLM will gain experience in this management as the PEV fleet grows.

4.2.3 Directorate of Community Activities Support Group Vehicles Mileage

The vehicle's annual miles factor into the calculations for replacement of vehicles as noted in Section 5 and Appendix G. The actual miles measured during the study are extrapolated to identify the calculated annual miles in the study. JBLM has also provided vehicle information that identified the average monthly miles and vehicle mileage in April 2012.

For the entire DCA Support Group fleet, the average travel provided by JBLM was 274 miles per month for an average annual travel of 3,291 miles. On an average basis, this reflects positively on the use of BEVs in the fleet.

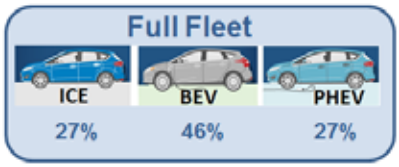
4.2.4 Directorate of Community Activities Support Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the DCA Support Group. The study indicates that PEVs offer alternatives to vehicles in the existing fleet, 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 one cargo van, one passenger van, one pickup truck, and one heavy-duty truck. Based on the travel data, Intertek suggests that retaining the conventional passenger van and replacing three vehicles with two PHEVs and one BEV would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix G provides specific recommendations.

The vehicles studied were utilized on 69% of the study days and averaged 1.3 hours of use per day. While daily usage was quite low, the vehicles were used often enough that eliminating one of these vehicles is not recommended.

Considering a full complement of 52 vehicles in the DCA Support Group fleet, Intertek suggests that a mixed fleet may be possible. Intertek suggests that a fleet of one conventional bus, eight conventional passenger vans, five heavy-duty trucks, 24 BEVs, and 14 PHEVs would conservatively meet the balance of vehicle travel requirements.



With the potential replacement by PEVs established, Section 5 and Appendix K 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 DCA Support Group. Those observations will be addressed in Task 4 of this project.

4.3 Analysis Results – Public Works Group

The Public Works Group fleet contains 250 vehicles. Table 13 identifies these vehicles by vehicle type according to site records. The mission assignments identified in Table 13 are based on survey responses received and extrapolation to the balance of the fleet. Fourteen vehicles were monitored as part of this study, including nine pickup trucks, two minivans, and three passenger vans. This section summarizes and aggregates data collection for the Public Works Group. The details of each vehicle monitored are included in Appendix D. Appendix H presents the full detailed analysis for the vehicles monitored and for the group as a whole.

Table 13. Public Works Group total fleet characterization.

Mission	Sedan Compact/ Subcompact	Sedan Midsize/ Large	Mini-van	SUV	Specialty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	5	2	2	7		8	35	48			107
Support			1	4		14	17	65	16		117
Transport								8	17		25
Specialty					1						1
Total	5	2	3	11	1	22	52	121	33		250

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 Public Works 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 Public Works, the pool vehicles include four pickups, two passenger vans, and two minivans. Although there currently 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 Public Works 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.

4.3.1.1 Summary for Public Works Pool Vehicles. Appendix D provides the vehicle data sheets for each of the pool vehicles monitored. This section aggregates data for all pool vehicles. Table 14 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. They traveled 3,620 miles, logged 259 hours, and idled for 76 hours during the 63-day study period.

Table 14. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	13.8/270.7	5.3/168.6	2.2/132.0	3,621.3
Travel Time (Minutes)	59.2/297.0	23.0/247.0	9.3/139.0	15,563
Idle Time (Minutes)	17.5/NA	6.9/NA	2.7/NA	4,595

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 21 shows the travel summary for all monitored pool vehicles.

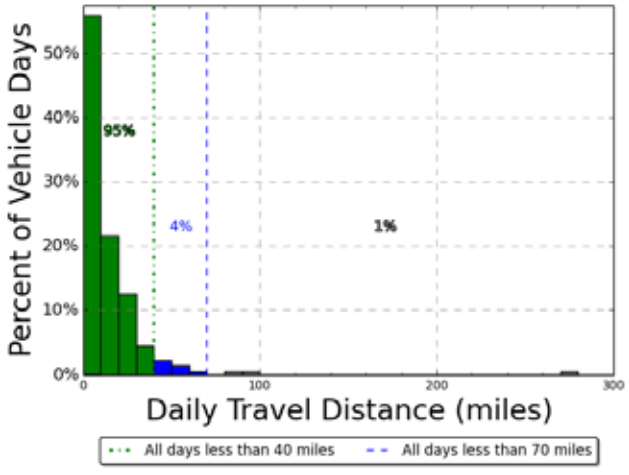


Figure 21. Pool vehicle daily travel miles (all vehicles).

The average travel distance per day when driven for pool vehicles was 13.8 miles. On 99% 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 21). Meanwhile, 95% of vehicle travel days were less than the 40 miles considered to be within the CD range of a PHEV (green bars of Figure 21).

The pool vehicles were used, on average, 52% 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 22 shows the outings for all vehicles.

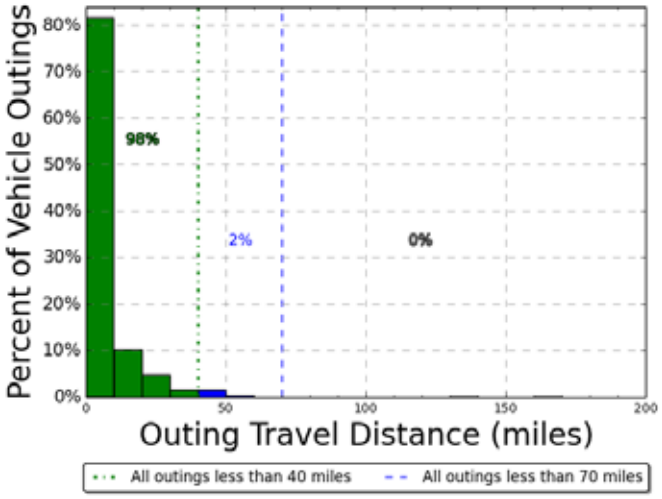


Figure 22. Pool vehicle combined outings.

Appendix D provides the details of each of the pool vehicle's outings. The average travel outing when driven for pool vehicles was 5.2 miles. All outings (except two), or essentially 100%, were less than the 70 miles considered to be within the BEV safe range. Furthermore, 98% percent of pool outings were less than the 40 miles considered to be within the CD mode range of a PHEV.

4.3.1.2 Pool 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 GHG.

The fleet of pool vehicles in this study included four pickup trucks, two minivans, and two passenger vans. While no PEV is currently available to replace the passenger van, other vehicles in the entire pool fleet have replacements available and Intertek would suggest four suitably styled BEVs and two 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 107 pool vehicles in the entire Public Works Group fleet, Intertek suggests that in extrapolating the collected data to the entire fleet, a mixed fleet of 57 BEVs, 15 PHEVs, and 35 conventional passenger vans 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.

4.3.1.3 Pool Vehicle Charging Needs. Upon review of these data, Intertek suggests replacement of the Public Works pool fleet with 57 BEVs and 15 PHEVs, while retaining 35 conventional passenger vans.

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 benefit from using public charging infrastructure. Figure 18 displays the availability of public charging for the JBLM area at the time of this writing. Because all travel was within the JBLM base, there may be little benefit in using public charging for the DCA Support Group pool vehicles.

4.3.2 Public Works 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, Public Works support vehicles that were monitored included five conventional pickup trucks and one conventional passenger van.

4.3.2.1 Summary for Public Works Support Vehicles. Appendix D provides the vehicle data sheets for each of the six support vehicles monitored. This section aggregates the data for all support vehicles.

Table 15 summarizes support vehicle travel during the study period. Vehicle use occurred primarily between 0700 and 1500 hours daily. The six support vehicles traveled 5,244 miles, logged 300 hours, and idled for 62 hours during the study period.

Table 15. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	25.6/598.5	7.6/608.8	3.4/236.9	5,244
Travel Time (Minutes)	88.1/585	26.2/628	11.6/215	18,053
Idle Time (Minutes)	18.2/NA	5.4/NA	2.4/NA	3,722

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 23 shows the travel summary for the support vehicles monitored.

The average travel distance per day when driven for support vehicles was 25.6 miles. On 96% of these vehicle days, the daily travel was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 4% percent of support vehicle daily travel was greater than 70 miles. Furthermore, 88% of vehicle travel days were less than the 40 miles considered to be within the CD mode range of a PHEV. Figure 24 shows the outings for all support vehicles combined.

Appendix D provides the details of each of the support vehicle's daily travel. The extended outage of Vehicle G43-1892H dominated the highest distance with a single outing of 608 miles and also accounts

for this highest daily travel. All other outings remained below the 70-mile range on all vehicle days and outings.

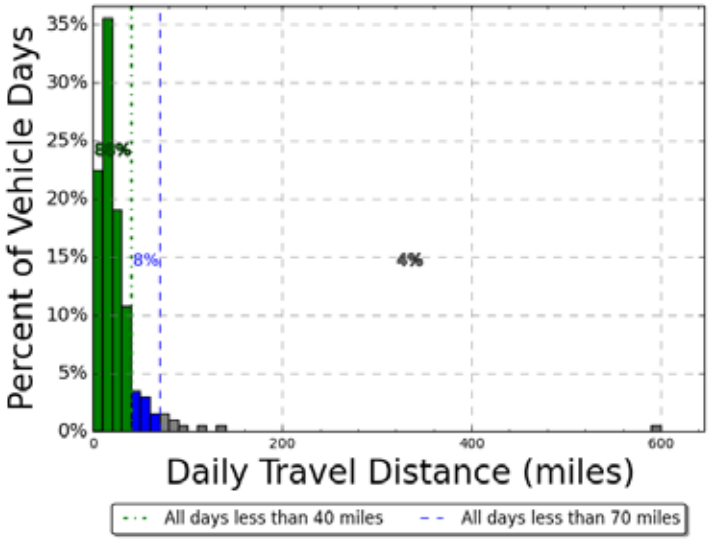


Figure 23. Support vehicle daily travel miles and usage time (all vehicles).

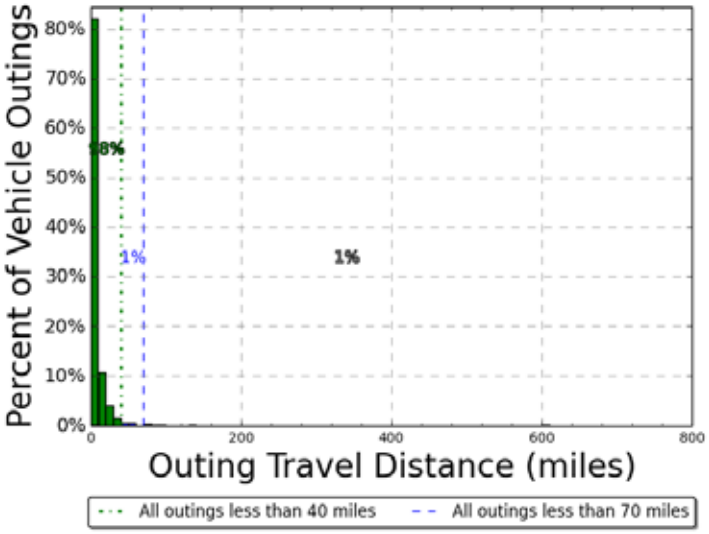


Figure 24. Support vehicle combined outings.

The average travel outing when driven for support vehicles was 7.6 miles. On 99% 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.

4.3.2.2 Public Works 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 GHG.

The fleet of pool vehicles in this study included five pickup trucks and one passenger van. While no PEV is currently available to replace the passenger van, other vehicles in the pool fleet that were

monitored have replacements available. Intertek would suggest four suitably styled BEVs and one PHEV 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 117 pool vehicles in the entire Public Works Group support fleet, Intertek suggests that in extrapolating the collected data to the entire fleet, a mixed fleet may of 67 BEVs, 17 PHEVs, 16 conventional heavy-duty trucks, and 17 conventional passenger vans 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.

4.3.2.3 Public Works 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 the 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. JBLM will gain experience in this management as the PEV fleet grows.

4.3.3 Public Works Group Vehicles Mileage

The vehicle's annual miles factor into the calculations for replacement of the vehicle as noted in Section 5 and Appendix H. The actual miles measured during the study were extrapolated to identify the calculated annual miles in the study. JBLM has also provided vehicle information that identified the average monthly miles and vehicle mileage in April 2012.

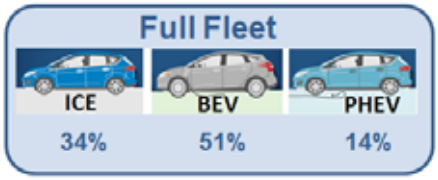
For the entire Public Works Group fleet, the average monthly miles traveled were 335 miles for an average annual travel of 4,024 miles. This is relatively low mileage and, on an average basis, this reflects positively on the use of BEVs in the fleet.

4.3.4 Public Works Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the Public Works 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 three conventional passenger vans, nine pickup trucks, and two minivans. Based on the travel data, Intertek suggests that retaining the passenger vans and replacing the remaining vehicles with three PHEVs and eight BEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix H provides specific recommendations.

The vehicles studied were utilized on 74% of the study days and averaged 1.1 hours of use per day. While daily usage is quite low, the vehicles were used often enough that eliminating one of these vehicles is not recommended.



The Public Works Group's full fleet of vehicles contains 250 vehicles. Intertek suggests retaining the conventional specialty vehicle, 52 conventional passenger vans, and 33 conventional heavy-duty trucks for now, and

suggests a fleet of 128 BEVs and 36 PHEVs would conservatively meet the balance of vehicle travel requirements.

With the potential replacement by PEVs established, Section 5 and Appendix M 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 Public Works Group. Those observations will be addressed in Task 4 of this project.

4.4 Analysis Results – Motor Transport Branch

The Motor Transport Branch fleet contains 1,060 vehicles, not including the low-speed vehicles and non-powered trailer type vehicles. Table 16 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 16. Motor Transport Branch fleet vehicles by type and mission.

Mission	Sedan Compact/ Subcompact	Sedan Midsize/ Large	Mini -van	SUV	Speci alty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	20	36	59	23		72	168	117			495
Support	3	60	29	92		6	18	93			301
Transport	3		10			32	16	70	73		204
Specialty					4						4
Bus										56	56
Total	26	96	98	115	4	110	202	280	73	56	1,060

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.

4.4.1 Motor Transport Branch Pool Vehicles Analysis

Pool vehicles are typically light-duty motor vehicles for use in passenger transportation, with not more than 10 passengers. Pool missions can vary by agency, location, and jurisdiction, and for Motor Transport Branch, the pool vehicles include minivans, sedans, pickup trucks, cargo and passenger vans, and an SUV. Although there currently are no PEVs available to replace the passenger van vehicle, it is assumed that the usage of all these pool vehicles can be of value in considering the remaining pool vehicles in the Motor Transport fleet. The other vehicles 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.

4.4.1.1 Summary for Motor Transport Branch Pool Vehicles. Appendix E provides the vehicle data sheets for each of the 23 pool vehicles monitored. This section aggregates data for all pool vehicles. Table 17 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred at all hours of the day, but primarily between 0700 and 1800 hours. They traveled 23,746 miles, logged 1,158 hours, and idled for 312 hours during the 63-day study period.

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 then include the vehicle daily travel and vehicle outings. Section 2.3 provides the definitions of these terms. Figure 25 shows the travel summary for Motor Transport Branch pool vehicles.

Table 17. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	35.2/571.2	11.9/1,566.9	4.4/202.5	23,746
Travel Time (Minutes)	103.1/777.0	34.8/1,897	12.7/257.0	69,499
Idle Time (Minutes)	27.8/NA	9.4/NA	3.4/NA	18,748

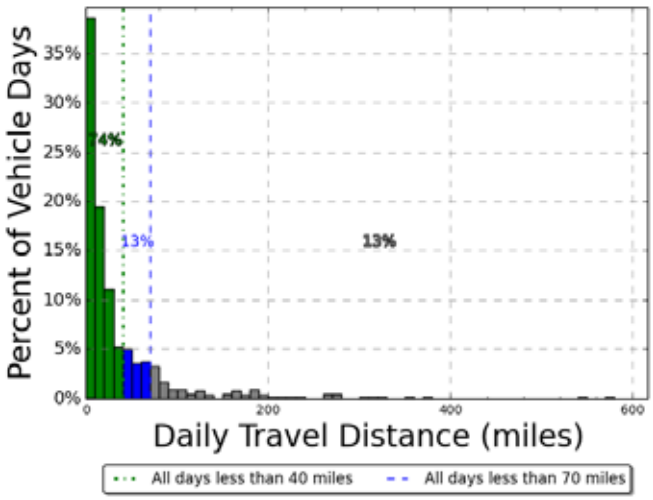


Figure 25. Motor Transport Branch pool vehicle daily travel miles (all vehicles).

The average travel distance per day when driven for pool vehicles was 35.2 miles. On 87% 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 25). Meanwhile, 74% of vehicle travel days were less than the 40 miles considered to be within the CD range of a PHEV (green bars of Figure 25). However, 13% of daily travel exceeds the 70-mile range. Figure 26 displays the summary of outings for all pool vehicles.

The outings graph is dominated by the highest outing recorded of 1,599.9 miles by Passenger Van 113 (Vehicle G43-3881H) during an April excursion to Idaho and Washington. Appendix E shows this vehicle having several outings exceeding 70 miles. The majority of high-distance outings were experienced by Minivan 84, Sedan 110, Pickup 10, and most of the passenger vans in a manner similar to the daily travel maximums noted above. The other pool vehicles experienced 85 miles or less in their maximum outings. Truncating the graph at 150 miles provides a clearer view of the left side of the above graph. Figure 27 provides the truncated graph.

Appendix E provides details for each of the pool vehicle's outings. The average travel outing when driven for pool vehicles was 11.9 miles. Meanwhile, 75% of all outings for all 23 vehicles in the pool mission were less than 10 miles. Furthermore, 95% of all outings were less than the 70 miles considered to be within the BEV safe range. However, 90% of pool vehicle outings were less than 40 miles considered to be within the CD mode range of a PHEV.

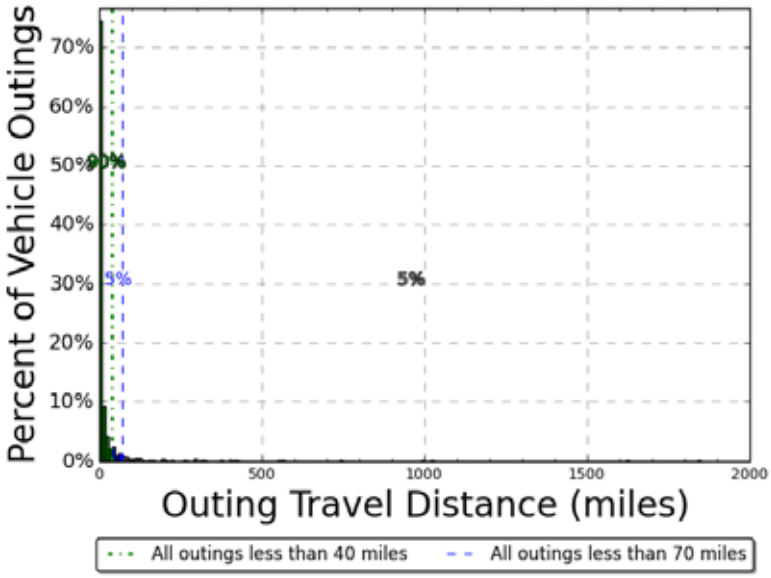


Figure 26. Motor Transport Branch pool vehicle outings (all vehicles).

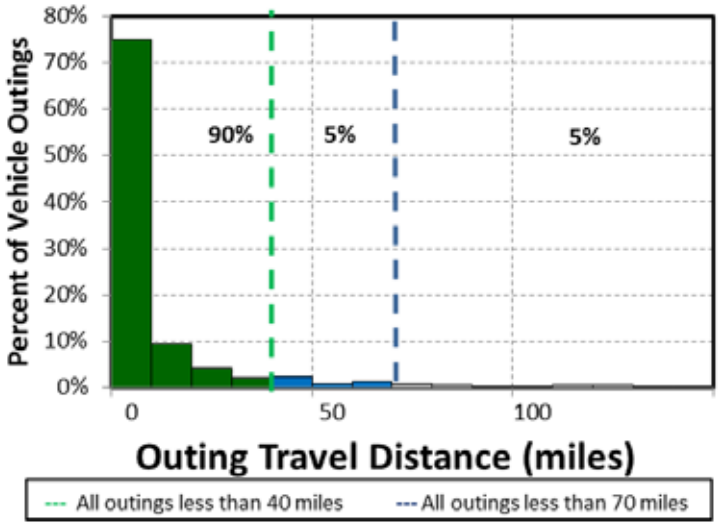


Figure 27. Motor Transport Branch pool vehicle outings (all vehicles) truncated at 150 miles.

4.4.1.2 Motor Transport Branch Pool Vehicle Observations/Summary. The vast majority of daily travel and outings were short and well within the capabilities of BEVs. This was consistent with the optimum goal to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

The fleet of pool vehicles in this study included three minivans, four pickups, five sedans, one SUV, three cargo vans, and seven passenger vans. While no PEVs are currently available to replace the passenger van, other vehicles in the entire pool fleet have replacements available and Intertek would suggest that 10 BEVs and six 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 495 pool vehicles in the entire Motor Transport Branch fleet, Intertek suggests that by extrapolating the collected data to the entire fleet, a mixed fleet of 196 BEVs, 131 PHEVs, and 168 conventional passenger vans 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.

4.4.1.3 Motor Transport Branch Pool Vehicle Charging Needs.

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 from the charging stations 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 benefit from using public charging infrastructure. Figure 18 displays the availability of public charging for the JBLM area at the time of this writing. Significant travel occurs off base by several vehicles that may find benefit in increased range for these vehicles.

4.4.2 Motor Transport Branch Support Vehicles Analysis

Support vehicles provide a specific work function, facilitating the mission of a particular group. The vehicles are generally passenger vehicles 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.

4.4.2.1 Summary for Motor Transport Branch Support Vehicles.

Appendix E provides the vehicle data sheets for each of the 11 support vehicles monitored. This section aggregates the data for all support vehicles.

Table 18 summarizes support vehicle travel during the study period. Vehicle use may occur at any hour, but primarily occurred between 0700 and 1500 hours daily. Support vehicles traveled 19,336 miles, logged 1,886 hours, and idled for 989 hours during the study period.

Table 18. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	46.9/555.0	13.3/1,236	5.3/245.6	19,336
Travel Time (Minutes)	274.8/1,502	78.0/1,440	30.8/512.0	113,202
Idle Time (Minutes)	58.2/NA	16.5/NA	6.5/NA	59,355

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. Figure 28 shows the travel summary for support vehicles by vehicle.

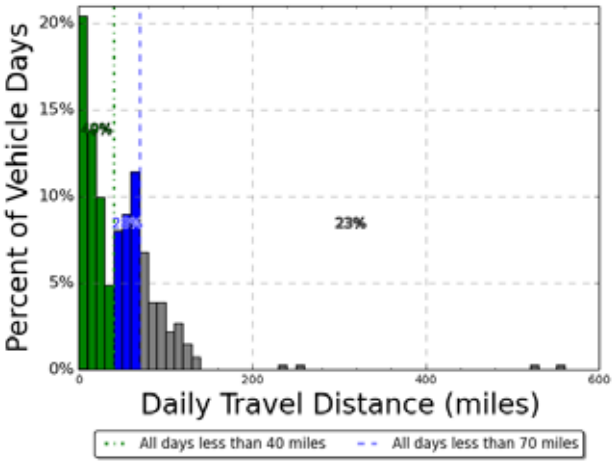


Figure 28. Motor Transport Branch support vehicle daily travel miles (all vehicles).

Sedans 119 and 16 (i.e., Vehicles G10-6379 L and G11-0493 L) and Minivan 112 (i.e., Vehicle G41-1392G) dominate the maximum daily travel with maximums of 1,236 miles, 237 miles, and 253 miles, respectively. All other vehicles in this group had maximum daily travel less than 92 miles. Pickup #15 (i.e., Vehicle G42-0698K) was used most frequently, experiencing travel 92% of the study days.

The average travel distance per day when driven for support vehicles was 46.9 miles. On 77% of these vehicle days, the daily travel was less than the 70 miles considered to be within the BEV safe range. Meanwhile, 23% percent of support vehicle daily travel was greater than 70 miles. Furthermore, 49% of vehicle travel days were less than the 40 miles considered to be within the CD range of a PHEV. Figure 29 shows the outings for all support vehicles combined.

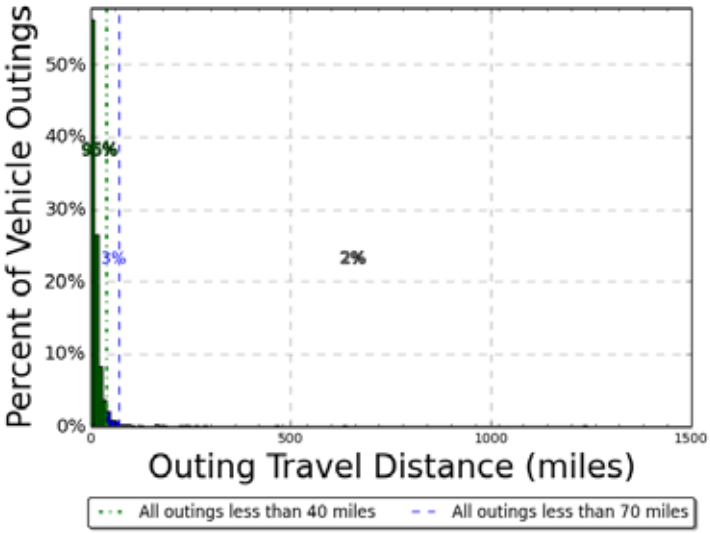


Figure 29. Motor Transport Branch support vehicle combined outings.

Sedans 119 and 16 and Minivan 112 dominate the maximum outings traveled with maximums of 1,236 miles, 237 miles, and 253 miles, respectively. All other vehicles in this group had maximum outings less than 92 miles.

Because the single highest travel of Sedan 119 sets the upper limit of distance in Figure 29, the same figure is duplicated in Figure 36, but it is truncated at 200 miles to more clearly show the lower outing distances.

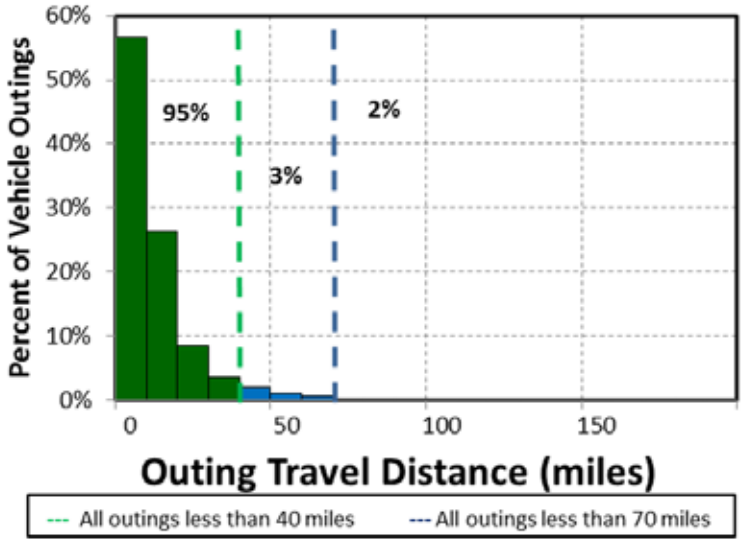


Figure 30. Motor Transport Branch support vehicle outings (all vehicles) truncated to 200 miles.

The average travel outing when driven for support vehicles was 13.3 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, 95% of vehicle travel outings were less than the 40 miles considered to be within the CD range of a PHEV.

4.4.2.2 Motor Transport Branch Support Vehicle Observations/Summary. As with the pool fleet, the vast majority of daily travel and outings for the support fleet 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 GHG.

The fleet of support vehicles in this study included two minivans, three pickups, three sedans, two SUVs, and one cargo van. Intertek would suggest that six 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 301 support vehicles in the entire Motor Transport Branch fleet, Intertek suggests that by extrapolating the collected data to the entire fleet, a mixed fleet of 155 BEVs, 128 PHEVs, and 18 conventional passenger vans 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.

4.4.2.3 Motor Transport Branch Support Vehicle Charging Needs. As noted above, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can be accomplished using AC Level 1 charging. Opportunity charging at intermediate stops obtains the 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. 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. JBLM will gain experience in this management as the PEV fleet grows.

4.4.3 Motor Transport Branch Transport Vehicles Analysis

Transport vehicles are typically light or heavy-duty motor vehicles for use in cargo transportation and typically not for personnel transport. Transport missions can vary by agency, location, and jurisdiction. For the Motor Transport Branch, the transport vehicles include pickup trucks, heavy-duty trucks, passenger vans, and cargo vans. Although there currently are no PEVs available to replace heavy-duty trucks and passenger vans, it is assumed that usage of these transport vehicles can be of value in considering the remaining transport vehicles in the Motor Transport Branch fleet. The other vehicles may be replaced by currently available PEVs.

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

4.4.3.1 Summary for Motor Transport Branch Transport Vehicles. Appendix E provides the vehicle data sheets for each of the transport vehicles monitored. This section aggregates data for all transport vehicles. Table 19 summarizes transport vehicle travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0600 and 1700 hours daily. The vehicles traveled 1,803 miles, logged 148 hours, and idled for 77 hours during the 63-day study period.

Table 19. Transport vehicles travel summary.

Transport Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	53.0/393.8	22.9/393.8	6.5/142.5	1,803
Travel Time (Minutes)	237.9/669.0	102.5/673.0	29.2/218.0	8,090
Idle Time (Minutes)	136.6/NA	58.8/NA	16.8/NA	4,643

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. Figure 31 shows the travel summary for transport vehicles. Four vehicles failed to report sufficient data for analysis, as noted in the vehicle data sheets of Appendix E. This is most likely due to infrequent use because there were few data points logged.

The average travel distance per day when driven for transport vehicles was 53.0 miles. On 72% of 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 31). Meanwhile, 69% of vehicle travel days were less than the 40 miles considered to be within the CD mode range of a PHEV (green bars of Figure 31). Figure 32 shows the outings for all vehicles.

Appendix E provides the details of each of the transport vehicle's outings. Pickup Truck 111 (i.e., Vehicle G63-3881H) was used on the three longest outings and the longest daily travel.

The average travel outing for transport vehicles when driven was 22.9 miles. Meanwhile, 90% percent of transport outings were less than the 40 miles considered to be within the CD mode range of a PHEV.

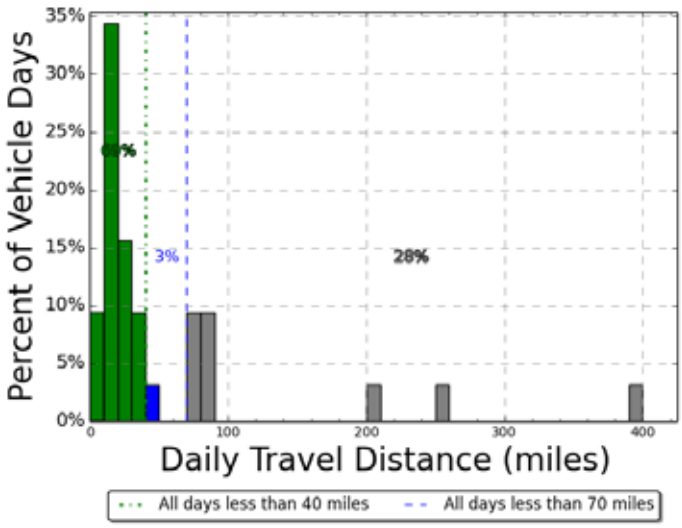


Figure 31. Motor Transport Branch transport vehicle daily travel miles (all vehicles).

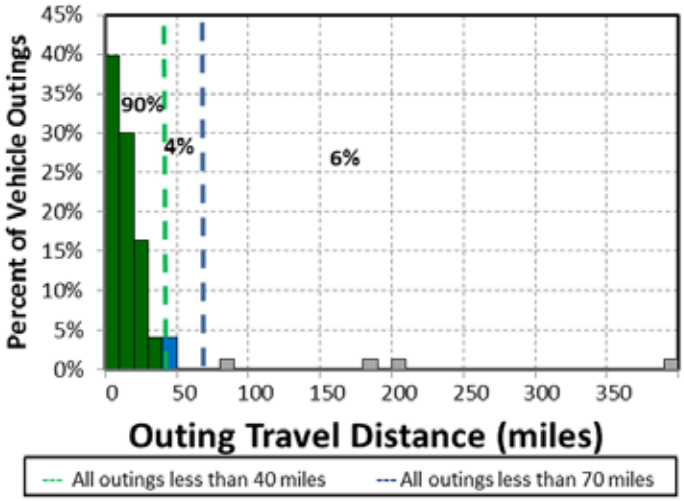


Figure 32. Motor Transport Branch transport vehicle combined outings.

4.4.3.2 Motor Transport Branch Transport Vehicle Observations/Summary. Again, the vast majority of daily travel and outings for the transport fleet 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 GHG.

The fleet of transport vehicles in this study included two pickups, two heavy-duty trucks, and two cargo vans. However, there currently are no PEV replacements for heavy-duty trucks. Intertek would suggest that two suitable styled BEVs and two 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 204 transport vehicles in the entire Motor Transport Branch fleet, Intertek suggests that by extrapolating the collected data to the entire fleet, a mixed fleet of 58 BEVs, 57 PHEVs, 73 conventional heavy-duty trucks, and 16 conventional passenger vans 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.

4.4.3.3 Motor Transport Branch Transport Vehicle Charging Needs. As noted previously, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs uses the AC Level 1 outlet.

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 by charging during visits to the location as part of their normal operation. 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 benefit from using public charging infrastructure. Figure 18 displays the availability of public charging at the time of this writing for the JBLM area. This may be of benefit for local travel, but the availability of public EVSE cannot be assured and is not considered as part of this evaluation.

4.4.4 Motor Transport Branch Vehicles Mileage

The vehicle's annual miles factor into the calculations for replacement of vehicles as noted in Section 5 and Appendix I. The actual miles measured during the study were extrapolated to identify calculated annual miles in the study. JBLM has also provided vehicle information that identified the average monthly miles and vehicle mileage in April 2012.

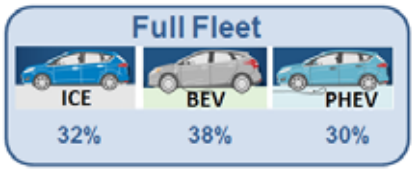
For the entire Motor Transport Branch fleet, the average monthly miles traveled were 527 miles for an average annual travel of 6,328 miles. In general, there is good correlation between the JBLM-provided averages and the study's calculated annual mileage. The JBLM-provided mileage information were used in the calculations when available, except for Logger 15, where the study information appears more reasonable. Overall, this annual mileage is relatively low and reflects positively on the use of BEVs in the fleet.

4.4.5 Motor Transport Branch Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the Motor Transport Branch. 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 eight sedans, five minivans, three SUVs, six cargo vans, seven passenger vans, nine pickup trucks, and two heavy-duty trucks (all conventional ICE based). Based on the travel data, Intertek suggests that retaining the seven passenger vans and two heavy-duty trucks and replacing the remaining vehicles with 13 PHEVs and 18 BEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix I provides specific recommendations.

The vehicles studied were utilized on 68% of the study days and averaged 2.3 hours of use per day. Daily usage was quite low, although most vehicles show frequent use.



The Motor Transport Branch full fleet of vehicles contains 1,060 vehicles. Intertek suggests that retaining the four conventional specialty vehicles, 202 conventional passenger vans, 56 conventional buses, and 73 conventional

heavy-duty trucks for now and a fleet of 409 BEVs and 316 PHEVs would conservatively meet the vehicle travel requirements.

With the potential replacement by PEVs established, Section 5 and Appendix M 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 Public Works Group. Those observations will be addressed in Task 4 of this project.

4.5 Balance of Joint Base Lewis McChord Fleet

The balance of the JBLM fleet consists of vehicles assigned to several agencies. Table 20 provides the balance of vehicles at JBLM using information provided by JBLM and sorted by vehicle type.

Table 20. JBLM balance of fleet vehicles.

	Sedan Compact/ Subcompact	Sedan Midsize/ Large	Mini -van	SUV	Specialty	Cargo Van	Pass. Van	Pickup or Light-Duty Truck	Middle-Duty or Heavy-Duty Truck	Bus	Total
Total	12	18	25	44	1	10	25	51	3	1	190

PEV replacement vehicles are available for all the above vehicle types, with the exception of the heavy-duty trucks, some specialty vehicles, and passenger vans. Further analysis would be required to identify missions and to provide specific observations. However, PEV are currently available to potentially replace all sedans, minivans, SUVs, cargo vans, and pickup trucks.

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 JBLM. The JBLM report provides the source of fuel consumption estimates for the study vehicles.

Several PEV types are available for potential replacement in the JBLM fleets as shown in Section 3. For this analysis, Table 21 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 21. PEV substitutions for current vehicles.

Vehicle Class	Current Vehicle Example	Replacement PHEV	Replacement BEV
Sedan – Midsize/Large	 Chevrolet Malibu	 Ford Fusion Energi 370 Wh/mi	 Nissan Leaf 300 Wh/mi
Sedan – Compact/Subcompact	 Dodge Avenger	 Chevrolet Volt 350 Wh/mi	 Ford Focus Electric 310 Wh/mi
SUV and Minivan	 Chevrolet Tahoe	 Mitsubishi Outlander PHEV 440 Wh/mi	 Toyota RAV4 EV 440 Wh/mi
Pickup Truck	 Dodge Dakota	 Via Motors VTRUX 475 Wh/mi	 Nissan eNV200 400 Wh/mi
Pickup Truck (alternate)	 Chevrolet C1500	 Mitsubishi Outlander PHEV 440 Wh/mi	 Toyota RAV4 EV 440 Wh/mi
Cargo Van	 Ford E350	 Via VTRUX Van 475 Wh/mi	 Nissan eNV200 400 Wh/mi

In order to perform the analysis, EPA fuel economy ratings are used.[19] The ratings for each vehicle are recorded in the vehicle data sheets of Appendices B through E. 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 JBLM reported miles. JBLM reported miles are used as records over a greater period. The JBLM reported miles are extrapolated to a full 365-day year. Miles in CD mode are the extrapolated miles times percent of daily travel less than 40 miles for the PHEV replacement and full extrapolated miles for the BEV replacement.
3. The energy consumption for the Mitsubishi Outlander is the same as the RAV4 and the energy consumption for the Via Motors vehicles and Nissan eNV200 are estimated because the EPA has not yet created ratings for these vehicles.
4. Some of the existing pickup trucks may be replaced by SUV-type vehicles as shown above.
5. The conventional heavy-duty trucks and passenger vans are not replaced.

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 JBLM 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 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.[20] The United States' average for GHG emissions for the production of electricity is 1.53 lb-CO_2e/kWh.[21]

JBLM reported receiving base power from Tacoma Power. Tacoma Power reports a mix of its own generation and power provided by other sources in its 2013 Integrated Resource Plan.[22] EPA reports GHG emissions from the production of electricity. The annual report is available in the Emissions and Generation Resource Integrated Database. The most recent publication is for 2010.[23] Using the generation mix reported by Tacoma Power in 2013 and the Emissions and Generation Resource Integrated Database plant reports, emissions for 2010 for the production of electricity were 0.1743 lb-CO_2e/kWh. This 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

[19] http://www.fueleconomy.gov/feg/Find.do?action=sbs&id=33558 [accessed February 2, 2014].

[20] http://www.theevproject.com/cms-assets/documents/106077-891082.ghg.pdf for the methodology for gasoline [accessed 19 July 2013].

[21] ibid

[22] http://www.tacomapower.org/file_viewer.aspx?id=27545 [accessed 30 June 2014].

[23] http://www.epa.gov/cleanenergy/energy-resources/egrid/ [accessed 8 June 2014].

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, EPA provides links to current fuel prices. At this report, fuel costs for regular gasoline are $3.679/gallon for the United States and $4.009/gallon for the Tacoma, Washington area.[24] Electrical cost assumptions are 0.13 $/kWh for the United States and 0.02783 $/kWh for industrial customers on Schedule CP in the Tacoma Power 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 J through M 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 Tacoma area figures are reported here for clarity.

5.2 Monitored Vehicles Fuel Cost Reduction

Tables 23, 24, and 25 provide the summary of potential fuel cost reduction with the replacement of monitored vehicles in the mission identified with PEVs as noted in Appendices J through M. Note that no replacements are suggested for passenger vans and heavy-duty trucks. 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 Tacoma Power 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.

During the study, both the Public Works Group and the Motor Transport Branch identified the vehicle with Logger 84 as part of their fleet. The appendices include this vehicle in both fleets, but omit this vehicle from the Motor Transport Branch fleet for the totals shown in these tables. Table 25 provides a total of all vehicles monitored.

Table 22. Monitored pool mission PEV replacement fuel cost reduction.

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %
6th MP Group	3	97%	17,065	859	$ 3,442	$ 182	$ 3,259	95%
DCA Support Gp	2	100%	3,276	234	$ 937	$ 39	$ 898	96%
Public Works	6	96%	17,638	1,027	$ 4,116	$ 206	$ 3,910	95%
Motor Transport	15	88%	66,838	3,806	$ 15,260	$ 738	$ 14,522	95%
Total	26		104,817	5,926	$ 23,755	$ 1,165	$ 22,589	95%

Table 23. Monitored support mission PEV replacement fuel cost reduction (Washington State).

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %
6th MP Group	NA	NA	NA	NA	NA	NA	NA	NA
DCA Support Gp	1	98%	2,940	128	$ 512	$ 39	$ 474	93%
Public Works	5	88%	18,574	1,152	$ 4,617	$ 226	$ 4,392	95%
Motor Transport	11	88%	64,364	3,653	14,645	688	13,956	95%
Total	17		85,877	4,933	$ 19,774	$ 953	$ 18,822	95%

[24] http://www.tacomagasprices.com/ [accessed June 30, 2014].

[25] https://www.mytpu.org/file_viewer.aspx?id=6168 [Accessed June 30, 2014].

Table 24. Monitored transport mission PEV replacement fuel cost reduction (Washington State).

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %
6th MP Group	NA	NA	NA	NA	NA	NA	NA	NA
DCA Support Gp	NA	NA	NA	NA	NA	NA	NA	NA
Public Works	NA	NA	NA	NA	NA	NA	NA	NA
Motor Transport	4	82%	13,256	987	$ 3,955	$ 164	$ 3,791	96%
Total	4		13,256	987	$ 3,955	$ 164	$ 3,791	96%

Table 25. Monitored vehicle PEV replacement fuel cost reduction (Washington State) all vehicles.

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %
6th MP Group	3	97%	17,065	859	$ 3,442	$ 182	$ 3,259	95%
DCA Support Gp	3	99%	6,216	362	$ 1,449	$ 78	$ 1,372	95%
Public Works	11	92%	36,212	2,178	$ 8,733	$ 432	$ 8,302	95%
Motor Transport	30	86%	144,457	8,446	$ 33,860	$ 1,590	$ 32,270	95%
Total	47		203,950	11,845	$ 47,484	$ 2,282	$ 45,202	95%
Average/vehicle			4,339	252	$ 1,010	$ 49	$ 962	95%

In summary, if all possible monitored vehicles were replaced with PEVs, nearly 12,000 gallons of gasoline would be avoided each year. This would save over $47,000 in gasoline fuel costs, while only using about $2,300 of electricity. As shown in Table 31, there is an average of over $1,000 savings in fuel cost per vehicle annually when replaced by a PEV. Appendices J through M show vehicles with higher annual miles having potential fuel savings of over $4,000 annually.

5.3 Monitored Vehicles Greenhouse Gas Emissions Reduction

Tables 27, 28, and 29 provide the summary of potential GHG emission reduction with the replacement of monitored vehicles with PEVs in the mission identified as noted in Appendices J through M. Again, no replacements are suggested for passenger vans and heavy-duty trucks. Only the local Washington State GHG reductions are considered in these tables. However, as mentioned previously, because JBLM receives it power from Tacoma Power and Tacoma Power 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 29 provides a total of all vehicles monitored.

Table 26. Monitored pool mission PEV replacement GHG emission reduction.

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
6th MP Group	3	97%	11,674	17,253	1,140	16,113	93%
DCA Support Gp	2	100%	2,368	4,703	247	4,456	95%
Public Works	6	96%	15,168	20,637	1,290	19,347	94%
Motor Transport	16	88%	37,077	76,509	4,620	71,889	94%
Total	27		66,286	119,102	7,297	111,805	94%

Table 27. Monitored support mission PEV replacement GHG emission reduction.

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
6th MP Group	NA	NA	NA	NA	NA	NA	NA
DCA Support Gp	1	100%	2,940	2,569	243	2,326	91%
Public Works	5	96%	18,574	23,150	1,414	21,736	94%
Motor Transport	11	88%	64,364	73,424	4,312	69,112	94%
Total	17		85,877	99,142	5,969	93,174	94%

Table 28. Monitored transport mission PEV replacement GHG emission reduction.

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
6th MP Group	NA	NA	NA	NA	NA	NA	NA
DCA Support Gp	NA	NA	NA	NA	NA	NA	NA
Public Works	NA	NA	NA	NA	NA	NA	NA
Motor Transport	4	88%	13,256	19,830	1,026	18,804	95%
Total	4		13,256	19,830	1,026	18,804	95%

Table 29. Monitored vehicle PEV replacement GHG emission reduction (Washington State) all vehicles.

Fleet Group	Number of Vehicles	Avg % of Travel CD Mode	Annual Miles CD Mode	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
6th MP Group	3	97%	11,674	17,253	1,140	16,113	93%
DCA Support Gp	3	99%	5,308	7,272	490	6,782	93%
Public Works	11	92%	33,742	43,787	2,704	41,083	94%
Motor Transport	30	86%	114,696	169,762	9,958	159,805	94%
Total	47		165,419	238,074	14,292	223,783	94%
Average/vehicle			3,520	5,065	304	4,761	94%

In summary, if all possible monitored conventional vehicles are replaced with PEVs, GHG emissions are reduced nearly 224,000 lb-CO_2e per year. On average, each vehicle replaced results in over 4,750 lb-CO_2e reduction in GHG emissions per year. Appendices F through I show vehicles with higher annual miles having potential GHG emission reductions of over 22,000 lb-CO_2e annually.

The appendices also identify the potential if all appropriate vehicles in these fleets are replaced by PEVs using the averages identified for each. Table 30 shows these results.

Table 30. Projected fuel costs and GHG reduction potential for all vehicles in monitored fleets.

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
4,333,622	$1,065,302	$ 49,957	$1,015,345	95%	977,613	233,359	744,251	76%

For the vehicles represented by these four groups, the annual potential fuel savings are over $1million and the potential annual GHG reduction is over 370 tons-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 analysis of Section 5 shows average vehicle travels as less than 3,600 miles per year. This is an average of 300 miles per month or 75 miles per week. This may reflect the opportunity to increase the percentage of BEVs over that analyzed in Section 5.

Intertek suggests that JBLM may wish to move forward in the near future with replacement of pool, support, and transport 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

6th MP Group Vehicle Data Sheets

Table B-1. JBLM 6th MP Group vehicle index.

Vehicle Index						
Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
82	G61-0546L	GMC	Terrain	2011	SUV	Pool
86	G61-0689A	Ford	Ranger	2004	Pickup Truck	Pool
103	G41-5433B	Dodge	Gr Caravan	2006	Minivan	Pool

Vehicle G61-0546L

www.edmunds.com

Make/Model/Year	GMC/Terrain/2011
EPA Class Size	SUV
Mission	Pool
Contact	C Simmons/6th MP Group
Parking Location	Building 4291
Fleet Vehicle ID	G61-0546L
Fuel Type	Gas/Eth
EPA Label/MPG (City/Hwy/Combined)	16/22/19 12/17/14
EPA GHG Emissions (Grams CO_2/Mi)	468/450
Study Logger ID	Logger 82
Total Vehicle Days/Total Study Days	33/63

Vehicle G61-0546L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	25.7/167	15.4/156.1	8.7/83	849
Travel Time (Minutes)	72/223	43.2/253	24.3/181	2,378
Idle Time (Minutes)	15.2/NA	9.1/NA	5.1/NA	503

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	97	95.1	Less than 1	59
10 to 20	0	0	1 to 4	9
20 to 40	5	4.9	4 to 8	2
40 to 60	0	0	Greater than 8	32

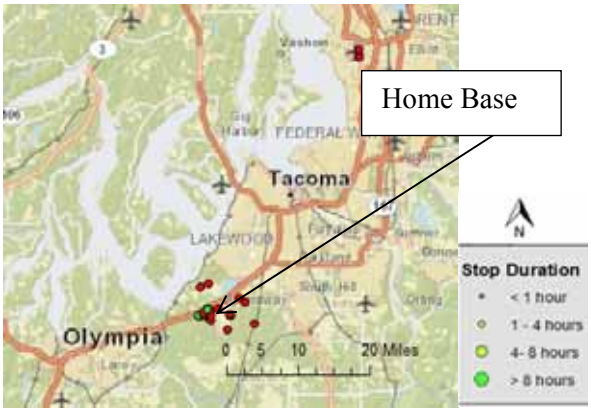


Figure B-1. Vehicle G61-0546L stops.

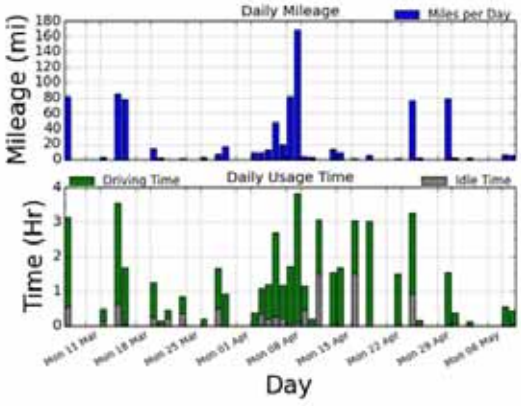


Figure B-2. Vehicle G61-0546L history.

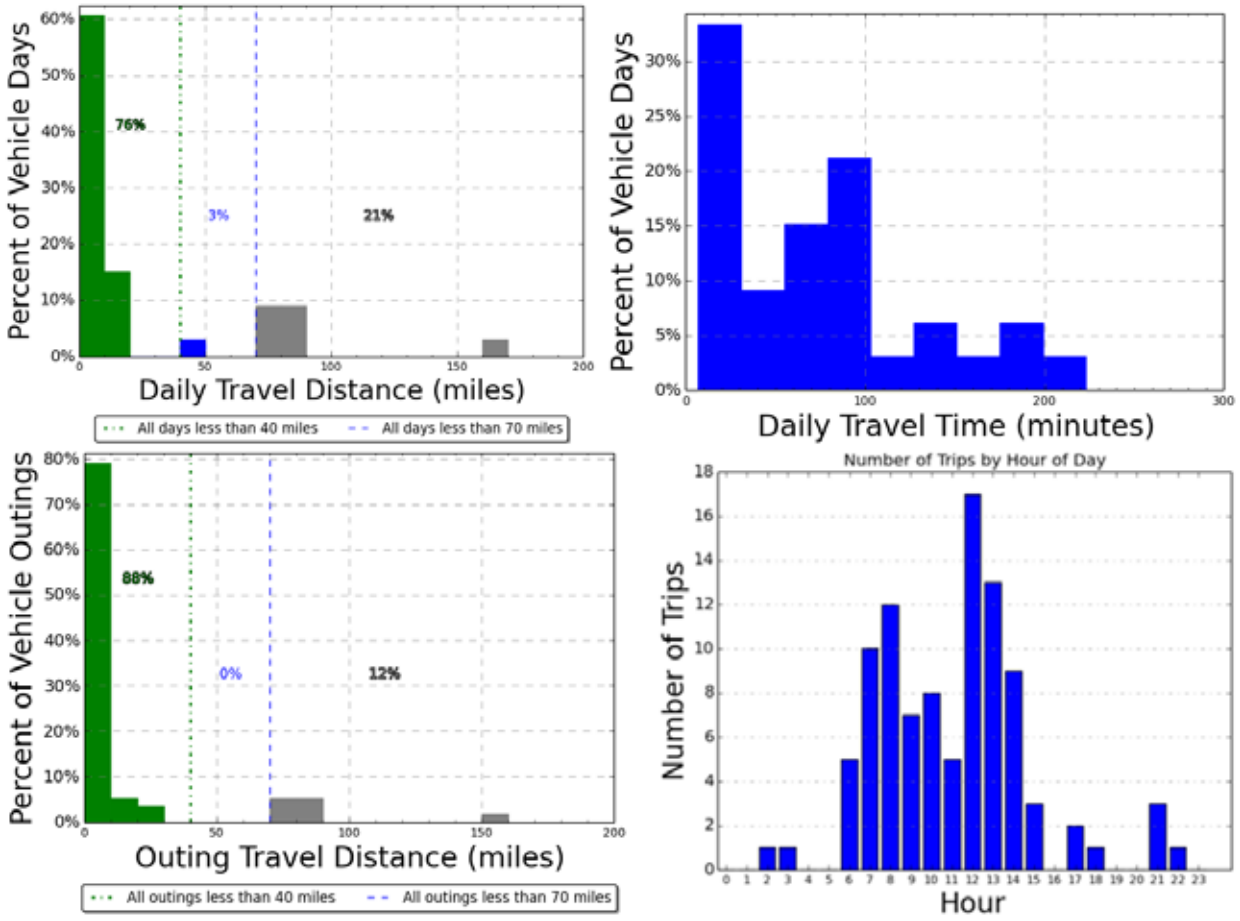


Figure B-3. Vehicle G61-0546L travel graphs.

Vehicle G61-0546L Observations

Logger 82 collected data on this vehicle for 33 days of the 63-day study period. Data validation occurred on 99.5% of the vehicle data. Base information indicated this vehicle averages 516 miles per month. The odometer reading in January 2012 was 5,162.The vehicle is a pool vehicle typically parked in the pool parking area on Idaho Ave near Building 4291.

The responses to the survey as part of this study show the expected retention of this vehicle is access to this vehicle and the number of persons carried varies. The vehicle frequently travels off base. Although ethanol is available as a fuel, it is never used.

Stop data for this vehicle show that for all but three of the 36 recorded stops of greater than 2-hours duration were at the pool parking area.

The longest single outing of the vehicle was 156 miles of just more than 4.2 hours. The longest single trip was of 83 miles. However, this long trip was not the norm for this vehicle, with 88% of the outings less than 70 miles and 79% of the daily travel was less than 70 miles. These data suggest that a BEV could provide most of the travel, but a PHEV would be required for the longer trips. The BEV or PHEV that could replace this vehicle should be able to support other requirements that may exist for this pool vehicle.

Vehicle G61-0689A

www.edmunds.com

Make/Model/Year	Ford/Ranger /2004
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	C Simmons/6th MP Group
Parking Location	Building 4291
Fleet Vehicle ID	G61-0689A
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	21/27/23
EPA GHG Emissions (Grams CO_2/Mi)	386
Study Logger ID	Logger 86
Total Vehicle Days/Total Study Days	24/63

Vehicle G61-0689A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	19.1/51.8	9.2/41.8	3.11/26	458
Travel Time (Minutes)	70/203	33.8/197	11.5/119	1,688
Idle Time (Minutes)	13.8/NA	6.6/NA	2.2/NA	330

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	187	99.5	Less than 1	131
10 to 20	1	0.5	1 to 4	22
20 to 40	0	0	4 to 8	0
40 to 60	0	0	Greater than 8	35

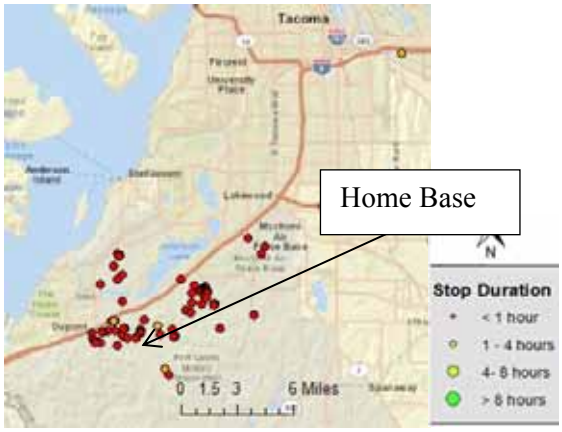


Figure B-4. Vehicle G61-0689A stops.

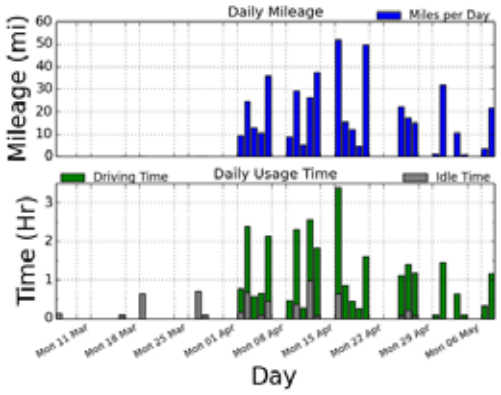


Figure B-5. Vehicle G61-0689A history.

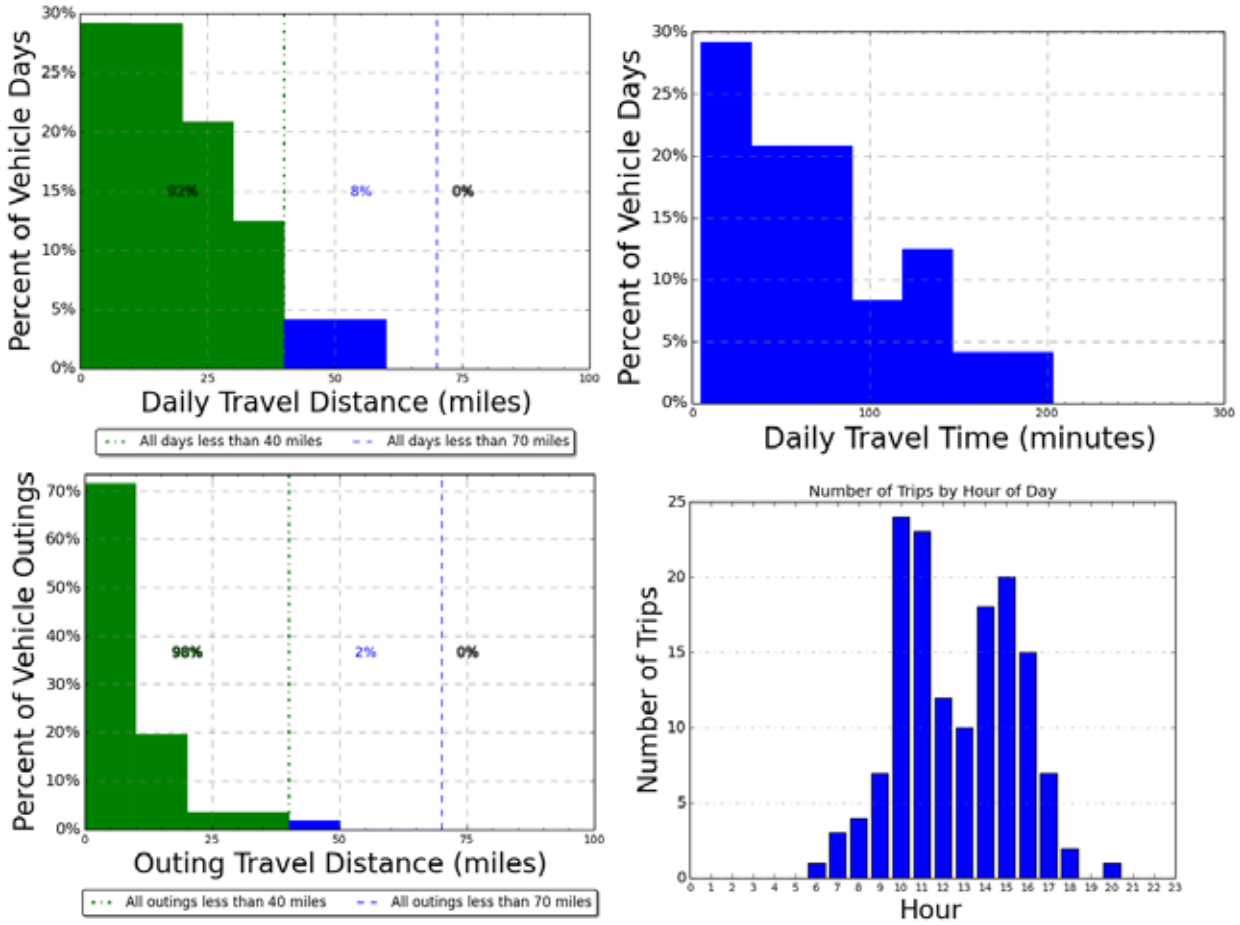


Figure B-4. Vehicle G61-0689A travel graphs.

Vehicle G61-0689A Observations

Logger 86 collected data on this vehicle for 24 days of the 63-day study period. Data validation occurred on 99.7% of the vehicle data. Base survey information indicated this vehicle averages 198 miles per month. The odometer reading in January 2012 was 22,243. The vehicle is a pool vehicle typically parked in the pool parking area on Idaho Ave near Building 4291.

The responses to the survey as part of this study showed the expected retention of this vehicle is unknown. This vehicle typically operates 11 to 40 miles per day. There are 6 to 10 persons who typically have access to this vehicle and the number of persons carried varies. Specific cargo or material carry requirements were not identified.

Stop data for this vehicle show that for all but two of the 44 recorded stops of greater than 2-hours duration were at the pool parking area.

The longest single outing of the vehicle was 41.8 miles of just more than 3 hours. The longest single trip was of 26 miles and the longest daily travel was 51.8. These data suggest it is within the advertised range of a typical BEV, which is approximately 70 miles. Intermediate charging stations could support longer trips without causing a change in the mission. Sufficient daily time is available for intermediate charging. A BEV could replace this vehicle and be able to support the mission.

Vehicle G41-5433B

www.edmunds.com

Make/Model/Year	Dodge/Grand Caravan/2006
EPA Class Size	Minivan
Mission	Pool
Contact	C Simmons/6th MP Group
Parking Location	Building 4291
Fleet Vehicle ID	G41-5433B
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)	17/24/20 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	444/484
Study Logger ID	Logger 103
Total Vehicle Days/Total Study Days	36/63

Vehicle G41-5433B Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.7/224	9.7/134.5	3.5/77.5	745
Travel Time (Minutes)	67/361	31.3/443	11.4/105	2,411
Idle Time (Minutes)	12/NA	5.7/NA	2.1/NA	436

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	211	96.8	Less than 1	145
10 to 20	0	0	1 to 4	34
20 to 40	7	3.2	4 to 8	5
40 to 60	0	0	Greater than 8	34

Figure B-7. Vehicle G41-5433B stops.

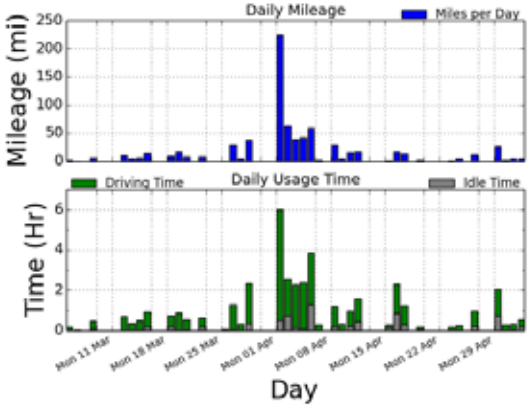


Figure B-8. Vehicle G41-5433B history.

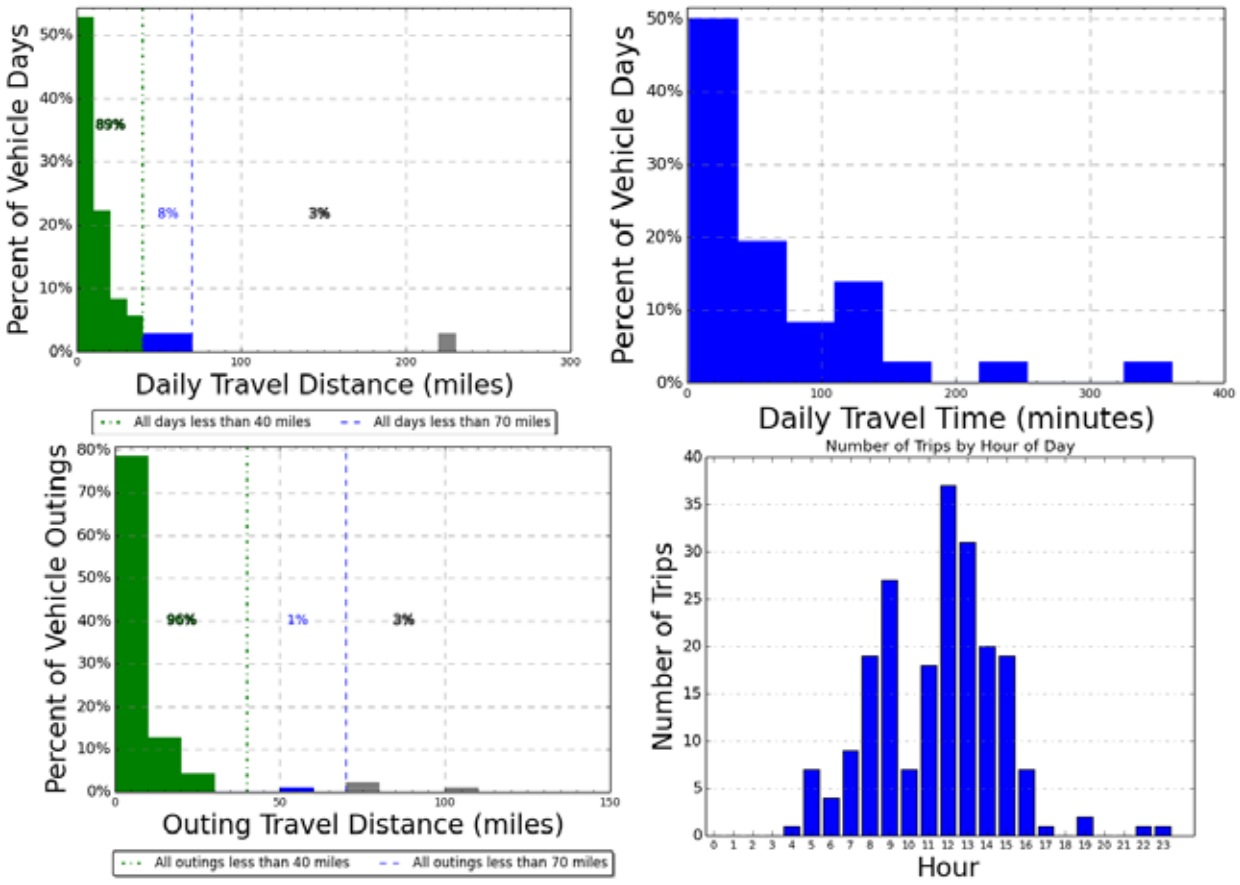


Figure B-5. Vehicle G41-5433B travel graphs.

Vehicle G41-5433B Observations

Logger 103 collected data on this vehicle for 36 days of the 63-day study period. Data validation occurred on 100% of the vehicle data. Base survey information indicated this vehicle averages 639 miles per month. The odometer reading in January 2012 was 44,804. The vehicle is a pool vehicle typically parked in the pool parking area on Idaho Ave near Building 4291.

The responses to the survey as part of this study showed the expected retention of this vehicle is unknown. This vehicle typically operates 11 to 40 miles per day. There are 6 to 10 persons who typically have access to this vehicle and the number of persons carried varies. The vehicle frequently travels off base. Although ethanol is available as a fuel, it is never used.

Stop data for this vehicle show that 80% of the 56 recorded stops of greater than 2-hours duration were at the pool parking area. The remaining stops were distributed among seven other locations.

The longest single outing of the vehicle was 135 miles of about 7.5 hours. The longest single trip was 78 miles. However, this long trip is not the norm for this vehicle, with 97% of the outings less than 70 miles and 97% of the daily travel was less than 70 miles. These data suggest that a BEV could provide most of the travel, but a PHEV would be required for the longer trips. The BEV or PHEV could replace this vehicle if it is able to support the other requirements that may exist for this pool vehicle.

Appendix C

DCA Support Group Vehicle Data Sheets

Table C-1. JBLM DCA support vehicle index.

Vehicle Index						
Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
83	G41-74299	Ford	Ranger	2004	Pickup Truck	Support
94	G71-0684A	Chevrolet	C6500 Stake	2005	Pickup Truck HD	Pool
96	G43-1195H	Chevrolet	15 Pas Van	2011	Passenger Van	Support
99	G42-0289G	Chevrolet	G1300	2008	Cargo Van	Pool

Vehicle G41-74299

www.edmunds.com

Make/Model/Year	Ford/Ranger/2004
EPA Class Size	Standard Pickup Truck
Mission	Support
Contact	D. Pettengill/DCA Support
Parking Location	Building 8050
Fleet Vehicle ID	G41-74299
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	21/27/23
EPA GHG Emissions (Grams CO_2/Mi)	386
Study Logger ID	Logger 83
Total Vehicle Days/Total Study Days	44/63

Vehicle G41-74299 Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	18/63.3	11.6/63.3	4.2/28.8	790
Travel Time (Minutes)	50.4/163	32.6/163	11.7/81	2,218
Idle Time (Minutes)	1.7/NA	1.1/NA	0.4/NA	76

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	168	100%	Less than 2	78
10 to 20	0	0%	2 to 4	14
20 to 40	0	0%	4 to 8	32
40 to 60	0	0%	Greater than 8	44

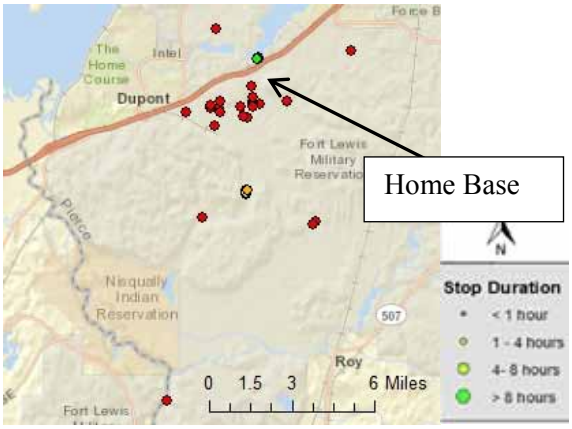


Figure C-6. Vehicle G41-74299 stops.

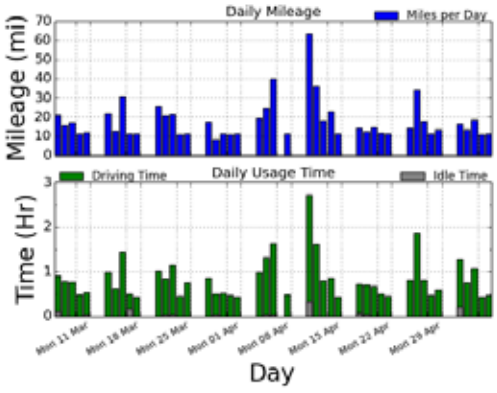


Figure C-7. Vehicle G41-74299 history.

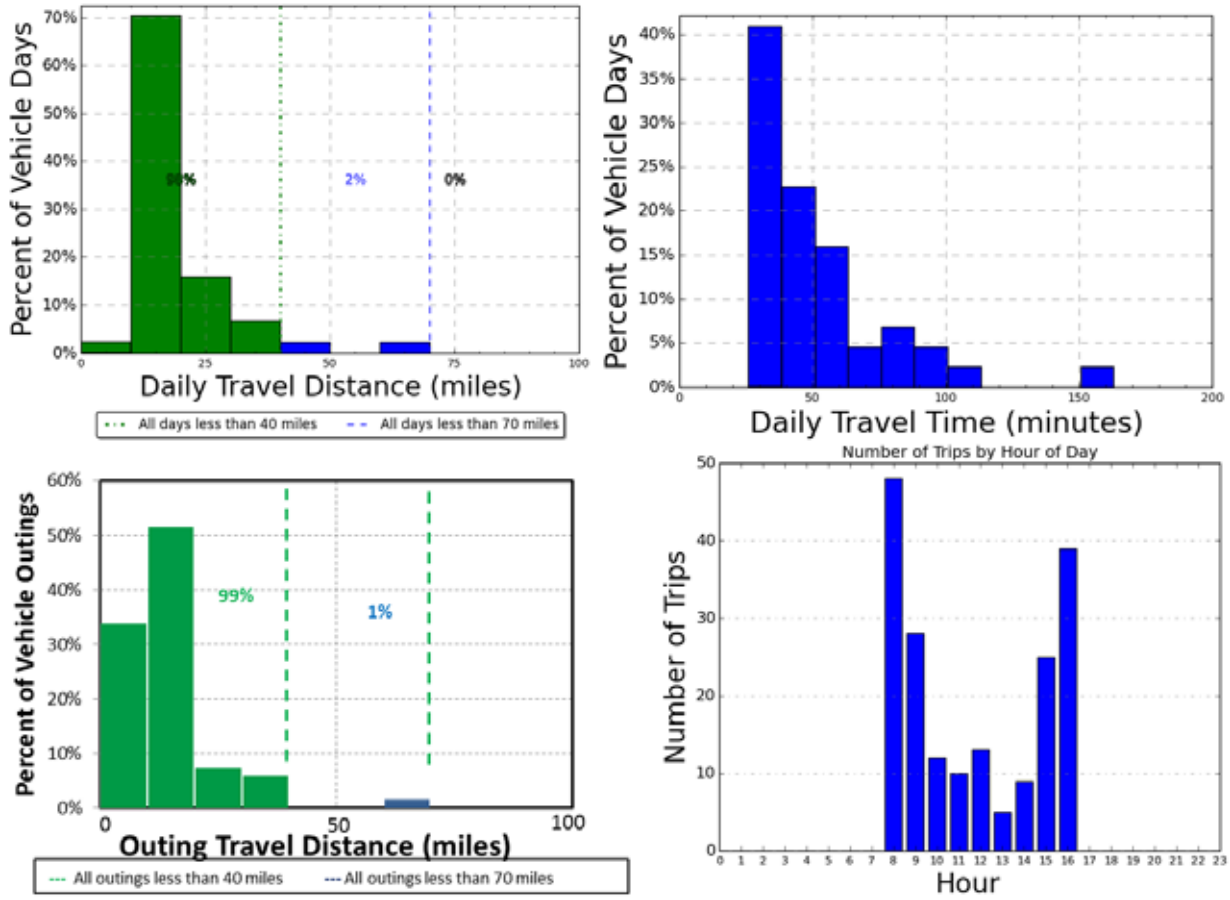


Figure C-8. Vehicle G41-74299 travel graphs.

Vehicle G41-74299Observations

Logger 83 collected data on this vehicle for 44 days of the 63-day study period. Data validation occurred on 98.7% of the vehicle data. Base information indicated this vehicle averages 262 miles per month. The odometer reading in January 2012 was 19,601.The vehicle supports the rifle range and parks in the Northwest Adventure Center Building 8050.

The responses to the survey as part of this study showed the expected retention of this vehicle is 3 to 5 more years. This vehicle typically operated 6 to 10 miles per day. There were 2 to 5 persons who typically had access to this vehicle and it usually carried one person. The vehicle occasionally travelled off base. Expected usage was from 1,000 to 1,500 hours Wednesday through Sunday. The vehicle is assigned to DFMWR Outdoor Recreation, transports ammunition to and from the range, and is considered an administrative support vehicle.

The longest single outing of the vehicle was 63 miles, which consumed the entire day of April 10, but required less than 3 hours of driving. The longest single trip was of 28.8 miles, which also occurred during the same outing. One hundred percent of the outings were less than 70 miles and all of the daily travel was less than the 70 miles that is the typical range of a BEV. These data suggest that a BEV could provide the necessary range for daily travel. The BEV could replace this vehicle if it was able to support the other requirements that may exist for this support vehicle. The BEV appears to be able to carry the materials identified in the survey.

Vehicle G71-0684A

www.youtube.com

Make/Model/Year	Chevrolet/C6500 Stake/2005
EPA Class Size	Stake Truck
Mission	Pool
Contact	D Pettengill/DCA Support
Parking Location	Building 2057
Fleet Vehicle ID	G71-0684A
Fuel Type	Diesel
EPA Label/MPG (City/Hwy/Combined)	Not available
EPA GHG Emissions (Grams CO_2/Mi)	Not available
Study Logger ID	Logger 94
Total Vehicle Days/Total Study Days	25/63

Vehicle G71-0684A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.2/26.6	5.1/26.5	1.8/10.5	206
Travel Time (Minutes)	46/106	28.8/133	9.8/43	1,151
Idle Time (Minutes)	13.7/NA	8.6/NA	2.9/NA	343

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	116	100	Less than 1	86
10 to 20	0	0	1 to 4	3
20 to 40	0	0	4 to 8	3
40 to 60	0	0	Greater than 8	24

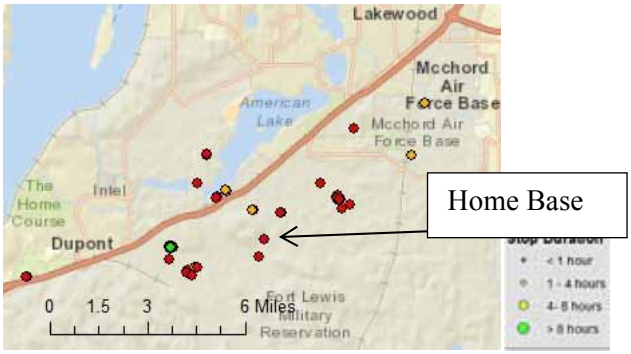


Figure C-4. Vehicle G71-0684A stops.

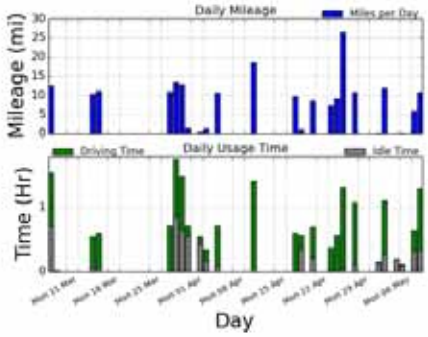


Figure C-5. Vehicle G71-0684A history.

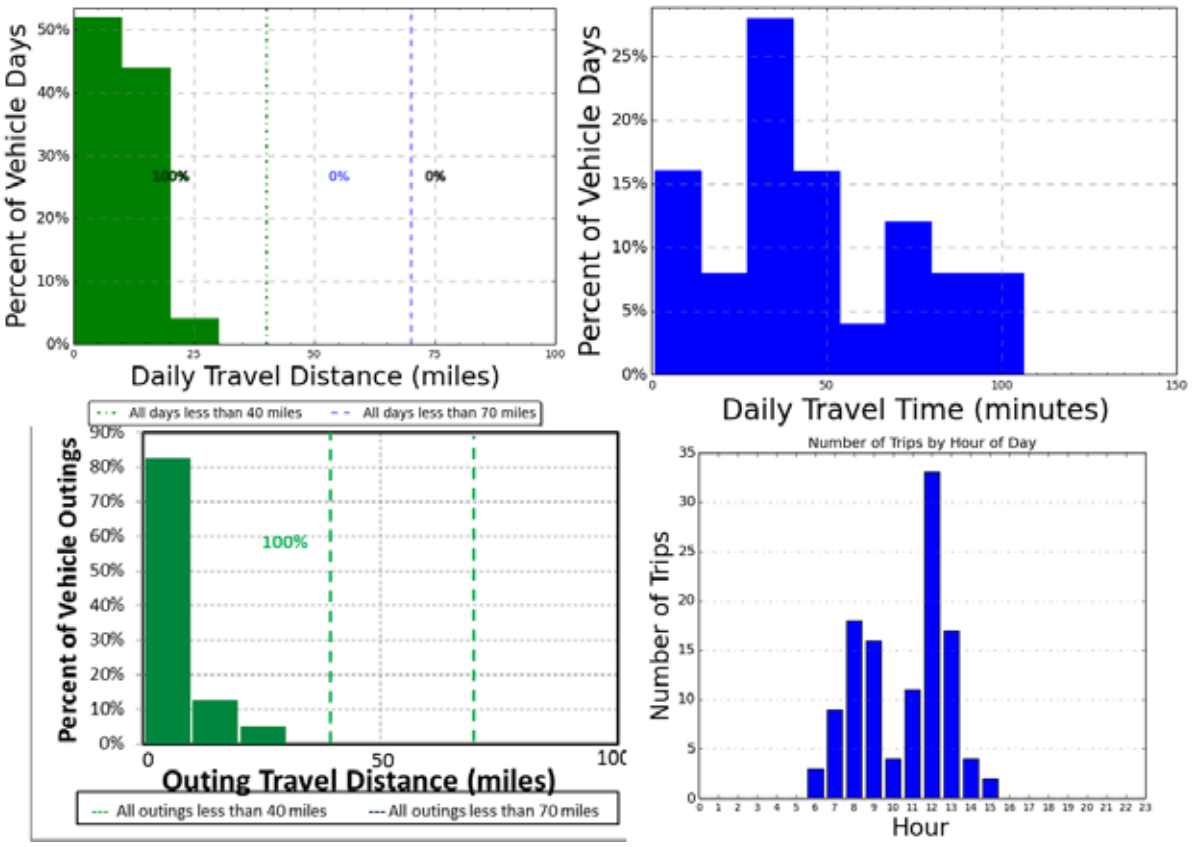


Figure C-9. Vehicle G71-0684A travel graphs.

Vehicle G71-0684A Observations

Logger 94 collected data on this vehicle for 25 days of the 63-day study period. Data validation occurred on 100% of the vehicle data. Base information indicated this vehicle averages 123 miles per month. The odometer reading in January 2012 was 10,640. The vehicle supports the rifle range and parks in the pool parking area near Building 2057.

The responses to the survey as part of this study showed the expected retention of this vehicle is greater than 6 more years. This vehicle typically operated 6 to 10 miles per day. More than 20 persons typically had access to this vehicle and it usually carried one person. The vehicle occasionally travelled off base. The vehicle is assigned to Fleet Mission Support and is considered a pool vehicle. The vehicle typically uses biodiesel fuel and carries a wide range of cargo and equipment.

The longest single outing of the vehicle was 26 miles that consumed just over 2 hours of driving. The longest single trip was 10.5 miles. All of the outings were less than 70 miles and all of the daily travel was less than 70 miles that typically is the range of a BEV. In fact all daily travel and outings are less than 40 miles; the CD portion of a typical PHEV motive power. These data suggest that a BEV could provide the necessary range for daily travel. Unfortunately, this vehicle is a heavy-duty truck and no BEV or PHEV exists that can replace this vehicle at this writing. PHEV demonstration vehicles may exist and JBLM may consider this replacement when commercially available.

Vehicle G43-1195H

www.edmunds.com

Make/Model/Year	Chevrolet/15 Pas Van/2011
EPA Class Size*	Passenger Van
Mission	Support
Contact	D Pettengill/DCA Support
Parking Location	Building 8050
Fleet Vehicle ID	G43-1195H
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)	11/16/12 8/12/9
EPA GHG Emissions (Grams CO_2/Mi)	741/699
Study Logger ID	Logger 96
Total Vehicle Days/Total Study Days	32/63

Vehicle G43-1195H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	121.5/354.1	45.7/354.1	20.7/129.4	3,887
Travel Time (Minutes)	187/544	70.5/544	31.9/222	5,990
Idle Time (Minutes)	24.9/NA	9.4/NA	4.2/NA	796

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	144	66.1	Less than 2	166
10 to 20	6	2.8	2 to 4	10
20 to 40	12	5.5	4 to 8	7
40 to 60	22	25.6	Greater than 8	35

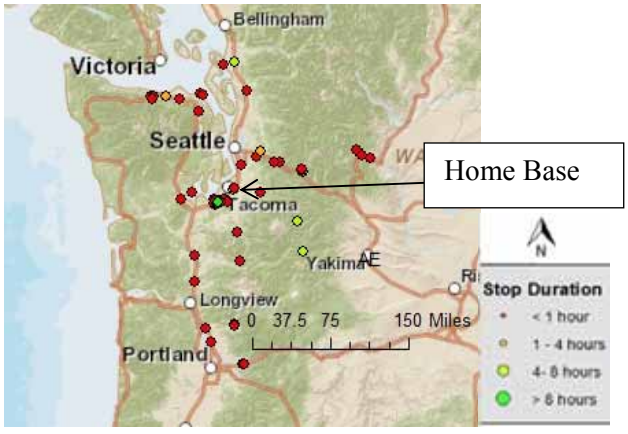


Figure C-7. Vehicle G43-1195H stops.

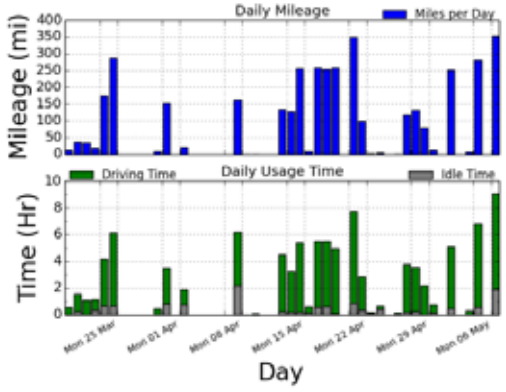


Figure C-8. Vehicle G43-1195H history.

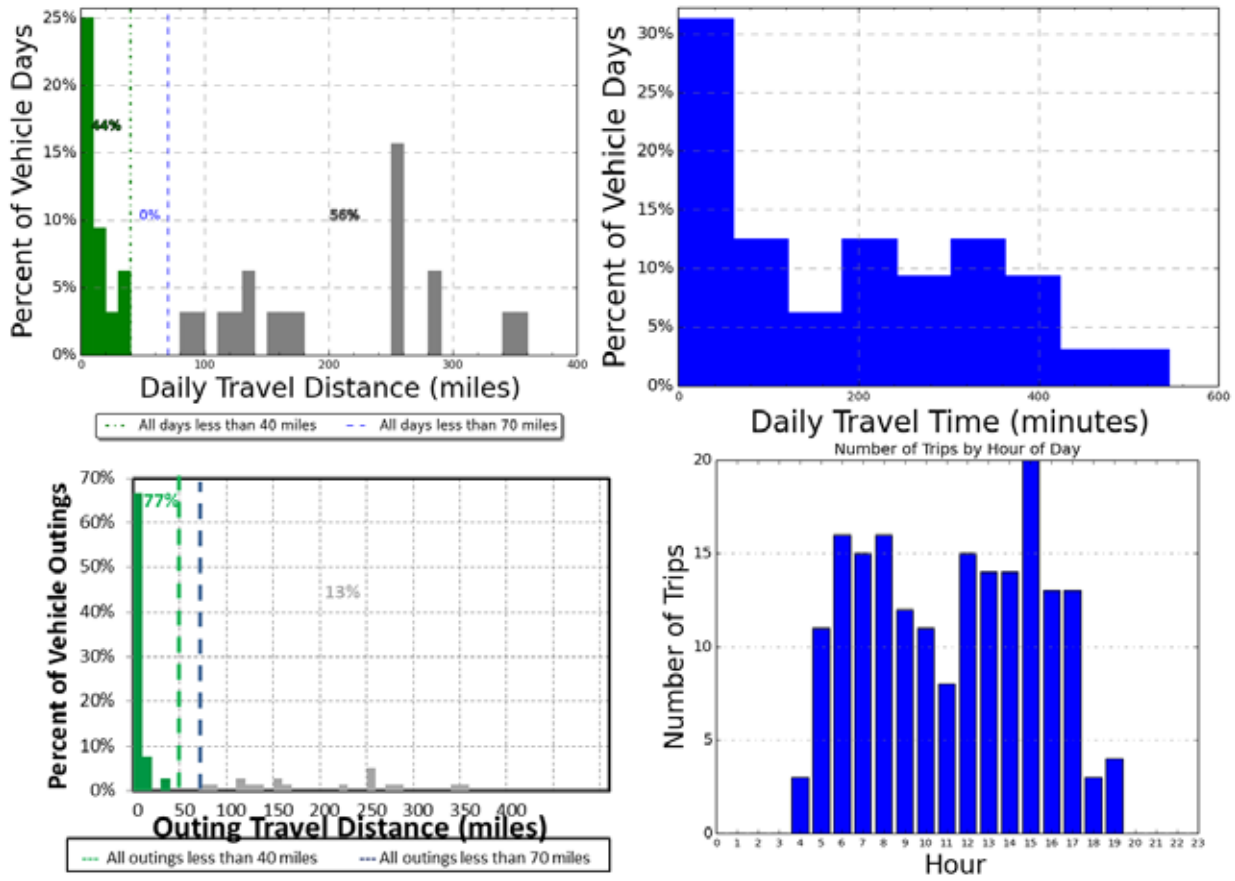


Figure C-10. Vehicle G43-1195H travel graphs.

Vehicle G43-1195H Observations

Logger 96 collected data on this vehicle for 32 days of the 63-day study period. Data validation occurred on 98.6% of the vehicle data. Base information indicated this vehicle averages 1,025 miles per month. The odometer reading in January 2012 was 10,594. The vehicle is a recreational trip vehicle and parks in the office parking area near Building 8050.

The responses to the survey as part of this study showed that the expected retention of this vehicle is between 3 and 6 more years. This vehicle typically operated between 100 and 150 miles per day. Two to five persons had access to this vehicle and it usually carried 12 to 15 persons at a time. The vehicle frequently travels off base. The vehicle typically uses E-85 ethanol fuel and carries equipment related to its use as a recreational trip transport vehicle.

The longest single outing of the vehicle occurred on May 6th and was 354 miles of approximately 9-hours duration. This outing involved travel to Woodland, White Salmon, and Duluth, WA. Long trips are frequent occurrences for this vehicle, with 9 days of travel exceeding 250 miles. Yet, 77% of the outings were less than 70 miles and 44% of the daily travel was less than 70 miles. Twenty-five percent of daily travel and nearly 70% of outings were less than 10 miles. These data suggest that a BEV could provide most of the travel, but a PHEV would be required for the longer trips. The number of vans in the total fleet may support this mix. The BEV or PHEV could replace this vehicle if they were able to support meet the other requirements that may exist for this support vehicle.

Vehicle G42-0289G

www.edmunds.com

Make/Model/Year	Chevrolet/G1300/2008
EPA Class Size*	Cargo Van
Mission	Pool
Contact	D Pettengill/DCA Support
Parking Location	Bldg 2057
Fleet Vehicle ID	G42-0289G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)	12/16/14 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)	635/630
Study Logger ID	Logger 99
Total Vehicle Days/Total Study Days	23/63

Vehicle G42-0289G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.8/53.5	7.5/53.5	1.8/20.2	203
Travel Time (Minutes)	34/123	28.7/123	6.7/55	775
Idle Time (Minutes)	4.0/NA	3.4/NA	0.8/NA	92

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	115	98.3%	Less than 2	83
10 to 20	2	1.7%	2 to 4	8
20 to 40	0	0%	4 to 8	3
40 to 60	0	0%	Greater than 8	23

Figure C-10. Vehicle G42-0289G stops.

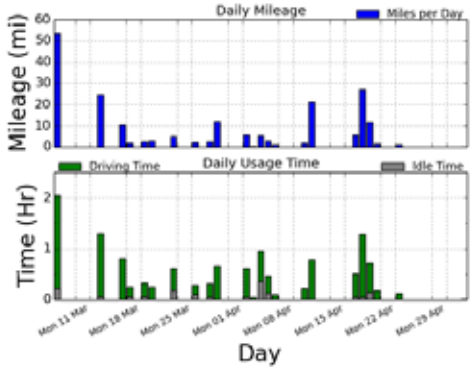


Figure C-11. Vehicle G42-0289G history.

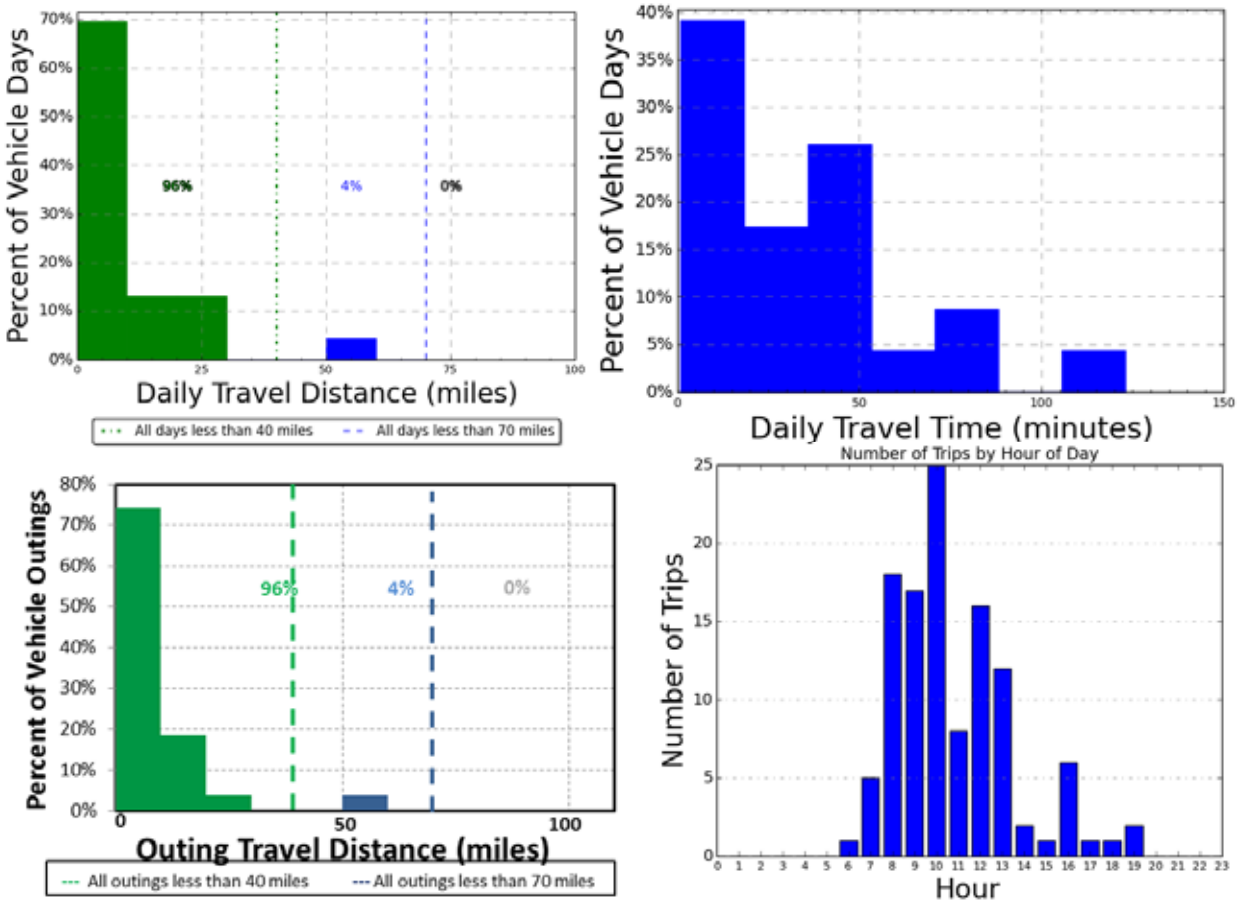


Figure C-11. Vehicle G42-0289G travel graphs.

Vehicle G42-0289G Observations

Logger 99 collected data on this vehicle for 23 days of the 63-day study period. Data validation occurred on 100% of the vehicle data. Base information indicated this vehicle averages 157 miles per month. The odometer reading in January 2012 was 7,018. The vehicle is a pool vehicle assigned to Fleet Mission Support and parks in the DFMWR Motor Pool parking area near Building 2057.

The responses to the survey as a part of this study showed that the expected retention of this vehicle is greater than 6 more years. This vehicle typically operated between 6 and 10 miles per day and two to five persons had access to this vehicle, with it usually carrying two persons at a time. The vehicle occasionally travelled off base. The vehicle typically uses E-85 ethanol fuel and is available to support all activities assigned to MWR.

The longest single outing of the vehicle occurred on March 6th and was 53.5 miles of approximately 2 hours duration. This outing involved travel to Tacoma, Olympia East, and Lacy, WA. All of the outings were less than 70 miles and all of the daily travel was less than 70 miles that is typically the range of a BEV. All but 4% of all daily travel and outings were less than 40 miles; the CD portion of a typical PHEV motive power. These data suggest that a BEV could provide the necessary range for daily travel. Unfortunately, this vehicle is a cargo van and no BEV or PHEV exists that can replace this vehicle unless the cargo is of small volume. Because DCA Support has many vans in its pool, replacement by a BEV may be possible.

Appendix D

Public Works Vehicle Data Sheets

Table D-1. JBLM Public Works vehicle index.

Vehicle Index						
Logger No.	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
1	G42-0658K	FORD	F150	2010	Pickup truck	Pool
2	G42-1054F	FORD	F150	2008	Pickup truck	Pool
3	G71-0133L	FORD	E450	2011	Passenger van	Pool
4	G43-0944G	CHEVROLET	G3500	2008	Passenger van	Pool
5	G43-0822G	FORD	F350	2008	Pickup truck	Support
84	G41-1100K	DODGE	GRCARAVAN	2010	Minivan	Pool
87	G42-0619K	CHEVROLET	C1500	2010	Pickup truck	Pool
88	G41-1180K	DODGE	GRCARAVAN	2010	Minivan	Pool
90	G43-1892H	CHEVROLET	C2500HD	2009	Pickup truck	Support
91	G43-1961H	CHEVROLET	C3500	2009	Pickup truck	Support
92	G42-0505A	CHEVROLET	G1300	2004	Passenger van	Support
95	G43-1155L	FORD	F350	2011	Pickup truck	Support
98	G41-1605L	DODGE	DAKOTA	2011	Pickup truck	Support
100	G42-0610K	CHEVROLET	C1500	2010	Pickup truck	Pool

Vehicle G42-0658K

www.edmunds.com

Make/Model/Year	Ford/F150/2010
EPA Class Size	Standard Pickup Truck
Mission	Pool Vehicle
Contact	J Ross/Public Works
Parking Location	Bldg 2044/Adkison/N 3rd St
Fleet Vehicle ID	G42-0658K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)	14/20/16 10/14/12
EPA GHG Emissions (Grams CO_2/Mi)	555/525
Study Logger ID	Logger 1
Total Vehicle Days/Total Study Days	37/63

Vehicle G42-0658K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	29.3/95.8	12.3/50.6	4.6/23.4	1,083
Travel Time (Minutes)	70/149	29.4/96.0	11/43	2,590
Idle Time (Minutes)	6/NA	2.5/NA	0.9/NA	223

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	229	98.3	Less than 2	186
10 to 20	4	1.7	2 to 4	11
20 to 40	0	0	4 to 8	2
40 to 60	0	0	Greater than 8	34

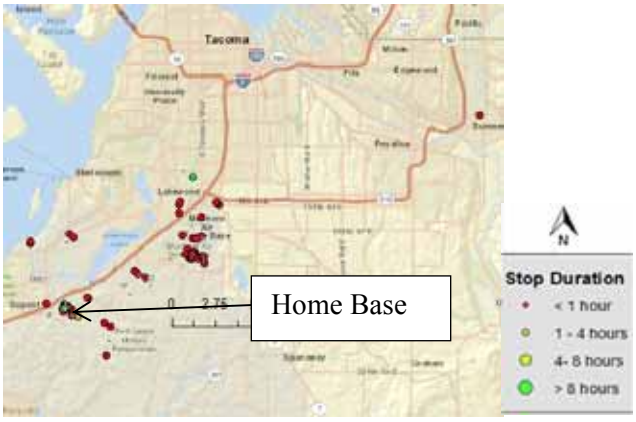


Figure D-12. Vehicle G42-0658K stops.

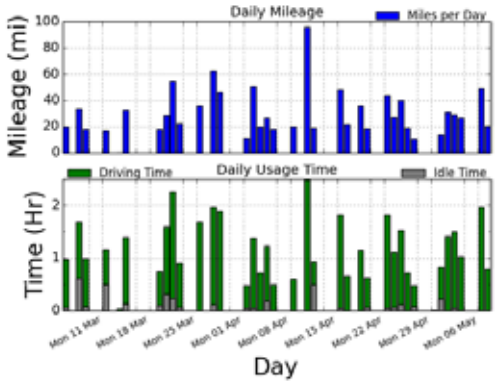


Figure D-13. Vehicle G42-0658K history.

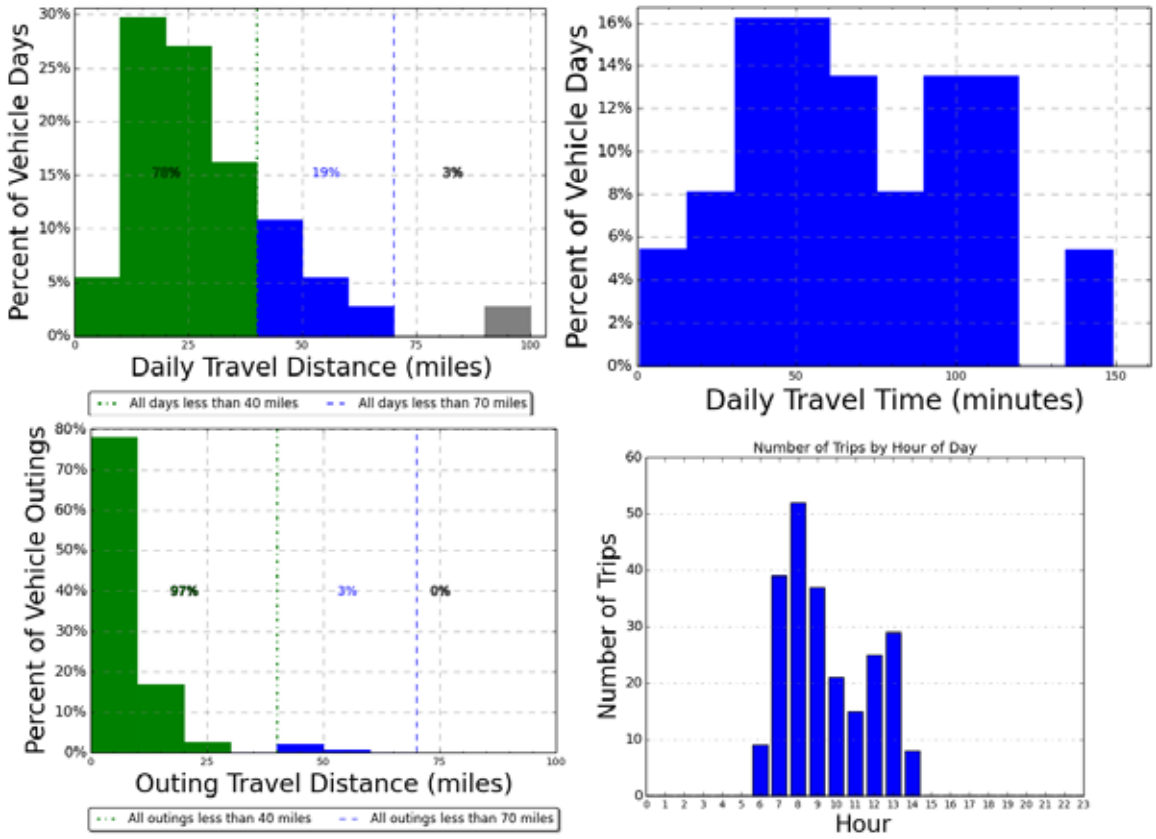


Figure D-14. Vehicle G42-0658K travel graphs.

Vehicle G42-0658K Observations

Information provided on the vehicle survey form for this vehicle indicated that this is a pool vehicle accessed by 2 to 5 people and typically is parked in the office parking lot near Building 2044. Expected use was over 50 miles per month, one person as passenger, used off-base 2 or 3 times per month, and used during dayshift hours of 0700 to 1630. The alternate fuel E-85 is a frequently used fuel. Public Works expects this vehicle will remain with the fleet for another 6 years or more. The vehicle is used for transportation to GSA vehicle incidents, use for the McChord Airfield Driver Certification Program manager, and use for the McChord Civil Engineer Squadron LMR manager for all squadron radio issues.

Site fuel records show average travel is 336 miles per month and the odometer read 7,005 in April 2012. The vehicle typically carries only documentation or portable handheld radios. Use is for transportation between bases for coordination, repair, or instruction of various assigned programs and processes.

Logger 1 collected data on this vehicle for a period of 37 days of the 63-study day period. Validation occurred on 98.5% of the input data. All but one stop exceeding the 2-hour duration occurred at the home base. The longest single trip and outing were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 96 miles; however, that day also had sufficient stop time to recharge the battery.

A BEV may provide the acceptable performance of this vehicle should the BEV meet the other mission requirements. The survey information suggests that no other special requirements exist. A PHEV would travel all but 3% of the outings on CD mode and would provide an alternative for this vehicle.

Vehicle G42-1054F

www.edmunds.com

Make/Model/Year	Ford/F150/2008
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	J Ross/Public Works
Parking Location	Bldg 2044/Adkison/N 3rd St
Fleet Vehicle ID	G42-1054F
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)	14/20/16
EPA GHG Emissions (Grams CO_2/Mi)	555
Study Logger ID	Logger 2
Total Vehicle Days/Total Study Days	35/63

Vehicle G42-1054F Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	15.4/82.0	6.4/42.8	2.5/36	540
Travel Time (Minutes)	62/248	25.5/247	10.1/88	2,170
Idle Time (Minutes)	13.4/NA	5.5/NA	2.2/NA	470

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	242	98	Less than 2	201
10 to 20	5	2	2 to 4	12
20 to 40	0	0	4 to 8	3
40 to 60	0	0	Greater than 8	31

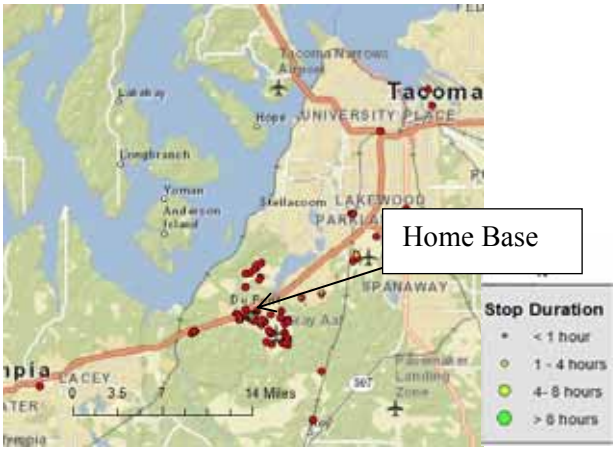


Figure D-4. Vehicle G42-1054F stops.

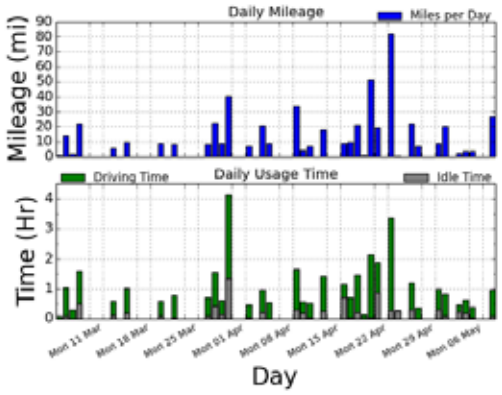


Figure D-5. Vehicle G42-1054F history.

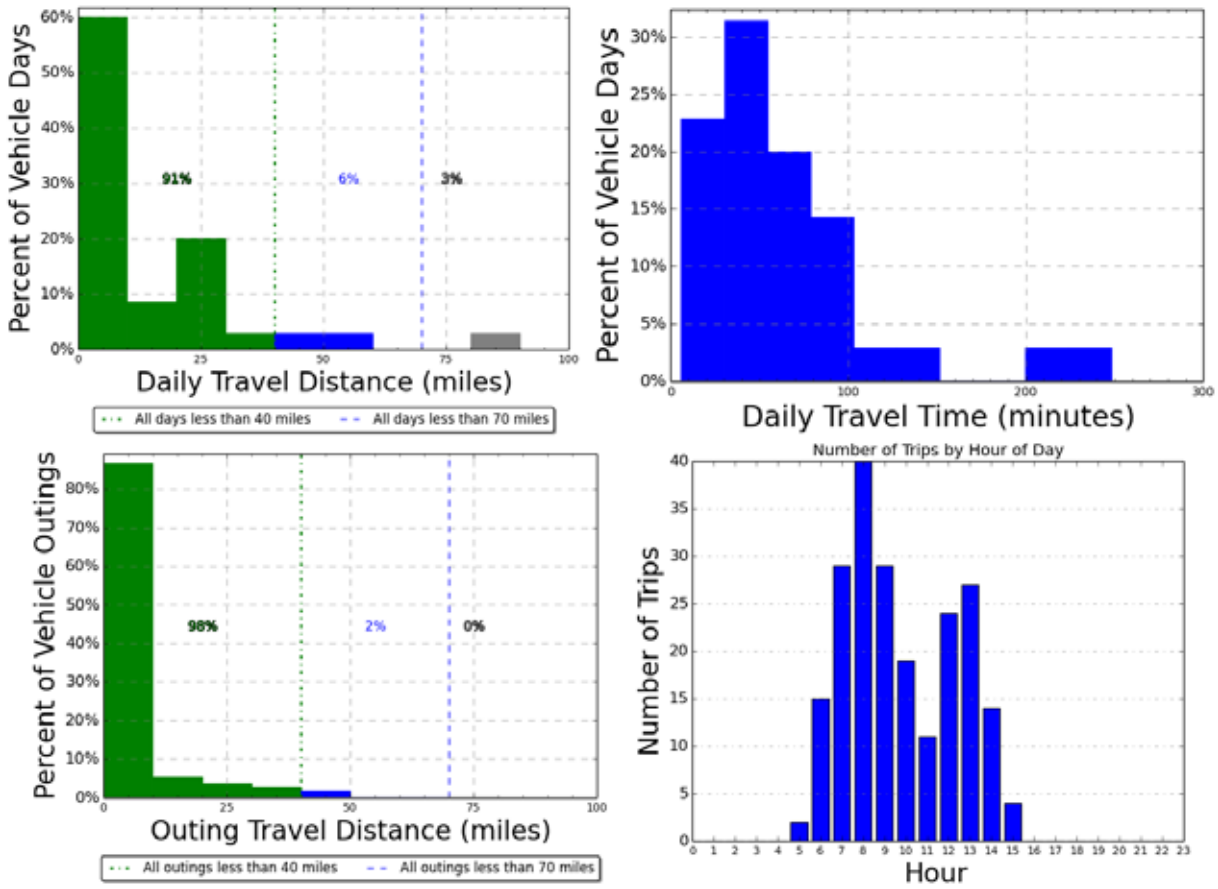


Figure D-15. Vehicle G42-1054F travel graphs.

Vehicle G42-1054F Observations

Survey information was not available for this vehicle. Stop data suggest this vehicle is typically parked near Building 2044 at Adkison Ave/N 4th St/N 3rd St/Utah Ave. Site data reports an odometer reading of 34,940 in January 2012 and low monthly mileage.

Logger 2 collected data on this vehicle for a period of 35 days of the 63-day study period. Validation occurred on 99.6% of the vehicle data. All stops of greater than 2-hours duration occurred at the home base. The longest single trip and outing were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 82 miles; however, that day also had sufficient stop time to recharge the battery. Only 2% of the outings exceeded the maximum CD range of 40 miles for a PHEV.

A BEV may provide acceptable performance for this vehicle should the BEV meet the other mission requirements. Information is unavailable that suggests special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G71-0133L

http://ownerford.com

Make/Model/Year	Ford/E450/2011
EPA Class Size	Vans, Passenger Type
Mission	Pool
Contact	J Ross/Public Works
Parking Location	Bldg 2063/N. 4th St
Fleet Vehicle ID	G71-0133L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	11/15/13 9/11/10
EPA GHG Emissions (Grams CO_2/Mi)*	684/630
Study Logger ID	Logger 3
Total Vehicle Days/Total Study Days	41/63

Vehicle G71-0133L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	11.5/39.4	2.9/22.1	1.2/12.8	470
Travel Time (Minutes)	94/181	24.0/87	9.7/74	3,867
Idle Time (Minutes)	41.3/NA	10.5/NA	4.3/NA	1,694

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	430	100	Less than 2	361
10 to 20	0	0	2 to 4	23
20 to 40	0	0	4 to 8	8
40 to 60	0	0	Greater than 8	38

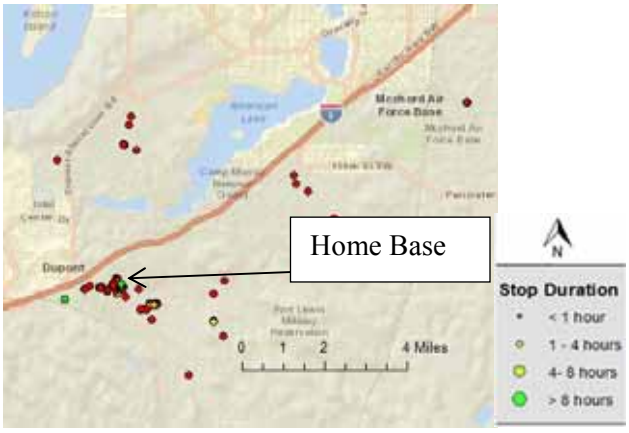


Figure D-7. Vehicle G71-0133L stops.

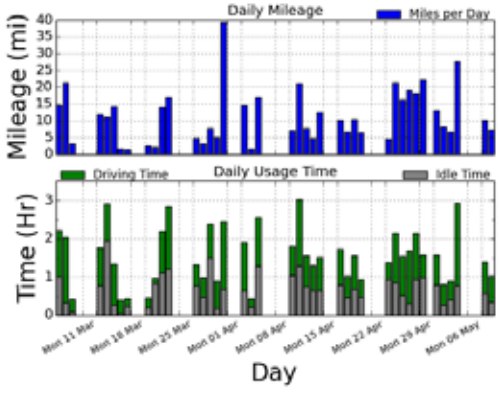


Figure D-8. Vehicle G71-0133L history.

*2011 Ford E350 Van information. EPA figures for 2011 Ford E450 are not available.

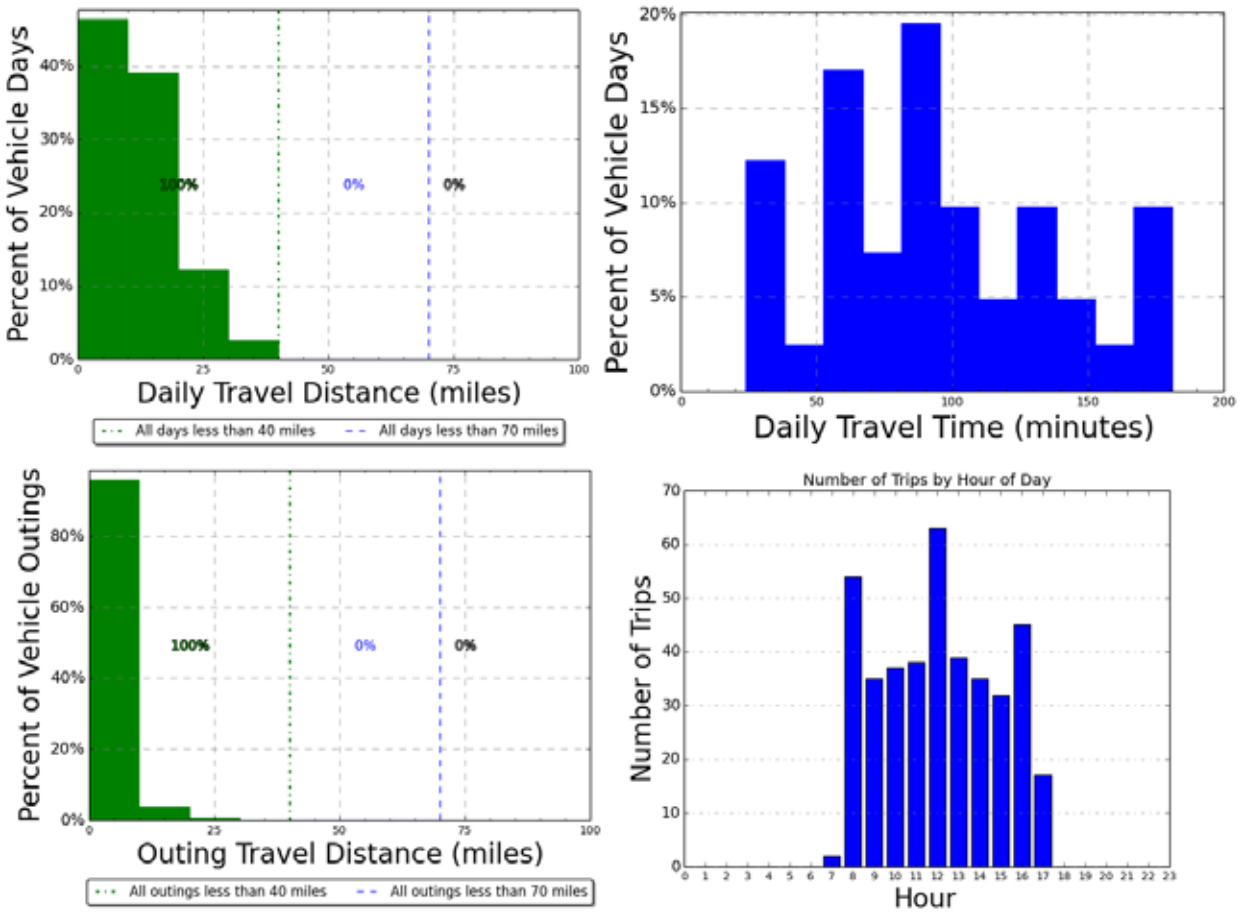


Figure D-16. Vehicle G71-0133L travel graphs.

Vehicle G71-0133L Observations

Vehicle survey information was not available for this vehicle. Data loggers show the primary home base is near Building 2063 on Adkison Ave/N 4th St/N 3rd St/Utah Ave. JBLM records indicated the vehicle travels 275 miles per month and the odometer read 5,677 in May 2012.

Logger 3 collected data on this vehicle for a period of 41 days of the 63-day study period. Validation occurred on 99.8% of the vehicle data. Fifty-eight percent of stops greater than 2-hours duration occurred primarily at the home base, with 24% occurring on Liggett Ave, and 13% on 9th Division Road. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range of 40 miles for a PHEV.

A BEV may provide acceptable performance for this vehicle should the BEV meet the other mission requirements. Information that suggests special requirements exist is unavailable. Daily travel requirements also allow the use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G43-0944G

http://autos.aol.com/cars

Make/Model/Year	Chevrolet/G3500 Express /2008
EPA Class Size	Passenger Van
Mission	Pool
Contact	J Ross/Public Works
Parking Location	Bldg 2044/Utah Ave
Fleet Vehicle ID	G43-0944G
Fuel Type	Diesel
EPA Label/MPG (City/Hwy)	14/17/15
EPA GHG Emissions (Grams CO_2/Mi)	Not available
Study Logger ID	Logger 4
Total Vehicle Days/Total Study Days	34/63

Vehicle G43-0944G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.0/20.3	2.0/15.4	0.8/14.5	272
Travel Time (Minutes)	77/149	19.7/80.0	7.8/58	2,618
Idle Time (Minutes)	37.8/NA	9.7/NA	3.8/NA	1,284

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	289	100	Less than 2	225
10 to 20	0	0	2 to 4	23
20 to 40	0	0	4 to 8	9
40 to 60	0	0	Greater than 8	32

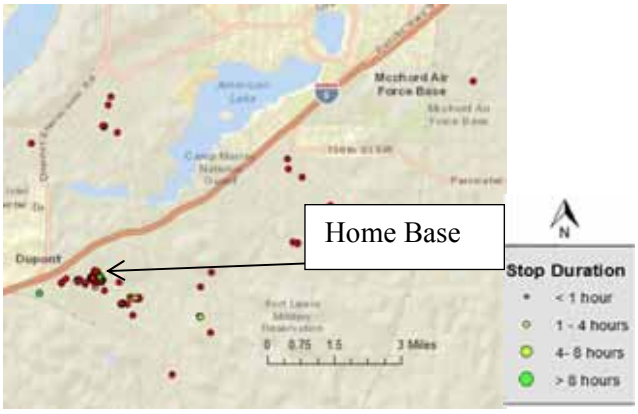


Figure D-10. Vehicle G43-0944G stops.

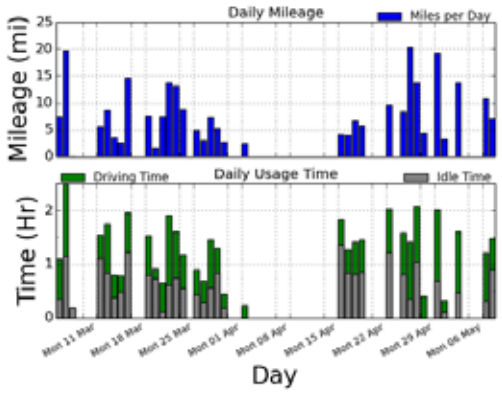


Figure D-11. Vehicle G43-0944G history.

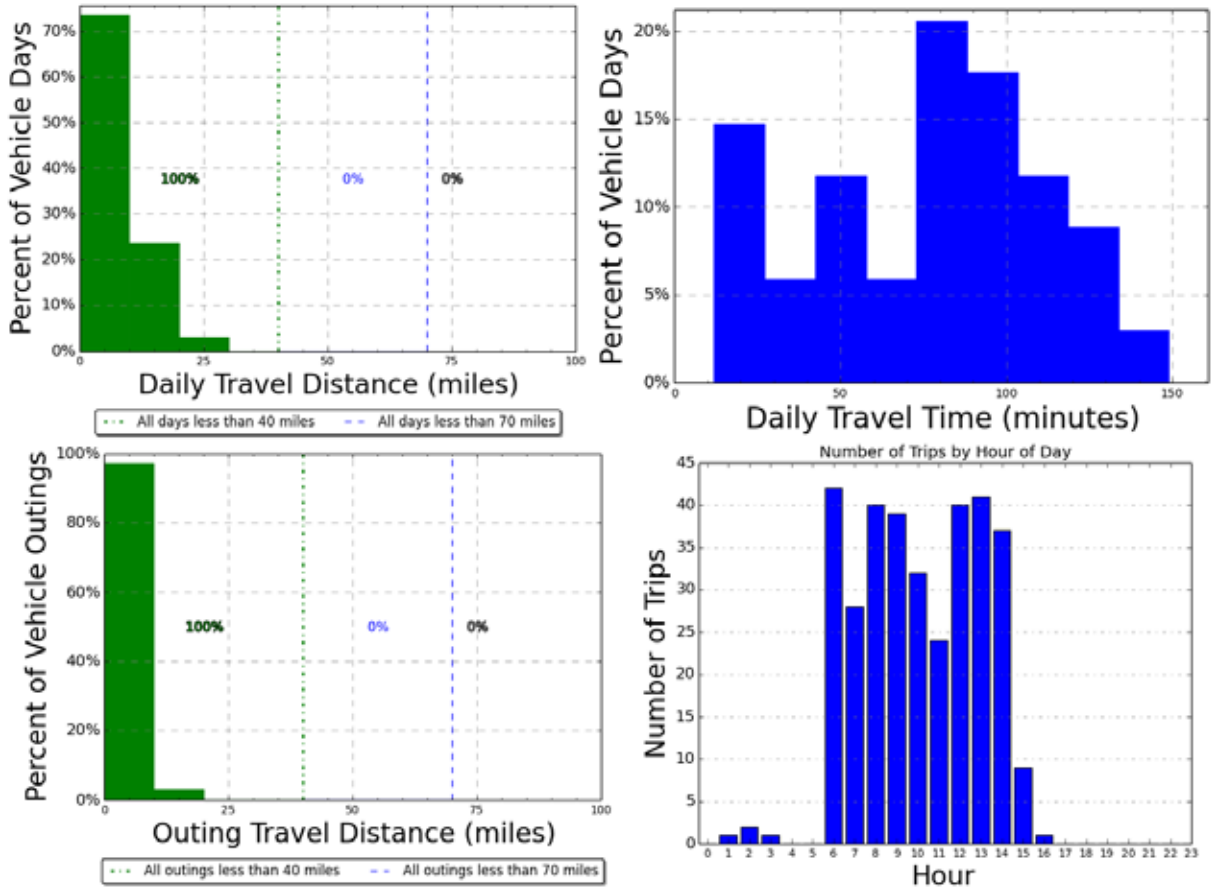


Figure D-17. Vehicle G43-0944G travel graphs.

Vehicle G43-0944G Observations

Vehicle survey information was not available for this vehicle. Site records report the vehicle is used 145 miles per month on average and the odometer read 6,849 in May 2012. Data logger information suggests the home base for this vehicle is near Building 2044 on Utah Ave.

Logger 4 collected data on this vehicle for 34 days of the 63-day study period. Validation occurred on 99.9% of the vehicle data. Forty-five percent of stops of greater than 2-hours duration occurred at the home base. The remaining stops varied among many locations, with 21% on Pendleton and 8% on North 3rd Street. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range of 40 miles for a PHEV.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow the use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G43-0822G

http://autos.yahoo.com/used-cars

Make/Model/Year	Ford/F350/2008
EPA Class Size	Pickup Trucks
Mission	Support
Contact	J Ross/Public Works
Parking Location	Bldg 2044/Utah Ave
Fleet Vehicle ID	G43-0822G
Fuel Type	Gas
EPA Label/MPG (City/Hwy)*	14/19/16
EPA GHG Emissions (Grams CO_2/Mi)*	555
Study Logger ID	Logger 5
Total Vehicle Days/Total Study Days	45/63

Vehicle G43-0822G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	22.3/42.4	5.6/22.1	2.6/9.4	1,005
Travel Time (Minutes)	75/129	18.8/74	8.7/30	3,391
Idle Time (Minutes)	8.3/NA	2.1/NA	1.0/NA	372

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	343	100	Less than 2	277
10 to 20	0	0	2 to 4	24
20 to 40	0	0	4 to 8	0
40 to 60	0	0	Greater than 8	48

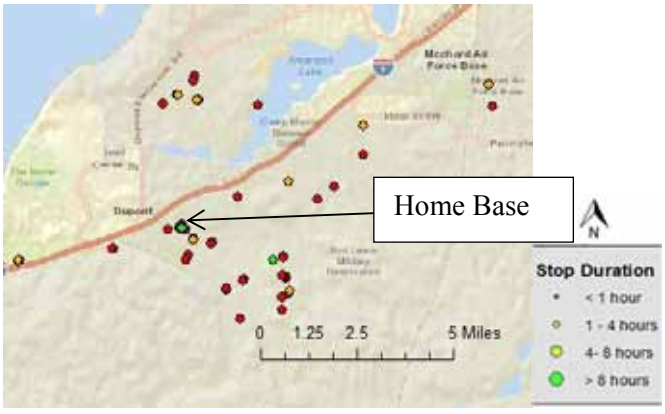


Figure D-13. Vehicle G43-0822G stops.

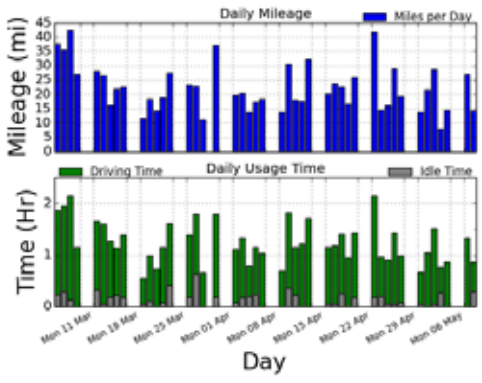


Figure D-14. Vehicle G43-0822G history.

*2008 Ford F150 truck information provided. EPA figures for Ford F350 are not available.

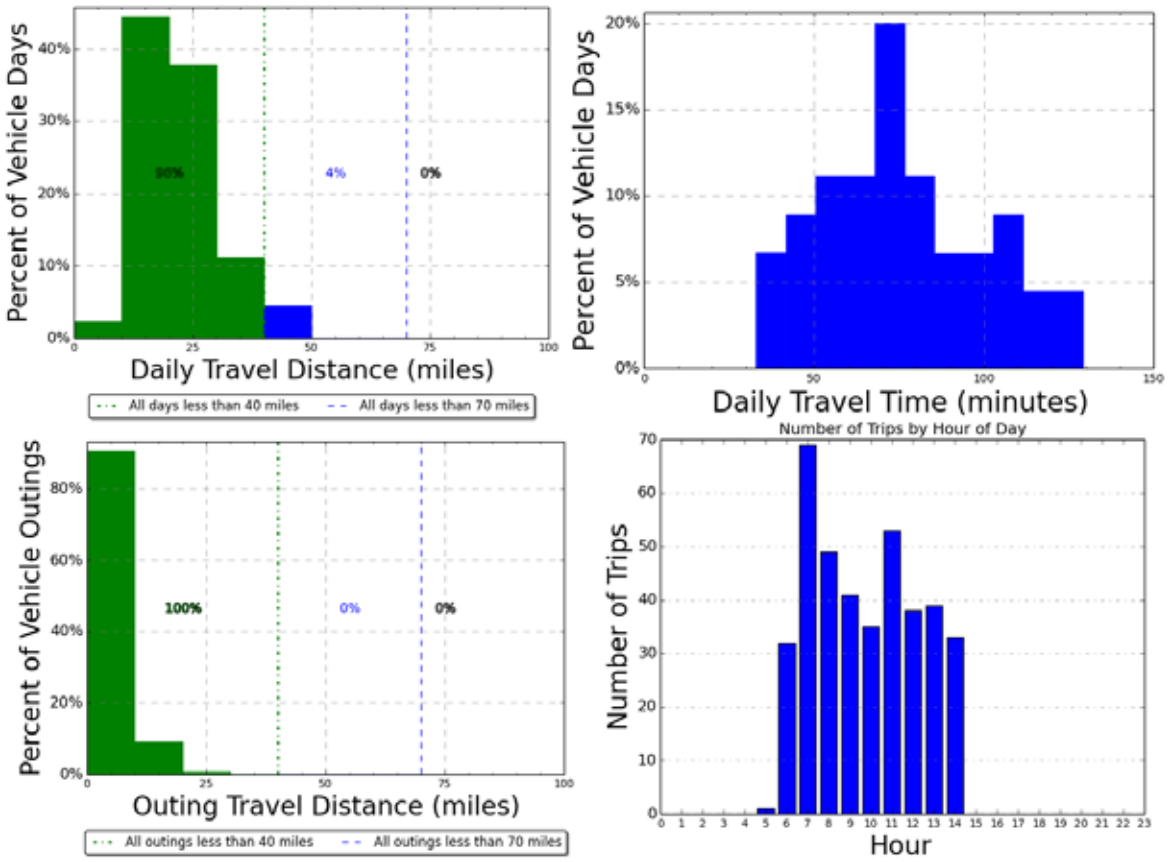


Figure D-18. Vehicle G43-0822G travel graphs.

Vehicle G43-0822G Observations

Vehicle survey information was not available for this vehicle. Site records report this vehicle travels an average of 470 miles per month. The odometer read 22,101 in May 2012. Vehicle data suggest the vehicle is home based near Building 2044 on Utah Avenue.

Logger 5 collected data on this vehicle for 45 days of the 63-day study period. Validation occurred on 99.4% of the vehicle data. Sixty-nine percent of stops greater than 2-hours duration occurred at the home base. The remaining stops varied among several locations, with 14% on 41st Division Drive and 6% on Faith Avenue. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range for a PHEV of 40 miles.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G41-1100K

http://autos.yahoo.com/

Make/Model/Year	Dodge/Grand Caravan/2010
EPA Class Size	Minivan
Mission	Pool
Contact	C. Sallinger/Motor Trans.Br
Parking Location	Bldg 2012/Pendleton Ave
Fleet Vehicle ID	G41-1100K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/484
Study Logger ID	Logger 84
Total Vehicle Days/Total Study Days	28/63

Vehicle G41-1100K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.5/270.7	19.8/168.6	5.3/132	573
Travel Time (Minutes)	44/297	42.1/223	11.2/139	1,221
Idle Time (Minutes)	1.3/NA	1.2/NA	0.3/NA	36

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	103	96.3	Less than 2	70
10 to 20	0	0	2 to 4	7
20 to 60	0	0	4 to 8	4
Greater than 60	4	3.7	Greater than 8	26

Figure D-16. Vehicle G41-1100K stops.

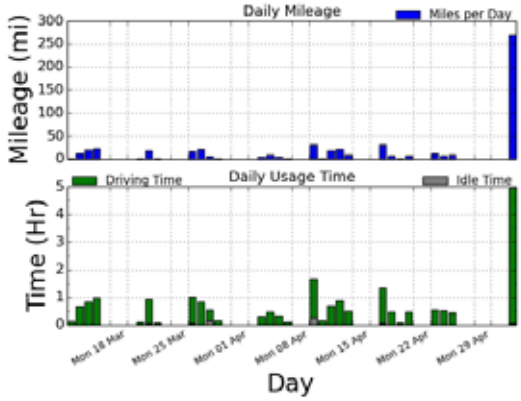


Figure D-17. Vehicle G41-1100K history.

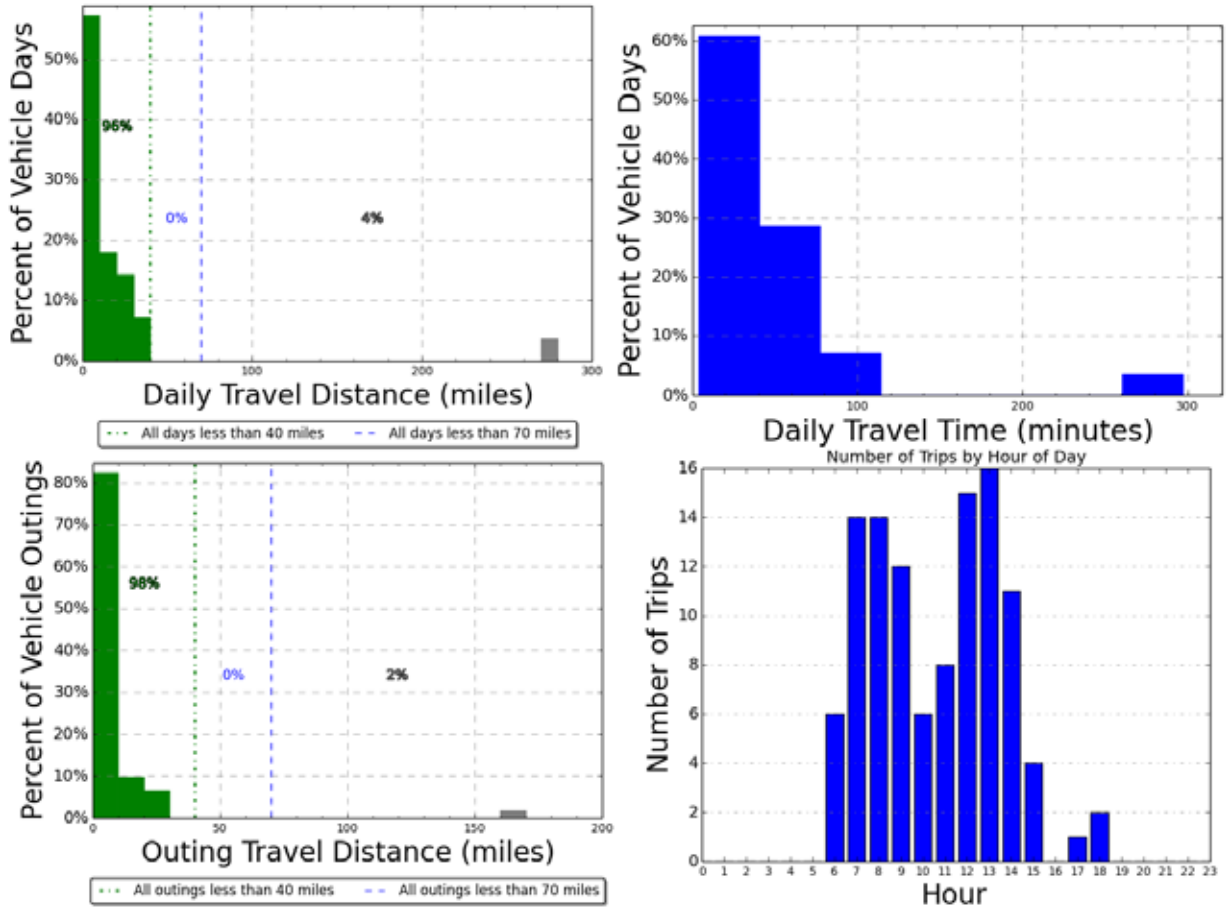


Figure D-19. Vehicle G41-1100K travel graphs.

Vehicle G41-1100K Observations

Information provided on the vehicle survey form for this vehicle indicated that this is a pool vehicle assigned to Environmental Services and is accessible by 50 people. It parks in the office parking lot near Building 2012 on Pendleton Avenue. The alternate fuel E-85 is almost exclusively used. Public Works expects this vehicle will remain with the fleet for 3 to 6 years. This vehicle travels for a wide variety of missions related to Pollution Prevention, Sustainability, Informational Tours, Transporting Dignitaries, Kids Fest, Earth Day Events, Armed Forces Day, Freedom Fest, McChord Field Rodeo, and Air Shows. Site fuel records show average travel is 336 miles per month and the odometer read 5,087 in April 2012. It carries no specific cargo or equipment on a regular basis.

Logger 84 collected data on this vehicle for 28 days of the 63-day study. Validation occurred on 97.8% of the vehicle data. Forty-one percent of stops greater than 2 hours occurred at the home base on Pendleton Avenue, with 19% on 4th Street and 16% on Kaufman Avenue. The longest single trip, outing, and daily travel occurred on May 1, 2013, on a trip to Ellensburg Washington. Other than that one day, all trips, outings, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the remaining outings exceeded the maximum CD range for a PHEV of 40 miles.

While a BEV may not provide the acceptable performance of this specific vehicle's travel, it is part of a pool that could contain other vehicles capable of this long trip. Should the BEV meet other mission requirements, it would meet 98% of this vehicle's usage. Information about other mission requirements is unavailable, suggesting special requirements exist. Daily travel requirements also allow for use of a PHEV traveling all but one day in CD mode, thus providing an alternative for this vehicle.

Vehicle G42-0619K

www.edmunds.com/

Make/Model/Year	Chevrolet/C1500/2010
EPA Class Size	Standard Pickup Trucks
Mission	Pool
Contact	J Ross/Public Works
Parking Location	Bldg 555/Lincoln Blvd
Fleet Vehicle ID	G42-0619K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy)	15/21/17 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	523/484
Study Logger ID	Logger 87
Total Vehicle Days/Total Study Days	30/63

Vehicle G42-0619K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	4.4/17.5	2.1/14.6	0.9/11.5	132
Travel Time (Minutes)	32/145	14.9/140	6.3/62	955
Idle Time (Minutes)	11.1/NA	5.2/NA	2.2/NA	332

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	157	100	Less than 2	117
10 to 20	0	0	2 to 4	6
20 to 40	0	0	4 to 8	4
40 to 60	0	0	Greater than 8	30

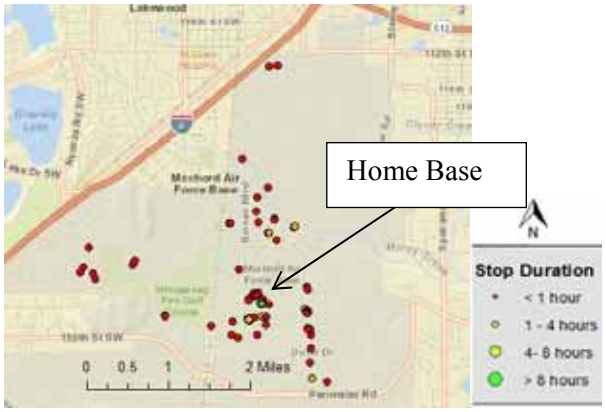


Figure D-19. Vehicle G42-0619K stops.

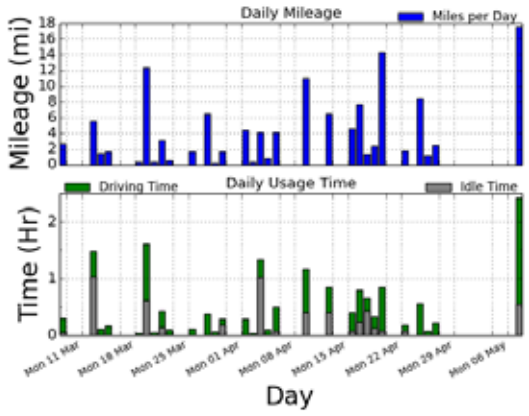


Figure D-20. Vehicle G42-0619K history.

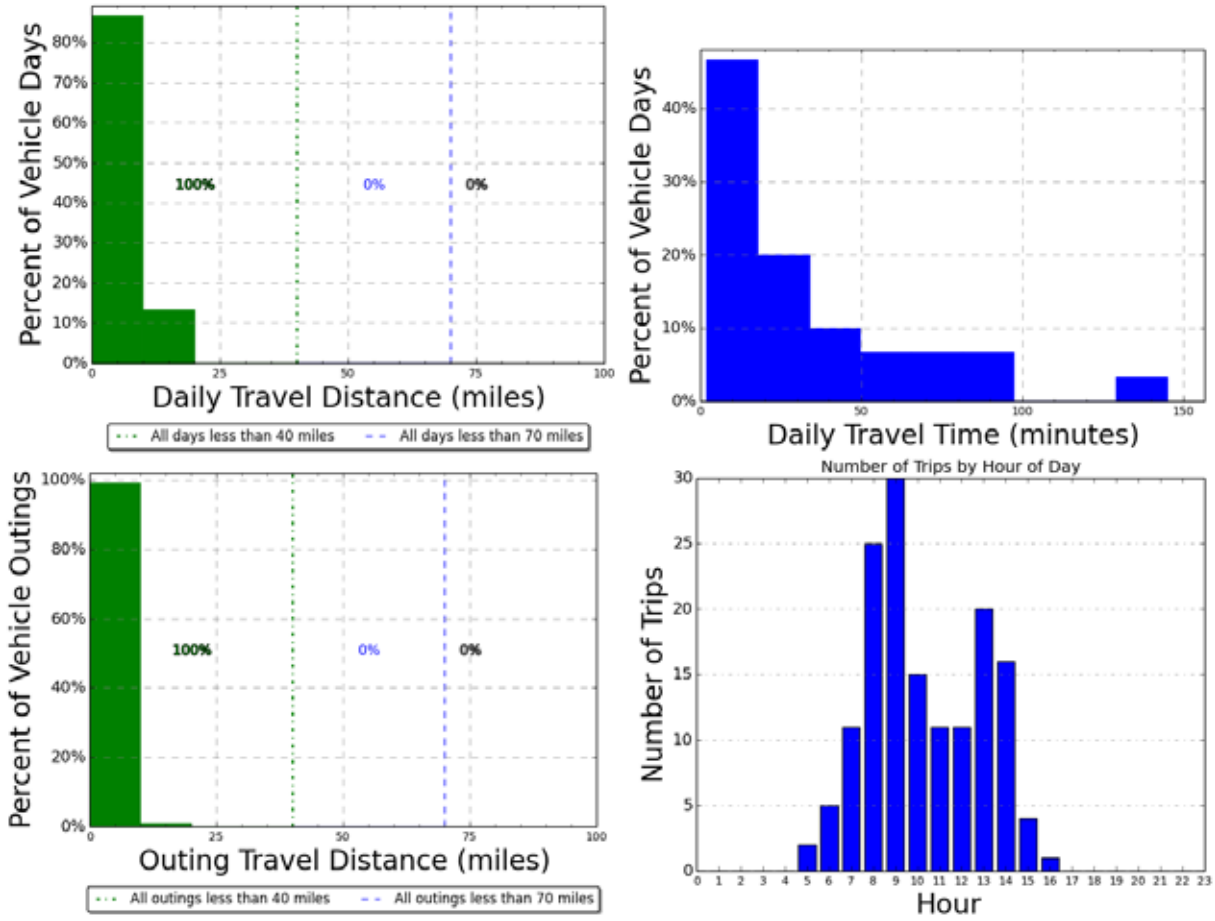


Figure D-20. Vehicle G42-0619K travel graphs.

Vehicle G42-0619K Observations

Vehicle survey information is not available for this vehicle. Logger data suggest the home base is located near Building 555 on Lincoln Boulevard. Site records report the vehicle travels approximately 163 miles per month and the odometer read 3,991 in May 2012.

Logger 87 collected data on this vehicle for 30 days of the 63-day study period. Validation occurred on 100% of the vehicle data. Ninety-two percent of all stops greater than 2-hours duration occurred at the home base. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range for a PHEV of 40 miles.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G41-1180K

http://autos.yahoo.com/

Make/Model/Year	Dodge/Grand Caravan/2010
EPA Class Size	Minivan
Mission	Pool
Contact	J Ross/Public Works
Parking Location	Bldg 540/A St SW
Fleet Vehicle ID	G41-1180K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy)	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)	468/484
Study Logger ID	Logger 88
Total Vehicle Days/Total Study Days	38/63

Vehicle G41-1180K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	7.4/27.7	3.5/18.8	1.7/16.8	282
Travel Time (Minutes)	34/198	15.8/86	7.8/68	1,280
Idle Time (Minutes)	13.7/NA	6.4/NA	3.1/NA	519

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	176	100	Less than 2	119
10 to 20	0	0	2 to 4	15
20 to 40	0	0	4 to 8	3
40 to 60	0	0	Greater than 8	39

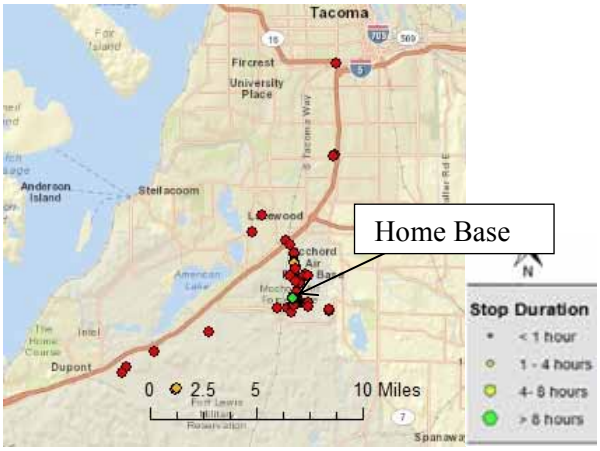


Figure D-22. Vehicle G41-1180K stops.

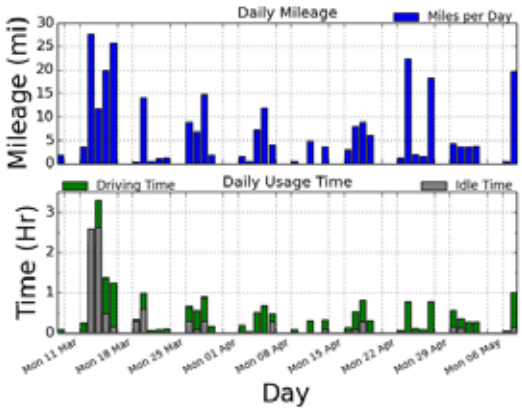


Figure D-23. Vehicle G41-1180K history.

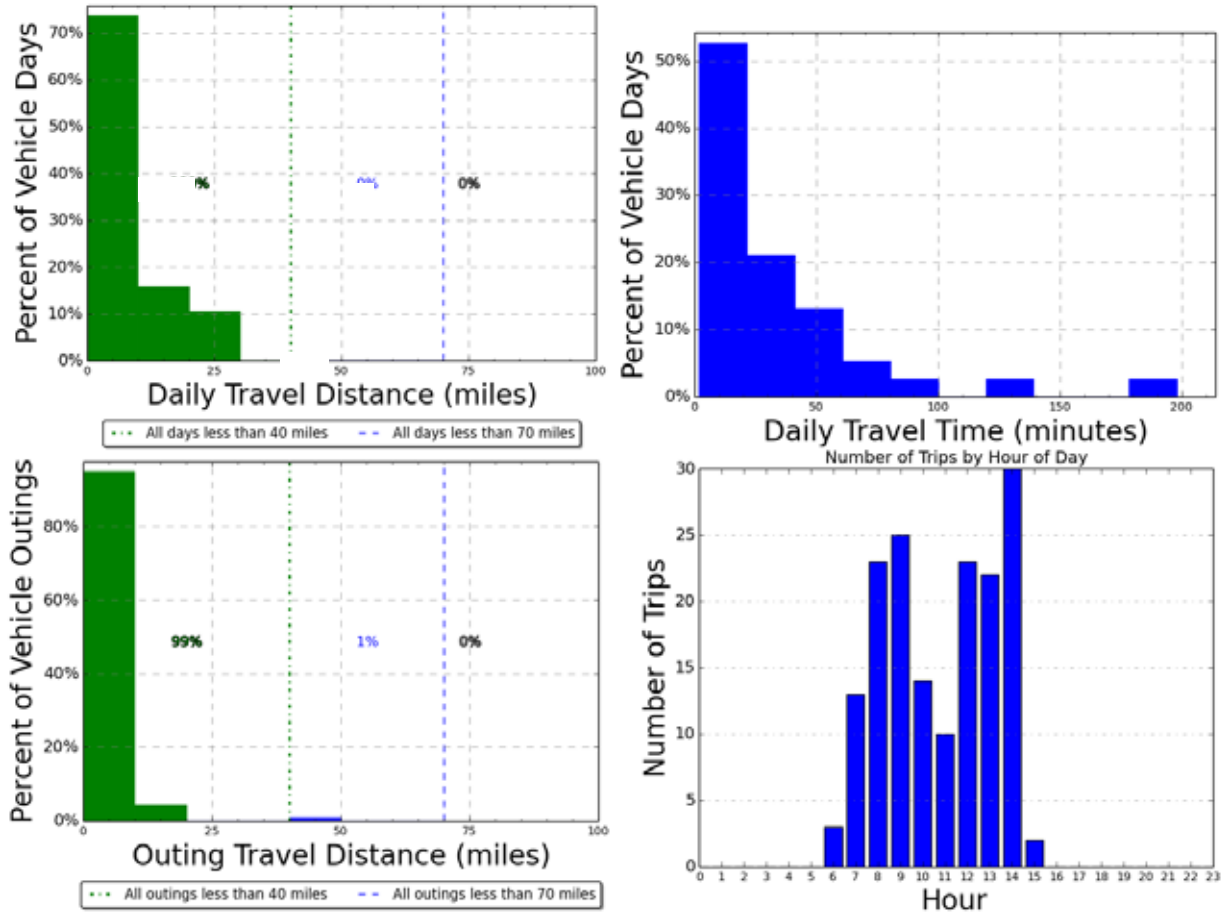


Figure D-21. Vehicle G41-1180K travel graphs.

Vehicle G41-1180K Observations

The vehicle survey reports that this vehicle is a pool vehicle, assigned primarily to a single person and parks near Building 540. DPW expects to retain it for another 2 to 3 years. The vehicle travels less than 10 miles per day and occasionally travels off base, with a typical outing of 11 to 40 miles; it may be used any time during the day. Up to 20 persons have access to this vehicle and it typically carries two people.

Site records report the vehicle travels approximately 83 miles per month and the odometer read 5,172 in May 2012. The vehicle typically parks across from Building 2012.

Logger 88 collected data on this vehicle for 38 days of the 63-day study period. Validation occurred on 98.9% of the vehicle data. Ninety-five percent of stops greater than 2-hours duration occurred at the home base. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range for a PHEV of 40 miles.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G43-1892H

www.edmunds.com

Make/Model/Year	Chevrolet/C2500HD/2009
EPA Class Size*	Pickup Truck
Mission	Support
Contact	J Ross/Public Works
Parking Location	6th St SW
Fleet Vehicle ID	G43-1892H
Fuel Type	Gas
EPA Label/MPG (City/Hwy)*	14/19/16
EPA GHG Emissions (Grams CO_2/Mi)*	555
Study Logger ID	Logger 90
Total Vehicle Days/Total Study Days	43/63

Vehicle G43-1892H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	24.8/598.5	6.5/608.8	3.4/236.9	1,066
Travel Time (Minutes)	90/585	23.5/628	12.2/215	3,857
Idle Time (Minutes)	30.4/NA	8.0/NA	4.2/NA	1,308

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	390	98.5	Less than 2	328
10 to 20	0	0	2 to 4	23
20 to 40	0	0	4 to 8	3
40 to 60	6	1.5	Greater than 8	42

Figure D-25. Vehicle G43-1892H stops.

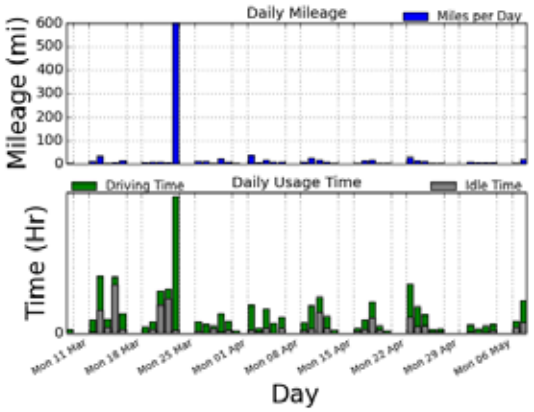


Figure D-26. Vehicle G43-1892H history.

*2009 Chevrolet Silverado C15 information provided. EPA figures for 2009 Chevrolet C2500HD are not available.

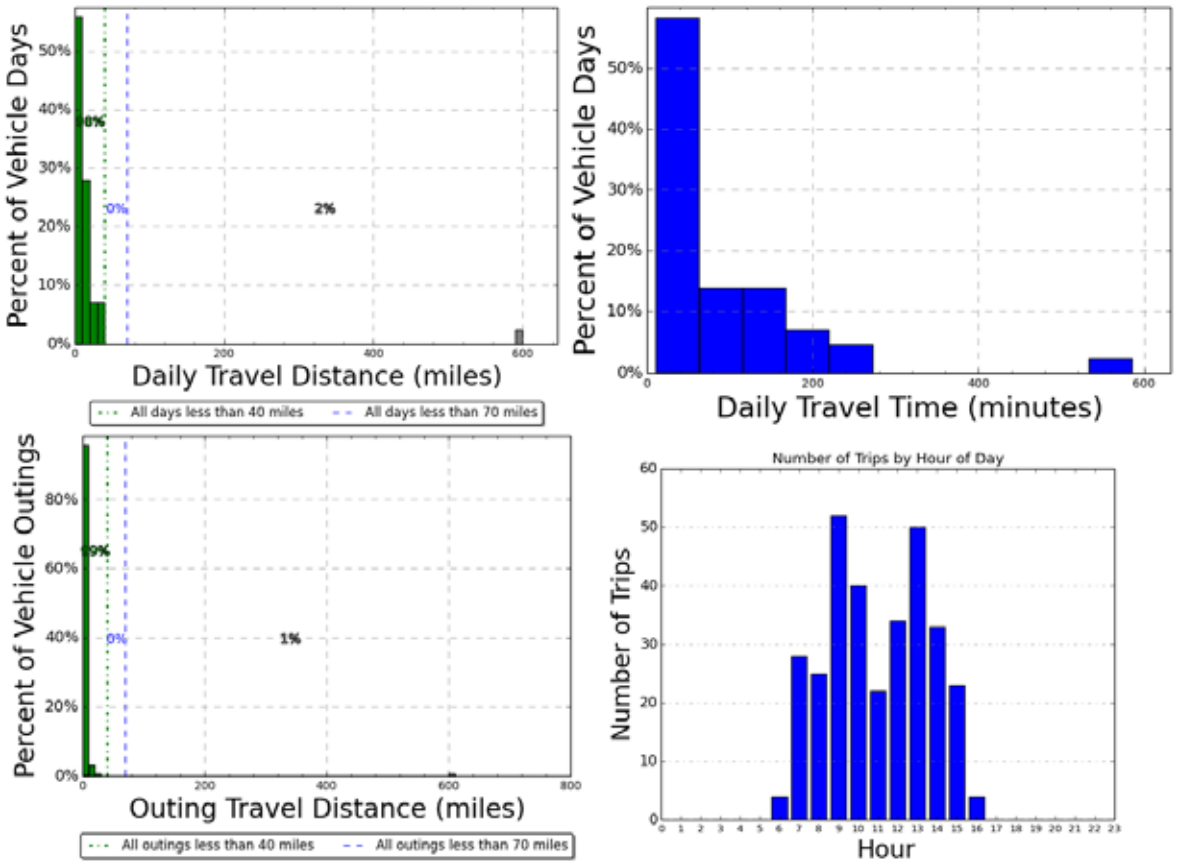


Figure D-22. Vehicle G43-1892H travel graphs.

Vehicle G43-1892H Observations

Vehicle survey information is not available for this vehicle. Logger data suggests the home base is located in the 300 building area on 6th Street SW. Site records report the vehicle travels approximately 300 miles per month and the odometer read 9,150 in May 2012.

Logger 90 collected data on this vehicle for 43 days of the 63-day study period. Validation occurred on 87.8% of the vehicle data. Ninety percent of all vehicle stops greater than 2-hours duration occurred at the home base.

The longest single outing of 609 miles occurred on March 22 and included a single long trip to Fairchild Air Force Base near Spokane. The outing distance is longer than the daily maximum because the outing took more than 1 day. Other than this single outing, the maximum outing was 13.1 miles. Other than that one outing, all trips, outings, and daily travel are within the typically advertised range of a BEV of approximately 70 miles. None of the remaining outings exceeded the maximum CD range for a PHEV of 40 miles.

While a BEV may not provide acceptable performance for this specific vehicle's travel, it is part of a pool of vehicles. Other vehicles may be relied on for trips of this length. Should the BEV meet other mission requirements, it would meet 99% of this vehicle's usage. Information is unavailable suggesting, special requirements exist. Daily travel requirements also allow use of a PHEV traveling all but one day in CD mode, thus providing an alternative for this vehicle.

Vehicle G43-1961H

www.edmunds.com

Make/Model/Year	Chevrolet/C3500/2009
EPA Class Size*	Pickup Truck
Mission	Support
Contact	J Ross/Public Works
Parking Location	6th St SW
Fleet Vehicle ID	G43-1961H
Fuel Type	Gas
EPA Label/MPG (City/Hwy)*	14/19/16
EPA GHG Emissions (Grams CO_2/Mi)*	555
Study Logger ID	Logger 91
Total Vehicle Days/Total Study Days	41/63

Vehicle G43-1961H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/10.0/Peak	Total
Travel Distance (Miles)	17.1/32.4	3.9/25.8	1.6/19.7	701
Travel Time (Minutes)	104/215	24.0/186	10.0/168	4,272
Idle Time (Minutes)	35.4/NA	8.2/NA	3.4/NA	1,452

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	541	100	Less than 2	480
10 to 20	0	0	2 to 4	19
20 to 40	0	0	4 to 8	1
40 to 60	0	0	Greater than 8	41

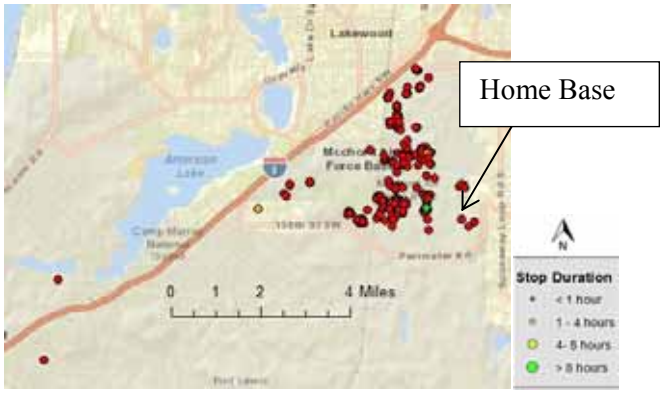


Figure D-28. Vehicle G43-1961H stops.

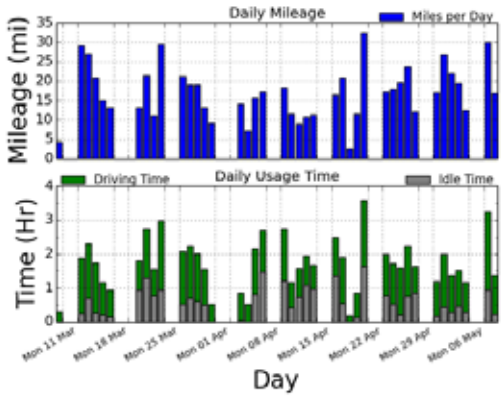


Figure D-29. Vehicle G43-1961H history.

*2009 Chevrolet Silverado C15 information provided. EPA figures for 2009 Chevrolet C3500 are not available.

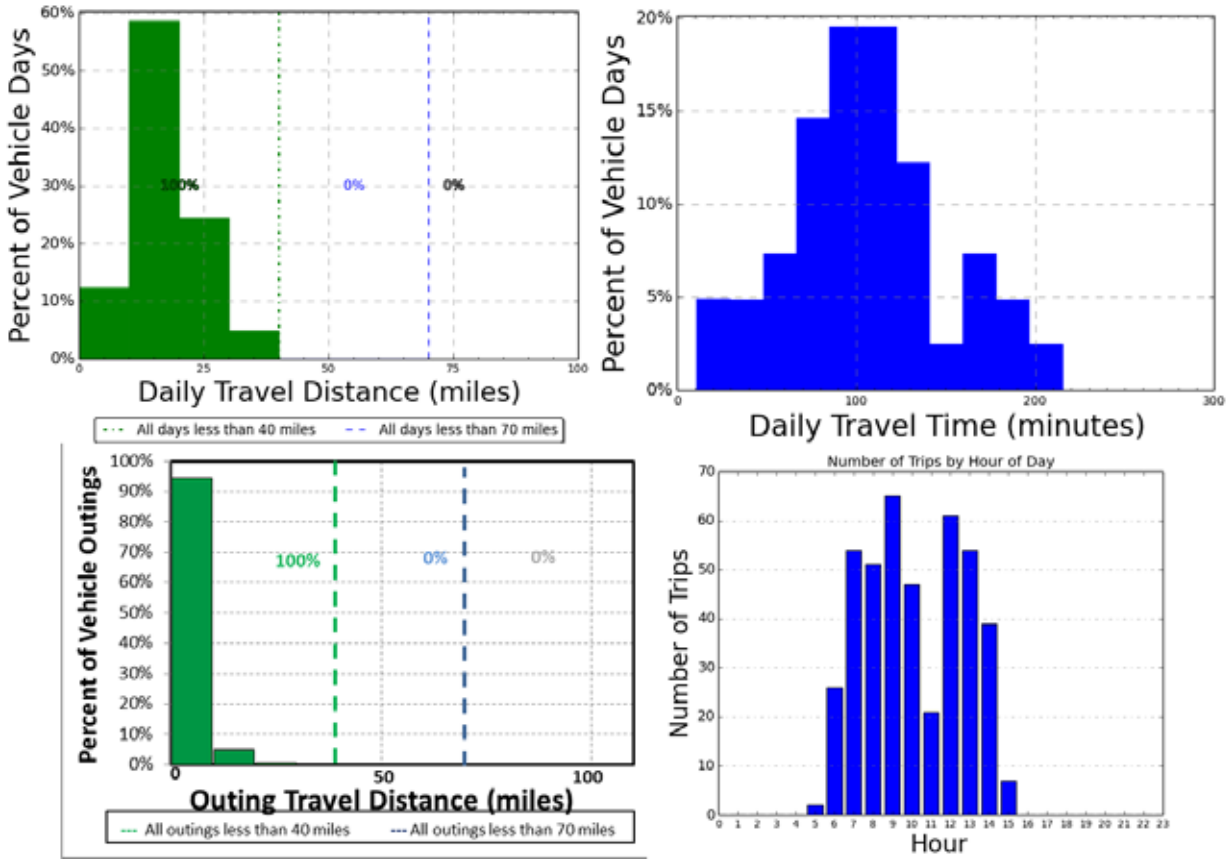


Figure D-23. Vehicle G43-1961H travel graphs.

Vehicle G43-1961H Observations

Vehicle survey information is not available for this vehicle. Data logger information suggests this vehicle's home base is in the 300 building area on 6th Street SW. Site records report the vehicle travels approximately 364 miles per month and the odometer read 12,209 in May 2012.

Logger 91 collected data on this vehicle for 41 days of the 63-day study period. Validation occurred on 100% of the vehicle data. Ninety-eight percent of the recorded stops greater than 2-hours duration occurred at the home base. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings or daily travel exceeded the maximum CD range for a PHEV of 40 miles.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G42-0505A

www.edmunds.com

Make/Model/Year	Chevrolet/G1500 Express /2004
EPA Class Size	Passenger Van
Mission	Support
Contact	J Ross/Public Works
Parking Location	Bldg 555/2012 Lincoln Blvd
Fleet Vehicle ID	G42-0505A
Fuel Type	Gas
EPA Label/MPG (City/Hwy)	14/18/15
EPA GHG Emissions (Grams CO_2/Mi)	592
Study Logger ID	Logger 92
Total Vehicle Days/Total Study Days	35/63

Vehicle G42-0505A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	17.8/40.1	11.5/36.5	3.9/15.3	622
Travel Time (Minutes)	53/138	34.6/113	11.7/107	1,867
Idle Time (Minutes)	6.5/NA	4.2/NA	1.4/NA	229

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	154	100	Less than 2	93
10 to 20	0	0	2 to 4	13
20 to 40	0	0	4 to 8	7
40 to 60	0	0	Greater than 8	41

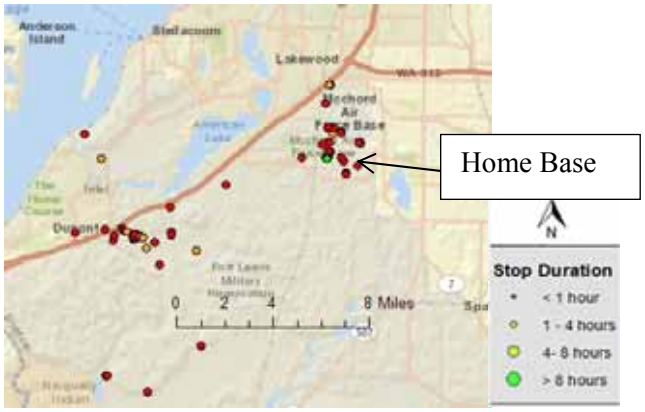


Figure D-31. Vehicle G42-0505A stops.

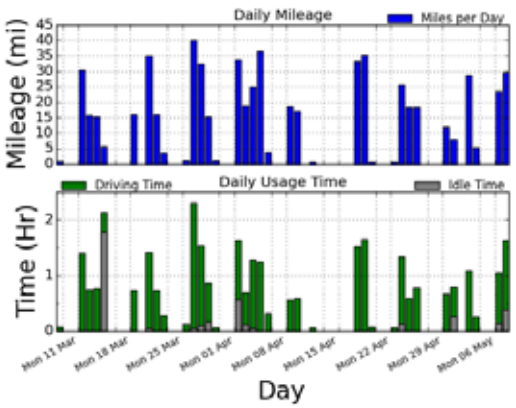


Figure D-32. Vehicle G42-0505A history.

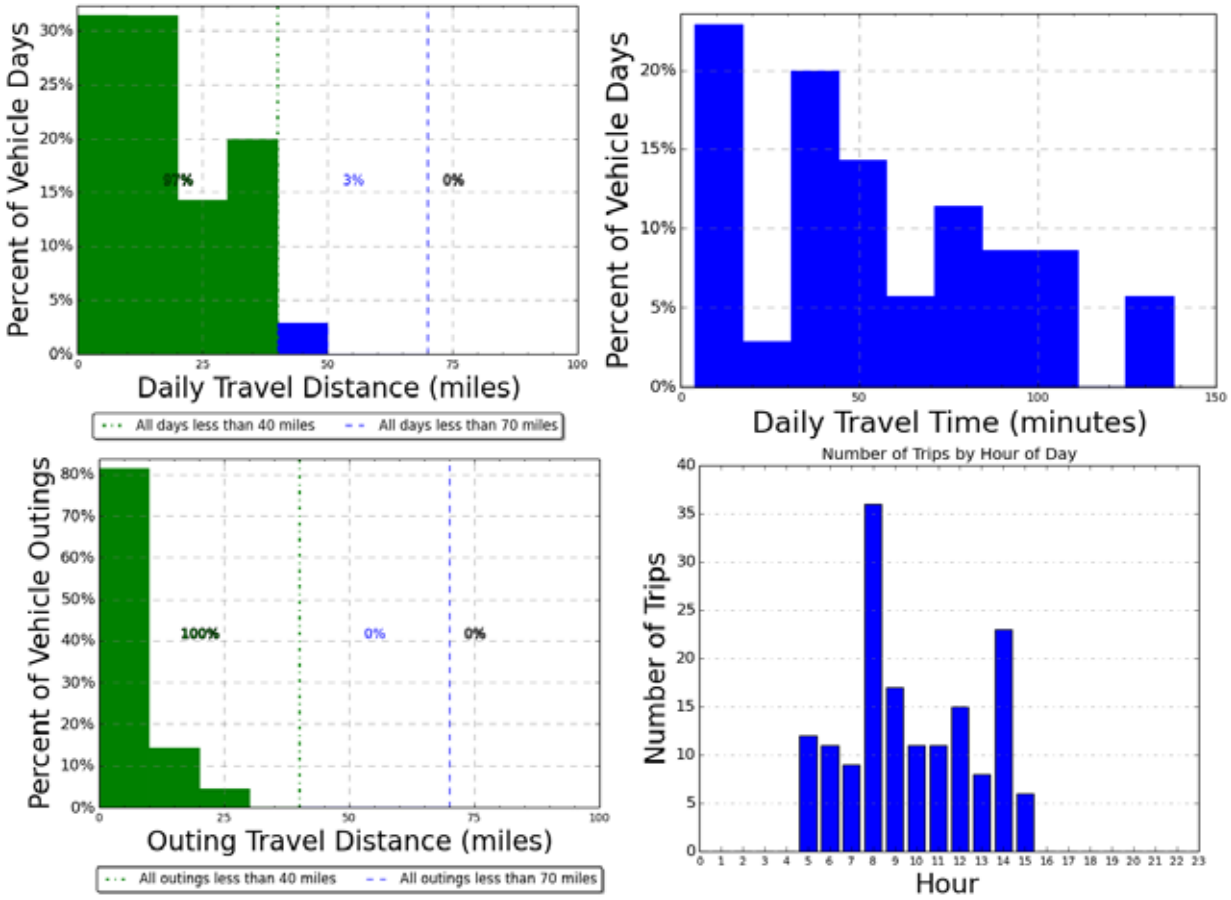


Figure D-24. Vehicle G42-0505A travel graphs.

Vehicle G42-0505A Observations

The project survey response identifies this vehicle as a pool vehicle that is assigned to a specific person, Information Technology/GeoSpatial Support Section, to transport personnel and survey/GIS equipment to carry out land surveying operations and the collection of geospatial data. GeoSpatial Support provides support to the Operations/Maintenance branch of DPW in execution of their assigned tasks. When supporting surveying and geospatial data tasks, the van carries survey equipment.

Site records report this vehicle travels approximately 383 miles per month and the odometer read 25,346 in April 2012. The vehicle parks in the office parking lot at Building 555 at McChord Field or Building 2012 at Lewis. DPW expects to retain the vehicle more than 6 years. Two to five persons have access to the vehicle. It travels off base occasionally to attend meetings in Seattle, transport personnel to and from SeaTac Airport, and other trips. When used off base, typical travel is between 40 and 100 miles, with an average outing of 90 miles. Operation occurs during normal duty hours of 0700 to 1630.

Logger 92 collected data on this vehicle for 35 days of the 63-day study period. Validation occurred on 99.4% of the vehicle data. Sixty-three percent of the recorded stops greater than 2-hours duration occurred at the home base, with 22% of the stops on Pendleton Avenue and 22% of the stops in DuPont, WA. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range for a PHEV of 40 miles. A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G43-1155L

www.autocatch.com

Make/Model/Year	Ford/F350/2011
EPA Class Size*	Pickup Truck
Mission	Support
Contact	J Ross/Public Works
Parking Location	Bldg 2044/Utah Ave
Fleet Vehicle ID	G43-1155L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy)*	15/21/17 11/15/13
EPA GHG Emissions (Grams CO_2/Mi)*	523/484
Study Logger ID	Logger 95
Total Vehicle Days/Total Study Days	35/63

Vehicle G43-1155L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	51.4/139	17.5/132.6	7.1/44.3	1,798
Travel Time (Minutes)	129/302	43.9/209	17.9/81	4,522
Idle Time (Minutes)	10.1/NA	3.4/NA	1.4/NA	353

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	207	82.8	Less than 2	201
10 to 20	40	16	2 to 4	12
20 to 40	3	1.2	4 to 8	1
40 to 60	0	0	Greater than 8	36

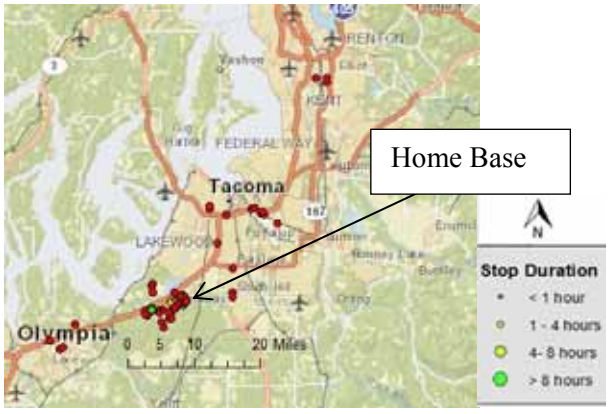


Figure D-34. Vehicle G43-1155L stops.

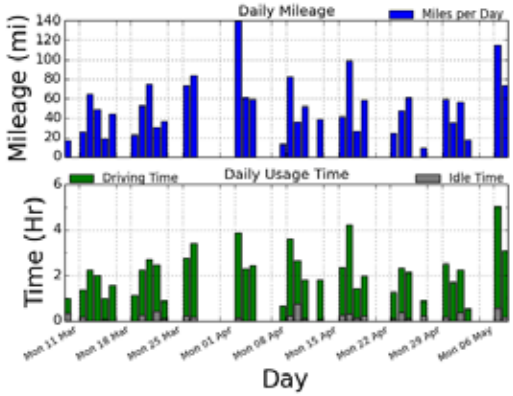


Figure D-35. Vehicle G43-1155L history.

*2011 Ford F150 information provided. EPA figures for 2011 Ford F350 are not available.

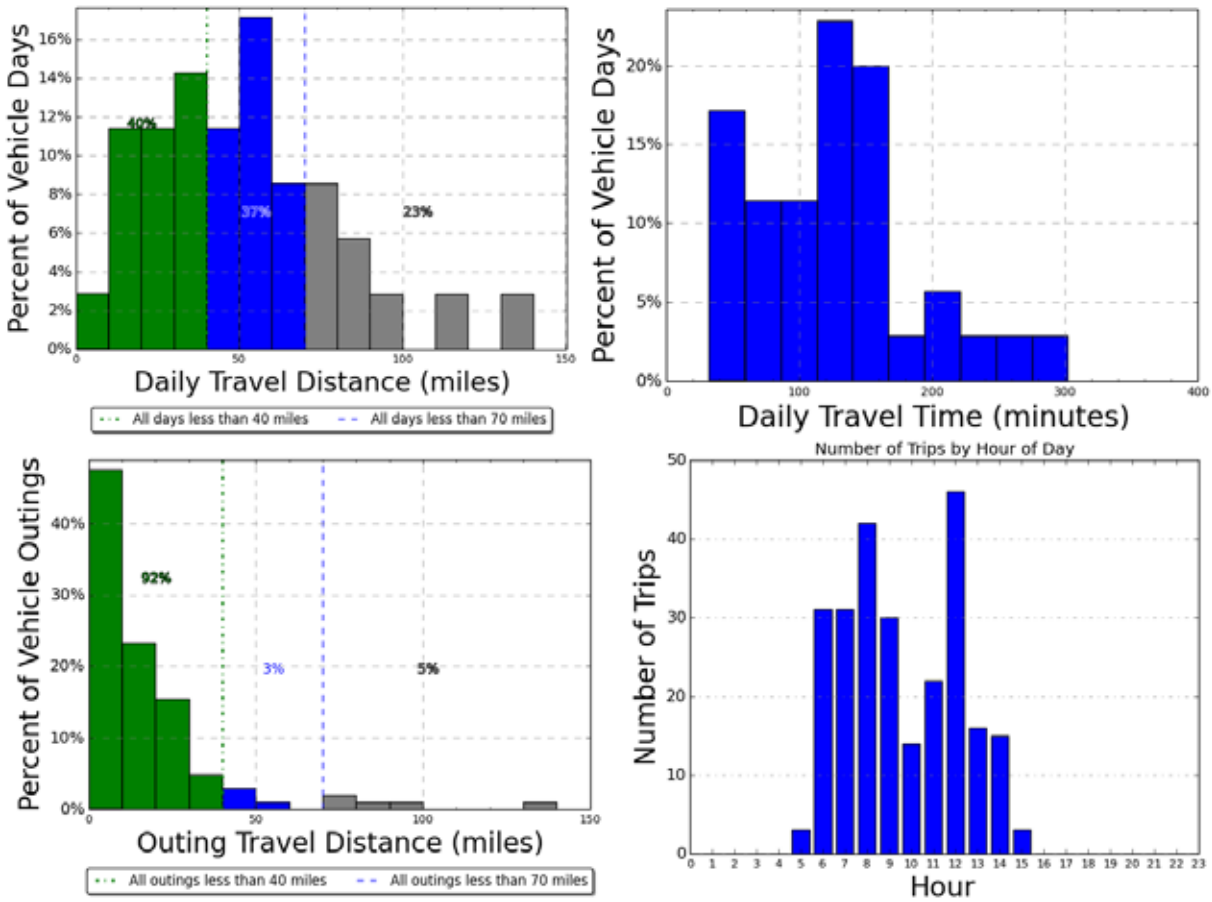


Figure D-25. Vehicle G43-1155L travel graphs.

Vehicle G43-1155L Observations

Vehicle survey information is not available for this vehicle. Data logger information suggests this vehicle's home base is on Utah Avenue near Building 2044. Site records report the vehicle travels approximately 406 miles per month and the odometer read 4,481 in May 2012.

Logger 95 collected data on this vehicle for 35 days of the 63-day study period. Validation occurred on 99.6% of the vehicle data. All of the recorded stops greater than the 2-hour duration occurred at the home base.

Seventy-seven percent of all vehicle travel days were within the 70-mile BEV advertised range of 70 miles, while 23% of the vehicle travel days exceed this range. Ninety-five percent of the outings were within the BEV range. With management attention, a BEV that is charged between outings may meet the mission objectives. However, several of the longer trips suggest that a PHEV would be a more suitable replacement. Ninety-two percent of the outings and 40% of the daily travel are within the battery only motive power for a PHEV.

Vehicle G41-1605L

www.edmunds.com

Make/Model/ ear	Dodge/Dakota/2011
EPA Class Size	Standard Pickup Truck
Mission	Support
Contact	J Ross/Public Works
Parking Location	Bldg 2044
Fleet Vehicle ID	G41-1605L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy)	14/19/16 9/13/10
EPA GHG Emissions (Grams CO_2/Mi)	555/630
Study Logger ID	Logger 98
Total Vehicle Days/Total Study Days	6/63

Vehicle G41-1605L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.6/19.8	7.4/29.0	4.7/19.8	52
Travel Time (Minutes)	24/49	20.6/71.0	13.1/48	144
Idle Time (Minutes)	1.3/NA	1.1/NA	0.7/NA	8

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	11	100	Less than 2	6
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	5

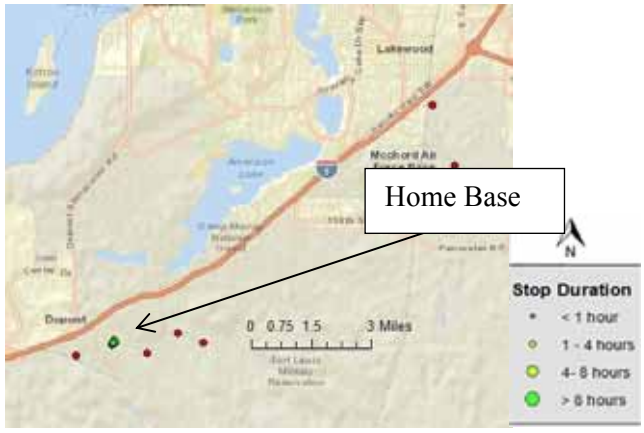


Figure D-37. Vehicle G41-1605L stops.

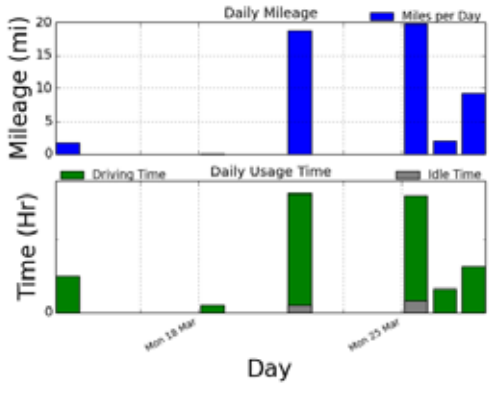


Figure D-38. Vehicle G41-1605L history.

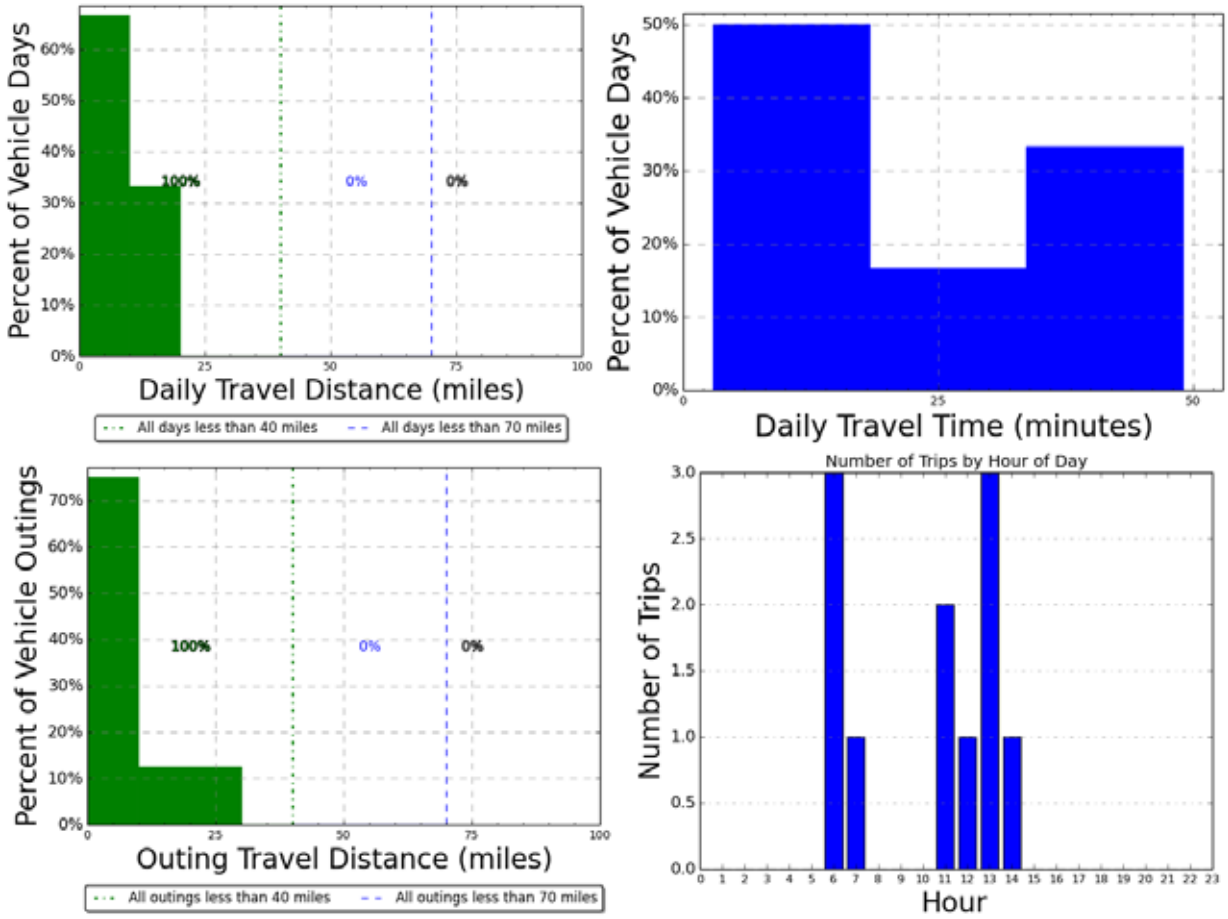


Figure D-26. Vehicle G41-1605L travel graphs.

Vehicle G41-1605L Observations

Vehicle survey information is not available for this vehicle. Data logger information suggests this vehicle's home base is on Pendleton Avenue near Building 2044. Site records report the vehicle travels approximately 171 miles per month and the odometer read 2,158 in May 2012.

Logger 98 collected data on this vehicle for 6 days of the 63-day study period. Validation occurred on 96.2% of the vehicle data. All recorded stops greater than the 2-hour duration occurred at the home base. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings exceeded the maximum CD range for a PHEV of 40 miles.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Vehicle G42-0610K

www.edmunds.com

Make/Model/Year	Chevrolet/C1500/2010
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	J Ross/Public Works
Parking Location	Bldg 2044/Pendleton Ave
Fleet Vehicle ID	G42-0610K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)	15/21/17 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)	523/484
Study Logger ID	Logger 100
Total Vehicle Days/Total Study Days	20/63

Vehicle G42-0610K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	13.4/34.5	10.7/27.5	3.8/15.4	269
Travel Time (Minutes)	43/128	34.5/79	12.1/44	862
Idle Time (Minutes)	1.9/NA	1.5/NA	0.5/NA	37

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	72	100	Less than 2	48
10 to 20	0	0	2 to 4	3
20 to 40	0	0	4 to 8	1
40 to 60	0	0	Greater than 8	20

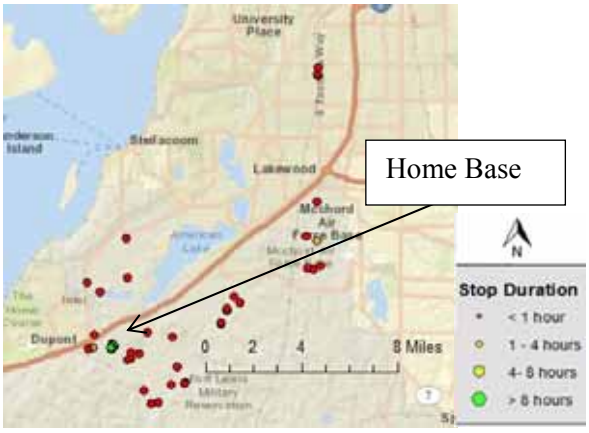


Figure D-40. Vehicle G42-0610K stops.

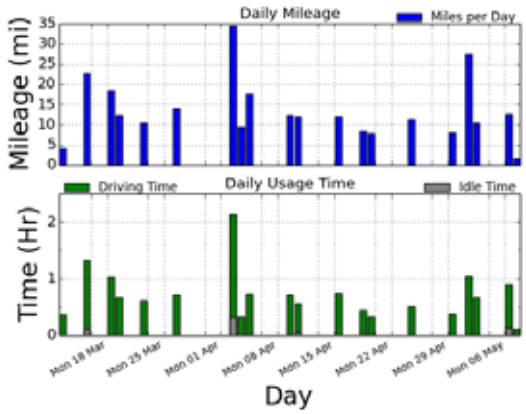


Figure D-41. Vehicle G42-0610K history.

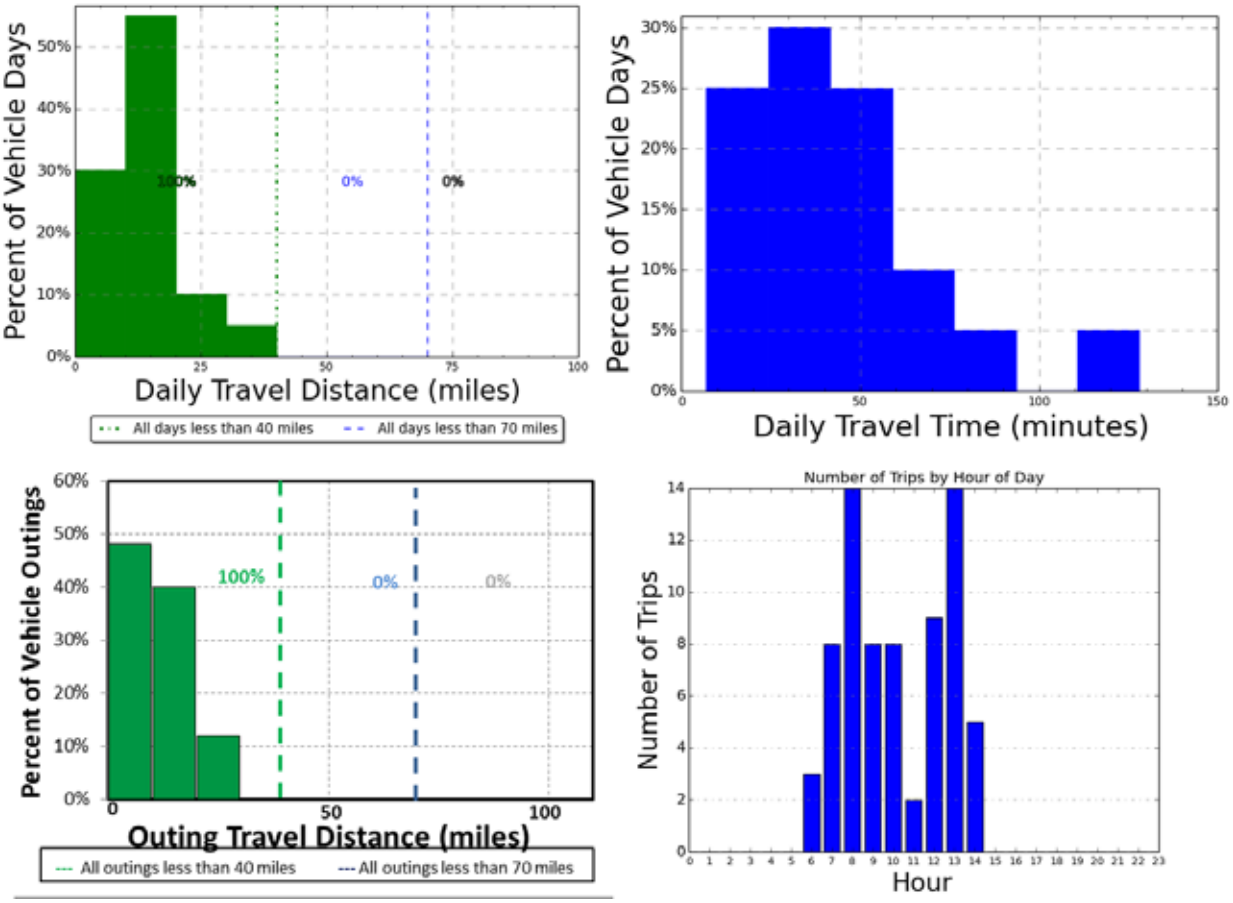


Figure D-27. Vehicle G42-0610K travel graphs.

Vehicle G42-0610K Observations

Public Works reports this is a pool vehicle, accessible by more than 20 persons, that typically parks in the lot near Building 2044. The expected retention of this vehicle is currently unknown. On a typical weekday, it travels between 11 and 40 miles and usually contains two persons. It does not regularly carry particular cargo or equipment.

Site records report this vehicle travels an average 281 miles per month. Its odometer read 6,557 in April 2012. This vehicle rarely travels off base.

Logger 100 collected data on this vehicle for 20 days of the 63-day study period. Validation occurred on 96.2% of the vehicle data. The longest single trip, outing, and daily travel were within the typically advertised range of a BEV of approximately 70 miles. None of the outings and daily travel exceeded the maximum CD range for a PHEV of 40 miles.

A BEV may provide acceptable performance for this vehicle should the BEV meet other mission requirements. Information is unavailable, suggesting special requirements exist. Daily travel requirements also allow use of a PHEV traveling all day in CD mode, thus providing an alternative for this vehicle.

Appendix E
Motor Transport Branch Vehicle Data Sheets

Table E-2. JBLM Motor Transport Branch vehicle index.

Vehicle Index						
Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
6	G43-0875K	Ford	E350	2010	Cargo Van	Pool
7	G41-1288A	Ford	SPORT TRAC	2004	Pickup Truck	Pool
8	G43-4937A	Ford	E350	2004	Cargo Van	Pool
9	G10-7664F	Dodge	AVENGER	2008	Compact Sedan	Pool
10	G41-65991	Dodge	DAKOTA	2002	Pickup Truck	Pool
11	G11-2676G	Chevrolet	IMPALA	2008	Large Car	Pool
12	G43-3717A	Ford	E350	2004	Cargo Van	Pool
13	G11-0678K	Chevrolet	IMPALA	2010	Large Car	Support
14	G62-4526H	Chevrolet	TAHOE	2009	SUV	Support
15	G42-0698K	Chevrolet	C1500	2011	Pickup Truck	Support
16	G11-0493L	Chevrolet	IMPALA	2012	Large Car	Support
17	G71-0062G	Ford	F750	2008	Stake Truck	Transport
18	G62-1094L	Chevrolet	AVALANCHE	2011	SUV	Support
19	G41-1395G	Chevrolet	UPLANDER	2008	Minivan	Pool
20	G61-1155D	Ford	ESCAPE HYB	2006	SUV	Pool
81	G10-2878L	Chevrolet	MALIBU	2011	Midsize Sedan	Pool
84	G41-1100K	Dodge	GRCARAVAN	2010	Minivan	Pool
85	G62-0979G	Dodge	1500	2008	Pickup Truck	Pool
89	G71-0674A	Ford	F650 18'BO	2004	Delivery Van	Transport
93	G41-1373G	Dodge	DAKOTA	2008	Pickup Truck	Support
97	G41-1367G	Dodge	DAKOTA	2008	Pickup Truck	Pool
101	G43-0792K	Chevrolet	CG3300	2010	Passenger Van	Pool
102	G43-0801K	Chevrolet	CG3300	2010	Passenger Van	Pool
104	G42-0988F	Chevrolet	EXPRESS 13	2007	Cargo Van	Support
105	G43-0860G	Chevrolet	CG3300	2008	Passenger Van	Pool
106	G43-1389K	Chevrolet	CG3300	2010	Passenger Van	Pool
107	G41-1180G	Chevrolet	UPLANDER	2008	Minivan	Support
108	G11-2675G	Chevrolet	IMPALA	2008	Large Sedan	Pool
109	G43-1191L	Chevrolet	CG3300	2011	Passenger Van	Pool
110	G12-0662H	Ford	FUSION HEV	2010	Midsize Sedan	Pool
111	G63-0271A	Ford	F350STAKE	2004	Stake Truck	Transport
112	G41-1392G	Chevrolet	UPLANDER	2008	Minivan	Support
113	G43-3881H	Ford	E350	2009	Passenger Van	Pool
114	G43-25839	Ford	F350	2003	Pickup Truck	Transport
115	G41-1376G	Dodge	DAKOTA	2008	Pickup Truck	Support
116	G41-1161G	Chevrolet	UPLANDER	2008	Minivan	Pool
117	G43-0790K	Chevrolet	CG3300	2010	Passenger Van	Pool
118	G82-0509A	Ford	F650 STAKE	2004	Stake Truck	Transport
119	G10-6379L	Dodge	AVENGER	2011	Midsize Sedan	Support
120	G42-3471A	Chevrolet	G2300	2005	Cargo Van	Transport

Vehicle G43-0875K

Make/Model/Year	Ford/E350/2010
EPA Class Size	Cargo Van
Mission	Pool
Contact	J. Lamantia/Motor Transport
Parking Location	Near J Ramp/Levitow Blvd
Fleet Vehicle ID	G43-0875K
Fuel Type	Gas/Eth
EPA Label/MPG (City/Hwy/Combined)*	12/15/13 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)*	684/630
Study Logger ID	Logger 6
Total Vehicle Days/Total Study Days	34/63

Vehicle G43-0875K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	19.5/51.7	0.8/8.9	0.6/7.9	664
Travel Time (Minutes)	219/777	9.2/128	6.9/113	7,454
Idle Time (Minutes)	89.8/NA	3.8/NA	2.8/NA	3,054

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	1,162	100%	Less than 2	1,099
10 to 20	0	0%	2 to 4	44
20 to 40	0	0%	4 to 8	8
40 to 60	0	0%	Greater than 8	11

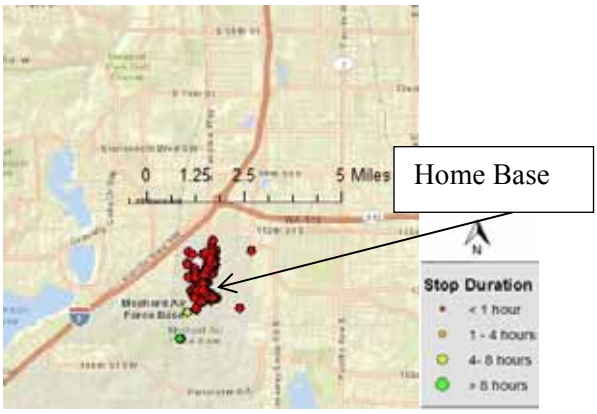


Figure E-28. Vehicle G43-0875K stops.

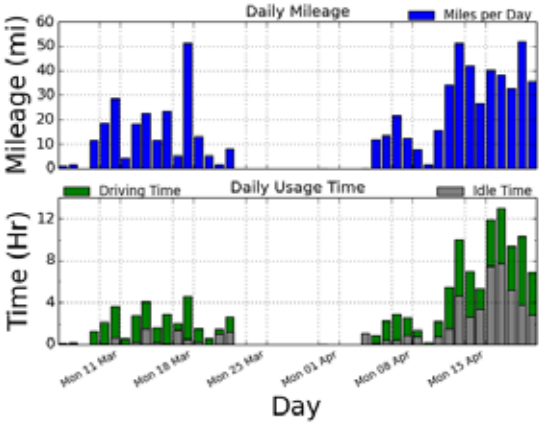


Figure E-29. Vehicle G43-0875K history.

*2011 Ford E350 Van information provided. EPA figures for 2010 Ford E350 not available.

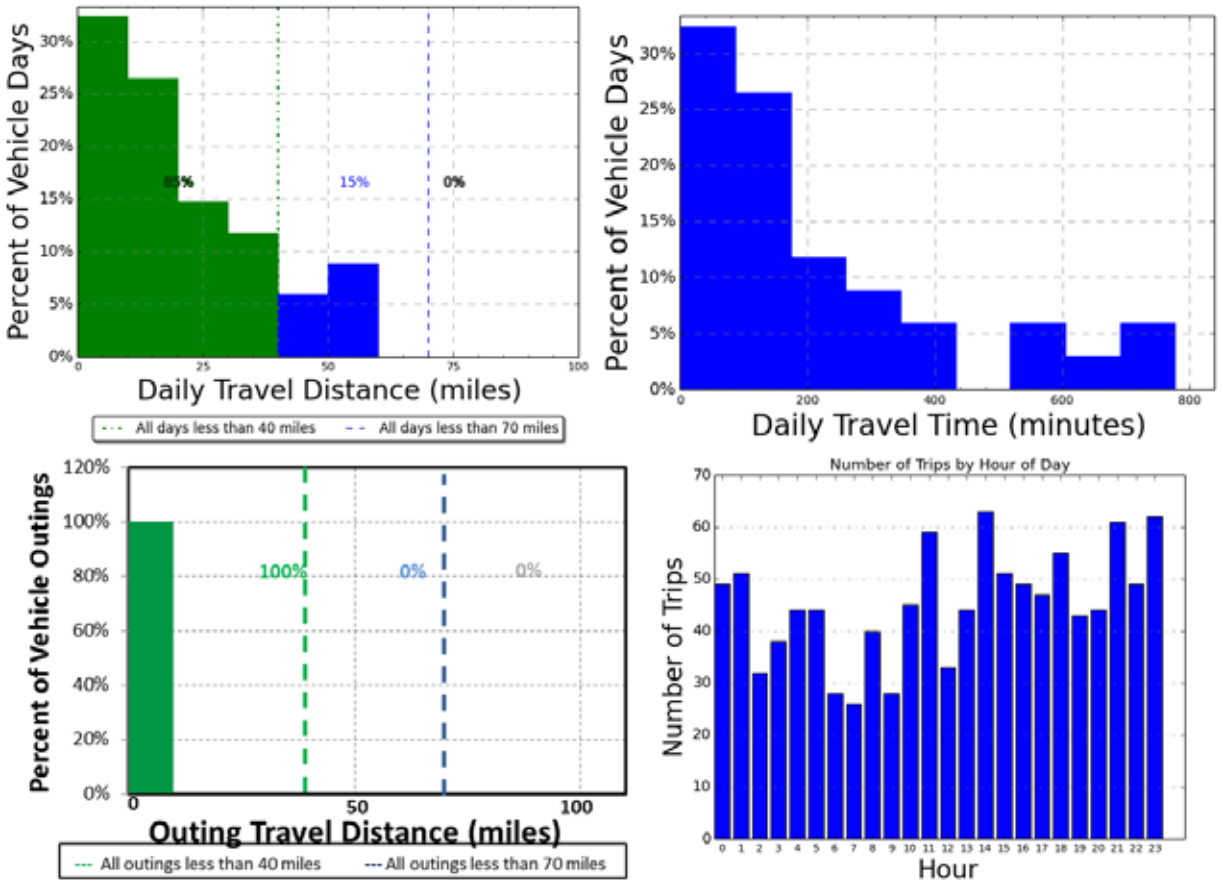


Figure E-30. Vehicle G43-0875K travel graphs.

Vehicle G43-0875K Observations

Survey information was not available for this vehicle. Stop data suggests it typically parks near J Ramp on Levitow Blvd (E St NW) or 2nd St NW. Site data reports an odometer reading of 15,214 in May 2012 with an average of 1,556 miles per month.

Logger 6 collected data on this vehicle for a period of 34 days of the 63-day study period. Validation occurred on 99.5% of the input data. All trips and outings were less than 10 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 52 miles, which was also within the BEV range.

This vehicle had an exceptionally high number of trips at 1085 trips in 34 days for an average of 32 trips per day monitored. However, all of the trips are of short range at an average of 0.6 miles each.

This is a large cargo van and no BEV is currently available for replacement. However, since survey information was not available, it is not known if special cargo requirements would preclude replacement by a smaller vehicle. Thus, a BEV may provide the acceptable performance of this vehicle should the BEV meet other mission requirements.

Vehicle G41-1288A

Make/Model/Year	Ford/Sport Trac /2004
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	J. Lamantia/Motor Transport
Parking Location	Bldg 100/Col. Joe Jackson Blvd
Fleet Vehicle ID	G41-1288A
Fuel Type	Gas/Eth
EPA Label/MPG (City/Hwy/Combined)	14/20/16 10/14/12
EPA GHG Emissions (Grams CO_2/Mi)	555/525
Study Logger ID	Logger 7
Total Vehicle Days/Total Study Days	44/63

Vehicle G41-1288A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	2.7/12.9	1.7/9.2	1.0/8.2	121
Travel Time (Minutes)	18/88.0	11.1/54	6.2/48	786
Idle Time (Minutes)	4.0/NA	2.5/NA	1.4/NA	174

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	119	100%	Less than 2	73
10 to 20	0	0%	2 to 4	4
20 to 40	0	0%	4 to 8	6
40 to 60	0	0%	Greater than 8	36

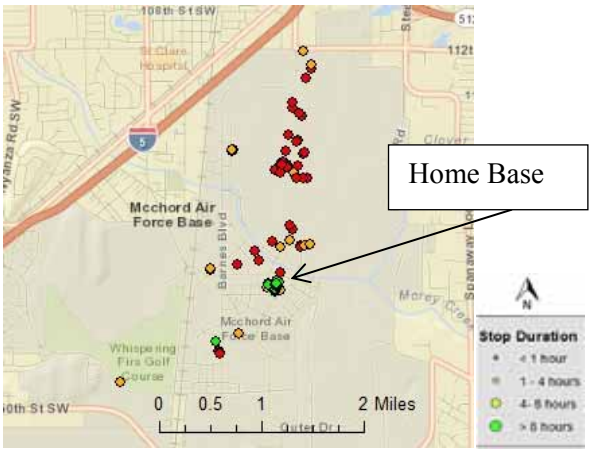


Figure E-4. Vehicle G41-1288A stops.

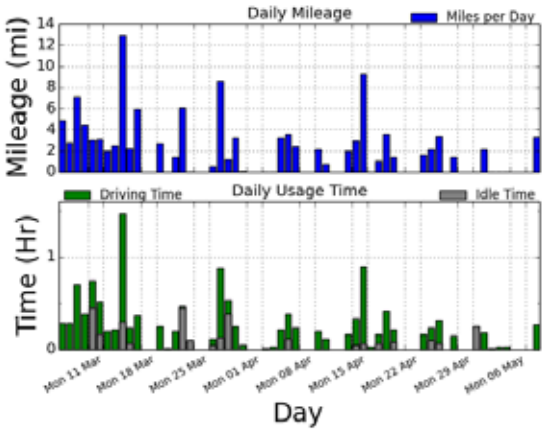


Figure E-5. Vehicle G41-1288A history.

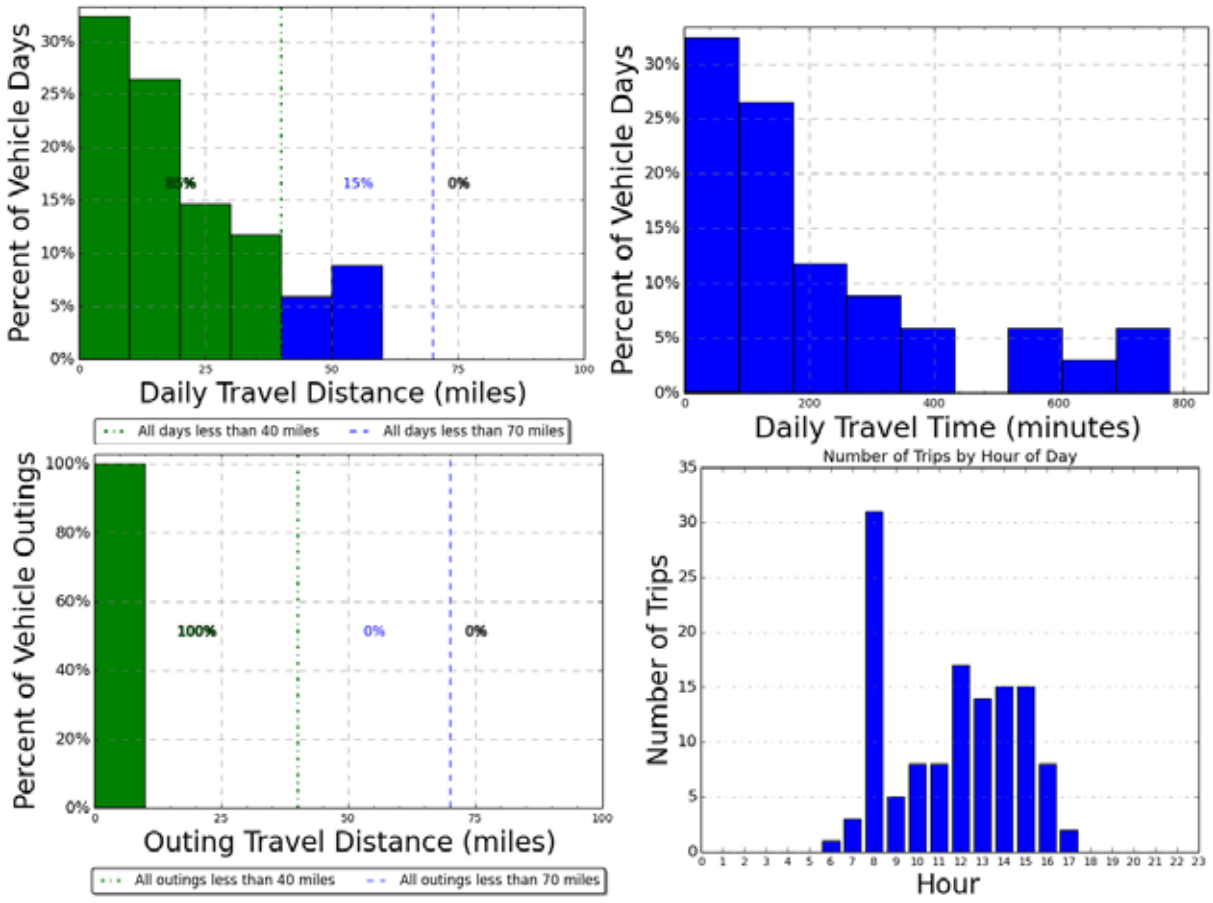


Figure E-31. Vehicle G41-1288A travel graphs.

Vehicle G41-1288A Observations

Logger 7 collected data on this vehicle for a period of 44 days of the 63-day study period. Validation occurred on 91.5% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 100/Col. Joe Jackson Blvd. Site data reports an odometer reading of 14,555 in May 2012 with an average of 53 miles per month.

All trips and outings were less than 10 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 12.9 miles that was also within the BEV range. Based upon travel alone, a BEV could be a suitable replacement.

This is a pickup truck. Since survey information was not available, it is not known if special cargo requirements would preclude replacement by a smaller vehicle, SUV, or minivan. Thus, a BEV may provide the acceptable performance of this vehicle should the BEV meet other mission requirements.

Vehicle G43-4937A

www.kbb.com/ford/

Make/Model/Year	Ford/E350 /2004
EPA Class Size	Cargo Van
Mission	Pool
Contact	J. Lamantia/Motor Transport
Parking Location	C Ramp/7th St NE
Fleet Vehicle ID	G43-4937A
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	14/18/15
EPA GHG Emissions (Grams CO_2/Mi)*	592
Study Logger ID	Logger 8
Total Vehicle Days/Total Study Days	9/63

Vehicle G43-4937A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	13.1/21.6	1.8/6.9	0.7/6.1	118
Travel Time (Minutes)	82/129.0	11.5/31.0	4.6/28	739
Idle Time (Minutes)	56/NA	7.9/NA	3.1/NA	504

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	454	100%	Less than 2	365
10 to 20	0	0%	2 to 4	57
20 to 40	0	0%	4 to 8	15
40 to 60	0	0%	Greater than 8	17

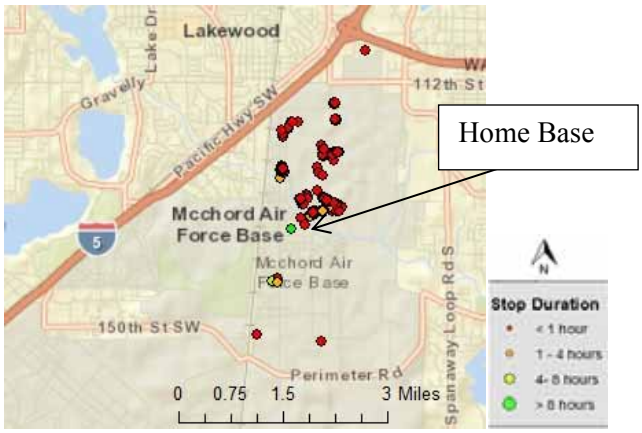


Figure E-7. Vehicle G43-4937A stops.

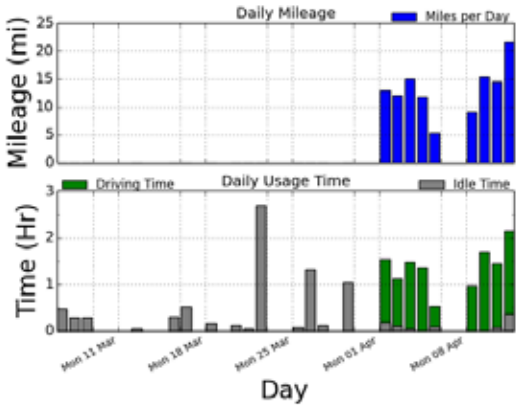


Figure D-32. Vehicle G43-4937A history.

*2004 Ford E250 information. EPA figures for 2004 Ford E350 not available.

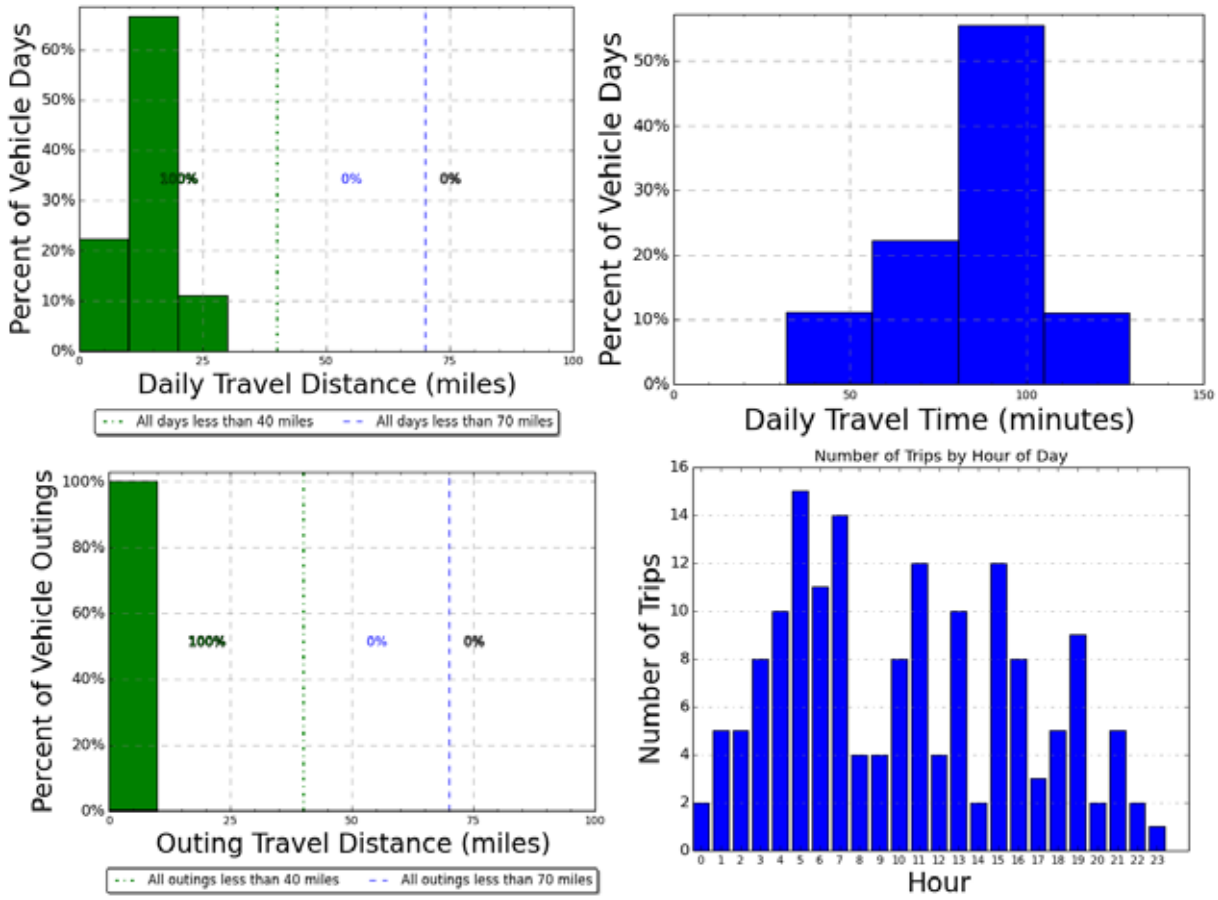


Figure E-33. Vehicle G43-4937A travel graphs.

Vehicle G43-4937A Observations

Logger 8 collected data on this vehicle for a period of 9 days of the 63-day study period. Validation occurred on 99.3% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks on 7th Street NW near C Ramp. Site data reports an odometer reading of 30,040 in May 2012 with an average of 338 miles per month.

All trips and outings were less than 10 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 21.6 miles that was also within the BEV range. Based upon travel alone, a BEV could be a suitable replacement.

This is a large cargo van and no BEV is currently available for replacement. However, since survey information was not available, it is not known if special cargo requirements would preclude replacement by a smaller vehicle. Thus, a BEV may provide the acceptable performance of this vehicle should the BEV meet other mission requirements.

Vehicle G10-7664F

www.edmunds.com/

Make/Model/Year	Dodge/Avenger /2008
EPA Class Size	Compact Sedan
Mission	Pool
Contact	J. Lamantia/Motor Transport
Parking Location	Bldg 100/ Westcott Hills
Fleet Vehicle ID	G10-7664F
Fuel Type	Gas/Eth
EPA Label/MPG (City/Hwy/Combined)*	19/27/22 13/20/16
EPA GHG Emissions (Grams CO_2/Mi)*	404/393
Study Logger ID	Logger 9
Total Vehicle Days/Total Study Days	25/63

Vehicle G10-7664F Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	6.2/25.6	7.8/30.2	2.2/11.5	156
Travel Time (Minutes)	25/75	31.9/125	9.0/57	637
Idle Time (Minutes)	8.4/NA	10.5/NA	3.0/NA	210

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	79	100%	Less than 2	44
10 to 20	0	0%	2 to 4	6
20 to 40	0	0%	4 to 8	5
40 to 60	0	0%	Greater than 8	24

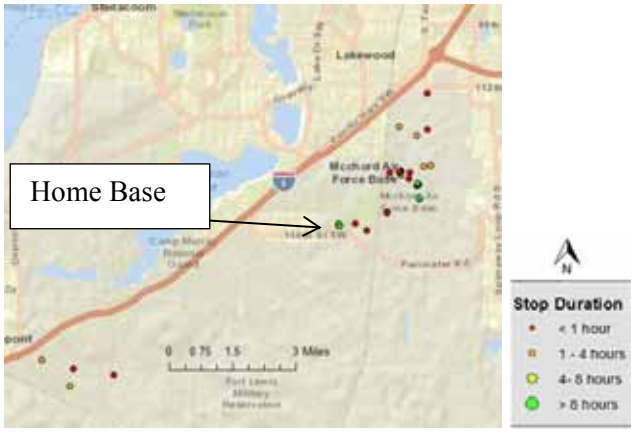


Figure E-10. Vehicle G10-7664F stops.

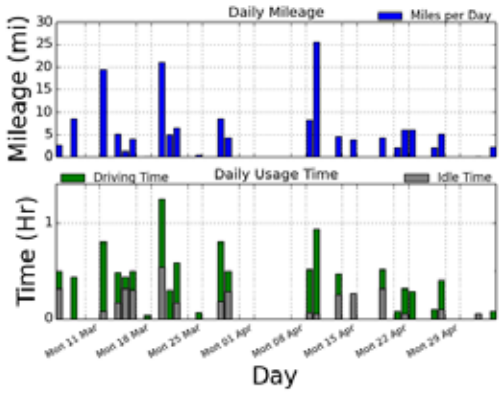


Figure E-11. Vehicle G10-7664F history.

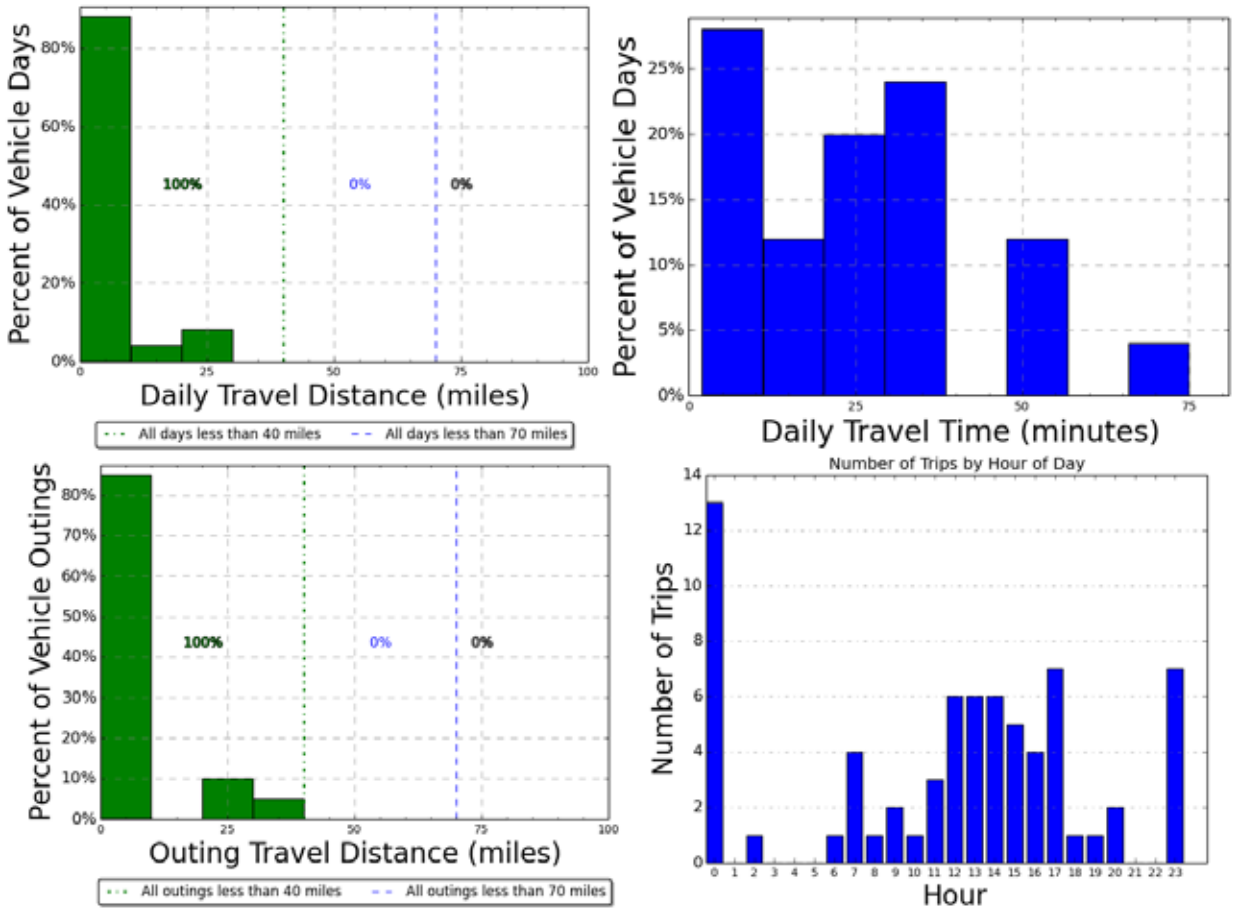


Figure E-34. Vehicle G10-7664F travel graphs.

Vehicle G10-7664F Observations

Logger 9 collected data on this vehicle for a period of 25 days of the 63-day study period. Validation occurred on 93.2% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Westcott Hills Housing on Lincoln Blvd. It also stops frequently at Bldg 100 near Col Joe Jackson Blvd. Site data reports an odometer reading of 12,358 in May 2012 with an average of 69 miles per month.

All trips and outings were less than 40 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 25.6 miles that was also within the BEV range. The longest single outing was 30.2 miles because the vehicle did not return to the home base over the evening. Based upon travel alone, a BEV could be a suitable replacement.

This is a compact sedan and BEVs are available for replacement. The BEV may provide the acceptable performance of this vehicle.

Vehicle G41-65991

www.edmunds.com/

Make/Model/Year	Dodge/Dakota/2002
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	J. Lamantia/ Transport
Parking Location	Bldg 100/Barrack St or 2nd St
Fleet Vehicle ID	G41-65991
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	16/18/17
EPA GHG Emissions (Grams CO_2/Mi)*	523
Study Logger ID	Logger 10
Total Vehicle Days/Total Study Days	40/63

Vehicle G41-65991Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	77.4/264.4	63.2/264.4	18.1/133.6	3,096
Travel Time (Minutes)	121/284	98.6/284	28.2/146	4,829
Idle Time (Minutes)	17.9/NA	14.6/NA	4.2/NA	717

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	90	55.9%	Less than 2	106
10 to 20	9	5.6%	2 to 4	14
20 to 40	32	19.9%	4 to 8	2
40 to 60	30	18.7%	Greater than 8	39

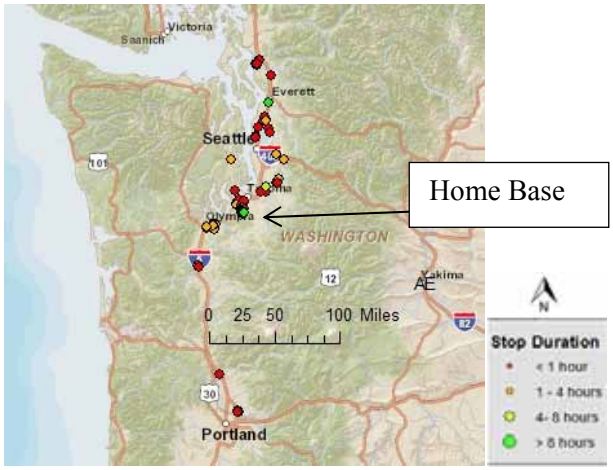


Figure E-13. Vehicle G41-65991 stops.

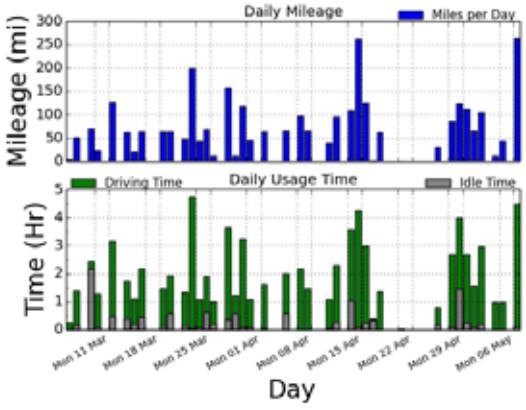


Figure E-14. Vehicle G41-65991 history.

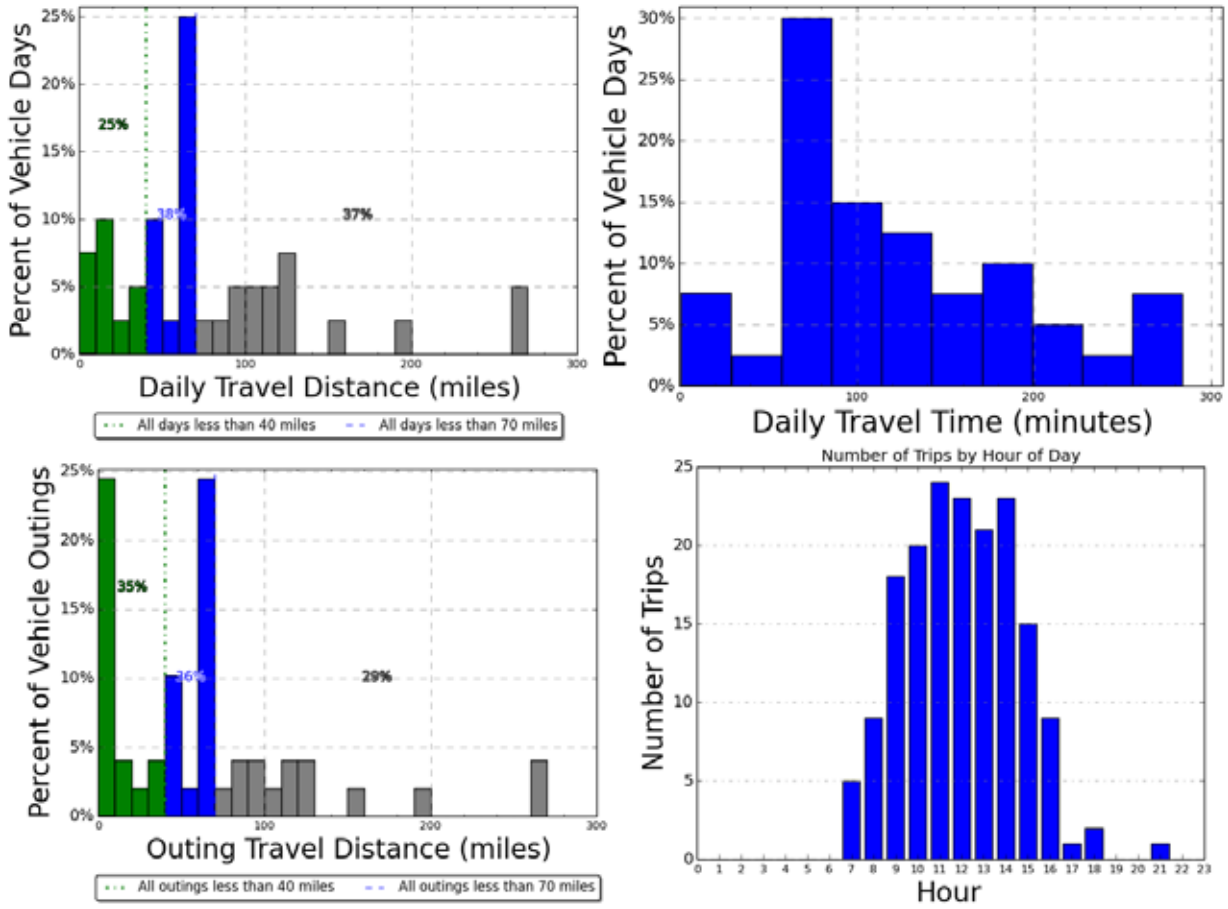


Figure E-35. Vehicle G41-65991travel graphs.

Vehicle G41-65991Observations

Logger 10 collected data on this vehicle for a period of 40 days of the 63-day study period. Validation occurred on 98.3% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 100 on Barrack or 2nd St SW. Site data reports an odometer reading of 18,370 in May 2012 with an average of 176 miles per month.

63% of all vehicle travel days were within the 70- mile BEV safe range (blue and green bars on Figure Appendix E-15) while 35% of the vehicle travel days were within the 40-mile PHEV safe range (green bars).

The longest single outing of 264 miles occurred on June 6 but several outings and daily travel exceeded the battery only limits of BEVs and PHEVs. 29% of outings and 37% of travel days exceeded those limits. The stop locations of greater than 2 hours show 65% at the home base location, 9% at B Street and the remainder at various other sites.

These data indicate that choosing a BEV for this duty may require intermediate charging stations opportunities at either the home base or a frequent intermediate stop. Yet, some travel days did not allow sufficient recharge opportunities or sufficient recharge time. Thus, a PHEV is required for the days that involve extended trips. A combination of BEVs and PHEVs may be desirable for this fleet.

Vehicle G11-2676G

www.edmunds.com

Make/Model/Year	Chevrolet/Impala/2008
EPA Class Size	Large Cars
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 9190/Sansone St
Fleet Vehicle ID	G11-2676G
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	18/29/22 14/21/16
EPA GHG Emissions (Grams CO_2/Mi)*	404/393
Study Logger ID	Logger 11
Total Vehicle Days/Total Study Days	15/63

Vehicle G11-2676G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	12.6/29.8	11.8/54.8	3.9/19.3	189
Travel Time (Minutes)	43/172	39.9/260	13.3/144	638
Idle Time (Minutes)	8.2/NA	7.7/NA	2.6/NA	123

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	50	94.3%	Less than 2	34
10 to 20	3	5.7%	2 to 4	3
20 to 40	0	0%	4 to 8	0
40 to 60	0	0%	Greater than 8	16

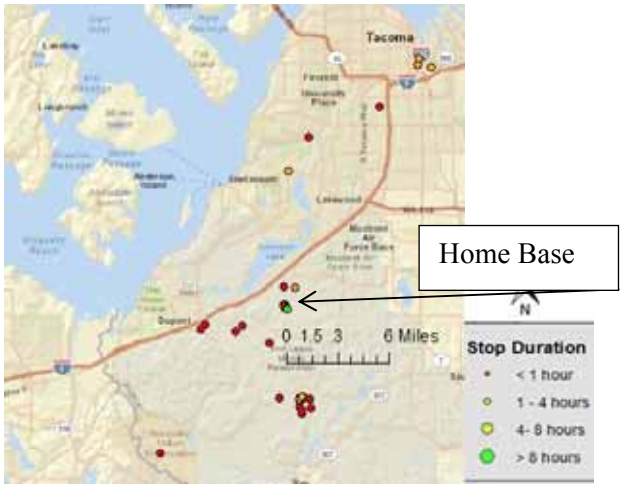


Figure E-16. Vehicle G11-2676G stops.

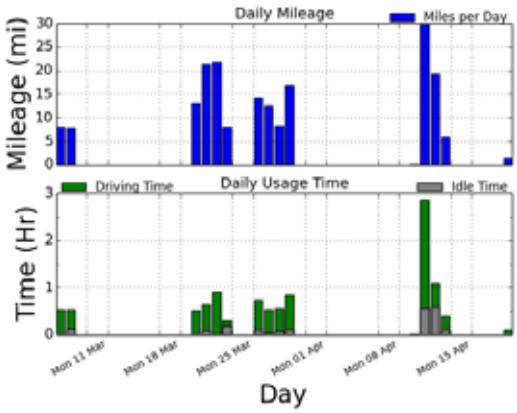


Figure E-17. Vehicle G11-2676G history.

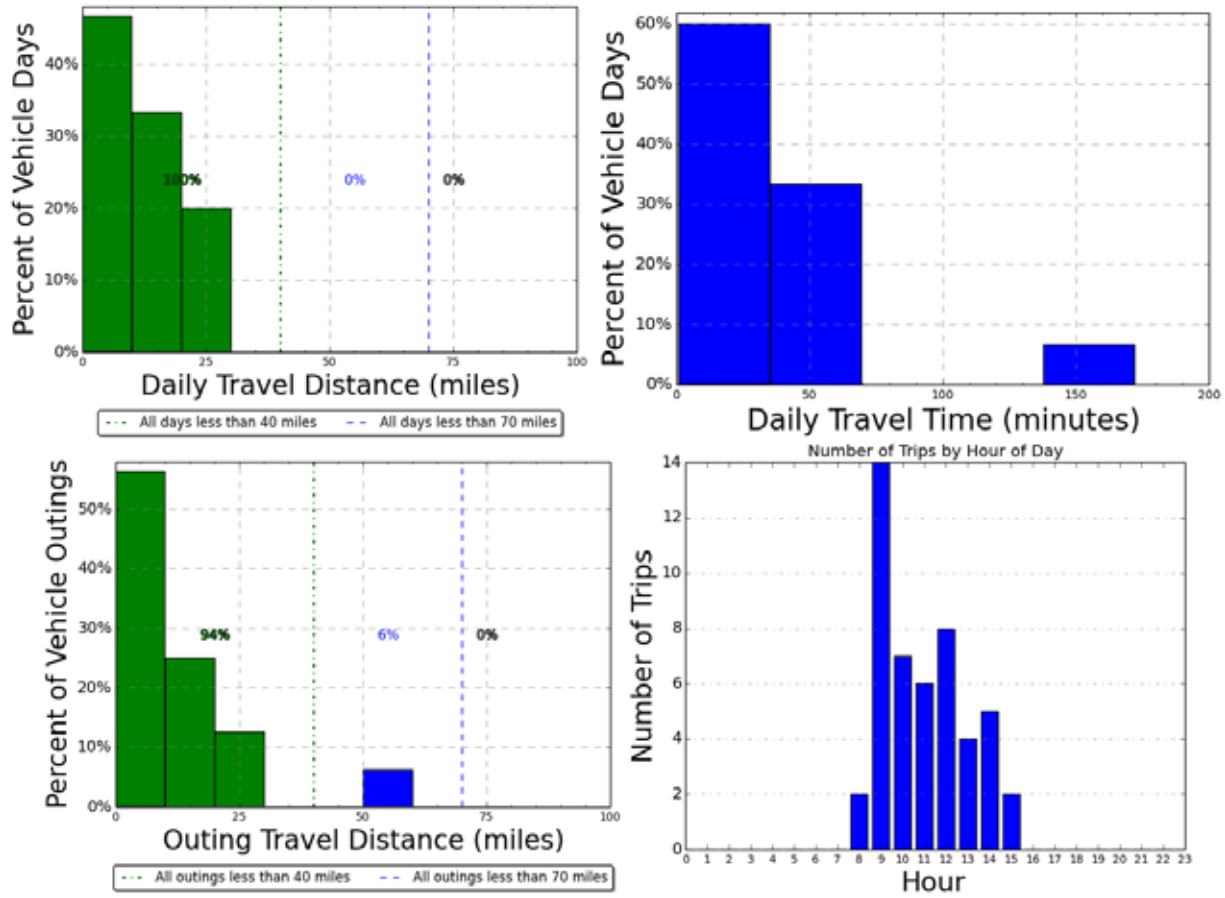


Figure E-36. Vehicle G11-2676G travel graphs.

Vehicle G11-2676G Observations

Logger 11 collected data on this vehicle for a period of 15 days of the 63-day study period. Validation occurred on 92.3% of the input data. The project survey response reports this vehicle travels less than 40 miles on a typical weekday. It frequently travels off base. Its use is primarily during daytime only. It parks regularly near Bldg 9190 on Sansone Street. Motor Transports expects to retain this vehicle more than six years.

Site data reports an odometer reading of 33,389 in May 2012 with an average of 667 miles per month.

All trips and outings were less than 70 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 29.8 miles that was also within the BEV range. The longest single outing was 54.8 miles because the vehicle did not return to the home base over the evening. Based upon travel alone, a BEV could be a suitable replacement.

This is a large sedan and BEVs are available for replacement. The BEV would be expected to provide the acceptable performance of this vehicle.

Vehicle G42-0658k

www.edmunds.com

Make/Model/Year	Ford/E350 Econoline/2004
EPA Class Size	Cargo Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 2027/N 8th St
Fleet Vehicle ID	G42-0658k
Fuel Type	Diesel
EPA Label/MPG (City/Hwy/Combined)*	13/16/14
EPA GHG Emissions (Grams CO_2/Mi)*	592
Study Logger ID	Logger 12
Total Vehicle Days/Total Study Days	13/63

Vehicle G42-0658k Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	13.4/78.2	5.6/77.4	2.5/39.0	174
Travel Time (Minutes)	48/214	20.1/206	10/139	623
Idle Time (Minutes)	10.7/NA	4.5/NA	2.2/NA	139

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	62	98.4%	Less than 2	47
10 to 20	0	0%	2 to 4	4
20 to 40	1	1.6%	4 to 8	2
40 to 60	0	0%	Greater than 8	10

Figure E-19. Vehicle G42-0658k stops.

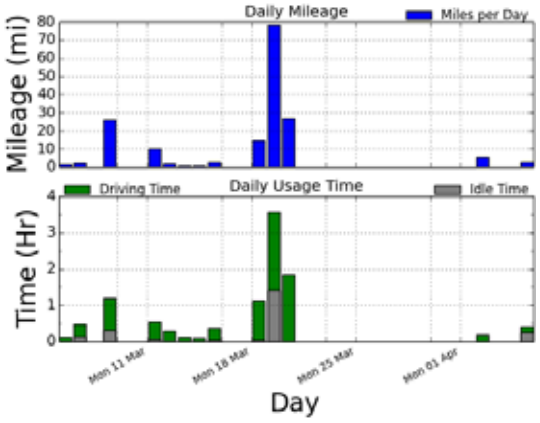


Figure E-20. Vehicle G42-0658k history.

*2004 Ford E250 information. EPA figures for 2004 Ford E350 not available.

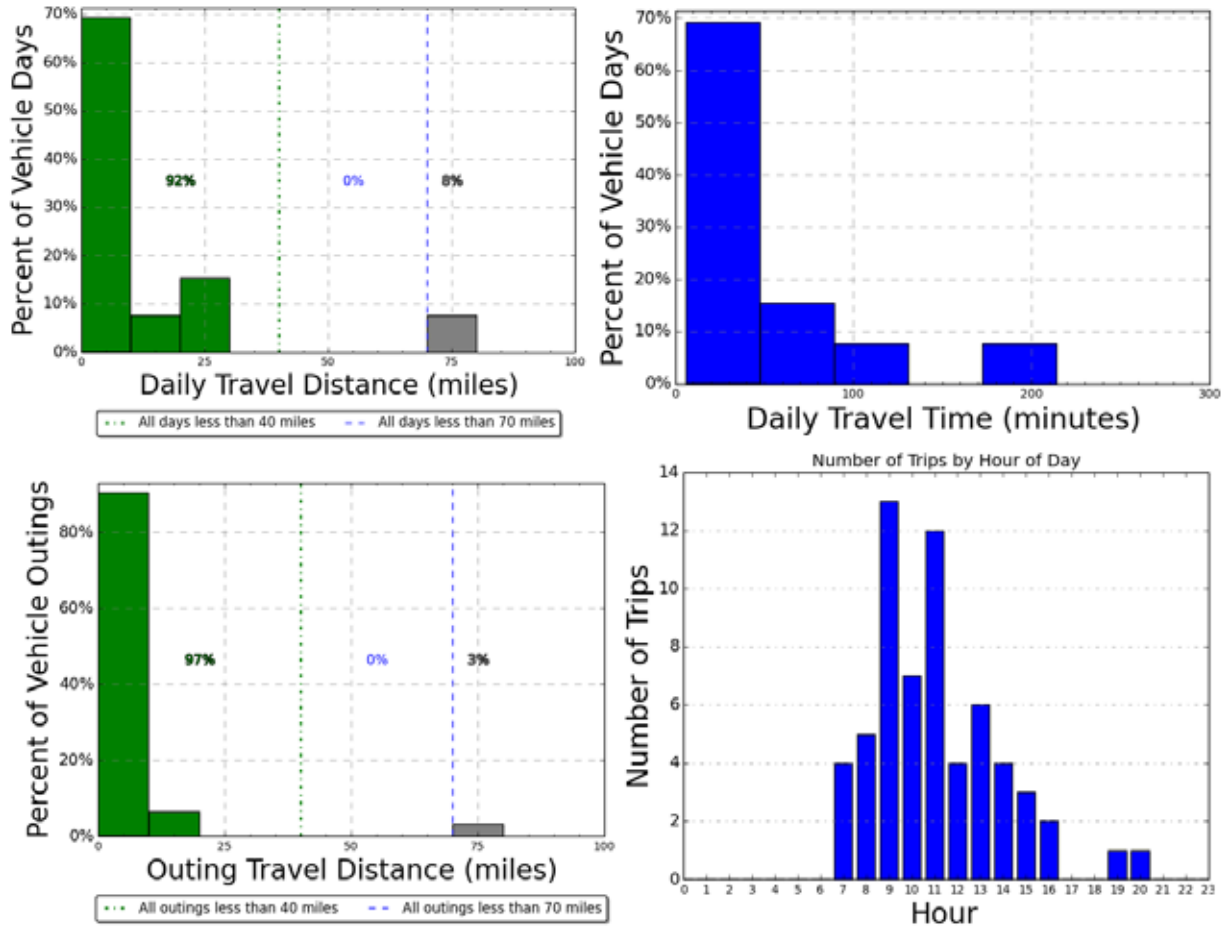


Figure E-37. Vehicle G42-0658k travel graphs.

Vehicle G42-0658k Observations

Logger 12 collected data on this vehicle for a period of 13 days of the 63-day study period. Validation occurred on 96.6% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 2027 on N 8th St. Site data reports an odometer reading of 37,338 in May 2012 with an average of 631 miles per month.

92% of all vehicle travel days were within the 70-mile BEV safe range (green bars on Figure D-4) and within the 40-mile PHEV safe range. 8% of the vehicle travel days exceed this BEV range.

The longest single outing and daily travel of 78 miles occurred on March 19 for a round trip to SEATAC airport. That outing took 3.4 hours of driving but the vehicle was away from home base all day.

These data indicate that choosing a BEV for this duty may require intermediate charging stations opportunities at either the home base or a frequent intermediate stop. Yet, some travel days did not allow sufficient recharge opportunities or sufficient recharge time. Thus, a PHEV is required for the days that involve extended trips. A combination of BEVs and PHEVs may be desirable for this fleet.

Vehicle G11-0678K

www.edmunds.com

Make/Model/Year	Chevrolet/Impala/2010
EPA Class Size	Large Sedan
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 100/2nd St NW
Fleet Vehicle ID	G11-0678K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	18/29/22 14/22/17
EPA GHG Emissions (Grams CO_2/Mi)*	404/370
Study Logger ID	Logger 13
Total Vehicle Days/Total Study Days	39/63

Vehicle G11-0678K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	18.3/40.1	9.0/33.4	4.2/19	713
Travel Time (Minutes)	57/208	28.3/394	13.3/206	2,232
Idle Time (Minutes)	15.9/NA	7.9/NA	3.7/NA	621

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	175	100%	Less than 2	124
10 to 20	0	0%	2 to 4	14
20 to 40	0	0%	4 to 8	1
40 to 60	0	0%	Greater than 8	36

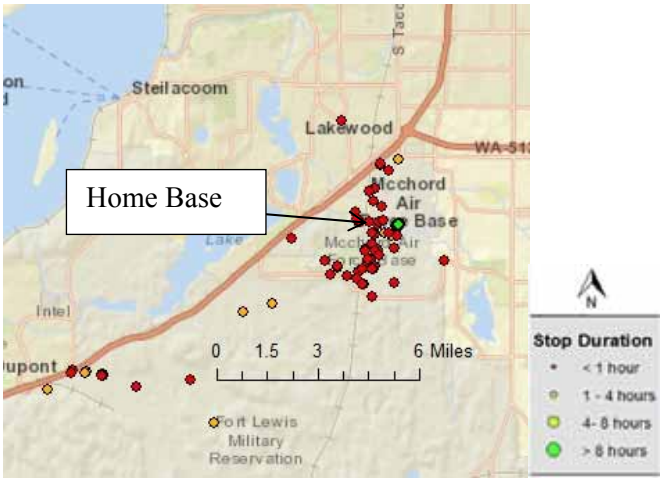


Figure E-22. Vehicle G11-0678K stops.

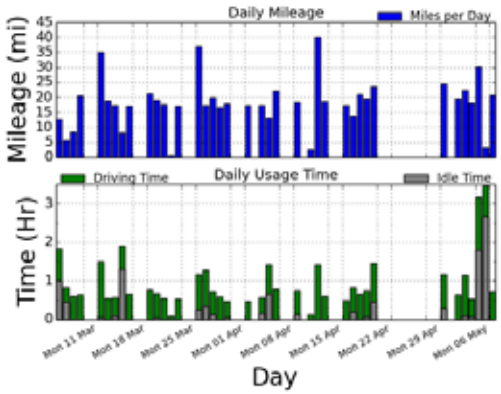


Figure E-23. Vehicle G11-0678K history.

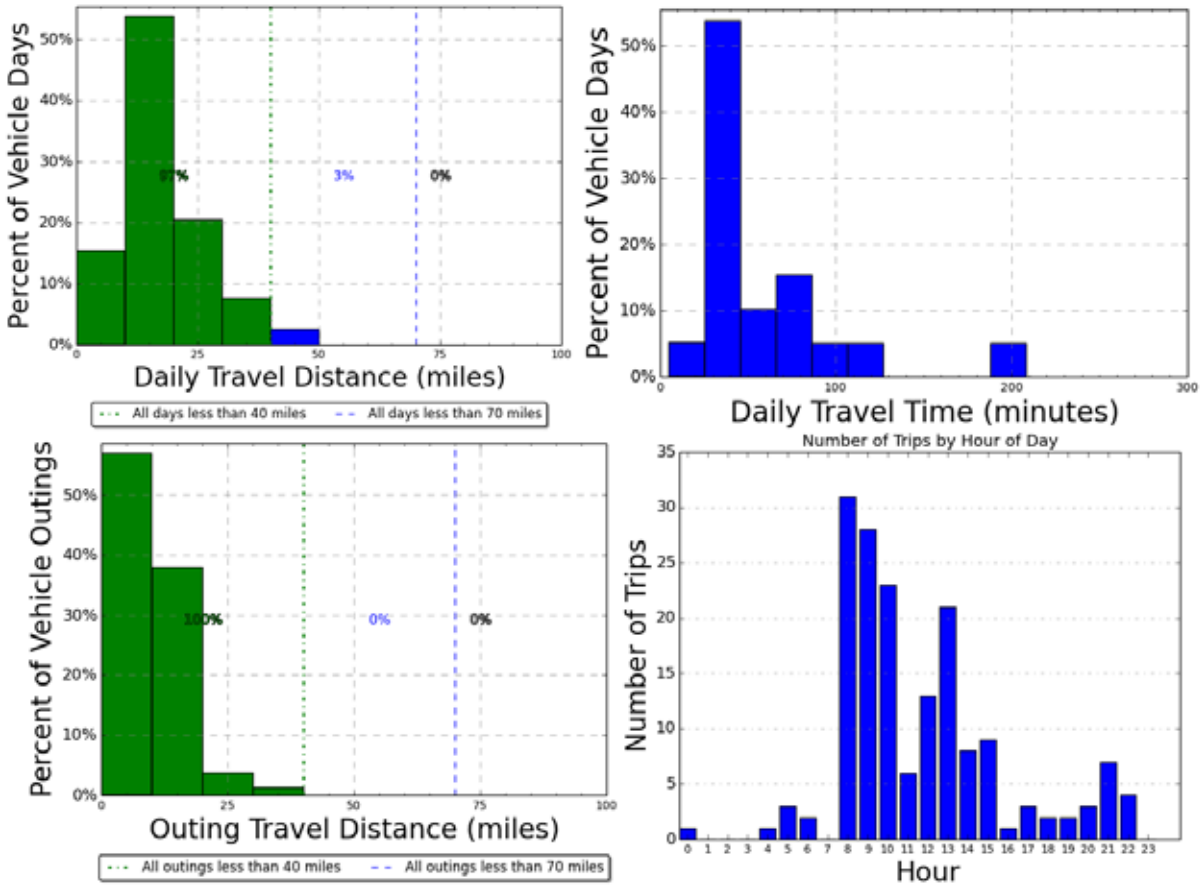


Figure E-38. Vehicle G11-0678K travel graphs.

Vehicle G11-0678K Observations

Logger 13 collected data on this vehicle for a period of 39 days of the 63-day study period. Validation occurred on 98.8% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 100 on 2nd St NW. Site data reports an odometer reading of 3,078 in May 2012 with an average of 139 miles per month.

All trips and outings were less than 70 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. The longest day's travel was 40.1 miles that was also within the BEV range. The longest single outing was 33.4 miles which is also well within the BEV range. Based upon travel alone, a BEV could be a suitable replacement.

This is a large sedan and BEVs are available for replacement. The BEV would be expected to provide the acceptable performance of this vehicle.

Vehicle G62-4526H

www.edmunds.com

Make/Model/Year	Chevrolet/Tahoe/2009
EPA Class Size	Sports Utility Vehicle
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 2007/Pendleton Ave
Fleet Vehicle ID	G62-4526H
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	14/20/16 10/15/12
EPA GHG Emissions (Grams CO_2/Mi)*	555/525
Study Logger ID	Logger 14
Total Vehicle Days/Total Study Days	41/63

Vehicle G62-4526H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	26.3/133.2	11.5/69.5	4.1/30.9	1,078
Travel Time (Minutes)	109/571	47.4/281	17.1/165	4,454
Idle Time (Minutes)	29.7/NA	13.0/NA	4.7/NA	1,218

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	279	100%	Less than 2	220
10 to 20	0	0%	2 to 4	9
20 to 40	0	0%	4 to 8	17
40 to 60	0	0%	Greater than 8	32

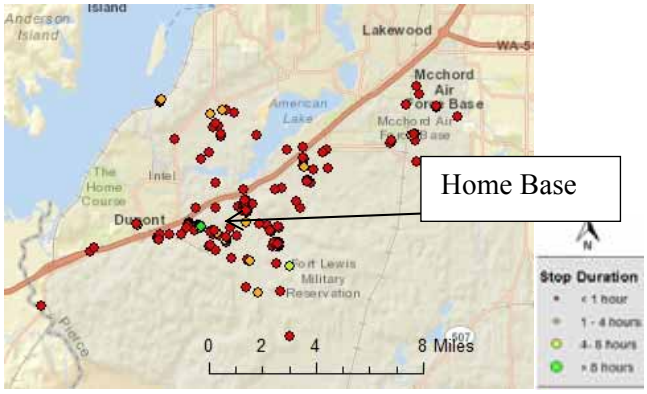


Figure E-25. Vehicle G62-4526H stops.

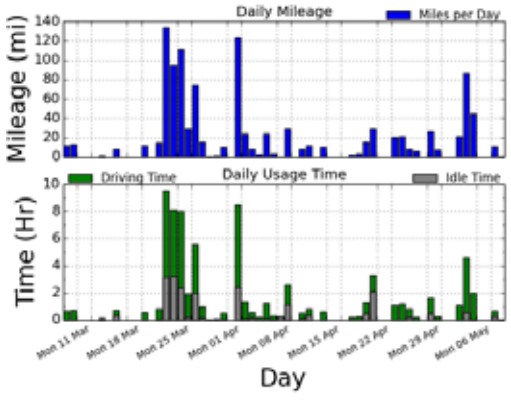


Figure E-26. Vehicle G62-4526H history.

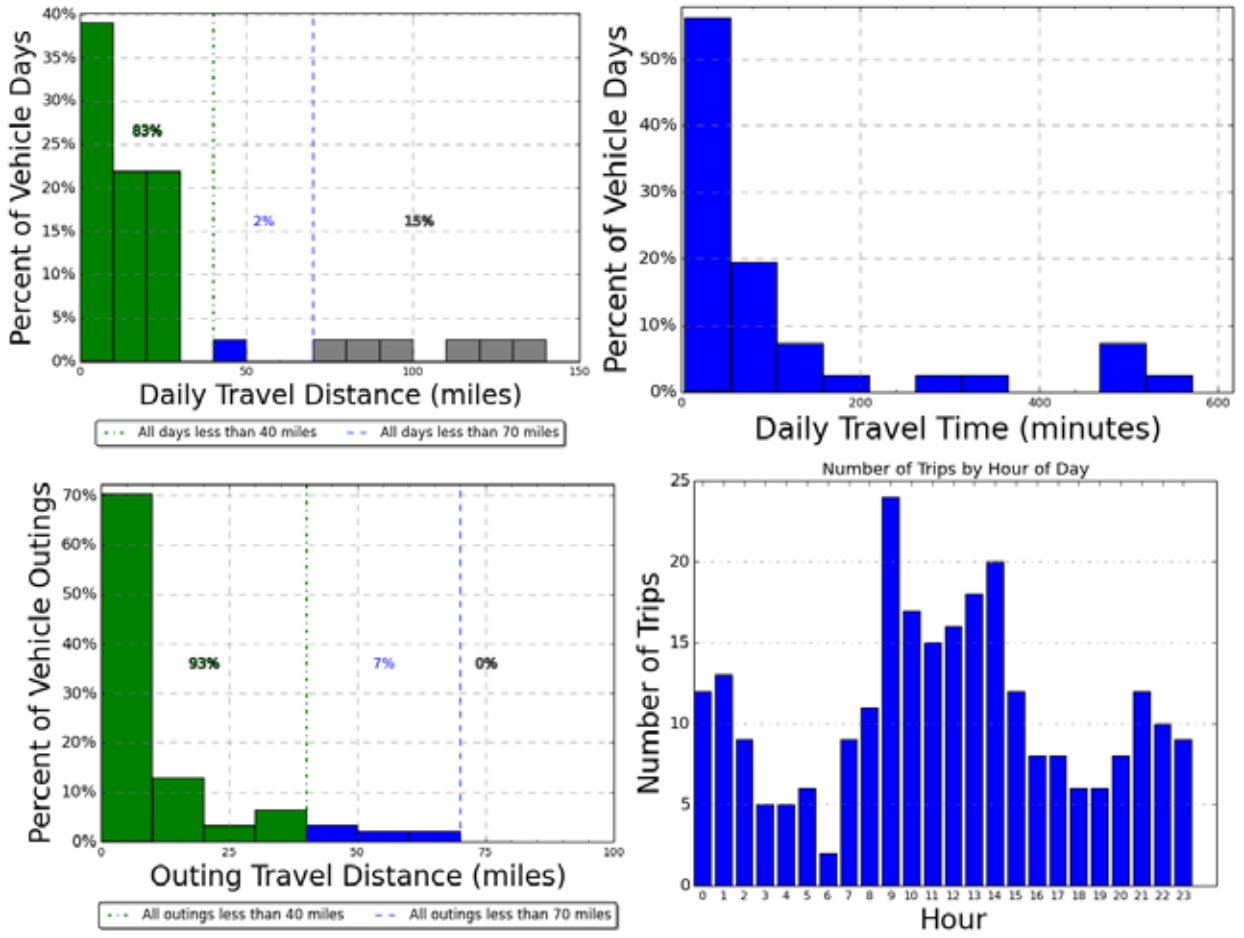


Figure E-39. Vehicle G62-4526H travel graphs.

Vehicle G62-4526H Observations

Logger 14 collected data on this vehicle for a period of 41 days of the 63-day study period. Validation occurred on 83.3% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 2007 on Pendleton Ave. Site data reports an odometer reading of 34,934 in May 2012 with an average of 1027 miles per month.

The longest travel day of 133.2 miles occurred on March 21 and consisted of five outings; the longest of which was 69.5 miles. There was insufficient time between this outing and the previous outing of 22.5 miles for any recharge.

Eighty-five percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-27) and essentially all outings are within this range, and 15% of daily travel is beyond the range capabilities of a BEV.

These data indicate that choosing a BEV for this duty may require intermediate charging stations opportunities at either the home base or a frequent intermediate stop. Yet, some travel days did not allow sufficient recharge opportunities or sufficient recharge time. Thus, a PHEV is required for the days that involve extended trips. A combination of BEVs and PHEVs may be desirable for this fleet.

Vehicle G42-0698K

www.edmunds.com

Make/Model/Year	Chevrolet/C1500/2011
EPA Class Size	Standard Pickup Truck
Mission	Support
Contact	J. Lamantia/Motor Transport
Parking Location	Near D Ramp/2nd St NW
Fleet Vehicle ID	G42-0698K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	15/21/17 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)*	523/484
Study Logger ID	Logger 15
Total Vehicle Days/Total Study Days	58/63

Vehicle G42-0698K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	68.8/119.2	10.4/71.5	4.7/46.4	3,989
Travel Time (Minutes)	933/1,502	141.2/1,029	63.6/512	54,095
Idle Time (Minutes)	72.9/NA	11.0/NA	5.0/NA	4,229

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	2495	100%	Less than 2	2,413
10 to 20	0	0%	2 to 4	74
20 to 40	0	0%	4 to 8	8
40 to 60	0	0%	Greater than 8	0

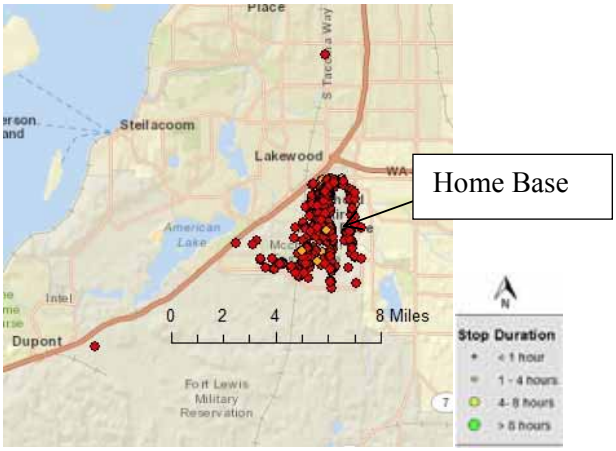


Figure E-28. Vehicle G42-0698K stops.

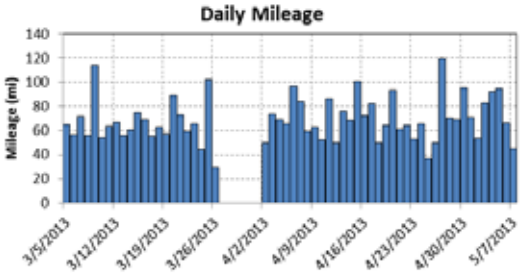


Figure E-29. Vehicle G42-0698K history.

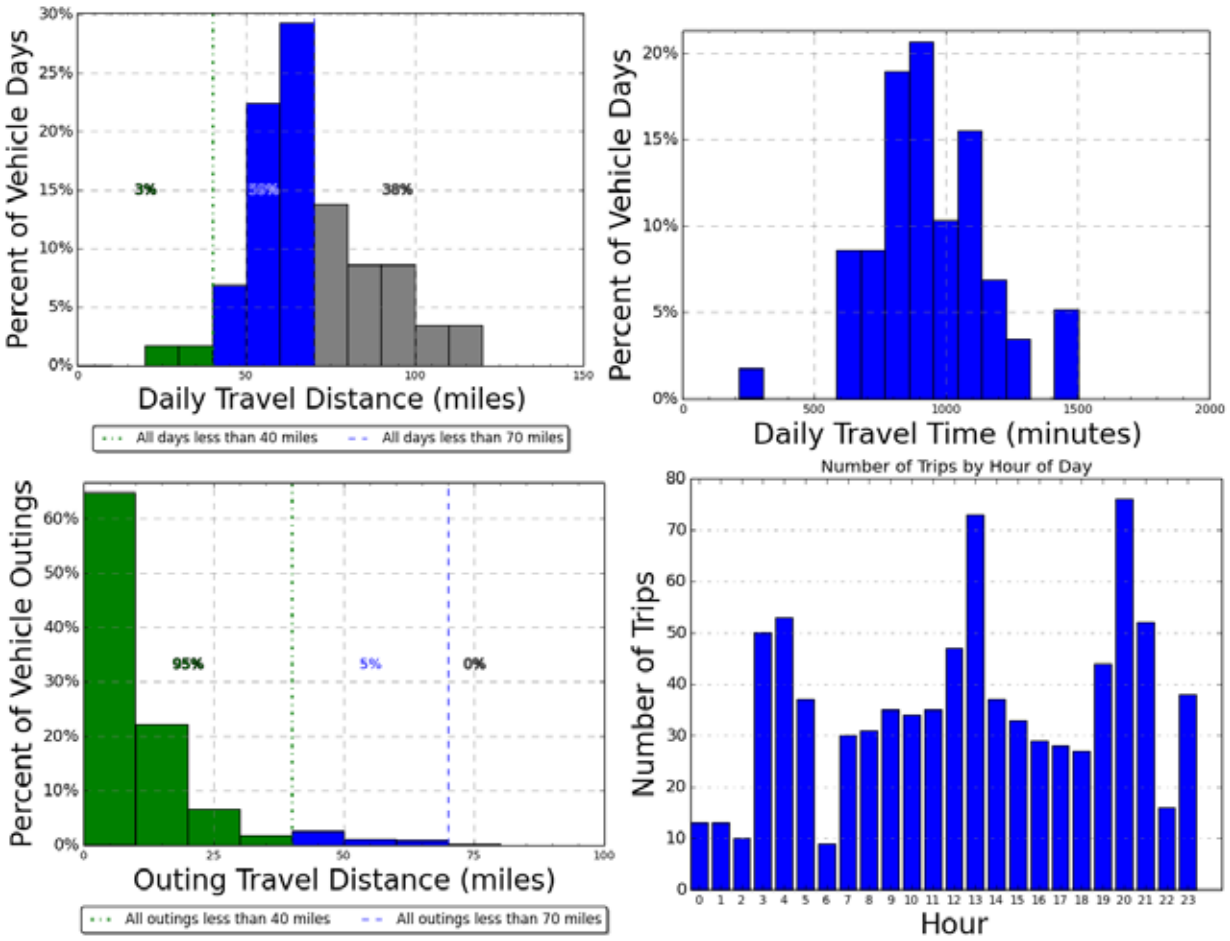


Figure E-40. Vehicle G42-0698K travel graphs.

Vehicle G42-0698K Observations

Logger 15 collected data on this vehicle for a period of 58 days of the 63-day study period. Validation occurred on 95.1% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near D Ramp on 2nd St NW and McCarthy Blvd. Site data reports an odometer reading of 18,097 in May 2012 with an average of 1046 miles per month.

The data shows extensive usage with usage possible at all hours of the day with most vehicle travel characterized typically by very short trips (average of 4.7 miles). It operated all but 5 days of the 63-day study period. During the study period, the vehicle traveled a total distance of 3,989 miles over 900 hours. Sixty-two percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-30), while all the outings were within this range, and 38% of the vehicle travel days exceed this BEV range capability.

Logger 15 data was inconsistent in reporting idle times. Idle time was corrected but total idle and travel time was not included in the history graphs.

While travel data might suggest a BEV could replace this vehicle for most trips, the high usage suggests a PHEV is more suitable assuming that it can accommodate any other vehicle requirements such as carrying capacity.

Vehicle G11-0493L

www.edmunds.com

Make/Model/Year	Chevrolet/Impala/2012
EPA Class Size	Large Sedan
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 2007/Pendleton Ave
Fleet Vehicle ID	G11-0493L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	18/30/22 13/22/16
EPA GHG Emissions (Grams CO_2/Mi)*	404/393
Study Logger ID	Logger 16
Total Vehicle Days/Total Study Days	55/63

Vehicle G11-0493L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	65.3/130.3	14.0/236.8	7.0/67.3	3,591
Travel Time (Minutes)	476/1,333	102.3/1,440	50.8/466	26,180
Idle Time (Minutes)	268.7/NA	57.7/NA	27.7/NA	14,777

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	1,009	100%	Less than 2	921
10 to 20	0	0%	2 to 4	27
20 to 40	0	0%	4 to 8	19
40 to 60	0	0%	Greater than 8	42

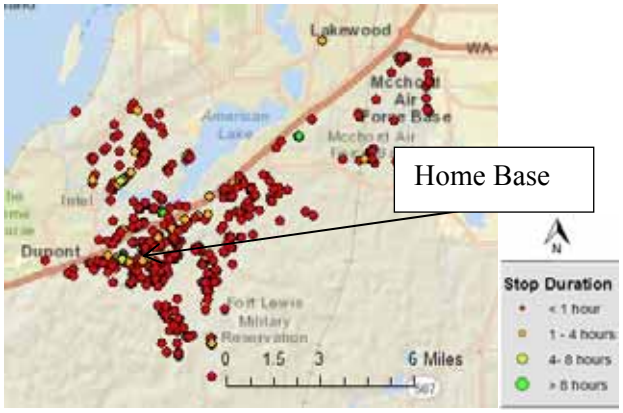


Figure E-31. Vehicle G11-0493L stops.

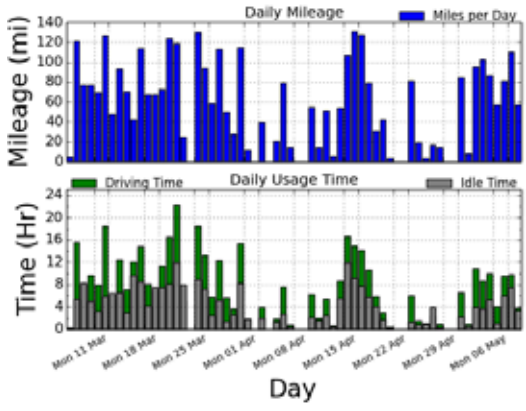


Figure E-32. Vehicle G11-0493L history.

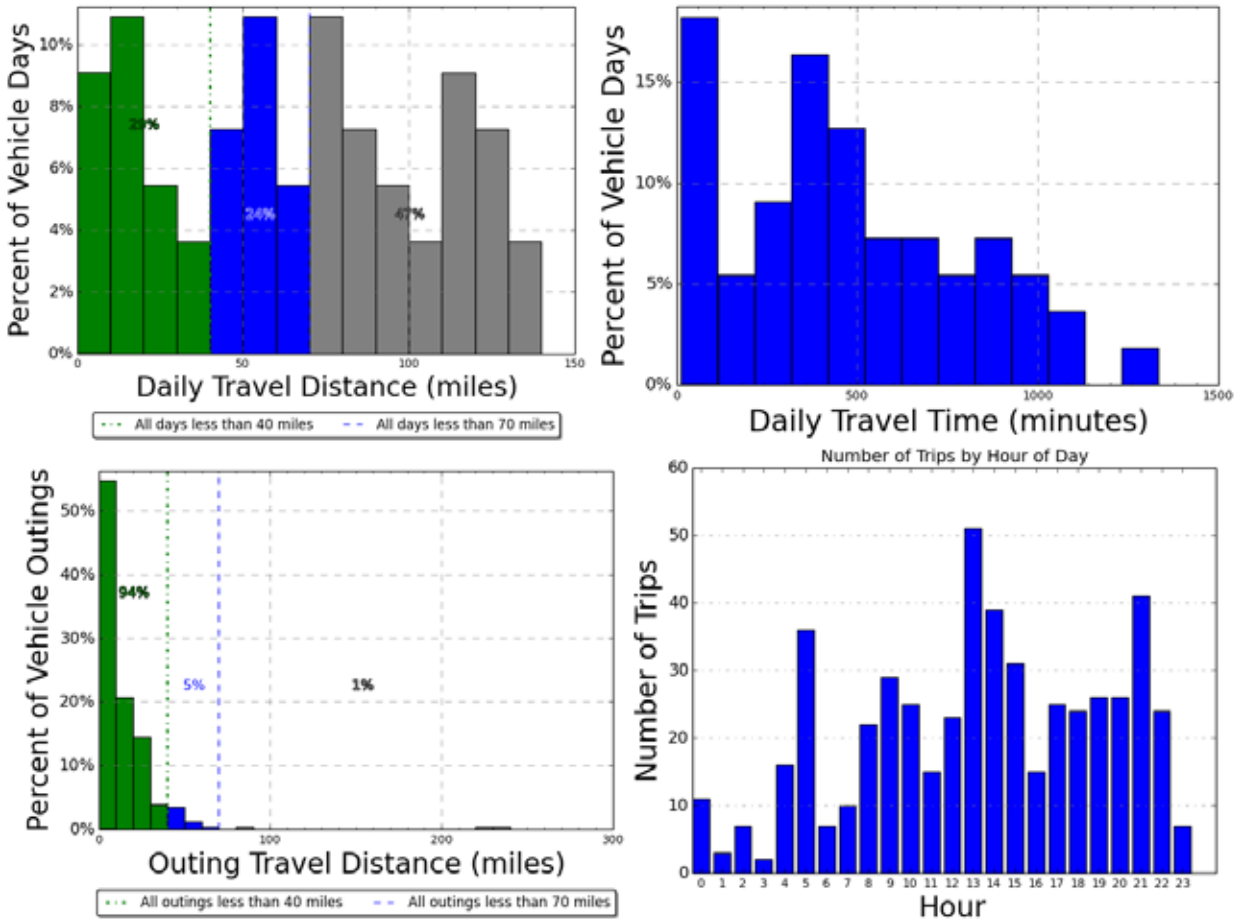


Figure E-41. Vehicle G11-0493L travel graphs.

Vehicle G11-0493L Observations

Logger 16 collected data on this vehicle for a period of 55 days of the 63-day study period. Validation occurred on 95.3% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 2007 on Pendleton Ave. Site data reports an odometer reading of 4,330 in May 2012 with an average of 614 miles per month.

The data shows extensive usage with usage possible at all hours of the day. It operated all but 8 days of the 63-day study period. During the study period, the vehicle traveled a total distance of 3,591 miles over 436 hours. However, this vehicle also shows extensive idle times with almost 250 hours spent idling. Fifty-three percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-33), while all the outings but one were within this range, and 47% of the vehicle travel days exceed this BEV range capability.

The vehicle travel is characterized typically by short trips (average of 7 miles) requiring 50 minutes but more than half that time is idle (27.7 minutes each).

While travel data might suggest a BEV could replace this vehicle for most trips, the high usage suggests a PHEV is more suitable assuming that it can accommodate any other vehicle requirements such as carrying capacity.

Vehicle G71-0062G

www.
commercialtrucktrader.com

Make/Model/Year	Ford/F750/2008
EPA Class Size	Stake Truck
Mission	Transport
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641
Fleet Vehicle ID	G71-0062G
Fuel Type	Diesel
EPA Label/MPG (City/Hwy/Combined)*	Not available
EPA GHG Emissions (Grams CO_2/Mi)*	Not available
Study Logger ID	Logger 17
Total Vehicle Days/Total Study Days	No data

Vehicle G71-0062G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	No Data	No Data	No Data	No Data
Travel Time (Minutes)	No Data	No Data	No Data	No Data
Idle Time (Minutes)	No Data	No Data	No Data	No Data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	No Data	No Data	Less than 2	No Data
10 to 20	No Data	No Data	2 to 4	No Data
20 to 40	No Data	No Data	4 to 8	No Data
40 to 60	No Data	No Data	Greater than 8	No Data

Vehicle G71-0062G Observations

Survey information was not available for this vehicle. For unknown reasons, Logger 17 transmitted no information other than a single entry. Site data reports an odometer reading of 7,871 in May 2012 with an average of 159 miles per month. No further information is available.

This is a heavy-duty stake truck. No PEV is currently available as a replacement for this vehicle.

Vehicle G62-1094L

www.edmunds.com

Make/Model/Year	Chevrolet/Avalanche/2011
EPA Class Size	Sports Utility Vehicle
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 4074/Kaufman Ave
Fleet Vehicle ID	G62-1094L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	15/21/17 11/16/13
EPA GHG Emissions (Grams CO_2/Mi)*	523/484
Study Logger ID	Logger 18
Total Vehicle Days/Total Study Days	30/63

Vehicle G62-1094L travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	18.6/93.6	15.1/91.3	5.2/42.5	559
Travel Time (Minutes)	48/264	38.9/259	13.3/94	1,438
Idle Time (Minutes)	6.3/NA	5.1/NA	1.8/NA	190

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	90	95.7%	Less than 2	59
10 to 20	4	4.3%	2 to 4	4
20 to 40	0	0%	4 to 8	2
40 to 60	0	0%	Greater than 8	29

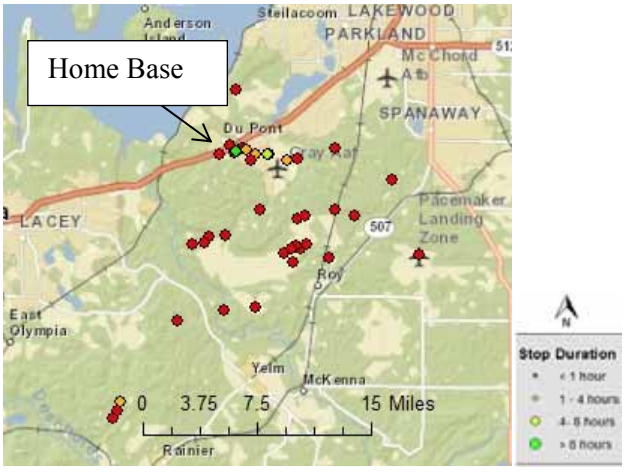


Figure E-34. Vehicle G62-1094L stops.

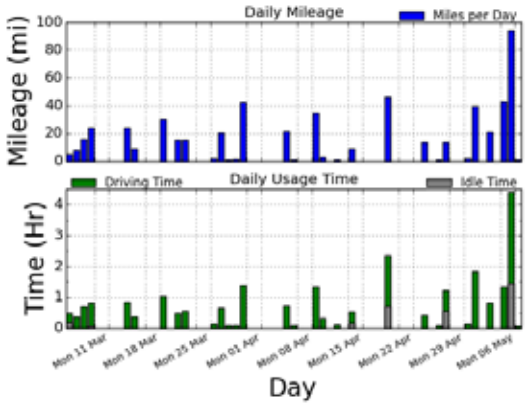


Figure E-35. Vehicle G62-1094L history.

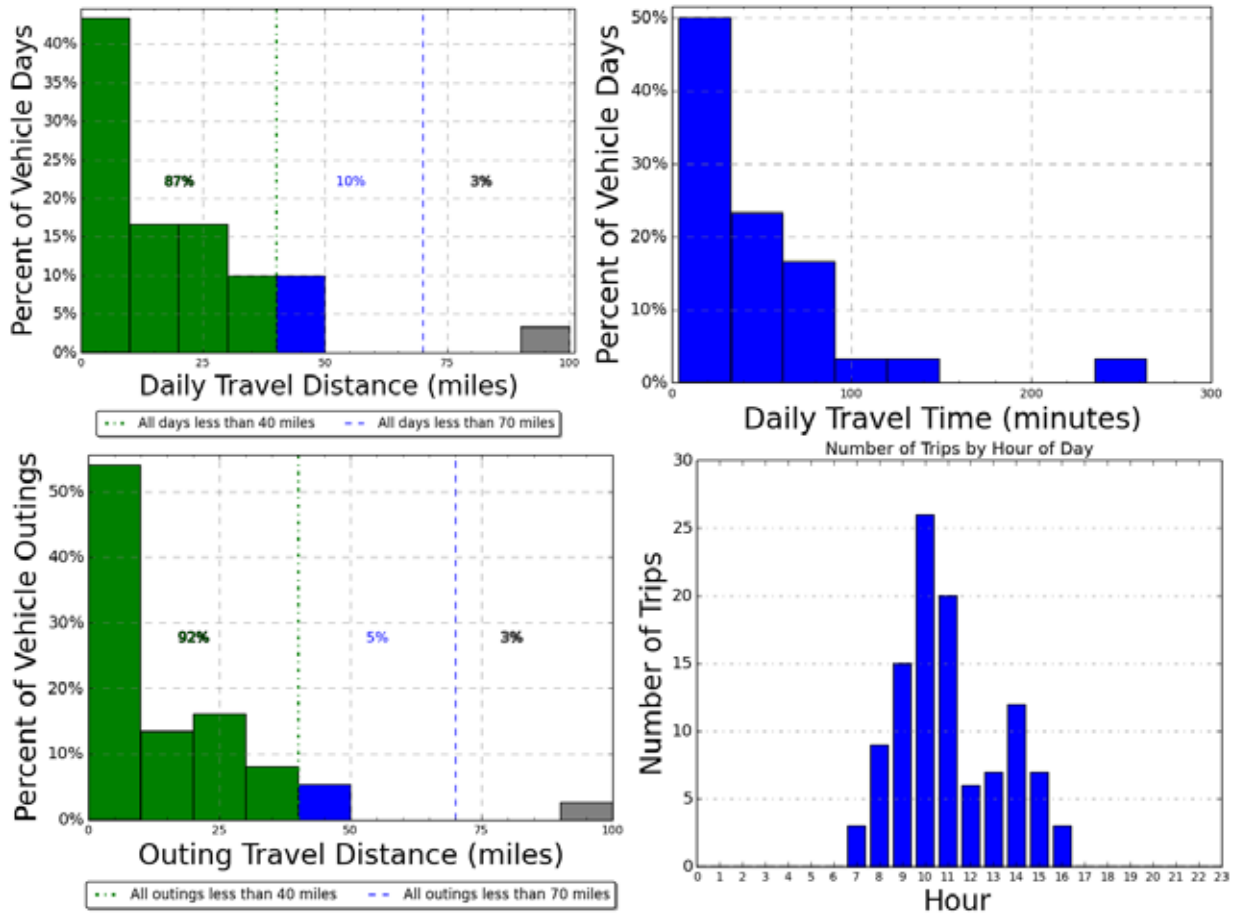


Figure E-42. Vehicle G62-1094L travel graphs.

Vehicle G62-1094L Observations

Logger 16 collected data on this vehicle for a period of 30 days of the 63-day study period. Validation occurred on 95.9% of the input data. The project survey response reports the Range Control Officer uses this vehicle to inspect ranges, visit units training in the range complex, and conducting VIP tours. It is accessible to between six and ten persons. It occasionally travels off base. While it typically operates during daytime hours, its availability at other times is necessary because Range Control is open and active 24 hours a day. It typically carries no particular cargo or equipment. It parks in the pool parking area near Bldg 4074.

Site data reports an odometer reading of 8,115 in May 2012 with an average of 624 miles per month. While the monthly mileage is not high, Motor Transport reports this vehicle has off road requirements. The expected retention of this vehicle is unknown.

Ninety-seven percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-36) and 97% of all outings were within this range. One trip (3%) of the vehicle travel days exceeded this range. The longest single outing of 91.3 miles occurred on May 5th that was also the day with the longest daily travel involving a trip to Olympia and Olympia East. That outing took approximately 5 hours of the whole day.

These data indicate that choosing a BEV for this duty may require intermediate charging stations opportunities at either the home base or a frequent intermediate stop. Yet, the one travel day did not allow sufficient recharge opportunities. Thus, a PHEV is required for the days that involve extended trips. A combination of BEVs and PHEVs may be desirable for this fleet.

Vehicle G41-1395G

www.edmunds.com

Make/Model/Year	Chevrolet/Uplander/2008
EPA Class Size	Minivan
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Rainier Dr
Fleet Vehicle ID	G41-1395G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	16/23/19 12/17 14
EPA GHG Emissions (Grams CO_2/Mi)*	468/450
Study Logger ID	Logger 19
Total Vehicle Days/Total Study Days	37/63

Vehicle G41-1395G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	6.0/31.3	4.2/22.3	1.9/18.3	222
Travel Time (Minutes)	22/86	15.4/55	7.1/46	815
Idle Time (Minutes)	2.0/NA	1.4/NA	0.7/NA	75

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	141	100%	Less than 2	98
10 to 20	0	0%	2 to 4	7
20 to 40	0	0%	4 to 8	2
40 to 60	0	0%	Greater than 8	34

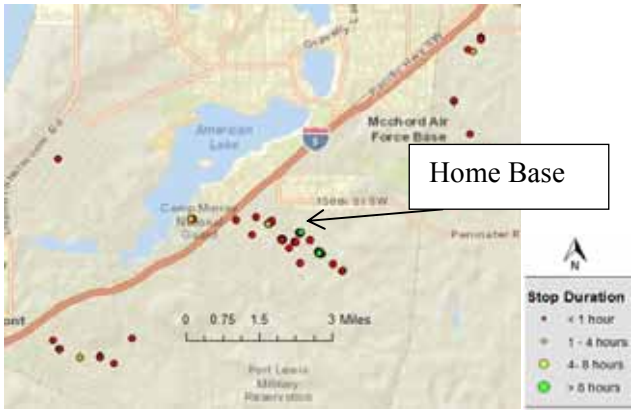


Figure E-37. Vehicle G41-1395G stops.

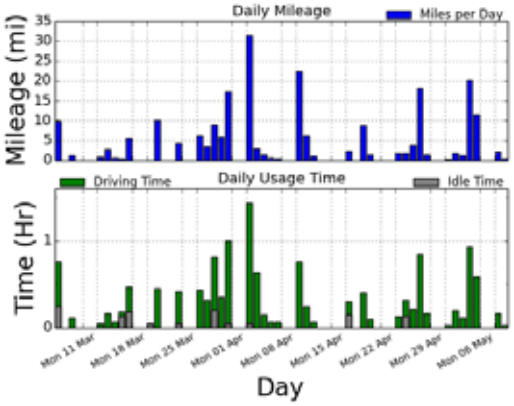


Figure E-38. Vehicle G41-1395G history.

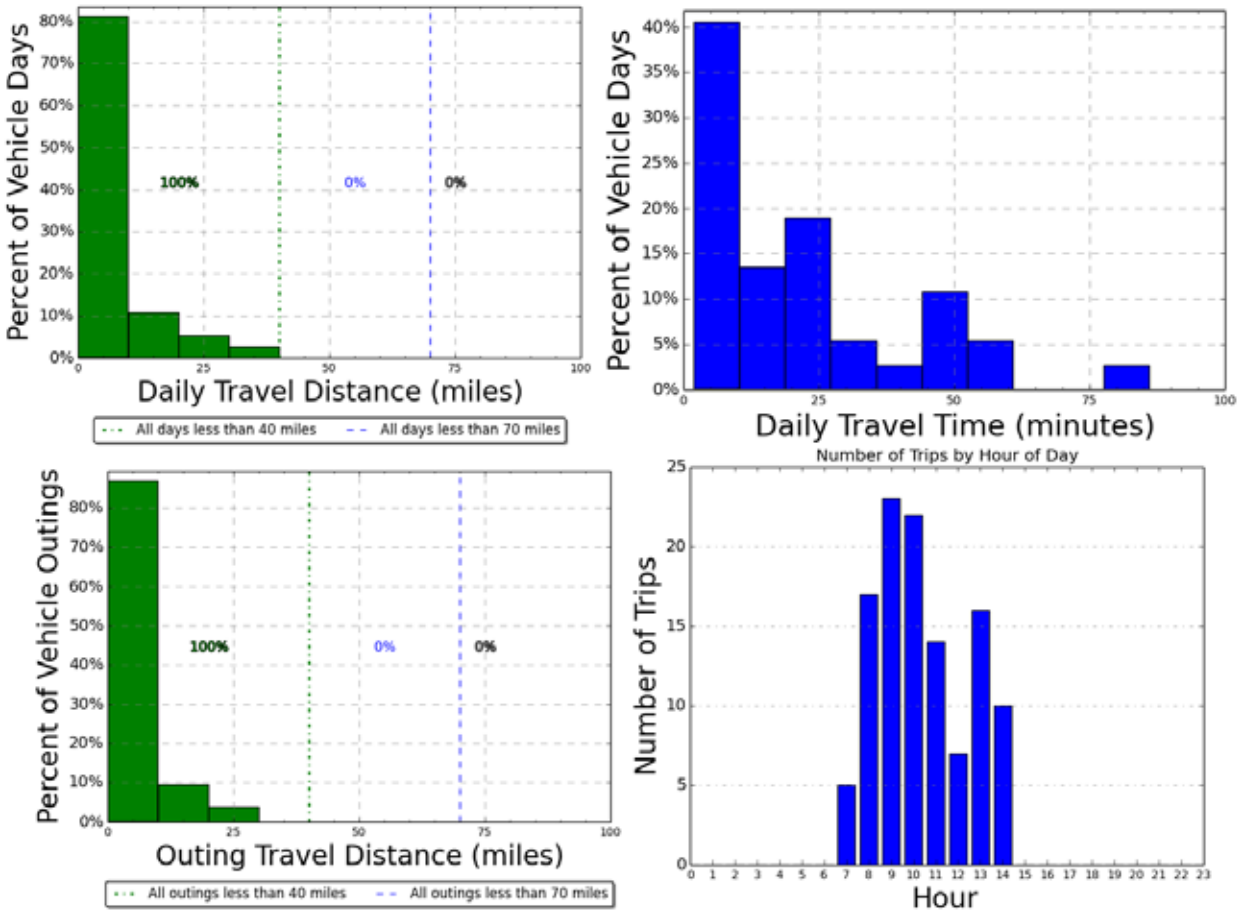


Figure E-43. Vehicle G41-1395G travel graphs.

Vehicle G41-1395G Observations

Logger 19 collected data on this vehicle for a period of 37 days of the 63-day study period. Validation occurred on 82.4% of the input data. The project survey response reports this vehicle is a pool vehicle used for IT service calls within JBLM to provide for computer troubleshooting, installations, and other preventive maintenance. It parks in the government vehicle parking area. No specific area was identified but the logger information suggests it is parked most frequently near Bldg 9614 on Rainier Dr. The expected retention of this vehicle is unknown. On a typical day, the vehicle travels between eleven and forty miles with each outing typically no more than ten miles. As a pool vehicle, more than twenty persons have access to this vehicle and it typically carries two persons. It typically operates only in the Fort Lewis and McChord Air Field areas. Normal operation is during daytime hours of 0700 to 1700 hours. The vehicle runs exclusively on gasoline. Equipment carried typically includes computer CPUs, monitors, printers and cables.

Site records report the vehicle travels approximately 319 miles per month and the odometer read 15,690 miles in May 2012.

All trips and outings were less than 70 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. In fact, all daily travel and outings are less than the 40-mile battery range of PHEVs.

This is a minivan and BEVs are available for replacement. The BEV would be expected to provide the acceptable performance of this vehicle.

Vehicle G61-1155D

Make/Model/Year	Ford/Escape Hybrid/2006
EPA Class Size	Sports Utility Vehicle
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 4074/Kaufman Ave
Fleet Vehicle ID	G61-1155D
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	28/26/27
EPA GHG Emissions (Grams CO_2/Mi)*	329
Study Logger ID	Logger 20
Total Vehicle Days/Total Study Days	24/63

Vehicle G61-1155D Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	22.3/62.3	17.2/64.1	1.3/13.7	534
Travel Time (Minutes)	50/141	38.5/141	2.9/27	1,193
Idle Time (Minutes)	0.4/NA	0.3/NA	0/NA	9

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	104	95.4%	Less than 2	79
10 to 20	5	4.6%	2 to 4	4
20 to 40	0	0%	4 to 8	3
40 to 60	0	0%	Greater than 8	23

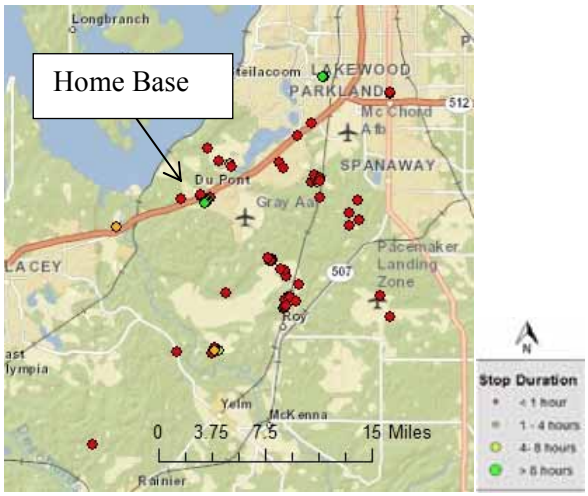


Figure E-40. Vehicle G61-1155D stops.

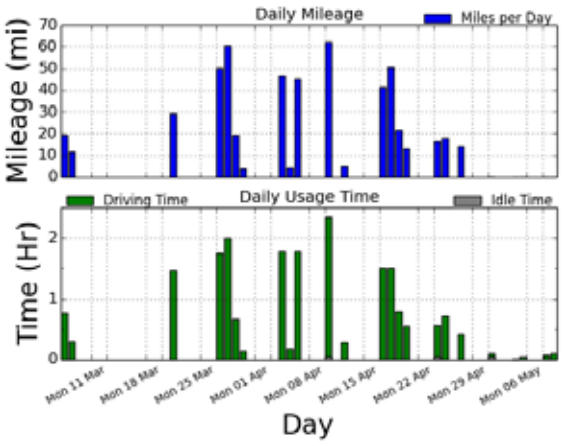


Figure E-41. Vehicle G61-1155D history.

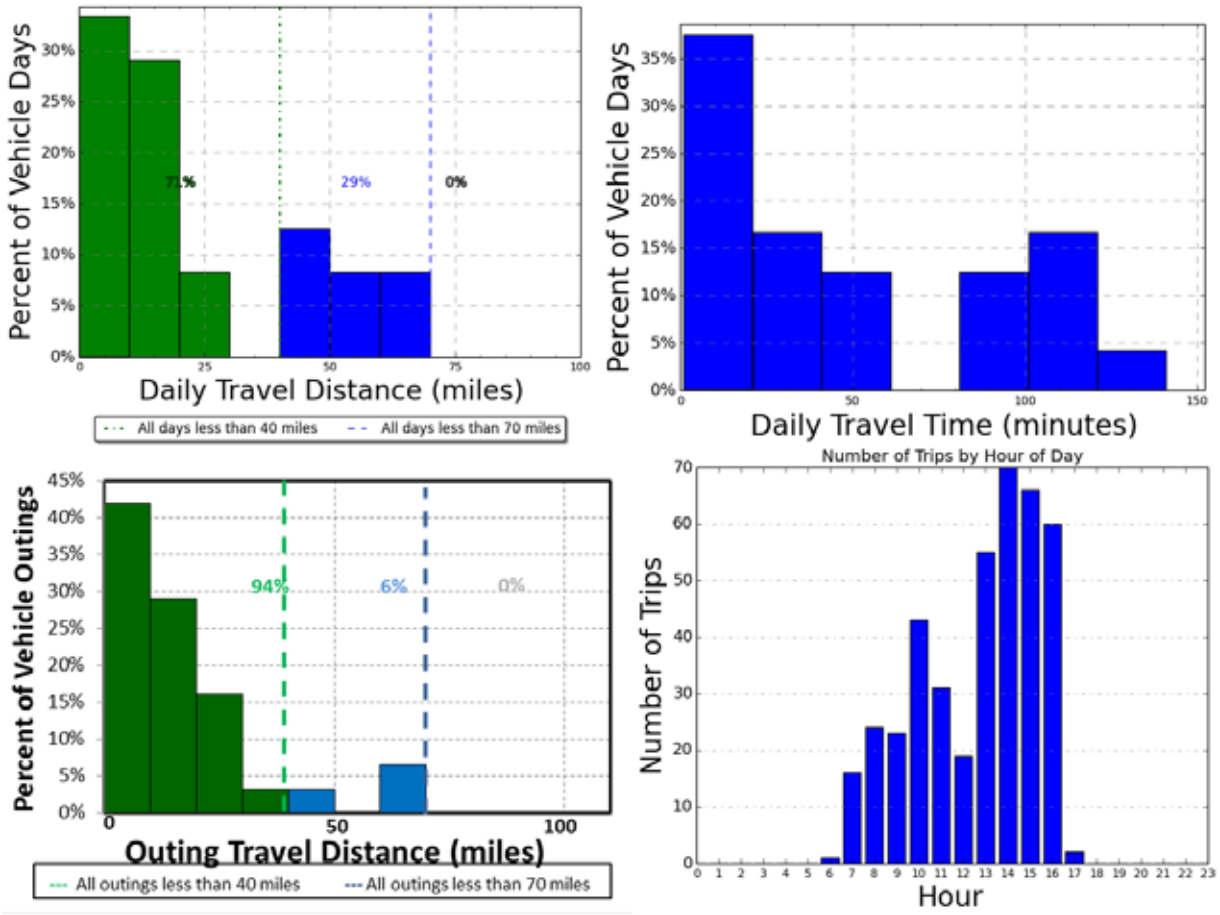


Figure E-44. Vehicle G61-1155D travel graphs.

Vehicle G61-1155D Observations

Logger 20 collected data on this vehicle for a period of 24 days of the 63-day study period. Validation occurred on 94.7% of the input data. The project survey response reports this is a pool vehicle used to transport equipment to field sites throughout all ranges and training areas of JBLM for the ITAM Program; transport personnel to other agencies on and off post for meetings, conferences, and general administration; and transport supplies and materials in support of ITAM and Range Control operations, maintenance, and administration. This vehicle regularly travels off pavement on improved and unimproved maintenance roads, firebreaks, forest tracks and cross-country. The vehicle parks in the motor pool area next to Range Control, Kaufman Ave Bldg 4074. DPTMS/Range Control/ITAM expects to retain this vehicle for less than two more years.

Expected daily travel is between forty and one hundred miles. Between six and ten persons have access to this vehicle that typically carries two persons. It travels off post once or twice per month with outings again between forth and one hundred miles. The vehicle daily usage is between 0630 and 1800 hours. It typically carries field equipment to include cameras, GPS equipment, marker flags, survey material, and personal gear for occupants. Site records report average travel to be 427 miles per month with an odometer reading of 31,200 in May 2012.The vehicle moved to the Lakewood, WA area on April 25th and was involved in mostly local trips after this date. The vehicle analysis does not include this timeframe.

All trips and outings were less than 70 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. This is a hybrid SUV and BEVs are available for replacement. The BEV would be expected to provide the acceptable performance of this vehicle.

Vehicle G10-2878L

www.edmunds.com

Make/Model/Year	Chevrolet / Malibu / 2011
EPA Class Size	Midsize Cars
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R1407/West Way
Fleet Vehicle ID	G10-2878L
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	22/33/26 15/23/18
EPA GHG Emissions (Grams CO_2/Mi)*	342/350
Study Logger ID	Logger 81
Total Vehicle Days/Total Study Days	37/63

Vehicle G10-2878L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.2/80.7	7.7/67.0	2.9/31.1	748
Travel Time (Minutes)	115/443	43.8/790	16.5/225	4,252
Idle Time (Minutes)	53.2/NA	20.3/NA	7.6/NA	1,969

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	254	96.6%	Less than 2	208
10 to 20	4	1.5%	2 to 4	13
20 to 40	5	1.9%	4 to 8	6
40 to 60	0	0%	Greater than 8	36

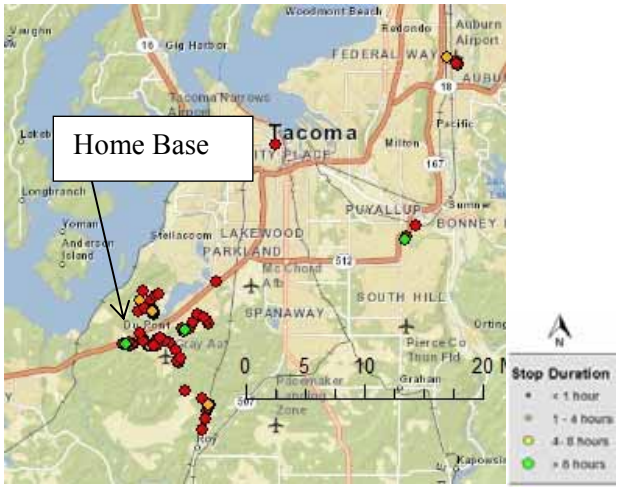


Figure E-43. Vehicle G10-2878L stops.

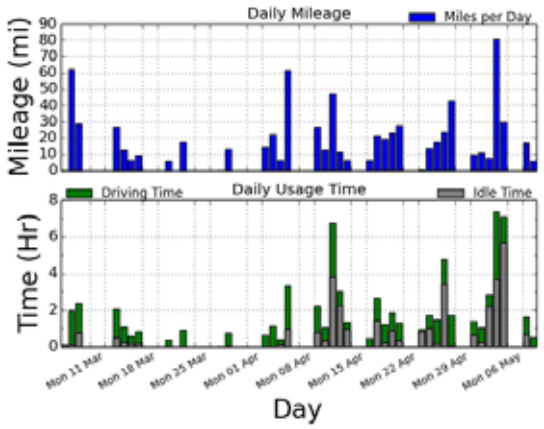


Figure E-44. Vehicle G10-2878L history.

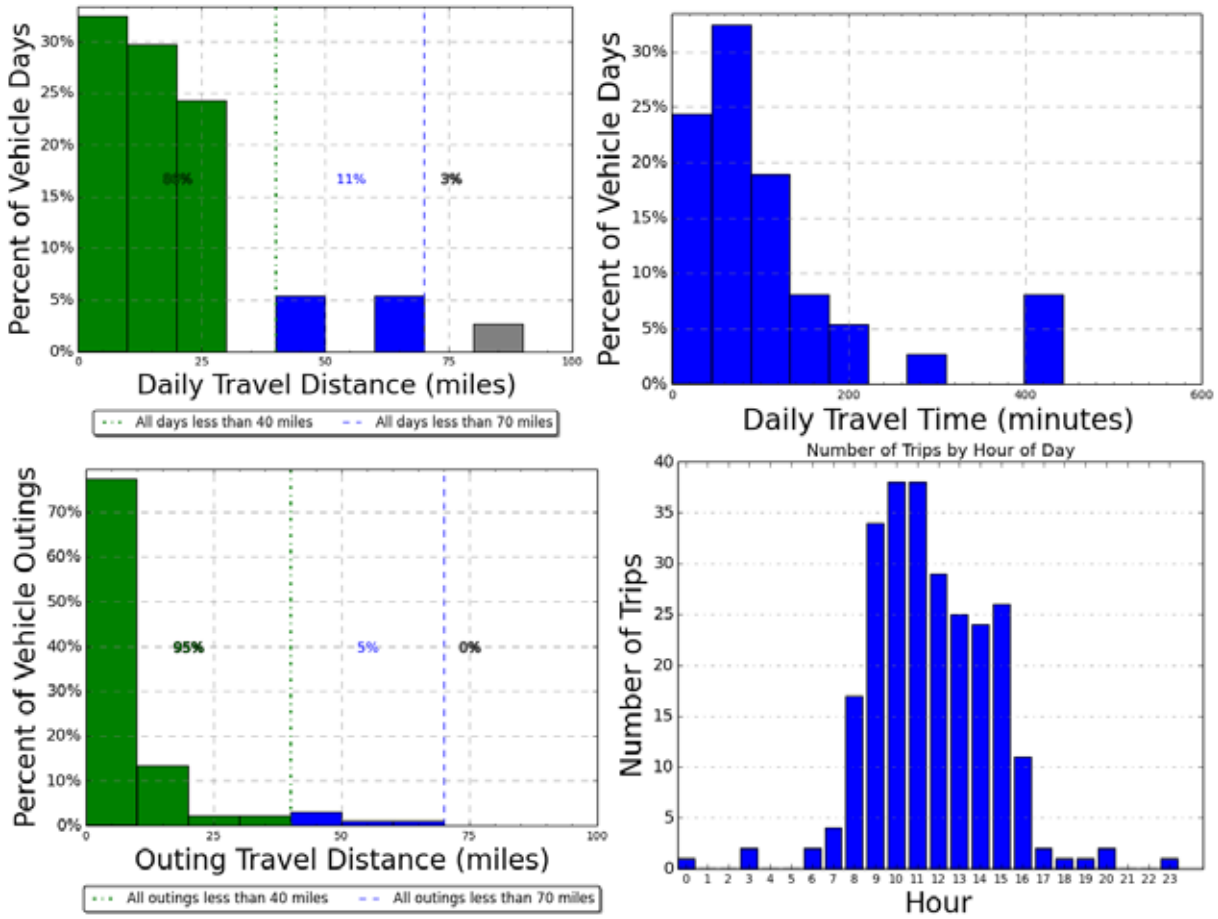


Figure E-45. Vehicle G10-2878L travel graphs.

Vehicle G10-2878L Observations

Logger 81 collected data on this vehicle for a period of 37 days of the 63-day study period. Validation occurred on 99.8% of the input data. Project survey response reports this vehicle is a pool vehicle typically parked in the gated lot near Bldg R1407. The vehicle supports the Warrior Training Academy. Primary usage is by the Commandant and Operations NCO to check on training at Combatives Training Area near R9651 and Combat Marksmanship Academy Training Areas (B3317 and Ranges). The vehicle is available to between two and five persons and usually travels between eleven and forty miles per day. It is occasionally used off base with outings less than 40 miles. Site records show average monthly travel to be 342 miles. The odometer read 4,887 miles in May 2012. G3 TREX, Warrior Training Academy operates the vehicle and expects to retain this vehicle more than 6 years. The vehicle typically operates from 0900 to 1700 hours daily. It frequently operates on the E-85 fuel. The response identified no specific cargo requirements.

Ninety-seven percent of all vehicle travel days were within the 70- mile BEV safe range (green and blue bars on Figure E-45) while all vehicle outings are within this range. The longest daily travel of 80.7 miles occurred on May 2 and consisted of several trips returning to the home base and allowing sufficient recharge opportunities to continue operation. The longest of the outings that day was 26.4 miles

This is a midsize car and BEVs are available for replacement. The BEV would be expected to provide the acceptable performance of this vehicle.

Vehicle G41-1100K

www.edmunds.com

Make/Model/Year	Dodge/Grand Caravan/2010
EPA Class Size	Minivan
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 2012/1210
Fleet Vehicle ID	G41-1100K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	17/24/19 12/17/13
EPA GHG Emissions (Grams CO_2/Mi)*	468/484
Study Logger ID	Logger 84
Total Vehicle Days/Total Study Days	28/63

Vehicle G41-1100K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.5/270.7	19.1/168.6	5.3/132	573
Travel Time (Minutes)	44/297	40.7/223	11.2/139	1,221
Idle Time (Minutes)	1.3/NA	1.2/NA	0.3/NA	36

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	103	96.3%	Less than 2	70
10 to 20	0	0%	2 to 4	7
20 to 40	0	0%	4 to 8	4
40 to 60	4	3.7%	Greater than 8	26

Figure E-46. Vehicle G41-1100K stops.

Figure E-47. Vehicle G41-1100K history.

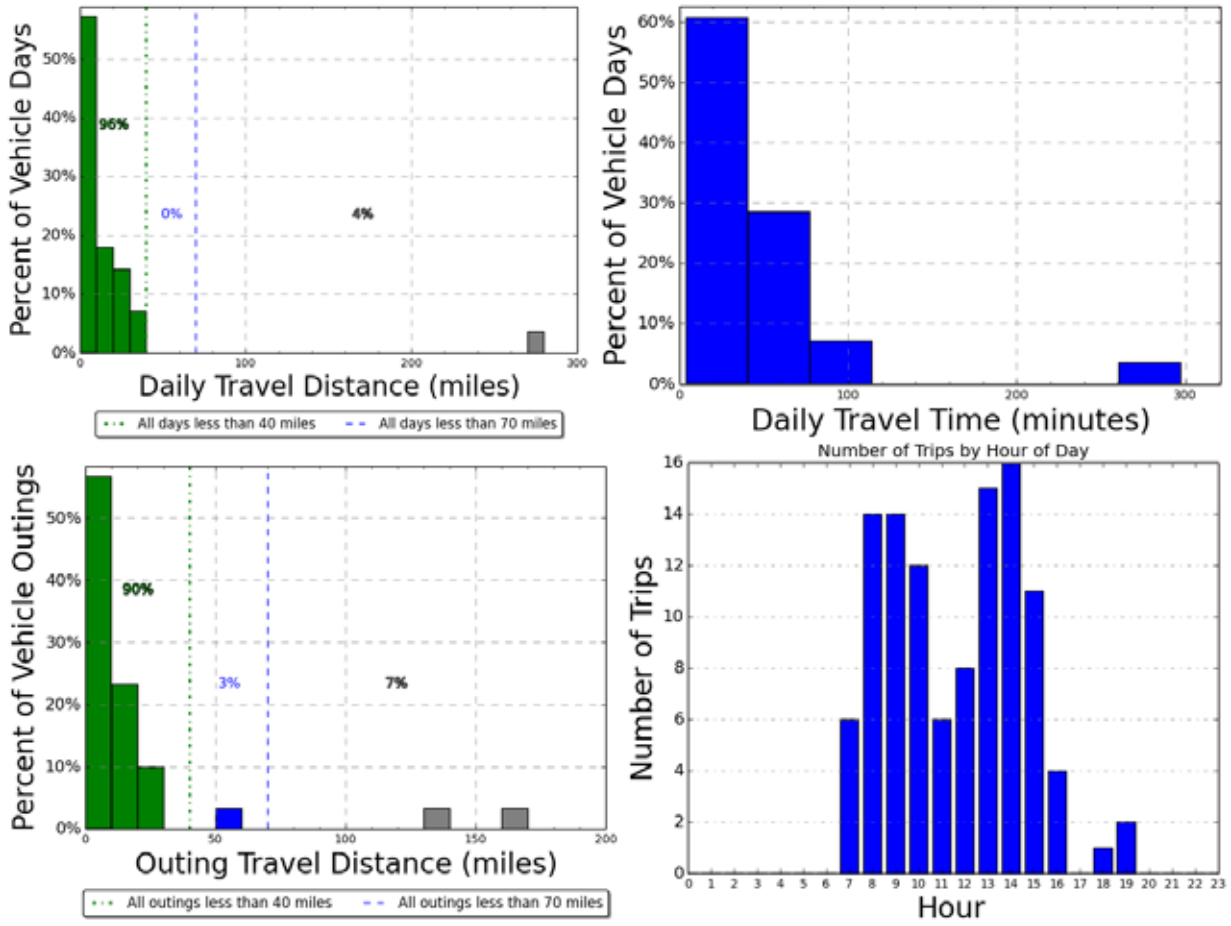


Figure E-46. Vehicle G41-1100K travel graphs.

Vehicle G41-1100K Observations

Logger 84 collected data on this vehicle for a period of 28 days of the 63-day study period. Validation occurred on 97.8% of the input data. The project survey response reports this vehicle is a pool vehicle available to 30 drivers located in Bldg 1210 and by 20 other drivers located in Bldg 2012. JBLM Public Works Environmental operates this vehicle and expects to retain it from three to six more years. On a typical day, this vehicle travels between eleven and forty miles. Site records report an average monthly travel of 83 miles with an odometer reading of 5,087 in May 2012. The vehicle provides tours for visiting VIPS and government officials. It occasionally travels off base for tours and training seminars but outings are typically less than 40 miles. The vehicle operates between 0700 and 1630 daily. There are no specific cargo requirements.

Ninety-six percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-48) and 93% of vehicle outings were within this range; 4% of the vehicle travel days exceed this range, which the history graph shows occurred on a single trip to Ellensburg, WA on May 1. The two outings shown in Figure E-48 exceeding the BEV range also occurred on this single trip.

This is a minivan and BEVs are available for replacement. The BEV would be expected to provide the acceptable performance of this vehicle with the exception of the single long trip. As a pool vehicle, the BEV could be used for 97% of the vehicle travel while other PHEVs in the pool could be used for longer trips.

Vehicle G62-0979G

www.edmunds.com

Make/Model/Year	Dodge/1500/2008
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 1210/Mann Ave
Fleet Vehicle ID	G62-0979G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	13/18/15 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)*	592/630
Study Logger ID	Logger 85
Total Vehicle Days/Total Study Days	33/63

Vehicle G62-0979G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	33.9/80.7	19.3/80.7	4.8/33.7	1,117
Travel Time (Minutes)	98/266	55.7/203	13.9/92.0	3,229
Idle Time (Minutes)	7.2/NA	4.1/NA	1.0/NA	239

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	192	86.1%	Less than 2	165
10 to 20	29	13.0%	2 to 4	14
20 to 40	2	0.9%	4 to 8	10
40 to 60	0	0%	Greater than 8	34

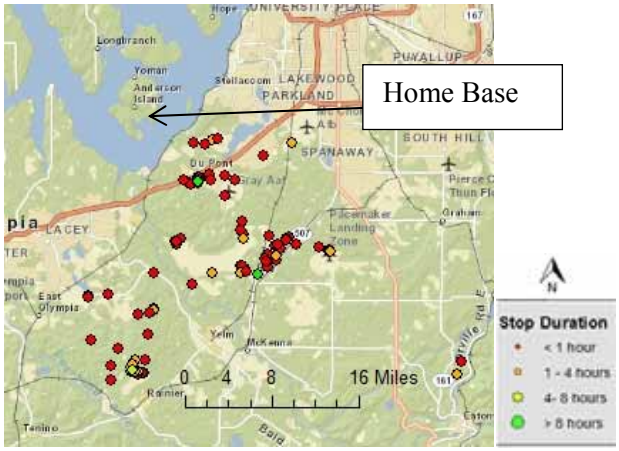


Figure E-49. Vehicle G62-0979G stops.

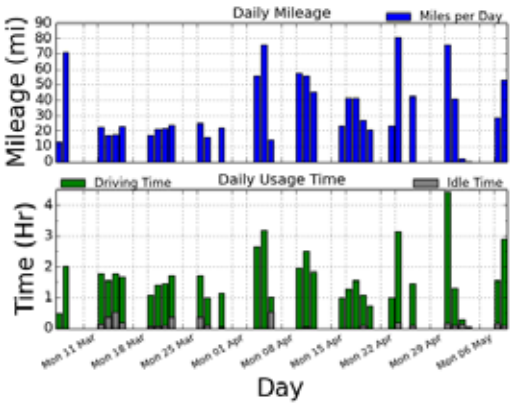


Figure E-50. Vehicle G62-0979G history.

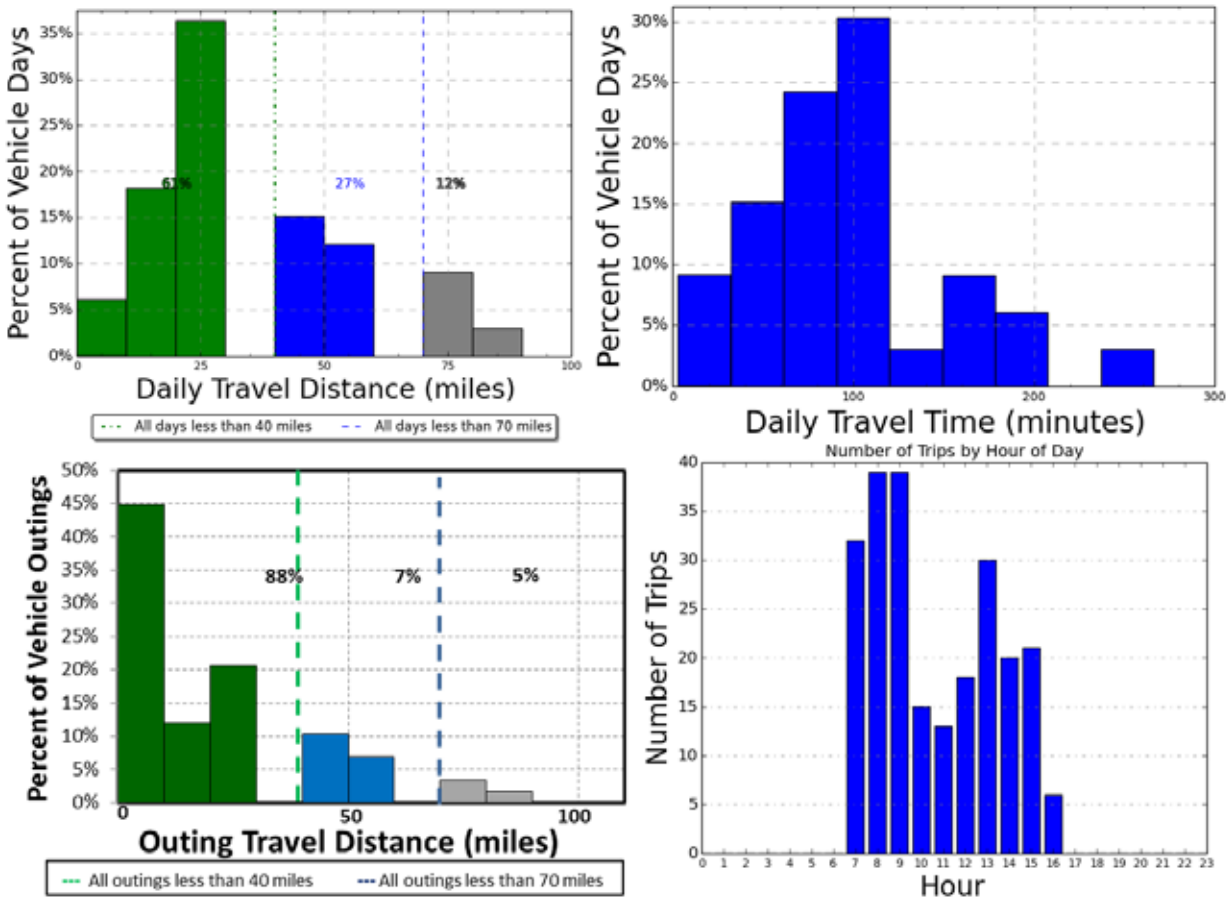


Figure E-47. Vehicle G62-0979G travel graphs.

Vehicle G62-0979G Observations

Logger 85 collected data on this vehicle for a period of 33 days of the 63-day study period. Validation occurred on 99.4% of the input data. The project survey response reports this vehicle assigned to Environmental is a pool vehicle typically parked in the pool parking area near Bldg 1210 on Mann or Kaufman Ave. They expect to retain this vehicle more than six years. It typically travels between eleven and forty miles per day and occasionally travels off base with outings of less than 40 miles. Site records report an average monthly travel of 135 miles with a recorded odometer reading of 30,654 in May 2012. Between six and ten people have access to this vehicle that typically carries two persons. The vehicle operates between 0700 and 1500 hours daily and occasionally later. It occasionally carries equipment and supplies.

Eighty-eight percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-51) and 95% of all outings were within this range; 12% of the vehicle travel days (4 days) exceed this range.

Sixty-one percent of all vehicle travel days were within the 40-mile PHEV safe range (green bars on Figure E-51) and 88% of all outings were within this range; 39% of the vehicle travel days (4 days) exceed this range.

This pickup truck occasionally carries equipment and supplies. Assuming that a PHEV or BEV could perform the load-carrying mission, a pool mix of BEVs and PHEVs could be expected to provide the acceptable performance of this vehicle. The BEV could be used for 61% of the vehicle travel while other PHEVs in the pool could be used for longer trips.

Vehicle G71-0674A


www.edmunds.com

Make/Model/Year	Ford/F650 18'BO/2004
EPA Class Size	Delivery Van
Mission	Transport
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Perry Ave
Fleet Vehicle ID	G71-0674A
Fuel Type	Diesel
EPA Label/MPG (City/Hwy/Combined)*	Not available
EPA GHG Emissions (Grams CO_2/Mi)*	Not available
Study Logger ID	Logger 89
Total Vehicle Days/Total Study Days	28/63

Vehicle G71-0674A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	No data	No data	No data	No data
Travel Time (Minutes)	No data	No data	No data	No data
Idle Time (Minutes)	No data	No data	No data	No data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	No data	No data	Less than 2	No data
10 to 20	No data	No data	2 to 4	No data
20 to 40	No data	No data	4 to 8	No data
40 to 60	No data	No data	Greater than 8	No data

Vehicle G71-0674A Observations

Survey information was not available for this vehicle. Site data reports an odometer reading of 37,210 in May 2012 with an average of 358 miles per month. Data transmittal occurred for only 6 days for unknown reasons. Trip data suggests it started parking near Bldg 9641 on Perry Ave but also spent considerable time in Yakima.

The data logger recorded only five vehicle trips during the first few days of the study period. The reason for the incomplete data is unknown but it is insufficient to provide a vehicle report.

Vehicle G41-1373G

www.edmunds.com

Make/Model/Year	Dodge/Dakota/2008
EPA Class Size	Standard Pickup Truck
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9654/Perry Ave
Fleet Vehicle ID	G41-1373G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	14/19/15 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)*	592/630
Study Logger ID	Logger 93
Total Vehicle Days/Total Study Days	63/63

Vehicle G41-1373G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	61.7/113.3	13.8/57.6	9.5/39.8	3,949
Travel Time (Minutes)	177/311	39.4/170	27.2/111	11,305
Idle Time (Minutes)	20.6/NA	4.6/NA	3.2/NA	1,319

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	448	100%	Less than 2	271
10 to 20	0	0%	2 to 4	77
20 to 40	0	0%	4 to 8	51
40 to 60	0	0%	Greater than 8	49

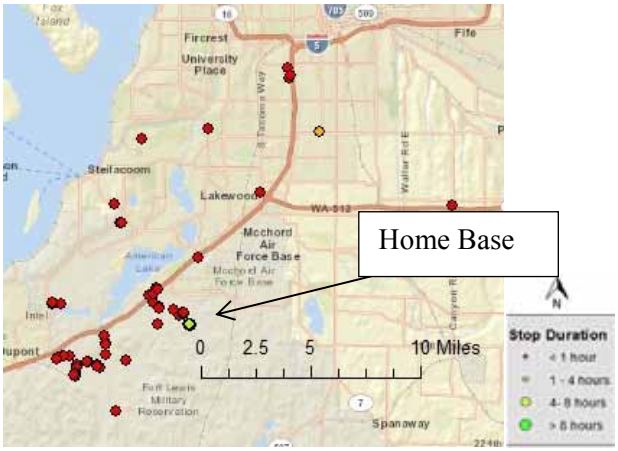


Figure E-52. Vehicle G41-1373G stops.

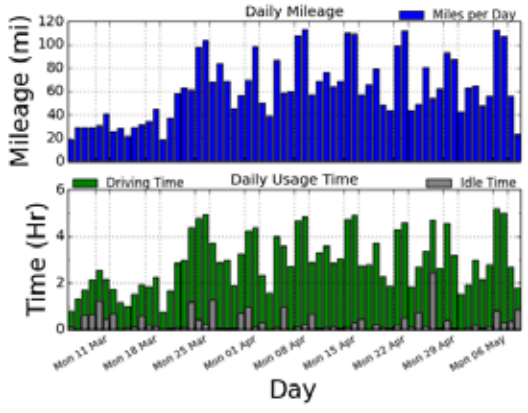


Figure E-53. Vehicle G41-1373G history.

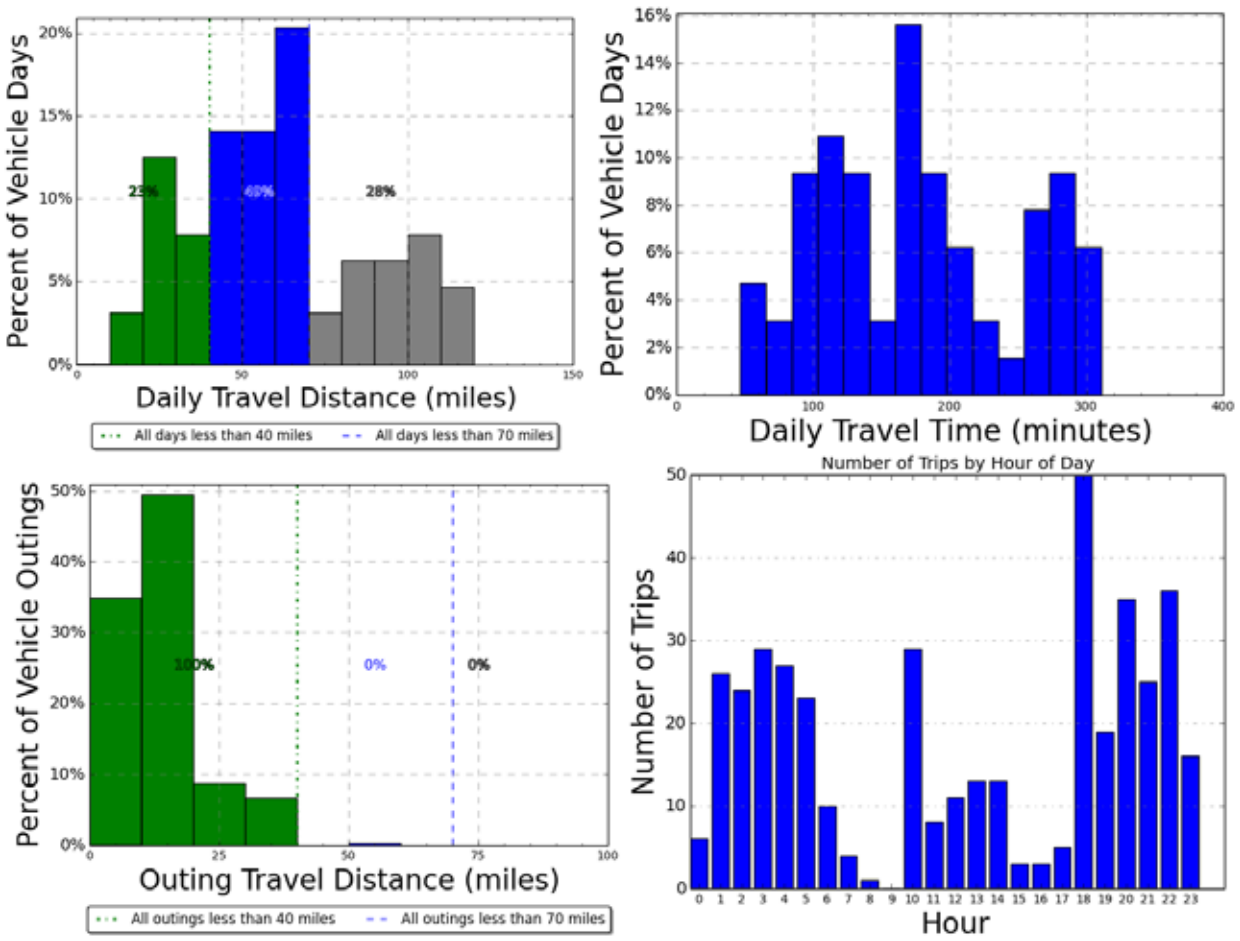


Figure E-48. Vehicle G41-1373G travel graphs.

Vehicle G41-1373G Observations

Logger 93 collected data on this vehicle for a period of 63 days of the 63-day study period. Validation occurred on 99.2% of the input data. The project survey response reports this vehicle assignment to Strategic Resources Inc Contractor to support the mission through a specific travel route in documenting transport security checks. It parks the office parking area near Bled R9654 on Perry or Cook Avenues. JMB HHC/S-1expects to retain this vehicle less than two years. It travels between 40 and 100 miles per day, rarely travels off base, and outings are typically less than 40 miles. Site records show an average monthly travel of 880 miles with an odometer reading of 45,361 in May 2012. Up to twenty persons have access to this vehicle and they typically travel alone. The response reports no specific cargo or equipment carry requirements.

The vehicle was used every day of the study period. During the study period, the vehicle traveled a total distance of 3,949 miles over 188 hours of travel. Seventy-two percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-54) and all outings except one were within this range; 28% of the vehicle travel days exceed this range.

The daily use of this vehicle, high number of travel days exceeding a BEV range and the high mileage suggests that a PHEV would be the best choice for a replacement vehicle assuming it can handle the balance of mission responsibilities. This is a pickup, but no specific carry requirements were identified.

Vehicle G41-1367G

www.edmunds.com

Make/Model/Year	Dodge/Dakota/2008
EPA Class Size	Standard Pickup Truck
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Rainier Dr
Fleet Vehicle ID	G41-1367G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	14/19/15 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)*	592/630
Study Logger ID	Logger 97
Total Vehicle Days/Total Study Days	47/63

Vehicle G41-1367G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	14.5/40	4.9/29.7	2.5/13.9	682
Travel Time (Minutes)	71/184	24.0/120	12.3/86	3,314
Idle Time (Minutes)	19.9/NA	6.8/NA	3.5/NA	935

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	322	100%	Less than 2	272
10 to 20	0	0%	2 to 4	14
20 to 40	0	0%	4 to 8	2
40 to 60	0	0%	Greater than 8	44

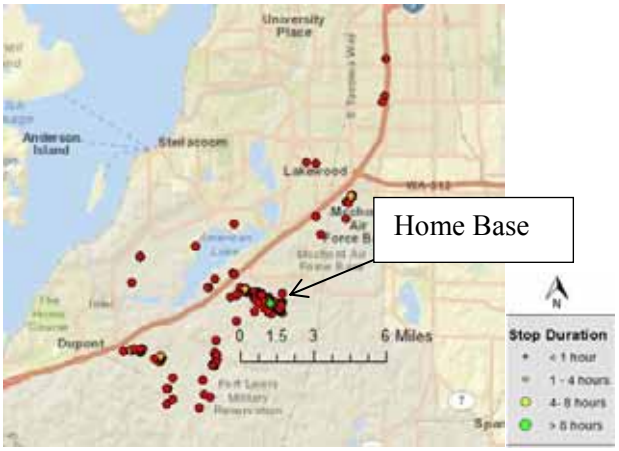


Figure E-55. Vehicle G41-1367G stops.

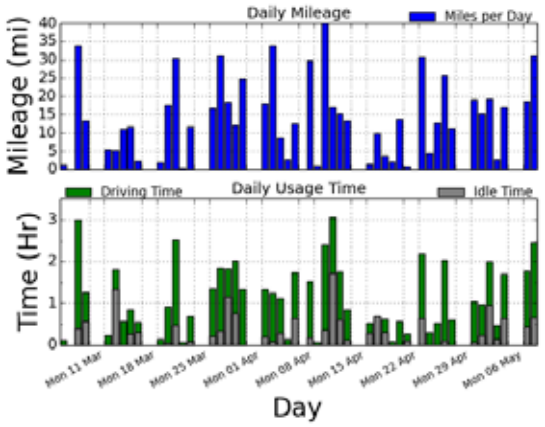


Figure E-56. Vehicle G41-1367G history.

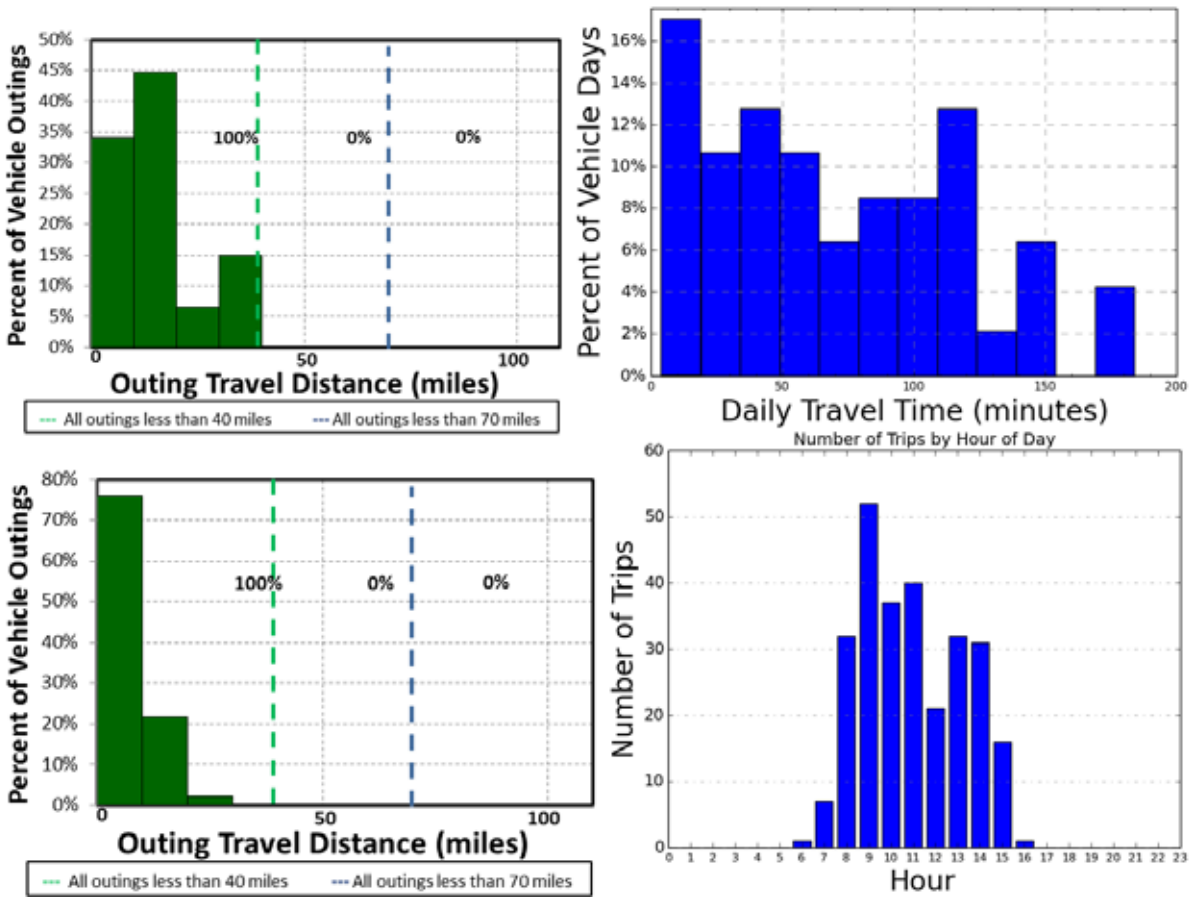


Figure E-49. Vehicle G41-1367G travel graphs.

Vehicle G41-1367G Observations

Logger 97 collected data on this vehicle for a period of 47 days of the 63-day study period. Validation occurred on 95.4% of the input data. The project survey response reports this is a pool vehicle assigned to ITD/TMP. It typically parks in the pool parking area but specific area was not identified. Data suggests the primary parking area is near Bldg 9641 on Perry Avenue or Rainier Dr. IDT/TMP suggests the vehicle travels between six and ten miles per day. Site records indicate average monthly travel is 316 miles and the vehicle's odometer read 21,670 in May 2012. More than twenty people have access to this vehicle. The response reports no particular cargo or equipment requirements.

All trips and outings were less than 70 miles and thus, were within the typically advertised range of a BEV of approximately 70 miles. Similarly, all trips and outings were less than 40 miles and thus, were within the typically advertised range of a PHEV. This is a standard pickup with no specific cargo or equipment requirements. Assuming available BEVs can support the balance of mission requirements, a BEV would be expected to provide the acceptable performance of this vehicle.

Vehicle G43-0792K

www.edmunds.com

Make/Model/Year	Chevrolet/CG3500 Express/2010
EPA Class Size	Passenger Van
Mission	Pool
Contact	C Sallinger/Motor Transport
Parking Location	Bldg R9640/Perry Ave
Fleet Vehicle ID	G43-0792K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	13/18/15 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	592/572
Study Logger ID	Logger 101
Total Vehicle Days/Total Study Days	44/63

Vehicle G43-0792K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	36.0/308.7	15.2/309.6	5.0/149.5	1,583
Travel Time (Minutes)	127/581	53.6/908	17.7/182	5,571
Idle Time (Minutes)	38.6/NA	16.3/NA	5.4/NA	1,697

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	306	90.8%	Less than 2	255
10 to 20	16	4.7%	2 to 4	18
20 to 40	5	1.5%	4 to 8	16
40 to 60	10	3.0%	Greater than 8	48

Figure E-58. Vehicle G43-0792K stops.

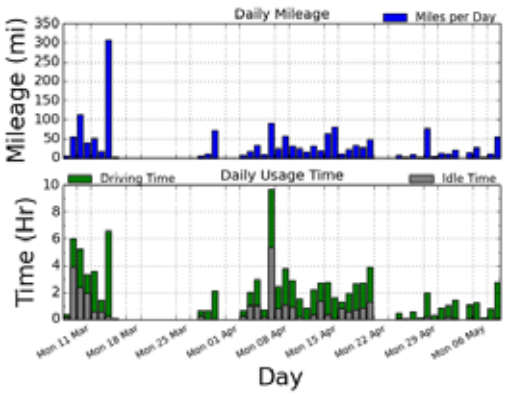


Figure E-59. Vehicle G43-0792K history.

*2010 Chevrolet Express 1500 information. EPA data for 2010 Chevrolet CG3500 Express not available.

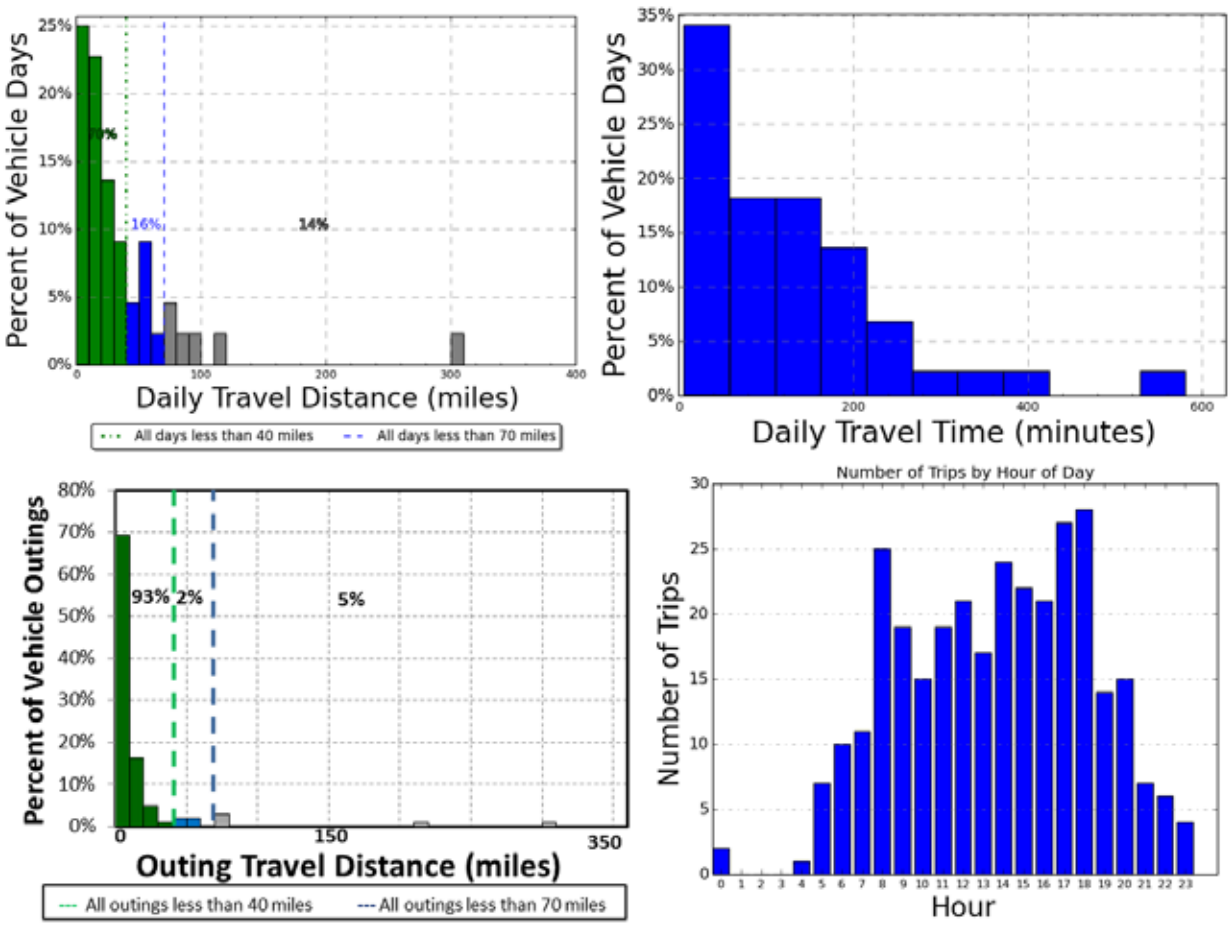


Figure E-50. Vehicle G43-0792K travel graphs.

Vehicle G43-0792K Observations

Logger 101 collected data on this vehicle for a period of 44 days of the 63-day study period. Validation occurred on 98.8% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9640 on Perry Ave or in the Eagle View Housing Area near 19th Street and F Street. Frequent stops on Utah and other locations are also evident. Site data reports an odometer reading of 25,683 in May 2012 with an average of 1014 miles per month.

86% of all vehicle travel days and 95% of all outings were within the 70-mile BEV safe range (green and blue bars on Figure E-60), while 14% of the vehicle travel days exceeds this range. The longest daily travel of 309 miles occurred on March 13 to Yakima and Tacoma that also included the longest single outing of 310 miles (the vehicle returned to the home base the next day). The next longest outing of 219 miles also occurred over a several day period involving a trip to Tumwater and Seattle, WA. Because this vehicle stops at many locations and does not return to a specific home base, outing information reported here may be overly conservative relative to a PEV, which would return to a home charging location. However, the longest outings shown are accurate depictions of vehicle travel.

While only 5 days of the 63 days in the study showed travel exceeding the 70-mile range, the occurrences were random suggesting that a BEV may not be a suitable replacement vehicle for this specific vehicle. However, a mix of BEVs and PHEVs may satisfy the necessary travel requirements of vehicles in this mission category depending upon the passenger carrying capabilities.

Vehicle G43-0801K

www.edmunds.com

Make/Model/Year	Chevrolet/Express CG3500/2010
EPA Class Size	Passenger Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641
Fleet Vehicle ID	G43-0801K
Fuel Type	Gas/E85
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/572
Study Logger ID	Logger 102
Total Vehicle Days/Total Study Days	34/63

Vehicle G43-0801K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	52.4/354.1	46.9/995.0	7.1/158.0	1,782
Travel Time (Minutes)	143/601.0	128.1/1614	19.5/169.0	4,867
Idle Time (Minutes)	52.8/NA	47.3/NA	7.2/NA	1,796

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	118	63.1%	Less than 2	140
10 to 20	1	0.5%	2 to 4	5
20 to 40	9	4.8%	4 to 8	9
40 to 60	60	32.1%	Greater than 8	33

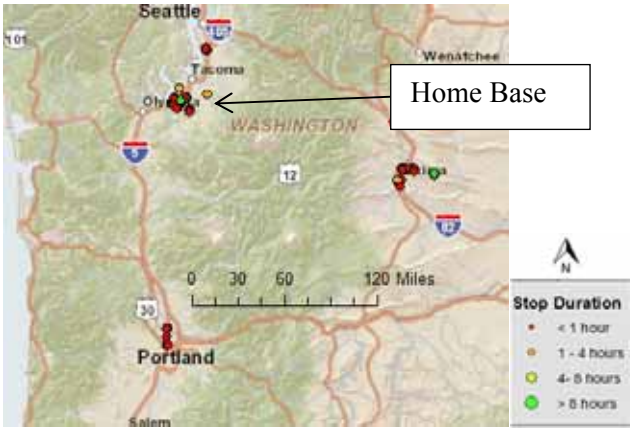


Figure E-61. Vehicle G43-0801K stops.

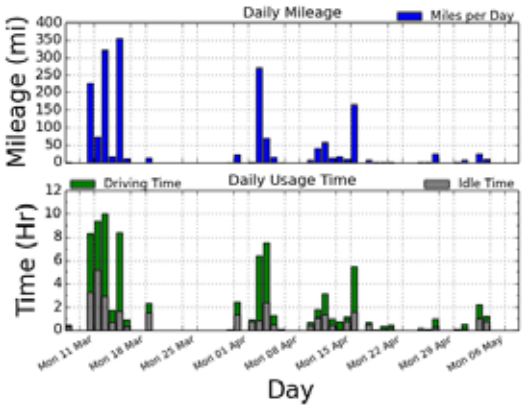


Figure E-62. Vehicle G43-0801K history.

*2010 Chevrolet Express 1500 information. EPA data for CG3500 not available.

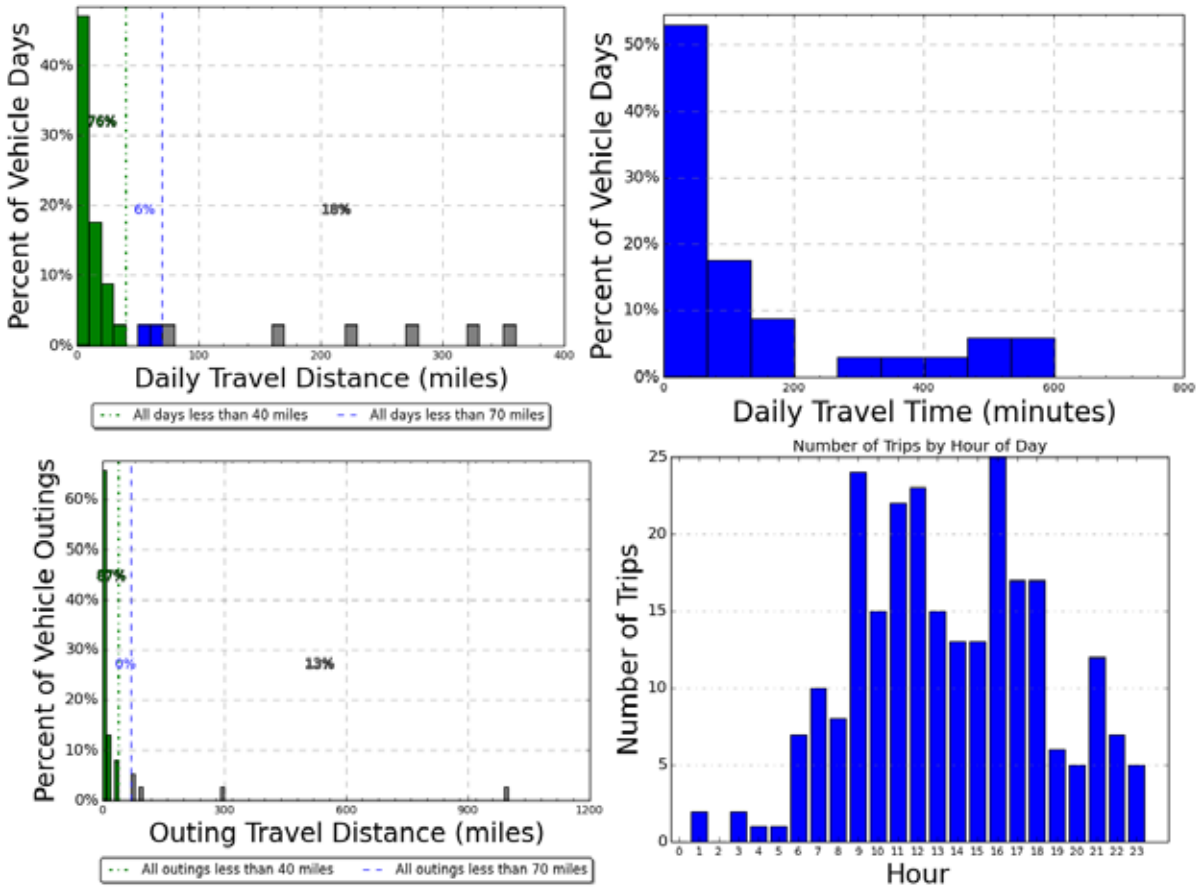


Figure E-51. Vehicle G43-0801K travel graphs.

Vehicle G43-0801K Observations

Logger 102 collected data on this vehicle for a period of 34 days of the 63-day study period. Validation occurred on 99.1% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9641 but is used extensively around the base. Site data reports an odometer reading of 17,820 in May 2012 with an average of 742 miles per month.

82% of all vehicle travel days and 87% of all outings were within the 70-mile BEV safe range (green and blue bars on Figure E-63), while 18% of the vehicle travel days exceeds this range. An extended outing to Ellensburg, Yakima and SEATAC occurred on March 10 – March 18 of 995 miles. While the vehicle returned to Ft Lewis on March 12, it did not return to its home base on Perry Avenue until March 18. A similar outing occurred from April 9 to April 15 reflecting the outing of 300 miles.

Because this vehicle stops at many locations and does not return to a specific home base, outing information reported here may be overly conservative relative to a PEV, which would return to a home charging location. However, the longest outings shown are accurate depictions of vehicle travel.

While only 5 days of the 63 days in the study showed travel exceeding the 70-mile range, the occurrences were random suggesting that a BEV may not be a suitable replacement vehicle for this specific vehicle. However, a mix of BEVs and PHEVs may satisfy the necessary travel requirements of vehicles in this mission category depending upon the passenger carrying capabilities.

Vehicle G42-0988F

www.edmunds.com

Make/Model/Year	Chevrolet/Express 13/2007
EPA Class Size	Cargo Van
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 9040/Fitzsimmons
Fleet Vehicle ID	G42-0988F
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	13/16/14
EPA GHG Emissions (Grams CO_2/Mi)*	635
Study Logger ID	Logger 104
Total Vehicle Days/Total Study Days	40/63

Vehicle G42-0988F Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	59.9/85.8	11.3/52.7	2.4/20.1	2,394
Travel Time (Minutes)	185/258.0	35.0/127.0	7.4/57.0	7,410
Idle Time (Minutes)	16.7/NA	3.2/NA	0.7/NA	669

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	907	97.5%	Less than 2	890
10 to 20	23	2.5%	2 to 4	0
20 to 40	0	0%	4 to 8	0
40 to 60	0	0%	Greater than 8	40

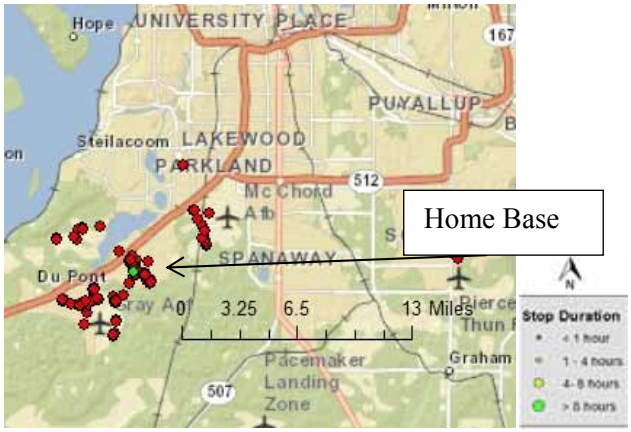


Figure E-64. Vehicle G42-0988F stops.

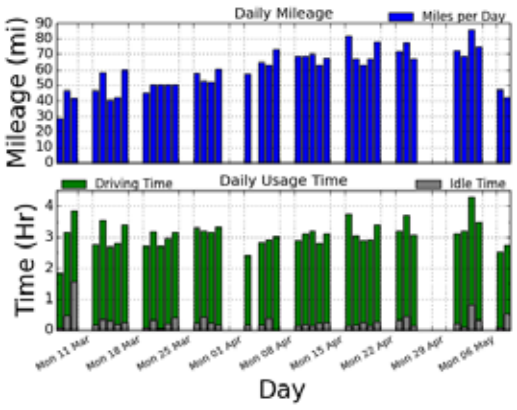


Figure E-65. Vehicle G42-0988F history.

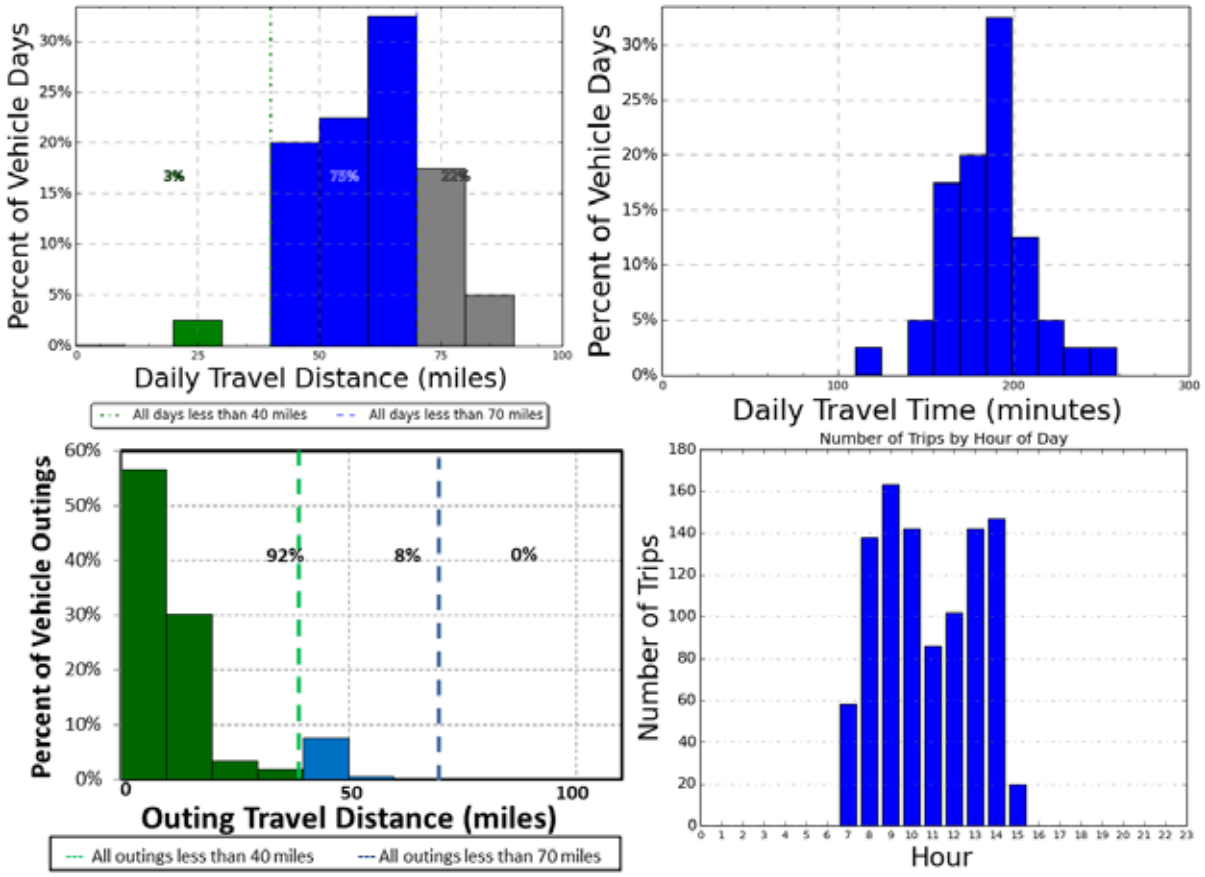


Figure E-52. Vehicle G42-0988F travel graphs.

Vehicle G42-0988F Observations

Logger 104 collected data on this vehicle for a period of 40 days of the 63-day study period. Validation occurred on 99.9% of the input data. The project survey response reports this vehicle, assigned to MAMC/PAD/OPR, is a delivery vehicle that typically parks in the Madigan Army Medical lot on Fitzsimons, Madigan or Gardener Loop. It expects to retain this vehicle more than six years. Expected travel is between forty and one hundred miles per day. Site data reports an odometer reading of 32,172 in May 2012 with an average of 724 miles per month. Between two and five persons access this vehicle and it typically carries one person at a time. This vehicle travels off base frequently – twenty to twenty five times per week with outings expected to be up to one hundred miles. It operates generally between 0700 and 1500 hours daily. It typically carries office supplies, furniture, and medical records.

During the study period, the vehicle traveled a total distance of 2,394 miles over 123 hours. As seen on the history graph (Figure E-65), this vehicle is used extensively. Over 990 individual trips were recorded during the study period. Seventy-eight percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-66), while 22% of the vehicle travel days exceeds this range.

Most of these daily travels consist of relatively short outings. The longest single outing of 52.7 miles occurred on April 9th that remains within the assumed range capability of a BEV. That outing took 1.8 hours of driving time. Total travel that day was 69 miles. There appeared to be insufficient time between trips for any opportunity charging that day. There are a sufficient number of days where the daily miles exceed the 70-mile range and it is suggested a PHEV would best be suited for this vehicle replacement should such meet the cargo carrying requirements.

Vehicle G43-0860G

www.edmunds.com

Make/Model/Year	Chevrolet/CG3300/2008
EPA Class Size	Passenger Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641or 19th St N
Fleet Vehicle ID	G43-0860G
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	12/16/14
EPA GHG Emissions (Grams CO_2/Mi)*	635
Study Logger ID	Logger 105
Total Vehicle Days/Total Study Days	41/63

Vehicle G43-0860G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	33.6/164.9	13.2/306.0	4.6/45.5	1,376
Travel Time (Minutes)	139/433.0	54.6/921	18.9/139.0	5,680
Idle Time (Minutes)	45.8/NA	18.0/NA	6.3/NA	1,876

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	299	86.7%	Less than 2	267
10 to 20	11	3.2%	2 to 4	25
20 to 40	35	10.1%	4 to 8	8
40 to 60	0	0%	Greater than 8	45

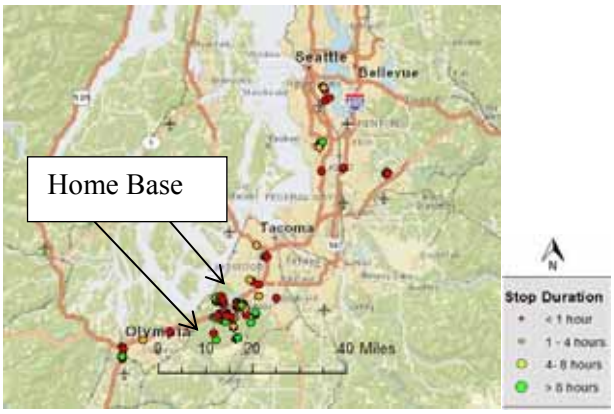


Figure E-67. Vehicle G43-0860G stops.

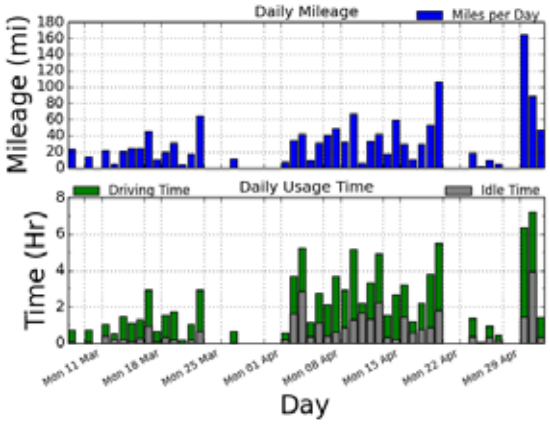


Figure E-68. Vehicle G43-0860G history.

*2008 Chevrolet Express 1500 information. EPA data for CG3300 not available.

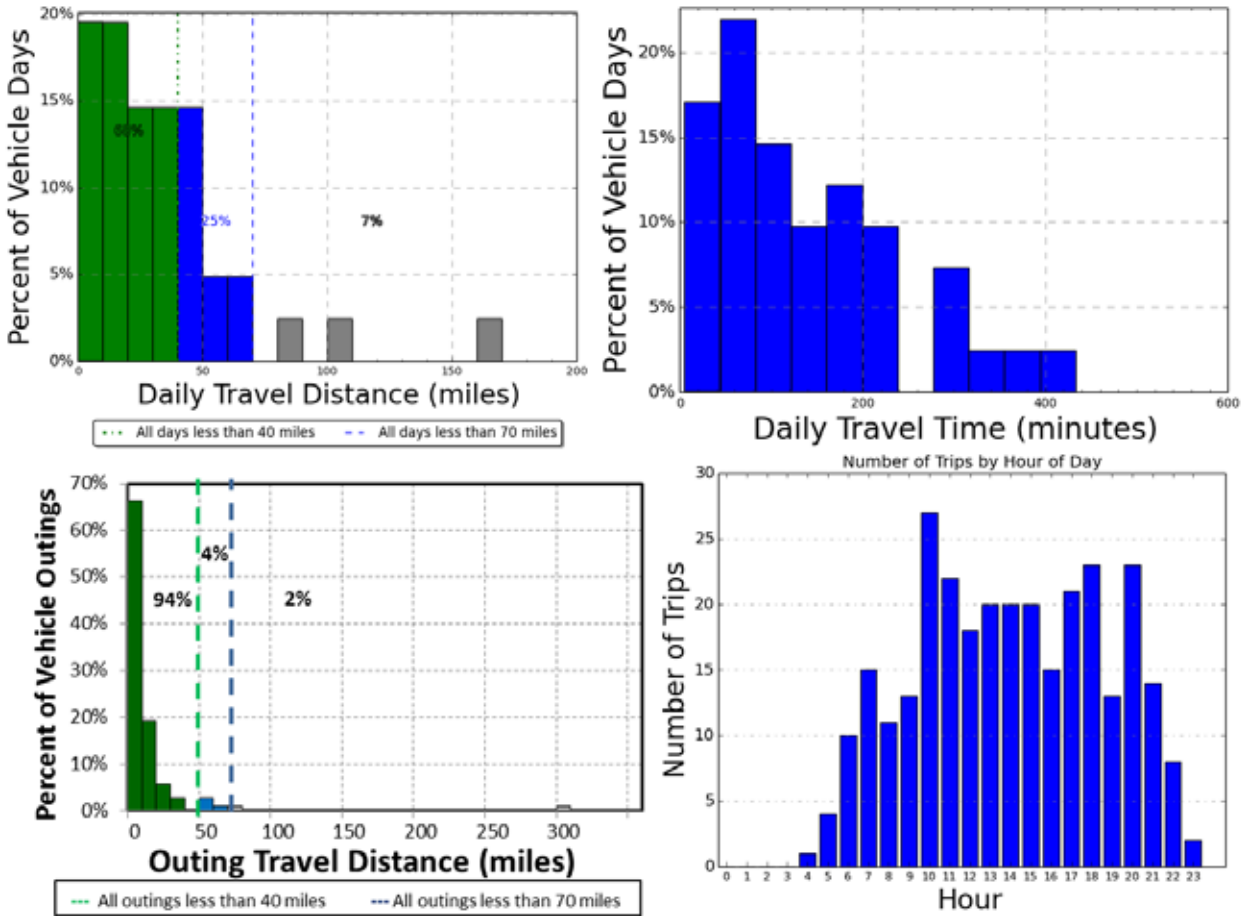


Figure E-53. Vehicle G43-0860G travel graphs.

Vehicle G43-0860G Observations

Logger 105 collected data on this vehicle for a period of 41 days of the 63-day study period. Validation occurred on 99.8% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9641 on Perry Ave or on 19th St N. near 12300 buildings area of Eagle View Housing Area. It is also used extensively around the base. Frequent trips to SEATAC were recorded. Site data reports an odometer reading of 39,267 in May 2012 with an average of 818 miles per month.

During the study period, the vehicle traveled a total distance of 1,376 miles over 94 hours. Ninety-three percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-69) while 7% of the vehicle travel days exceeds this range.

The longest single outing of 306 miles occurred over several days from April 29 through May 1 including travel to Shadow Lake, SEATAC, Kent, and Seattle. This outing also contained several of the longer daily travels. Most of the other travel consists of relatively short outings. There are a sufficient number of days where the daily miles exceed the 70-mile range and it is suggested a PHEV would best be suited for this vehicle replacement should such meet the typical passenger carrying requirements.

Vehicle G43-1389K

www.edmunds.com

Make/Model/Year	Chevrolet/CG3300/2010
EPA Class Size	Passenger Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Various
Fleet Vehicle ID	G43-1389K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/572
Study Logger ID	Logger 106
Total Vehicle Days/Total Study Days	34/63

Vehicle G43-1389K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	94.7/378.4	74.9/379.5	19.5/160.4	3,219
Travel Time (Minutes)	181/535.0	143.4/777.0	37.4/184.0	6,166
Idle Time (Minutes)	39.4/NA	31.1/NA	8.1/NA	1,338

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	124	50.8%	Less than 2	191
10 to 20	14	5.7%	2 to 4	14
20 to 40	41	16.8%	4 to 8	3
40 to 60	65	26.6%	Greater than 8	36

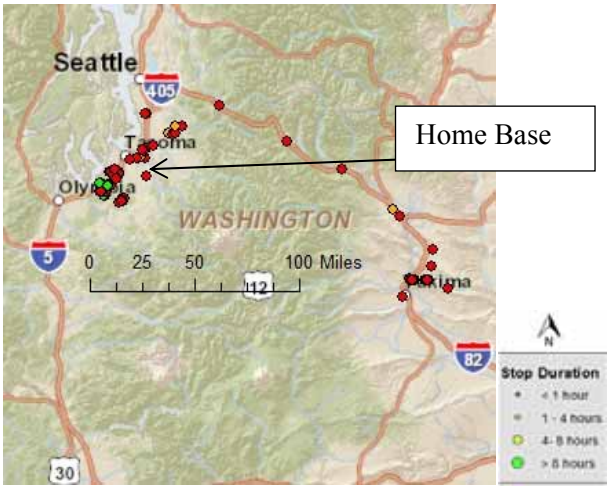


Figure E-70. Vehicle G43-1389K stops.

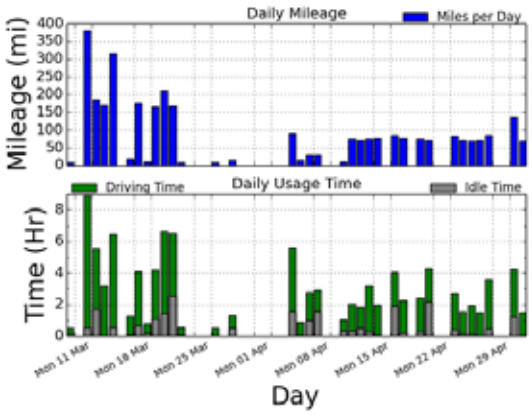


Figure E-71. Vehicle G43-1389K history.

*2010 Chevrolet Express 1500 information. EPA data for CG3300 not available.

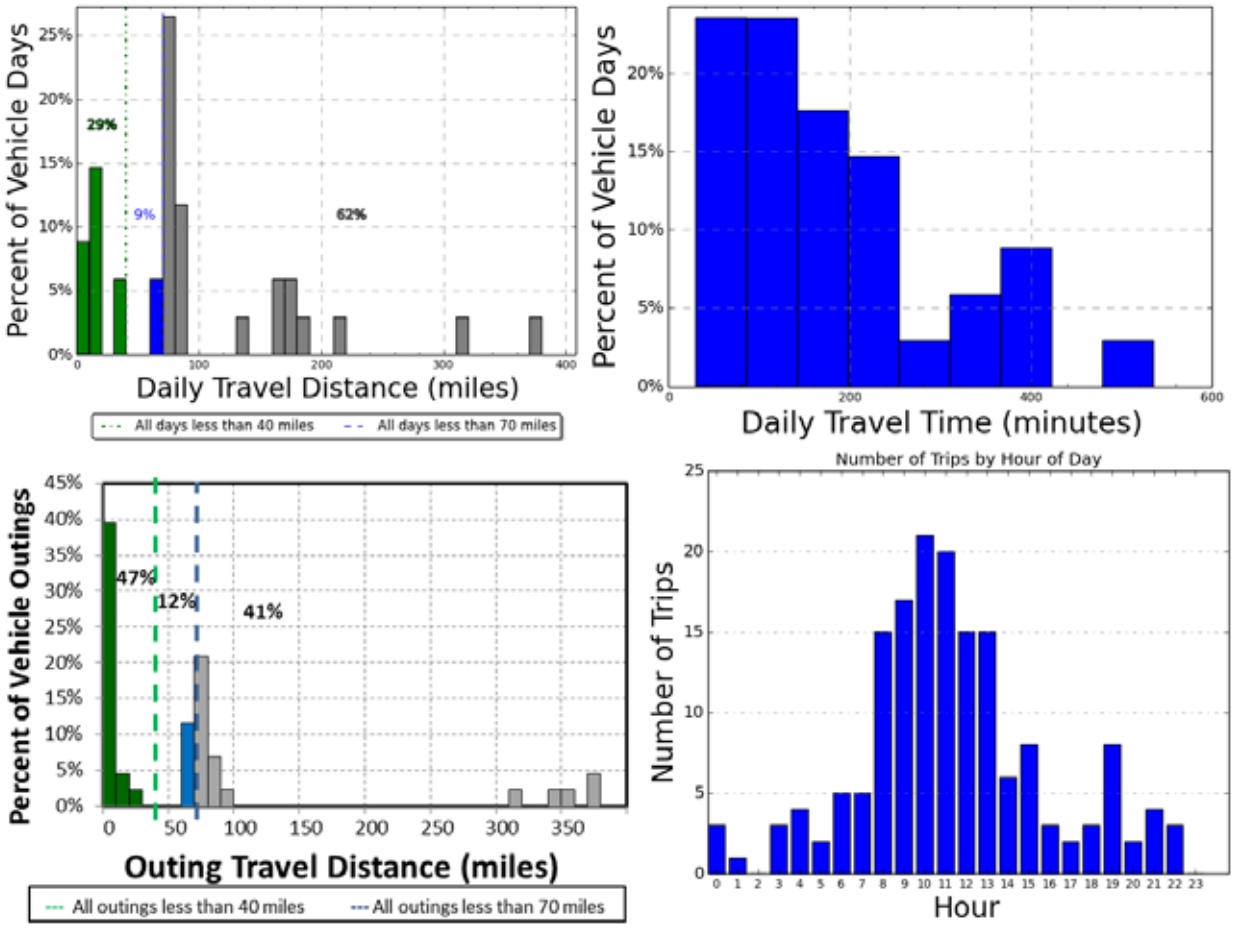


Figure E-54. Vehicle G43-1389K travel graphs.

Vehicle G43-1389K Observations

Logger 106 collected data on this vehicle for a period of 34 days of the 63-day study period. Validation occurred on 98.9% of the input data. Survey information was not available for this vehicle. For the first part of the study period, trip data suggests it was involved in frequent trips to Northeast Yakima on 6th Ave (approximately 300+ miles round trip) as well as typically parked near H St/I St/12th Street area in North Fort Lewis. It shifted parking areas to Perry Avenue near Bldg 9640. For the later part of the study period, the vehicle mostly parked on 41st Division Way in Camp Murray. Here it was involved in frequent trips to Shadow Lake, WA (approximately 70 miles round trip). Site data reports an odometer reading of 15,291 in May 2012 with an average of 694 miles per month.

During the study period, the vehicle traveled a total distance of 3,219 miles over 100 hours. Thirty-eight percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-72) while 62% of the vehicle travel days exceeds this range.

Because of the frequent long trips and frequent use, it is suggested a PHEV would best be suited for this vehicle replacement should such meet the typical passenger carrying requirements.

Vehicle G41-1180G

www.edmunds.com

Make/Model/Year	Chevrolet/Uplander/2008
EPA Class Size	Minivan
Mission	Support
Contact	J. Lamantia/Motor Transport
Parking Location	Bldg 9040/Fitzsimmons
Fleet Vehicle ID	G41-1180G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	16/23/19 12/17/14
EPA GHG Emissions (Grams CO_2/Mi)*	468/450
Study Logger ID	Logger 107
Total Vehicle Days/Total Study Days	16/63

Vehicle G42-0698K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	18.3/79.1	17.2/79.1	6.0/36.5	293
Travel Time (Minutes)	44/120.0	41.0/120	14.3/43.0	697
Idle Time (Minutes)	5.9/NA	5.5/NA	1.9/NA	94

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	51	94.4%	Less than 2	38
10 to 20	1	1.9%	2 to 4	2
20 to 40	2	3.7%	4 to 8	0
40 to 60	0	0%	Greater than 8	14

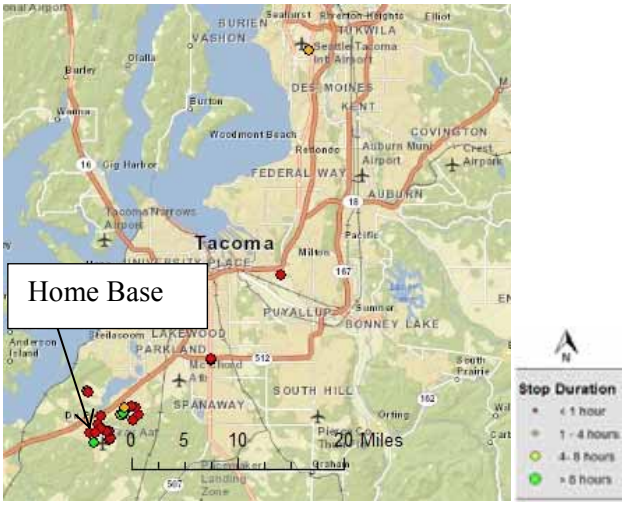


Figure E-73. Vehicle G41-1180G stops.

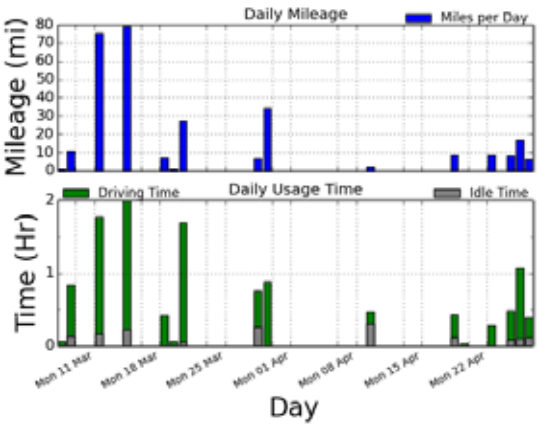


Figure E-74. Vehicle G41-1180G history.

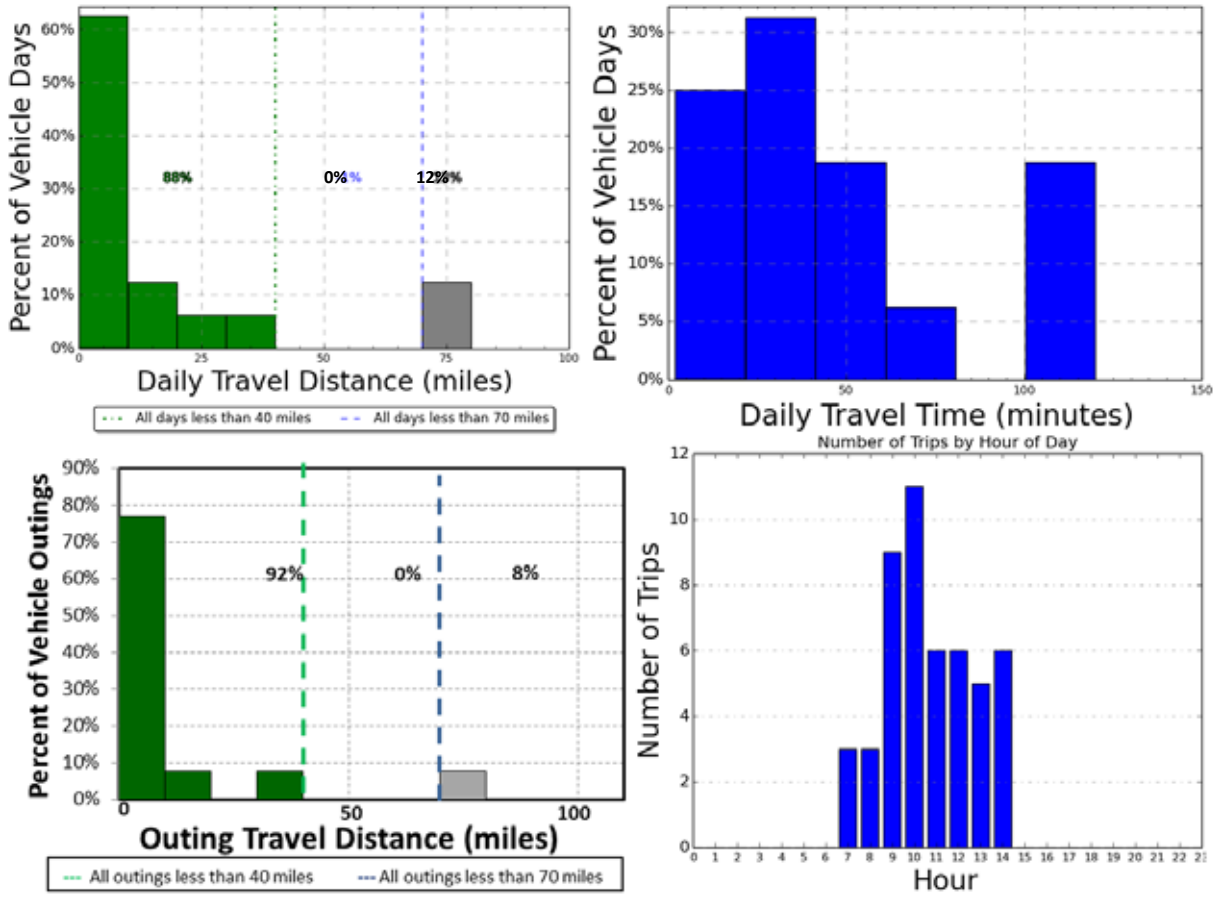


Figure E-55. Vehicle G41-1180G travel graphs.

Vehicle G41-1180G Observations

Logger 107 collected data on this vehicle for a period of 16 days of the 63-day study period. Validation occurred on 94.4% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9040, Madigan Army Medical Center, on Fitzsimmons or Gardner Lop Road. Site data reports an odometer reading of 17,820 in May 2012 with an average of 742 miles per month.

During the study period, the vehicle traveled a total distance of 293 miles over 11hours. Eighty-eight percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-75) while 12% of the vehicle travel days exceeds this range.

Two outings of 71.2 and 79.1 miles occurred on March 11 and March 14 during travel to SEATAC. That outing took less than 2 hours of driving time but unless charging stations are located at SEATAC that are convenient, the outing exceeds the BEV safe range. It is suggested a PHEV would best be suited for this vehicle.

Vehicle G11-2675G

www.edmunds.com

Make/Model/Year	Chevrolet/Impala/2008
EPA Class Size	Large Cars
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 9040/9900
Fleet Vehicle ID	G11-2675G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	18/29/22 14/21/16
EPA GHG Emissions (Grams CO_2/Mi)*	404/393
Study Logger ID	Logger 108
Total Vehicle Days/Total Study Days	8/63

Vehicle G11-2675G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.0/85.4	16.0/85.4	7.3/40.3	160
Travel Time (Minutes)	51/117.0	40.6/117.0	18.5/53.0	406
Idle Time (Minutes)	5.4/NA	4.3/NA	2.0/NA	43

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	28	93.3%	Less than 2	19
10 to 20	0	0%	2 to 4	2
20 to 40	2	6.7%	4 to 8	1
40 to 60	0	0%	Greater than 8	8

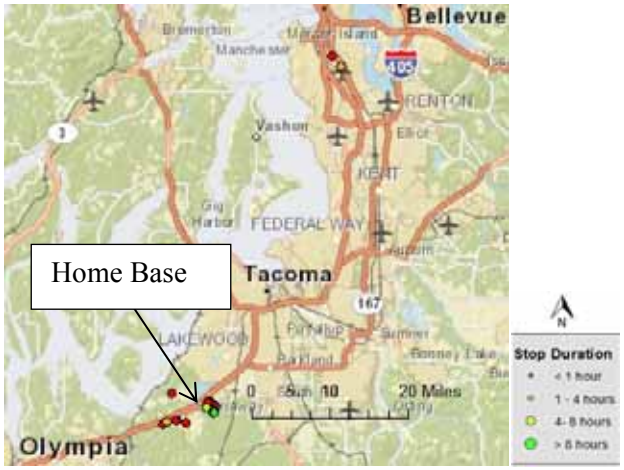


Figure E-76. Vehicle G11-2675G stops.

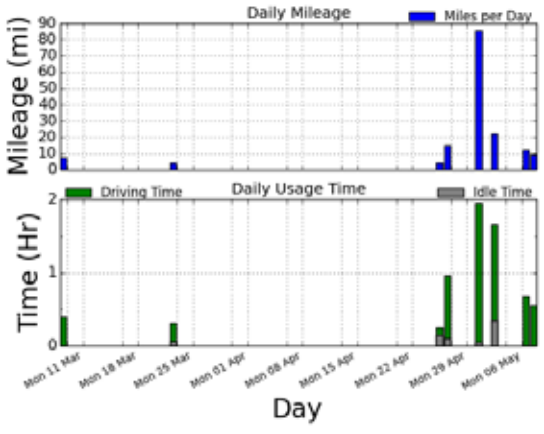


Figure E-77. Vehicle G11-2675G history.

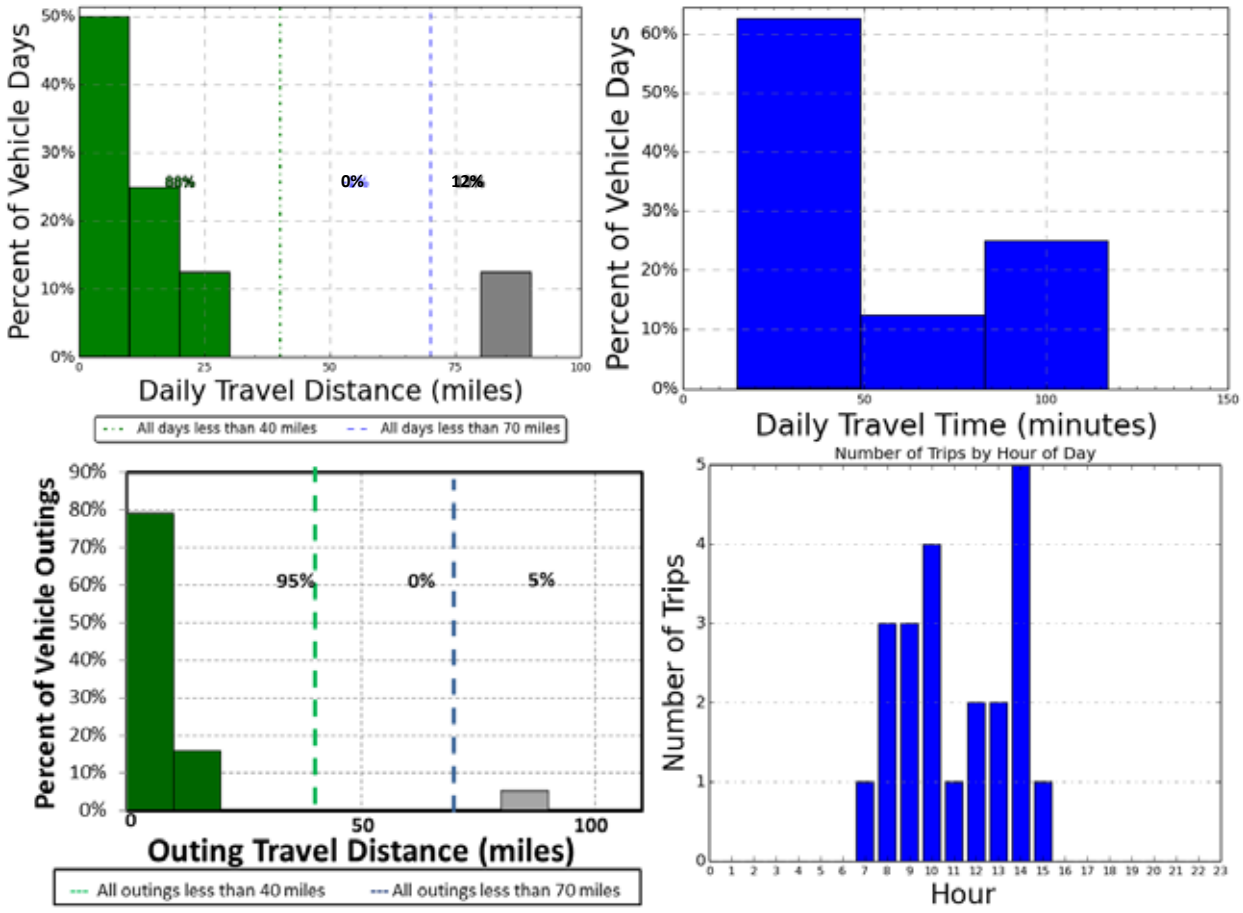


Figure E-56. Vehicle G11-2675G travel graphs.

Vehicle G11-2675G Observations

Logger 108 collected data on this vehicle for a period of 8 days of the 63-day study period. Validation occurred on 89.9% of the input data. Project survey response reports this pool vehicle, assigned to Military Personnel Division performs courier type tasks. This vehicle is used to transport documents and personnel to and from Western Regional Medical Command, finance and Waller Hall as well as the hospital. It parks in the office parking lot on Johnson St near Bldg 9900 or on Fitzsimmons near the Medical Center, Bldg 9040. Expected retention of this vehicle is unknown. It typically travels between six and ten miles per day. Between six and ten persons regularly access this vehicle and it typically carries up to three persons. It occasionally operates off base – typically twice per month. Off base outings are typically less than ten miles. Site data reports an odometer reading of 5,642 in May 2012 with an average of 107 miles per month. It frequently operates on the E-85 fuel.

Eighty-eight percent of all vehicle travel days were within the 70-mile BEV safe range (green bars on Figure E-78) while 12% of the vehicle travel days exceeds this range. This was one day's travel to Seattle, which also was the longest single outing. All other trips were of short distances.

This one outing exceeds the 70-mile range for a replacement BEV so strictly, the recommended replacement would be a PHEV. However, as a pool vehicle, a mix of BEVs and PHEVs may support the mission if vehicle are selected carefully.

Vehicle G43-1191L

www.edmunds.com

Make/Model/Year	Chevrolet/CG3300/2011
EPA Class Size	Passenger Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Yakima
Fleet Vehicle ID	G43-1191L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	11/16/12 8/12/9
EPA GHG Emissions (Grams CO_2/Mi)*	741/699
Study Logger ID	Logger 109
Total Vehicle Days/Total Study Days	37/63

Vehicle G43-1191L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	40.4/186.1	17.0/374.4	4.8/104.8	1,493
Travel Time (Minutes)	121/332.0	50.8/754.0	14.2/116.0	4,469
Idle Time (Minutes)	24.9/NA	10.5/NA	2.9/NA	920

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	249	76.4%	Less than 2	249
10 to 20	20	6.1%	2 to 4	26
20 to 40	0	0%	4 to 8	12
Greater than 40	57	17.5%	Greater than 8	39

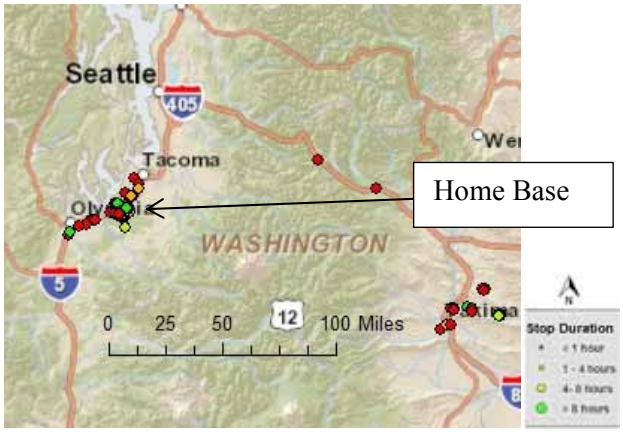


Figure E-79. Vehicle G43-1191L stops.

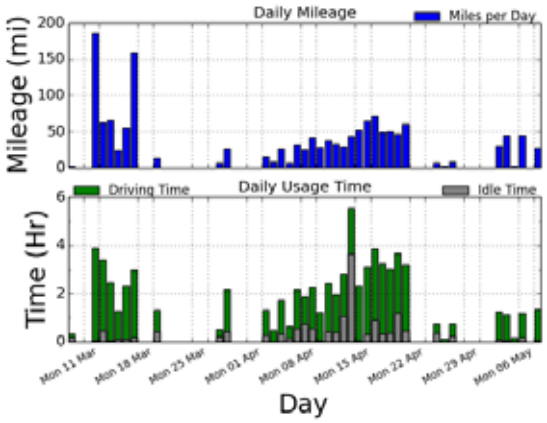


Figure E-80. Vehicle G43-1191L history.

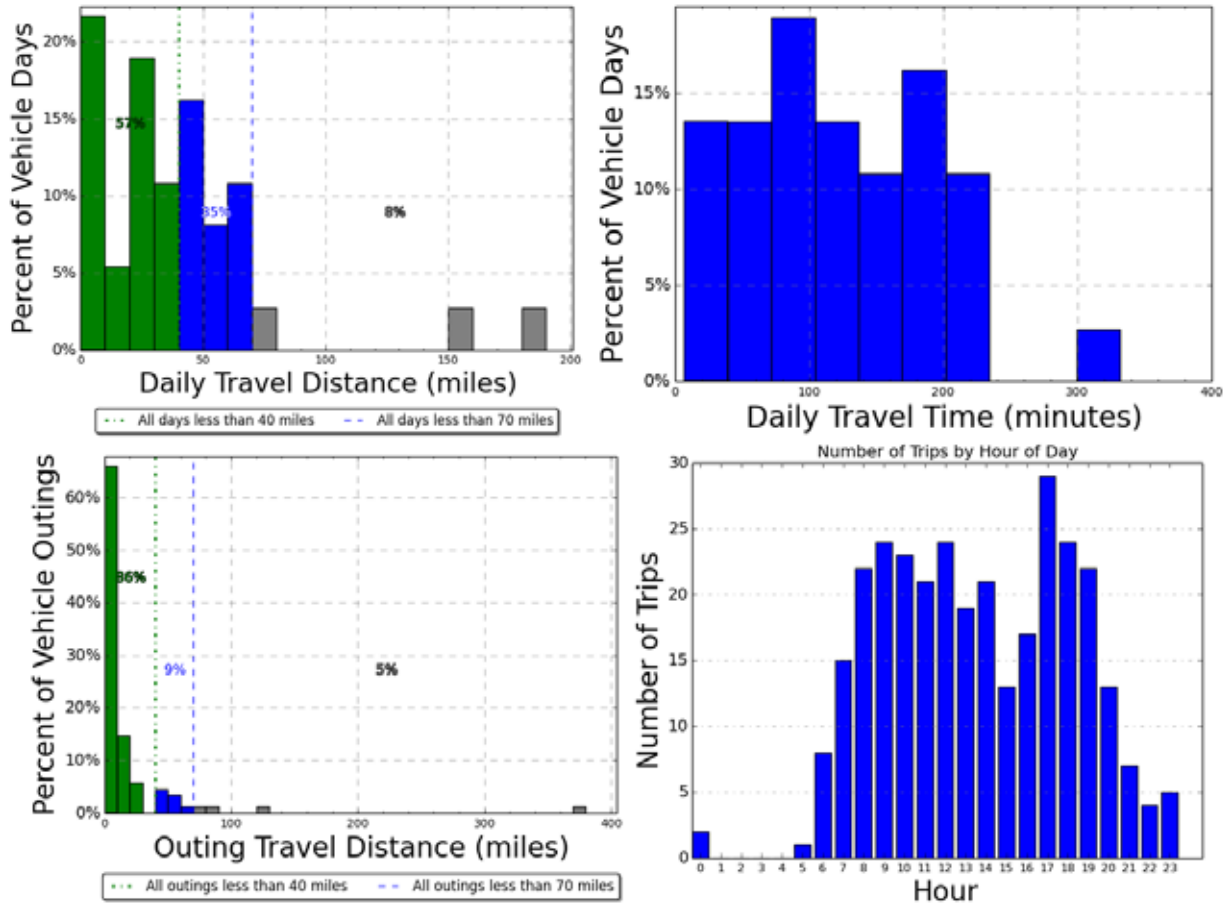


Figure E-57. Vehicle G43-1191L travel graphs.

Vehicle G43-1191L Observations

Logger 109 collected data on this vehicle for a period of 37 days of the 63-day study period. Validation occurred on 99.5% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9641 on Perry but frequently parked in the Eagle View Housing Area and in Yakima. Site data reports an odometer reading of 6,695 in May 2012 with an average of 514 miles per month.

During the study period, the vehicle traveled a total distance of 1,493 miles over 74 hours. Ninety-two percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-81), while 8% of the vehicle travel days exceeds this range.

Ninety-five percent of all outings were within the 70-mile BEV safe range, while 5% exceed this range. The longest single outing occurred on a several day travel to Yakima so the vehicle did not return to the home base during this time. The trip data also show frequent trips to the Olympia area.

Because there are several outings exceeding the BEV safe range, a BEV would not be recommended as a replacement vehicle for this particular vehicle. A PHEV would be recommended provided it can meet the passenger carrying requirements of this vehicle.

Vehicle G12-0662H

www.edmunds.com

Make/Model/Year	Ford/Fusion HEV/2010
EPA Class Size	Midsize Car
Mission	Pool
Contact	J. Lamantia/Motor Transport
Parking Location	Bldg R9641/3674
Fleet Vehicle ID	G12-0662H
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	41/36/39
EPA GHG Emissions (Grams CO_2/Mi)*	228
Study Logger ID	Logger 110
Total Vehicle Days/Total Study Days	27/63

Vehicle G12-0662H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	68.4/274.7	35.5/274.7	4.1/106.4	1,847
Travel Time (Minutes)	96/325.0	50.1/319.0	5.8/128.0	2,605
Idle Time (Minutes)	1.4/NA	0.7/NA	0.1/NA	37

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	93	66.9%	Less than 2	104
10 to 20	14	10.1%	2 to 4	6
20 to 40	16	11.5%	4 to 8	5
Greater than 40	16	11.5%	Greater than 8	24

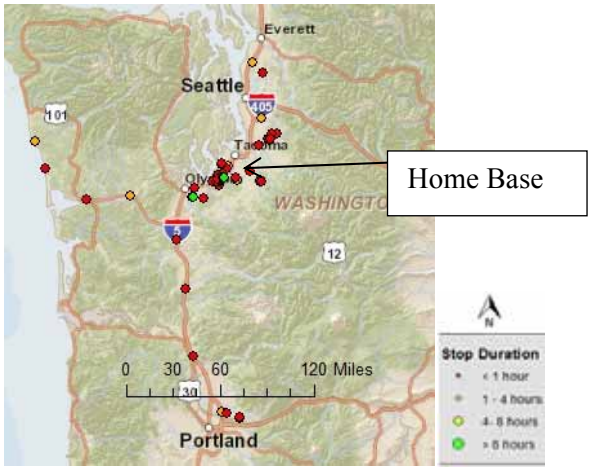


Figure E-82. Vehicle G12-0662H stops.

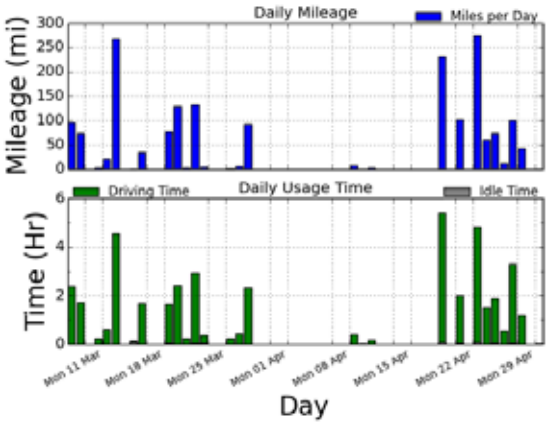


Figure E-83. Vehicle G12-0662H history.

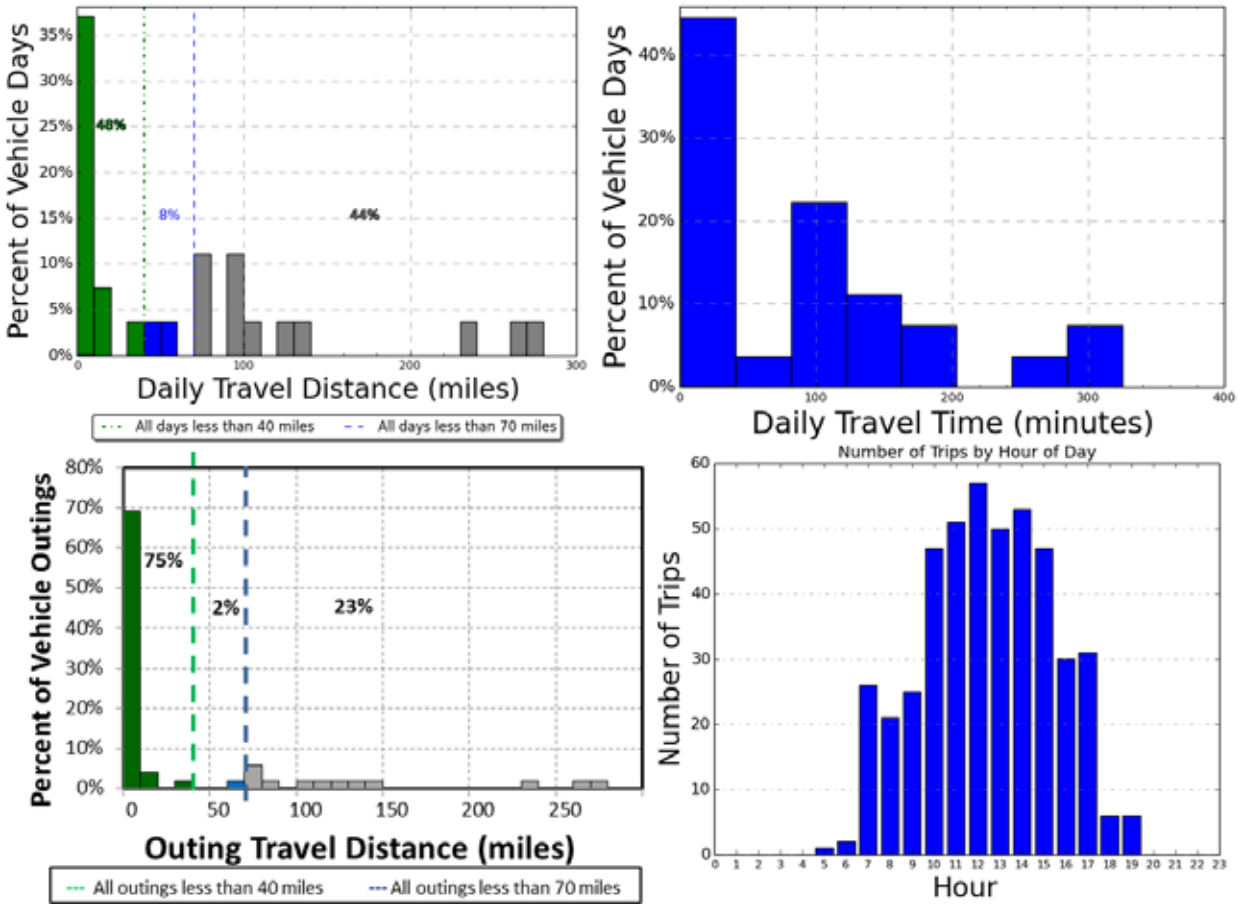


Figure E-58. Vehicle G12-0662H travel graphs.

Vehicle G12-0662H Observations

Logger 110 collected data on this vehicle for a period of 27 days of the 63-day study period. Validation occurred on 99.0% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9641 on Perry or Bldg 3674 on Railroad Avenue. Site data reports on odometer and mileage is unavailable.

This vehicle is used rather infrequently but selected for longer excursions. Fifty-six percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-84), while 44% of the vehicle travel days exceeds this range. Several excursions were made to several locations off-base in Washington State during the study period.

The longest single outing of 275 miles occurred on March 22 on an excursion to several locations in Washington State. Several other outings (23%) exceeded the 70-mile BEV safe range while 77% of outings were within this range. While a BEV cannot meet the travel requirements of this vehicle, a PHEV would provide significant benefit. 48% of daily travel and 75% of the outings are within the 40-mile battery only range of typical PHEVs. As this vehicle is a sedan, PHEVs are currently available to meet this mission.

Vehicle G63-0271A

www.commercialtruckt rade.com

Make/Model/Year	Ford/F350 Stake/2004
EPA Class Size	Stake Truck
Mission	Transport
Contact	C. Sallinger/Motor Transport
Parking Location	Camp Murray/Yakima
Fleet Vehicle ID	G63-0271A
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	11/15/13
EPA GHG Emissions (Grams CO_2/Mi)*	635
Study Logger ID	Logger 111
Total Vehicle Days/Total Study Days	22/63

Vehicle G63-0271A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	71.9/393.8	26.8/393.8	7.7/142.5	1,582
Travel Time (Minutes)	311/669.0	116.1/673.0	33.2/218.0	6,847
Idle Time (Minutes)	178.6/NA	66.6/NA	19.1/NA	3,930

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	115	52.8%	Less than 2	177
10 to 20	1	0.5%	2 to 4	11
20 to 40	0	0%	4 to 8	9
40 to 60	102	46.8%	Greater than 8	21

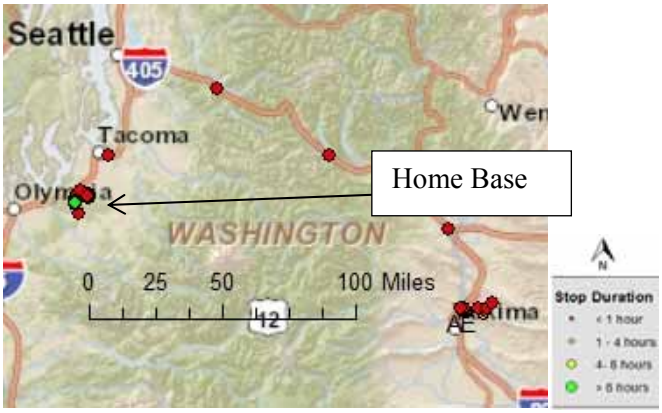


Figure E-85. Vehicle G63-0271A stops.

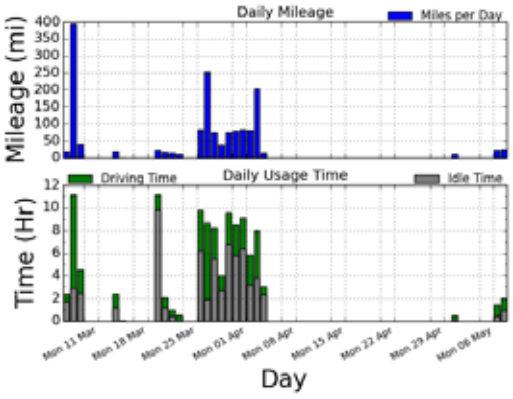


Figure E-86. Vehicle G63-0271A history.

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

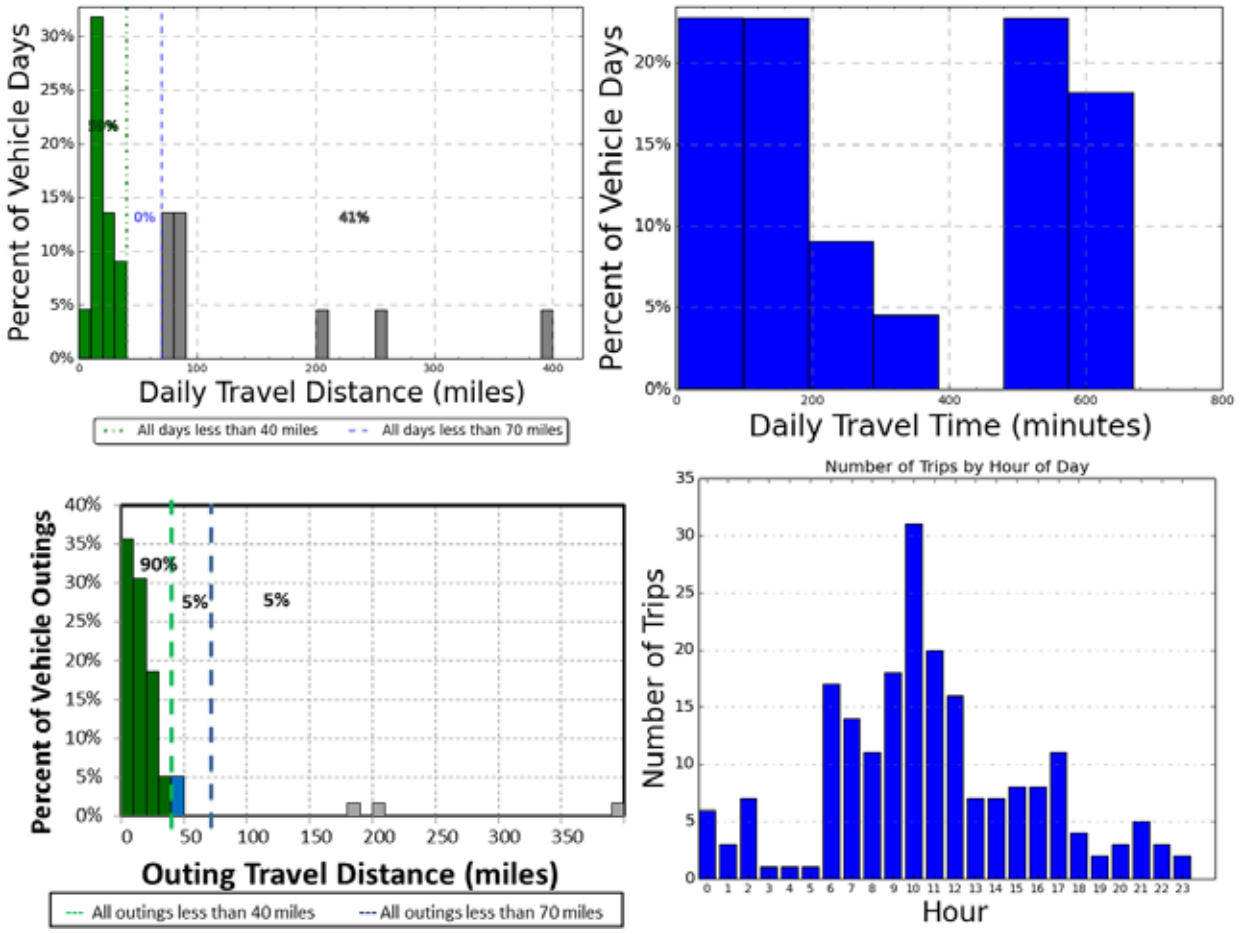


Figure E-59. Vehicle G63-0271A travel graphs.

Vehicle G63-0271A Observations

Logger 111 collected data on this vehicle for a period of 22 days of the 63-day study period. Validation occurred on 99.1% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks in Camp Murray on 41st Division Way but spent a considerable amount of time in Yakima apparently home based on 5th Avenue. Site data reports an odometer reading of 49,748 in May 2012 with an average of 360 miles per month.

A large percentage (41%) of all vehicle travel days exceeded the 70-mile BEV safe range (gray bars on Figure E-87). Several of the outings also exceeded this safe range. Thus, a BEV would not be recommended as a replacement. A PHEV could be utilized and there would be potential for significant savings with 59% of daily travel within the 40-mile battery only range and 90% of outings in this range. However, there are currently no PHEVs as suitable replacements for heavy-duty trucks.

Vehicle G41-1392G

www.edmunds.com

Make/Model/Year	Chevrolet/Uplander/2008
EPA Class Size	Minivan
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Bldg 3017
Fleet Vehicle ID	G41-1392G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	16/23/19 12/17/14
EPA GHG Emissions (Grams CO_2/Mi)*	468/450
Study Logger ID	Logger 112
Total Vehicle Days/Total Study Days	20/63

Vehicle G41-1392G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	42.1/251.9	40.1/253.8	7.4/125.1	842
Travel Time (Minutes)	108/306.0	102.5/715.0	19.1/120.0	2,153
Idle Time (Minutes)	28.4/NA	27.0/NA	5.0/NA	568

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	102	81.0%	Less than 2	97
10 to 20	10	7.9%	2 to 4	8
20 to 40	2	1.6%	4 to 8	2
Greater than 40	12	9.5%	Greater than 8	19

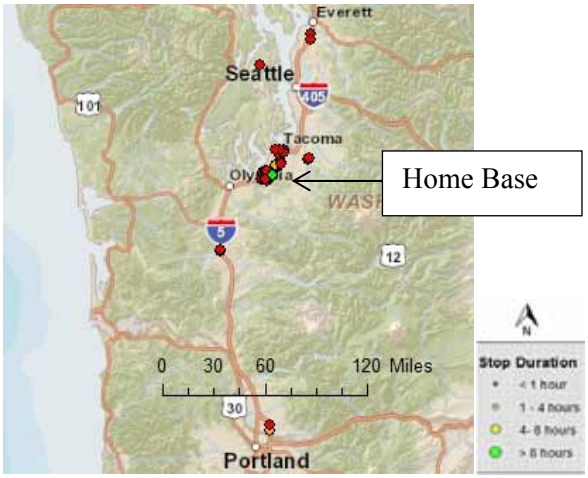


Figure E-88. Vehicle G41-1392G stops.

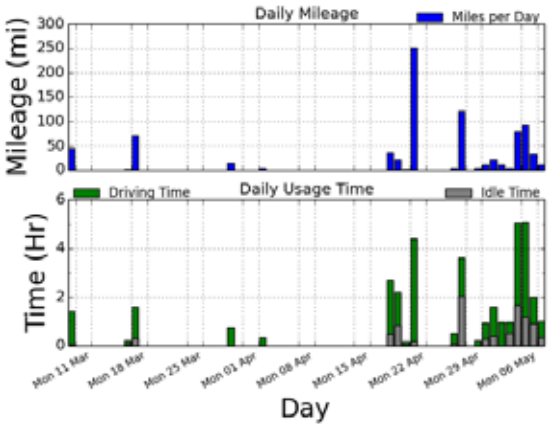


Figure E-89. Vehicle G41-1392G history.

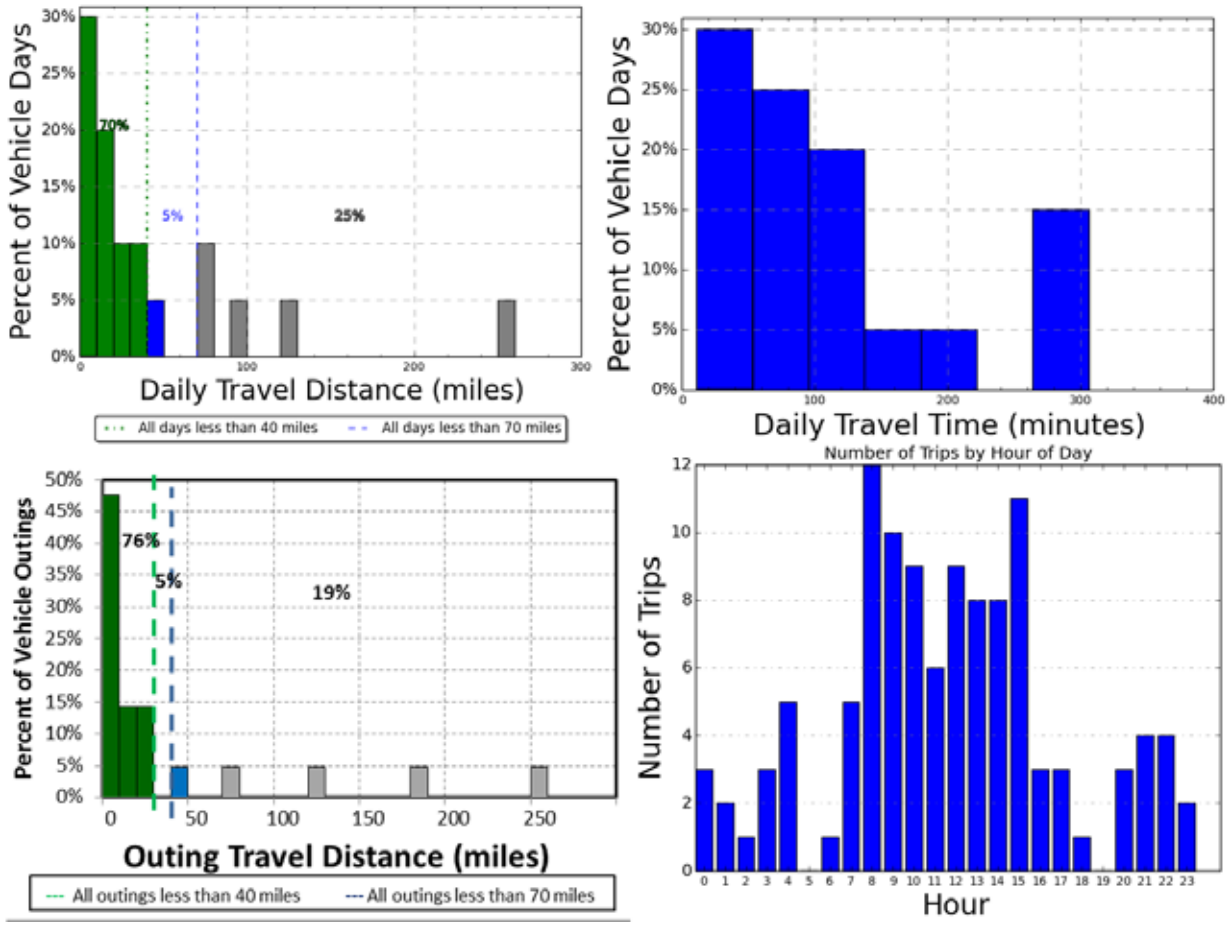


Figure E-60. Vehicle G41-1392G travel graphs.

Vehicle G41-1392G Observations

Logger 112 collected data on this vehicle for a period of 20 days of the 63-day study period. Validation occurred on 97.1% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9641 on Perry Avenue but from April 29 to May 3rd parked frequently at S 17th St and Stryker Rd near Bldg 3017. Starting May 3rd the vehicle spent several days in Tacoma. Site data reports an odometer reading of 28,122 in May 2012 with an average of 548 miles per month

This vehicle experienced light usage during the study period being unused for 68% of the period days. When driven, this vehicle had four travel days (25%) where the 70-mile BEV safe range (green and blue bars on Figure E-90) was exceeded. Conversely, 75% of the days were within this range.

These same days showed outings that also exceeded the assumed range capability of a BEV. However, 81% of the outings were within this BEV range. Aside from the longer trips, a BEV could be a replacement for this vehicle, especially if there are other vehicles that may be used for the longer trips.

Vehicle G43-3881H

www.kbb.com

Make/Model/Year	Ford/E350/2009
EPA Class Size	Passenger Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Perry Ave
Fleet Vehicle ID	G43-3881H
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	14/18/15 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	592/572
Study Logger ID	Logger 113
Total Vehicle Days/Total Study Days	34/63

Vehicle G43-3881H Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	105.0/571.2	56.7/1,566.9	10.2/202.5	3,570
Travel Time (Minutes)	257/639.0	139.0/1,897.0	24.9/257.0	8,754
Idle Time (Minutes)	82.7/NA	44.6/NA	8.0/NA	2,812

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	84	22.3%	Less than 2	307
10 to 20	3	0.8%	2 to 4	24
20 to 40	1	0.3%	4 to 8	15
Greater than 40	288	76.6%	Greater than 8	30

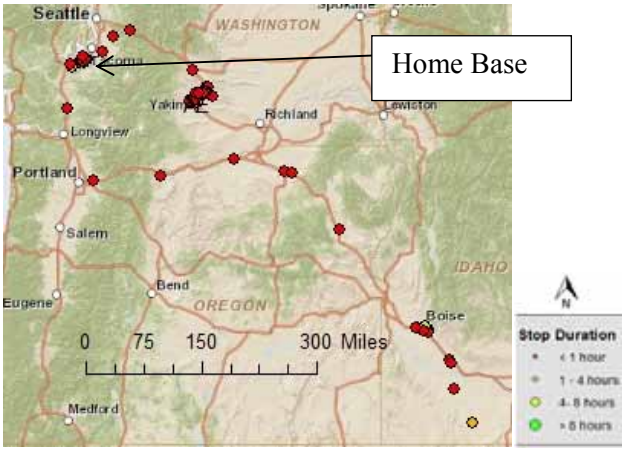


Figure E-91. Vehicle G43-3881H stops.

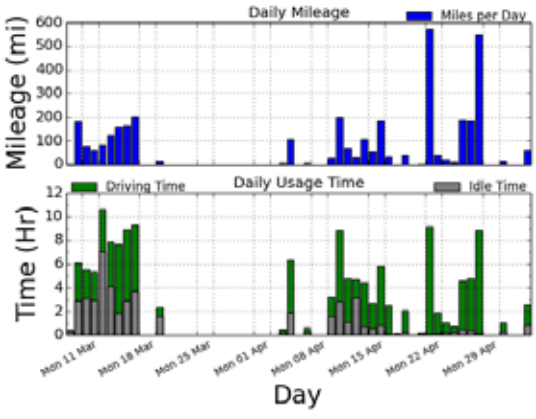


Figure E-92. Vehicle G43-3881H history.

*2009 Ford F150 pickup information. EPA data for 2009 Ford E350 not available.

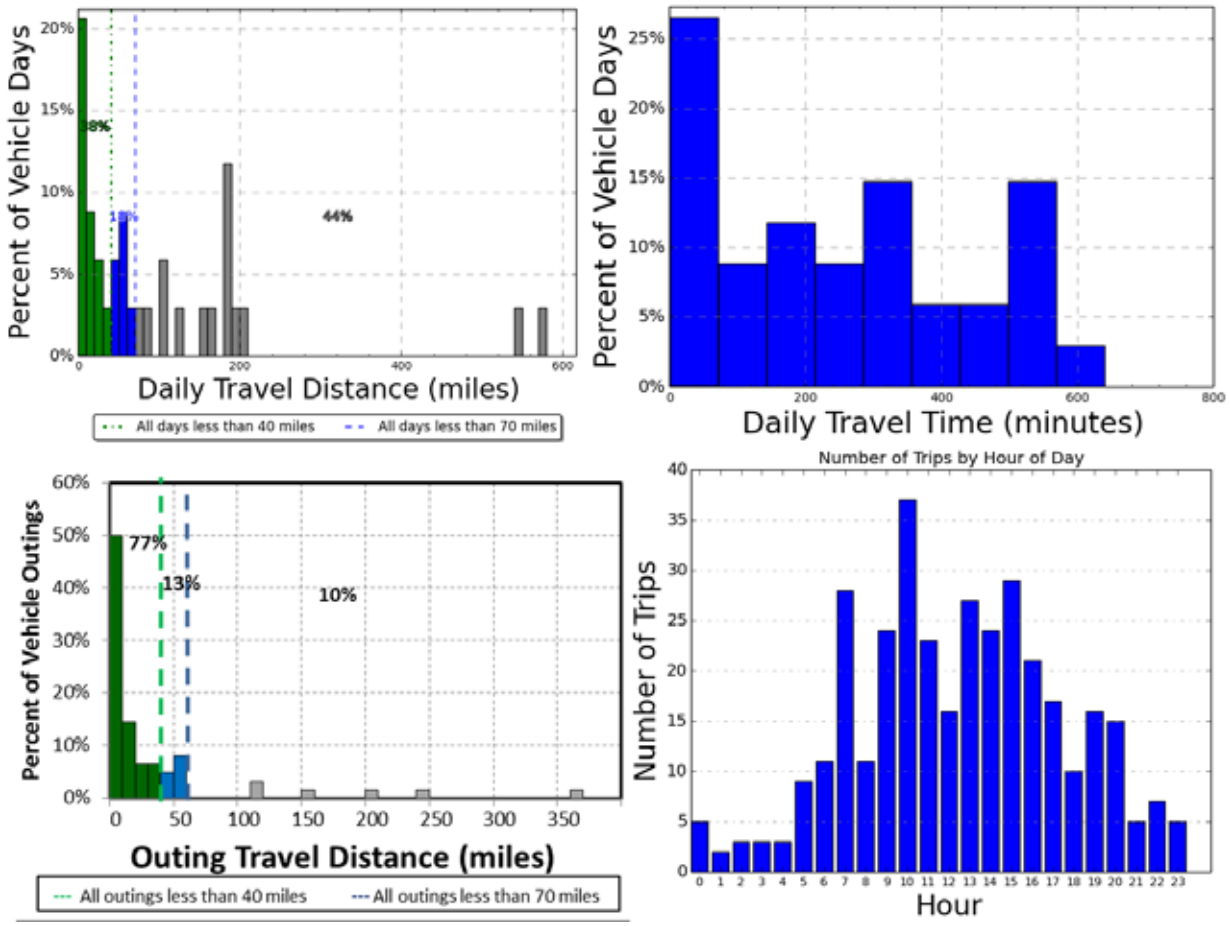


Figure E-61. Vehicle G43-3881H travel graphs.

Vehicle G43-3881H Observations

Logger 113 collected data on this vehicle for a period of 34 days of the 63-day study period. Validation occurred on 99.5% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9641 on Perry Avenue. However, this vehicle spent a considerable amount of test period time in Yakima and traveled to Boise, ID and Washington State from April 20 to 26. Site data reports an odometer reading of 22,613 in May 2012 with an average of 574 miles per month.

This vehicle was used for extended travel on many of the travel days. Forty-four percent of all vehicle travel days exceeded the 70-mile BEV safe range (gray bars on Figure E-93), while 56% of the vehicle travel days were within this range.

The longest single outing of 1,567 miles occurred on the April excursion to Idaho and Washington. (This several day outing is not shown in Figure E-93). Because several of the outings were also beyond the BEV safe range, a PHEV would be recommended as a replacement should one provide the rest of the mission requirements for this pool passenger van. A PHEV in this role would be of benefit for 38% of the travel days and 77% of the vehicle outings.

Vehicle G43-25839

www.kbb.com

Make/Model/Year	Ford /F350/2003
EPA Class Size	Pickup Truck
Mission	Transport
Contact	J. Lamantia/Motor Transport
Parking Location	Bldg R9641
Fleet Vehicle ID	G43-25839
Fuel Type	Diesel
EPA Label/MPG (City/Hwy/Combined)*	Not available
EPA GHG Emissions (Grams CO_2/Mi)*	Not available
Study Logger ID	Logger 114
Total Vehicle Days/Total Study Days	No data

Vehicle G43-25839Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	No data	No data	No data	No data
Travel Time (Minutes)	No data	No data	No data	No data
Idle Time (Minutes)	No data	No data	No data	No data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	No data	No data	Less than 2	No data
10 to 20	No data	No data	2 to 4	No data
20 to 40	No data	No data	4 to 8	No data
40 to 60	No data	No data	Greater than 8	No data

Vehicle G43-25839 Observations

Survey information was not available for this vehicle. Site data reports an odometer reading of 21,897 in May 2012 with an average of 332 miles per month. The Logger reported no data on this vehicle for the duration of the test period. No further information is available.

Vehicle G41-1376G

www.edmunds.com

Make/Model/Year	Dodge/Dakota/2008
EPA Class Size	Standard Pickup Truck
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9640/Perry Ave
Fleet Vehicle ID	G41-1376G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	14/19/15 9/12/10
EPA GHG Emissions (Grams CO_2/Mi)*	592/630
Study Logger ID	Logger 115
Total Vehicle Days/Total Study Days	30/63

Vehicle G41-1376G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.3/35.8	5.1/50.7	2.4/29.8	248
Travel Time (Minutes)	29/111.0	17.7/170.0	8.3/83.0	867
Idle Time (Minutes)	2.5/NA	1.6/NA	0.7/NA	76

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	114	100%	Less than 2	79
10 to 20	0	0%	2 to 4	5
20 to 40	0	0%	4 to 8	0
40 to 60	0	0%	Greater than 8	30

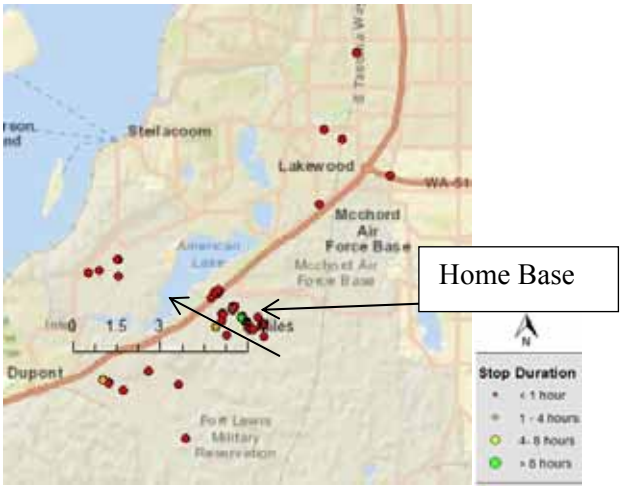


Figure E-94. Vehicle G41-1376G stops.

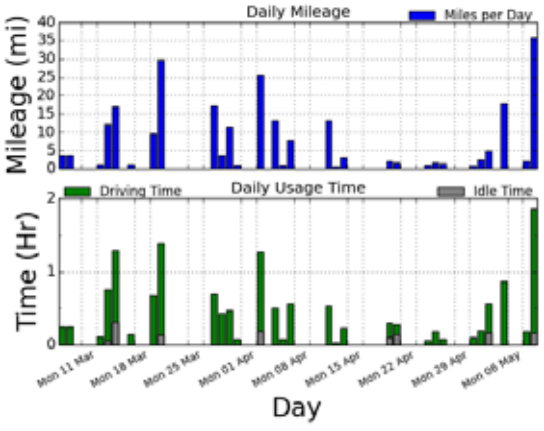


Figure E-95. Vehicle G41-1376G history.

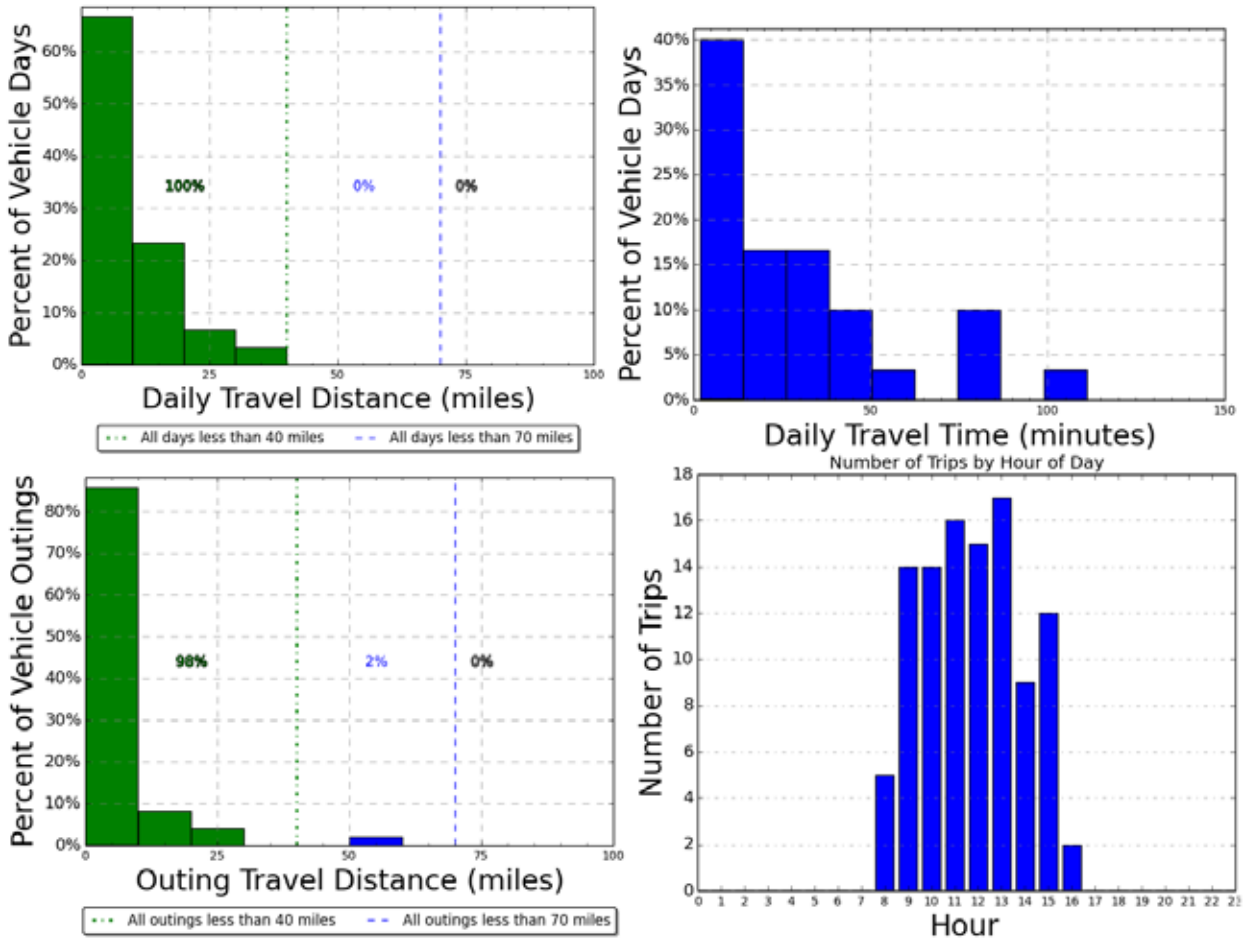


Figure E-62. Vehicle G41-1376G travel graphs.

Vehicle G41-1376G Observations

Logger 115 collected data on this vehicle for a period of 30 days of the 63-day study period. Validation occurred on 99.1% of the input data. Survey information was not available for this vehicle. Overnight parking typically occurs on Perry Ave or S I St near Bldg 9640. Site data reports an odometer reading of 10,921 in May 2012 with an average of 218 miles per month.

All of the vehicle travel days were within the 70-mile BEV safe range (green bars on Figure E-96).

The longest single outing of 50.7 miles occurred on March 26 and 27 when the vehicle returned to Perry Avenue instead of S I St. However, it remains within the assumed range capability of a BEV. These data suggest that a BEV could be a suitable replacement if the BEV meets the other mission requirements of this support vehicle. Survey information was not available to identify any such requirements.

Vehicle G41-1161G

www.edmunds.com

Make/Model/Year	Chevrolet/Uplander/2008
EPA Class Size	Minivan
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 9040A/Fitzsimmons
Fleet Vehicle ID	G41-1161G
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	16/23/19 12/17/14
EPA GHG Emissions (Grams CO_2/Mi)*	468/450
Study Logger ID	Logger 116
Total Vehicle Days/Total Study Days	29/63

Vehicle G41-1161G Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	11.2/31.6	12.5/45.1	2.0/8.1	324
Travel Time (Minutes)	43/109.0	48.1/168.0	7.7/29.0	1,251
Idle Time (Minutes)	1.6/NA	1.7/NA	0.3/NA	45

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	168	100%	Less than 2	129
10 to 20	0	0%	2 to 4	9
20 to 40	0	0%	4 to 8	0
40 to 60	0	0%	Greater than 8	30

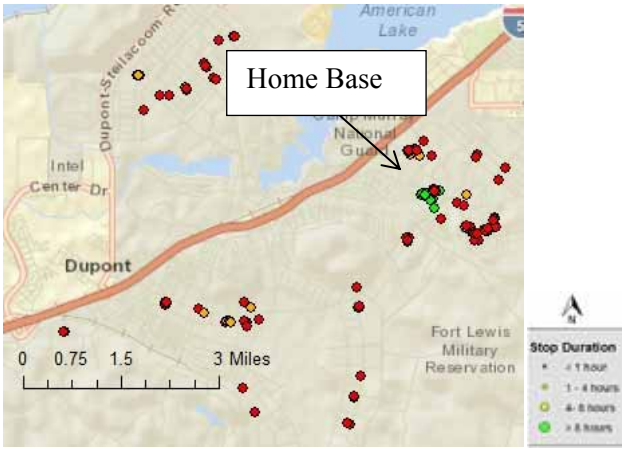


Figure E-97. Vehicle G41-1161G stops.

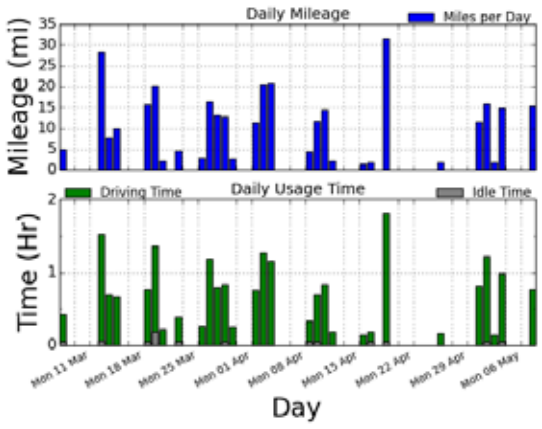


Figure E-98. Vehicle G41-1161G history.

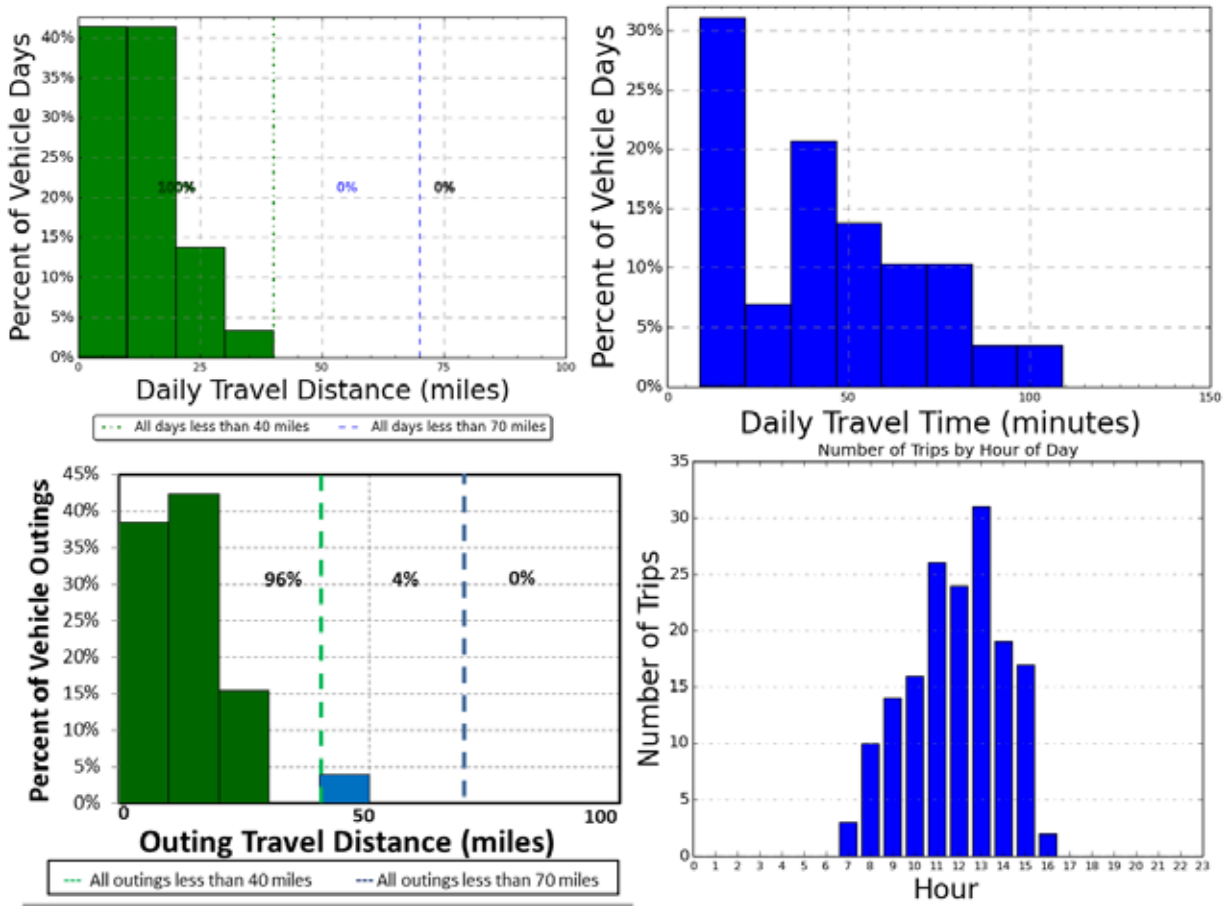


Figure E-63. Vehicle G41-1161G travel graphs.

Vehicle G41-1161G Observations

Logger 116 collected data on this vehicle for a period of 29 days of the 63-day study period. Validation occurred on 98.6% of the input data. The project survey response reports this vehicle is a pool vehicle used to provide transportation for IMD Techs to travel to user locations throughout the base, Camp Murray, and McChord. Device is also used by other branches of IMD, and available for use by other departments who are authorized drivers. It parks in the pool parking area on Fitzsimmons near Bldg 9040A: Logistics Loading Dock. The expected retention of this vehicle is unknown. It typically travels between six and ten miles daily but does travel off base to Camp Murray, McChord, Umatilla and Sacramento frequently. Such outings are typically between eleven and forty miles. Site data reports an odometer reading of 7,222 in May 2012 with an average of 141 miles per month. Between 11 and 20 people have access to this vehicle. It typically operates during regular hours of 0700 to 1600. The fuel used is typically E-85. It regularly carries recording, computers and network equipment for installation or repair. Vans are generally used by Customer Support, Visual Information, Networking, to setup at remote locations to include North Fort, Camp Murray and McChord.

All of the vehicle travel days were within the 70-mile BEV safe range (green bars on Figure E-99).

The longest single outing of 45 miles remains within the assumed range capability of a BEV. These data suggest that a BEV could be a suitable replacement if the BEV meets the other mission requirements of this pool vehicle. The survey information reports these requirements appear well within BEV capabilities.

Vehicle G43-0790K

www.edmunds.com

Make/Model/Year	Chevrolet/CG3300/2010
EPA Class Size	Passenger Van
Mission	Pool
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641
Fleet Vehicle ID	G43-0790K
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	13/17/14 10/13/11
EPA GHG Emissions (Grams CO_2/Mi)*	635/572
Study Logger ID	Logger 117
Total Vehicle Days/Total Study Days	No data

Vehicle G43-0790K Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	No data	No data	No data	No data
Travel Time (Minutes)	No data	No data	No data	No data
Idle Time (Minutes)	No data	No data	No data	No data

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	No data	No data	Less than 2	No data
10 to 20	No data	No data	2 to 4	No data
20 to 40	No data	No data	4 to 8	No data
40 to 60	No data	No data	Greater than 8	No data

*2010 Chevrolet Express 1500 information. EPA data for CG3300 not available.

Vehicle G43-0790K Observations

Survey information was not available for this vehicle. Site data reports an odometer reading of 16,287 in May 2012 with an average of 678 miles per month. Logger reported no data for the duration of the test period for unknown reasons. No further information is available.

Vehicle G82-0509A

www.edmunds.com

Make/Model/Year	Ford/F350/2004
EPA Class Size	Stake Truck
Mission	Transport
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg R9641/Perry Ave
Fleet Vehicle ID	G82-0509A
Fuel Type	Diesel
EPA Label/MPG (City/Hwy/Combined)*	Not available
EPA GHG Emissions (Grams CO_2/Mi)*	Not available
Study Logger ID	Logger 118
Total Vehicle Days/Total Study Days	Insufficient data

Vehicle G82-0509A 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

Vehicle G82-0509A Observations

Survey information was not available for this vehicle. The limited stop data suggests it typically parks near Bldg 9641 on Perry Avenue. Site data reports an odometer reading of 6,292 in May 2012 with an average of 13 miles per month.

Logger 118 collected data on the vehicle for only 2 days of the 63-day study period. This is insufficient for analysis.

Vehicle G10-6379L

www.edmunds.com

Make/Model/Year	Dodge/Avenger/2011
EPA Class Size	Midsize Car
Mission	Support
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 9040/Gardner Loop RD
Fleet Vehicle ID	G10-6379L
Fuel Type	Gas/ETH
EPA Label/MPG (City/Hwy/Combined)*	19/29/22 14/21/16
EPA GHG Emissions (Grams CO_2/Mi)*	404/393
Study Logger ID	Logger 119
Total Vehicle Days/Total Study Days	19/63

Vehicle G10-6379L Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	88.5/555.0	105.1/1,236.1	18.5/245.6	1,682
Travel Time (Minutes)	125/555.0	148.2/1,353.0	26.1/223.0	2,371
Idle Time (Minutes)	11.9/NA	14.2/NA	2.5/NA	227

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	45	43.7%	Less than 2	80
10 to 20	5	4.9%	2 to 4	1
20 to 40	6	5.8%	4 to 8	4
Greater than 40	47	45.6%	Greater than 8	18

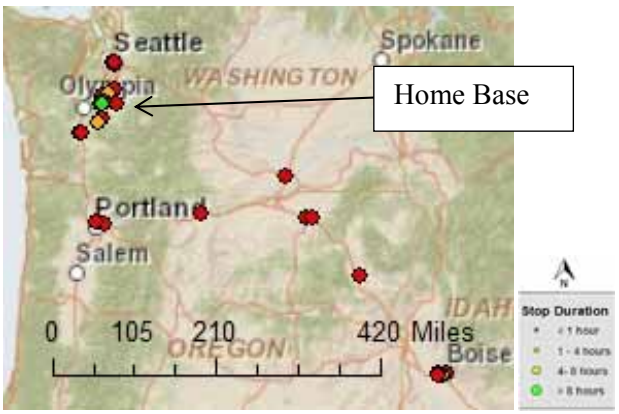


Figure E-100. Vehicle G10-6379L stops.

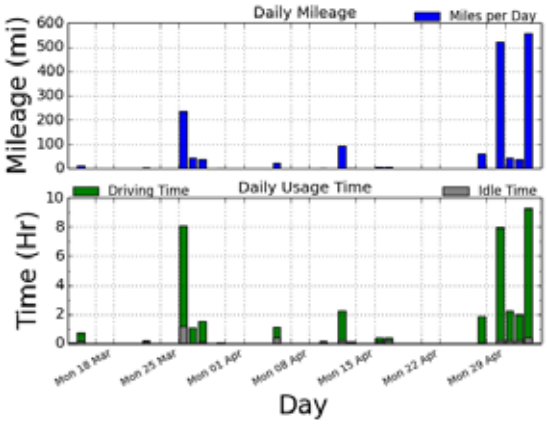


Figure E-101. Vehicle G10-6379L history.

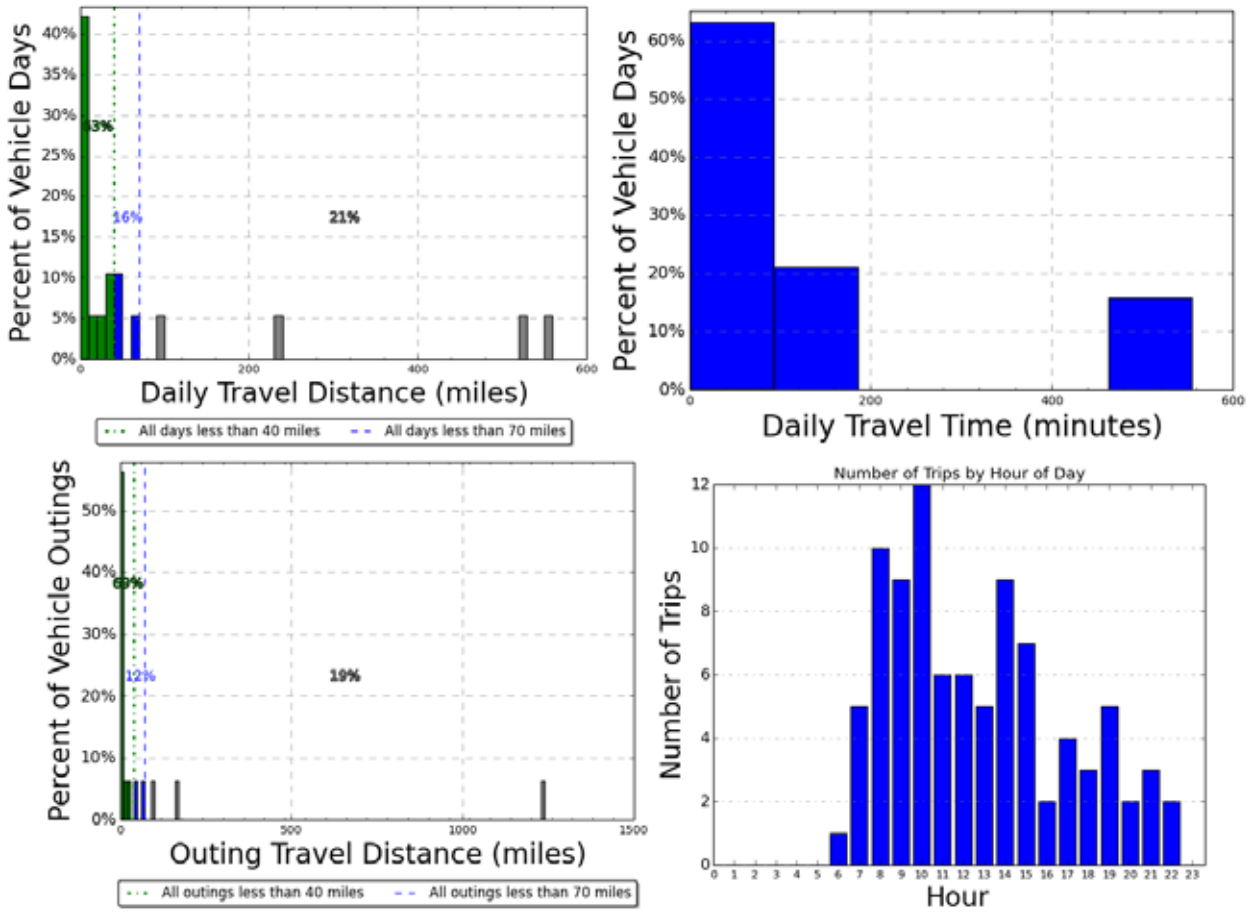


Figure E-64. Vehicle G10-6379L travel graphs.

Vehicle G10-6379L Observations

Logger 119 collected data on this vehicle for a period of 19 days of the 63-day study period. Validation occurred on 95.4% of the input data. Survey information was not available for this vehicle. Stop data suggests it typically parks near Bldg 9040 Medical Center on Fitzsimmons or Gardner Loop Rd. This vehicle took an extended excursion to Idaho and Oregon from April 28 through May 1. Site data reports an odometer reading of 9,478 in May 2012 with an average of 728 miles per month.

Seventy-nine percent of all vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-102), while 21% of the vehicle travel days exceeds this range. This vehicle was used rather infrequently but when used, was utilized for these longer excursions.

The longest single outing of 1236 miles occurred on the excursion to Idaho and Oregon from April 28 to May 1. Several other outings (19%) exceeded the 70-mile BEV safe range while 81% of outings were within this range. While a BEV cannot meet the travel requirements of this vehicle, a PHEV would provide significant benefit. 63% of daily travel and 69% of the outings are within the 40-mile battery only range of typical PHEVs. As this vehicle is a sedan, PHEVs are currently available to meet this mission.

Vehicle G42-3471A

www.edmunds.com

Make/Model/Year	Chevrolet/G2300/2005
EPA Class Size	Cargo Van
Mission	Transport
Contact	C. Sallinger/Motor Transport
Parking Location	Bldg 690
Fleet Vehicle ID	G42-3471A
Fuel Type	Gas
EPA Label/MPG (City/Hwy/Combined)*	14/19/15
EPA GHG Emissions (Grams CO_2/Mi)*	592
Study Logger ID	Logger 120
Total Vehicle Days/Total Study Days	10/63

Vehicle G42-3471A Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	20.2/44.6	14.4/83.5	3.6/38.9	202
Travel Time (Minutes)	102/241.0	73.1/241.0	18.3/65.0	1,023
Idle Time (Minutes)	50.0/NA	35.7/NA	8.9/NA	500

Total Stops			Stop Duration	
Distance From Home Base (Miles)	Stops	Percentages	Stop Duration (Hours)	Stops
Less than 10	40	90.9%	Less than 2	28
10 to 20	0	0%	2 to 4	7
20 to 40	4	9.1%	4 to 8	0
40 to 60	0	0%	Greater than 8	9

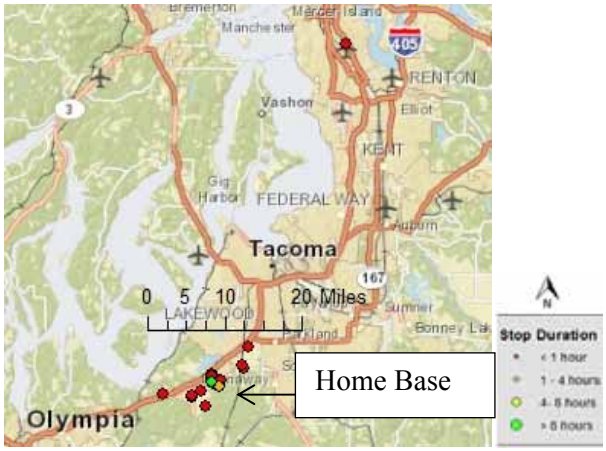


Figure E-103. Vehicle G42-3471A stops.

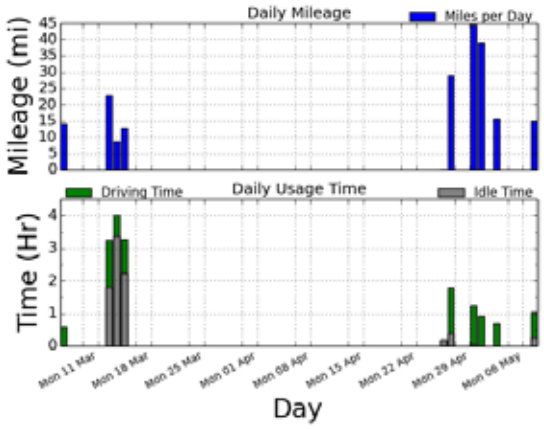


Figure E-104. Vehicle G42-3471A history.

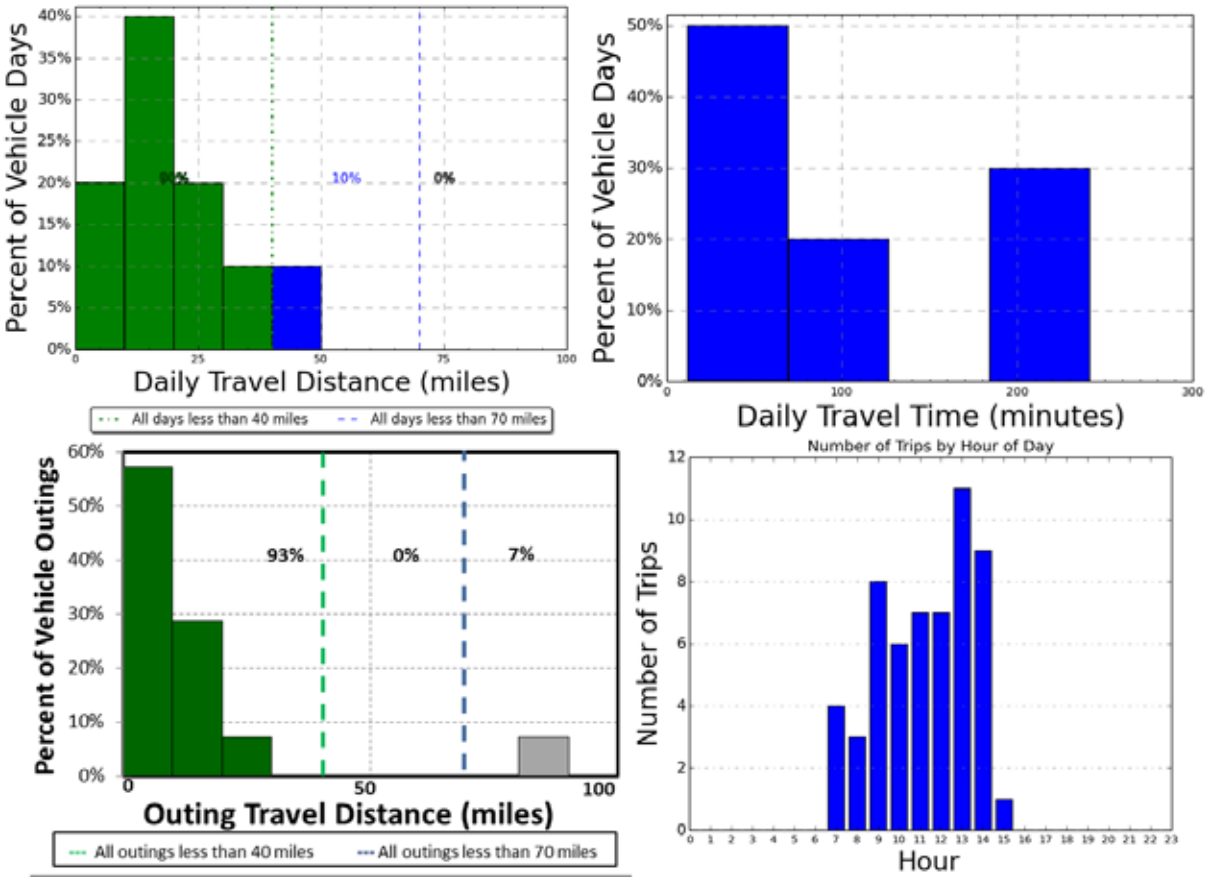


Figure E-65. Vehicle G42-3471A travel graphs.

Vehicle G42-3471A Observations

Logger 120 collected data on this vehicle for a period of 10 days of the 63-day study period. Validation occurred on 97.1% of the input data. The project survey response reports this vehicle, assigned to McChord Medical Clinic is a delivery vehicle used to transport all Class VIII items from Madigan to multiple clinic and squadron located on McChord Field. While the survey reported it parks in the office parking lot near Bldg 690 at the McChord Medical Clinic, the data report it parked most frequently near Bldg 9040, Medical Center on Fitzsimmons or Gardner Loop Road. From April 26 to May 2 it was parked overnight on Lincoln Street near Bldg 9993/9999. It typically travels between 11 and 40 miles per day. Site data reports an odometer reading of 9,478 in May 2012 with an average of 728 miles per month. Between two and five people have access to this vehicle and it carries one person per trip. It may be used at any time but typically operates from 0630 to 1730 hours daily.

This vehicle is the main support for transporting medical supplies and picking up supplies for the McChord Clinic, 62d Medical Squadron, McChord VET Clinic, McChord Dental Clinic and Multiple Air Force Squadrons located on McChord Field. This vehicle is the main logistic transportation for these multiple organization on McChord Air Field.

All vehicle travel days were within the 70-mile BEV safe range (green and blue bars on Figure E-105). All outings were within this range except for the single outing to King County Airport in Seattle on April 29/30. This single outing precludes the replacement by a BEV but a PHEV would provide significant benefit, if one can meet the other mission and carry requirements. 90% of daily travel and 93% of outings are within the battery-only range of typical PHEVs.

Appendix F

6th MP Group Vehicle Analysis

F.1 6th MP Group Vehicle Summary

This section summarizes and aggregates the data collection for the 6th MP Group. The details of each vehicle monitored are included in Appendix B.

The 6th MP Group fleet contains twenty vehicles. Table 9 provides a summary of all vehicles in the 6th MP Group fleet.

Table F-1. 6th MP Group total fleet summary.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	SUV	Mini -van	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Total
Pool	3	3	5	2	2		1	4		20
Other										0
Total	3	3	5	2	2		1	4		20

Error! Reference source not found. provides a summary of the vehicles monitored for this report.

Table F-2. 6th MP Group vehicle logger summary.

Vehicle Index						
Logger No.	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
82	G61-0546L	GMC	Terrain	2011	SUV	Pool
86	G61-0689A	Ford	Ranger	2004	Pickup Truck	Pool
103	G41-5433B	Dodge	Grand Caravan	2006	Minivan	Pool

In the following analysis, vehicles may be referenced by logger number or fleet vehicle ID.

JBLM data collection occurred from March 5, 2013 through May 7, 2013. Vehicle data sheets (presented in Appendix B) detail the collected data for each vehicle.

Of the data collected, validation occurred for 99.7% of the data, while null values exist for the balance. **Error! Reference source not found.** shows this information by mission type.

Table F-3. 6th MP Group vehicle data logger reporting summary.

Vehicle Data Logger Reporting Summary			
Mission	% Valid	% Null Values	Total
Pool	99.7	0.3	100%
Other			
All Vehicles	99.7	0.3	100%

F.2 6th MP Group Pool Vehicles Evaluation

Grouping the vehicles by mission creates an aggregated view of mission requirements to provide observations related to PEV replacement. All these vehicles assigned to the 6th MP Group are pool vehicles.

Pool vehicles are typically light-duty motor vehicles for use in passenger transportation, with not more than ten passengers. Pool 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.

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.

F.2.1 Summary for 6th MP Group Pool Vehicles

Appendix B provides the vehicle data sheets for each of the three pool vehicles monitored. This section aggregates data for all pool vehicles. Table summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0900 and 1900 hours daily. They traveled 2,052 miles, logged 108 hours, and idled for 21 hours during the 63-day study period.

Table F-4. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	22.1/224	11.3/156	4.5/83	2,050
Travel Time (Minutes)	69.6/361	35.6/443	14.2/181	6,477
Idle Time (Minutes)	13.6/NA	7.0/NA	2.8/NA	1,269

Figure F-1 shows the travel summary for pool vehicles: by vehicle, by daily mileage, and daily usage time. Figure F-2 shows the composite history for all pool vehicles. In the stacked bar charts of **Error! Reference source not found.**, the contribution of each vehicle is indicated by a different color.

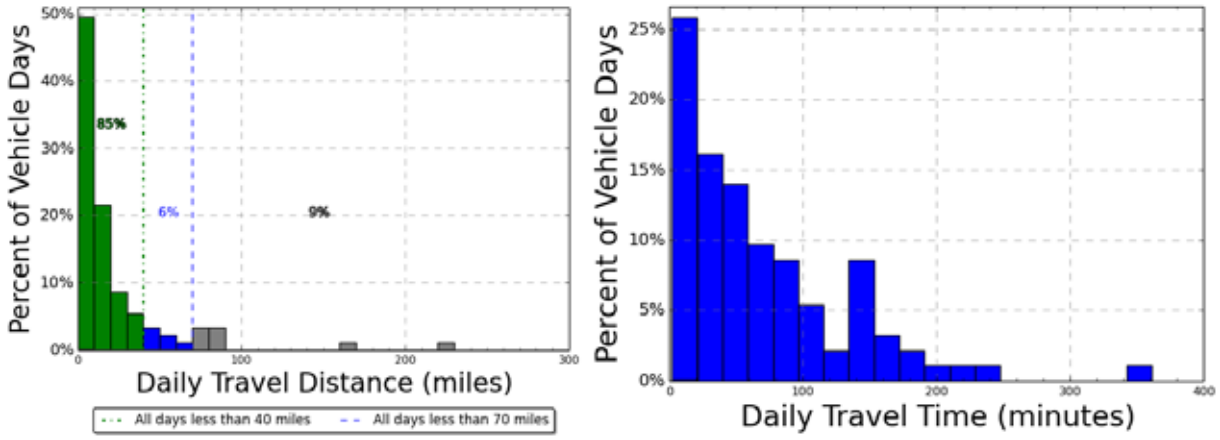


Figure F-1. Pool vehicle daily travel miles and time (all vehicles)

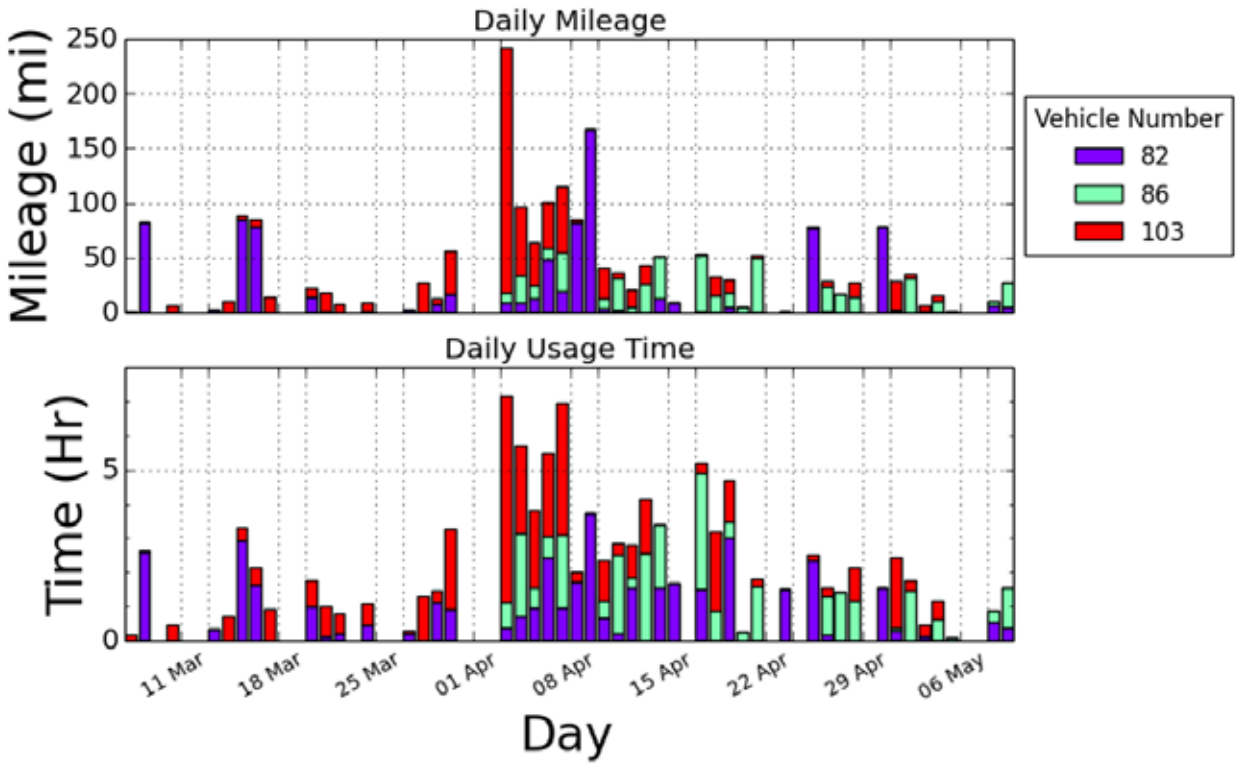


Figure F-2. Pool vehicles travel history (all vehicles)

F.2.2 Pool Vehicles Daily Summary

The average travel distance per day when driven for pool vehicles is 22.1 miles. On 91% of these vehicle days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure F-1). That is, while BEV range can vary based on several factors; most BEVs provide at least 70 miles of vehicle range on a single battery charge. Meanwhile, 9% percent of pool daily travel is greater than 70 miles. Eighty-five percent of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure F-1).

Figure F-2 shows that vehicles are used frequently. Vehicle G61-0546L traveled 52% of the days monitored, Vehicle G61-0689A traveled 38% of the days and Vehicle G41-5433B traveled 57% of the days. However, there are periods where each vehicle operated several days in a row and days that all vehicles are in use.

Figure F-3 displays the summary of use by time of day for all pool vehicles.

Figure F-4 shows the outings for all vehicles.

Appendix B provides the details of each of the pool vehicle's outings. At some point during the evaluation period, both vehicles G61-0546L and G61-0689A exceeded 70 miles in an outing.

The average travel outing when driven for pool vehicles is 11.3 miles. On 95% of these vehicle outings, the distance traveled is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 5% percent of pool outing travel is greater than 70 miles. Ninety-three percent of vehicle travel outings are less than 40 miles considered to be within the CD range of a PHEV.

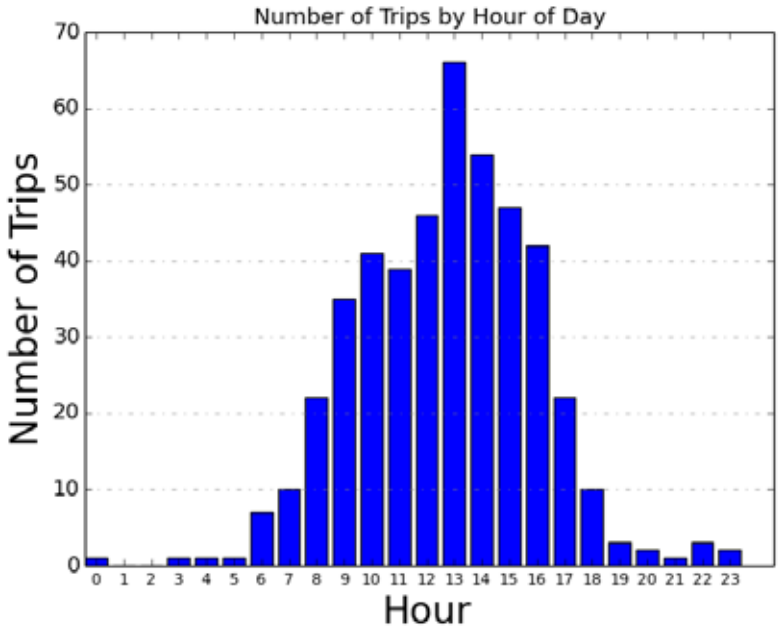


Figure F-3. Pool vehicles hourly usage

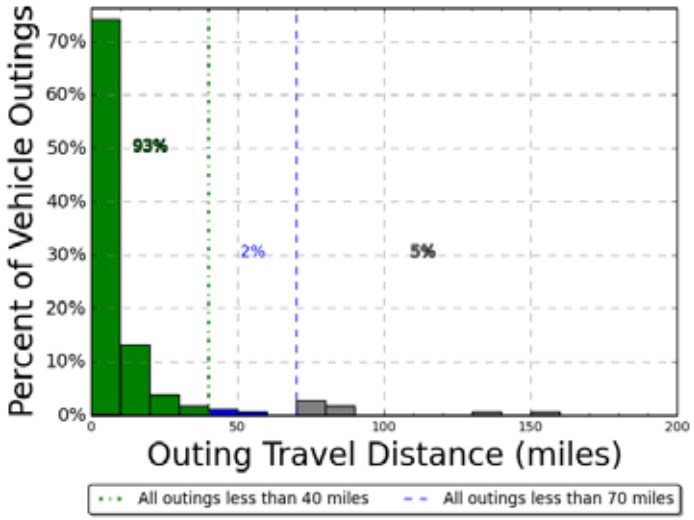


Figure F-4. Pool vehicle combined outings

F.2.3 Pool Vehicle Observations/Summary

There appear to be three choices for JBLM in implementing PEVs into the 6th MP Group pool fleet. It should be noted that the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, an all-BEV fleet does not appear to be possible due to the length of the daily outings.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances because the PHEV's gasoline engine can provide motive power when the battery has been depleted. The data reveal that on 85% of all vehicle travel days, the total daily travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. This represents a significant operating cost savings opportunity while

retaining the ability to go longer distances when needed. Furthermore, 93% of the outings are less than 40 miles and could be completed in CD mode for certain PHEVs if the battery is fully charged prior to the outing.

Fully 95% of the outings are within the typical capability of a BEV, and so the EVSE at the home base could provide recharge energy for another outing. A mixed fleet requires fleet manager attention to assign vehicles appropriately for the anticipated use on that day.

3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current pool requirements. Data show that for a significant number of days, the PHEV will operate in CD mode. As above, this represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Intermediate charging opportunities provide additional benefit, enhancing the CD mode. Data show significant charging opportunities throughout the day during stop times.

While it would appear that PEVs are suitable replacements for these pool vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Pool vehicles typically do not have such regular demands, nor were such identified on the vehicle surveys.

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 capital and operating costs.

Intertek suggests further mission evaluation be given to pool vehicles when considering the adoption of BEVs and PHEVs. The fleet of pool vehicles in this study included one SUV, one minivan, and one pickup truck. Section 4.4 provides information on PEV currently or soon to be available in the automotive market. Without specific cargo requirements, replacement PEVs currently exist for all these vehicles. Based on the travel data, Intertek suggests that replacing these three vehicles with one PHEV and two BEVs would meet current mission requirements.

Considering a full complement of 20 pool vehicles in the 6th MP Group fleet, Intertek suggests that a mixed fleet may be possible. While one of the vehicles is a passenger van and there are currently no PEVs in this class, the remaining vehicles may be replaced. These remaining vehicles were not monitored, but using the data collected for the three that were, Intertek suggests a fleet of 12 BEVs and 7 PHEVs conservatively meets vehicle travel requirements.

F.2.4 Pool Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of the 6th MP Group pool fleet with two BEVs and one PHEV. No available PHEVs at this writing provide for DC fast charging nor do the data suggest that this would be a significant benefit for PHEVs in the pool fleet. A DCFC at the home base will provide a more rapid recharge for BEVs but appears to be unnecessary if the fleet manager carefully assigns pool vehicles based upon anticipated outing lengths.

As noted previously, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can usually be accomplished with AC Level 1 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 pool vehicles, two BEVs require two AC Level 2 EVSE units for overnight charging and one PHEV require one AC Level 1 outlets for home base. 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 benefit from using public charging infrastructure. Figure F-5 displays the availability of public charging at the time of this writing for the JBLM area. The green-colored sites are AC sites indicating either AC Level 1 and Level 2 public locations and the orange-colored sites are DCFCs.

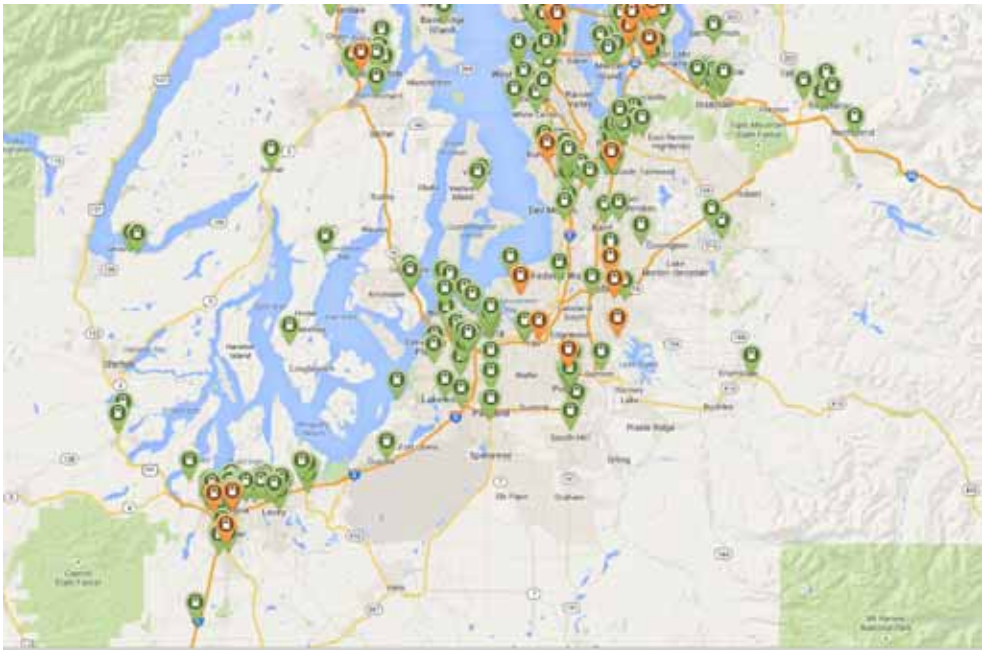


Figure F-5. Public EVSE in JBLM Region[26]

There is significant development in public charging infrastructure in the JBLM area due to the great public interest in PEV adoption and earlier emphasis on infrastructure through DOE granted programs and EVSE supplier interests. For the 6th MP Group fleet monitored, all travel was within the JBLM base but this may not be the case for all MP Group vehicles.

F.3 6th MP Group Vehicles Mileage

The vehicle annual miles factor into the calculations for replacement of vehicles as noted in Section 5 and Appendix F. The actual miles measured during the study are extrapolated to identify calculated annual miles in the study. JBLM has also provided vehicle information that identifies the average monthly miles and vehicle mileage in April 2012. Table F-5 shows these values and calculations with the study-extrapolated miles in the far right column.

Table F-5. 6th MP Group Vehicle Mileage.

Vehicle Mileage						
Logger No.	Fleet Vehicle Id	Year	Odometer	Monthly Miles	Calculated Annual Miles	Study-Extrapolated Miles
82	G61-0546L	2011	8,632	616	7,392	4,921
86	G61-0689A	2004	23,062	199	2,388	2,651
103	G41-5433B	2006	46,154	623	7,476	4,314

For the entire 6th MP Group fleet, the average monthly miles traveled as provided by JBLM are 509 miles for an average annual travel total of 6,114 miles. The JBLM-provided mileage information will be used in the fuel cost and GHG emissions calculations.

[26] http://www.plugshare.com/ [accessed June 19, 2014]

F.4 6th MP Group Vehicle Utilization

Vehicle utilization is an important factor in the evaluation of vehicles both from an inventory perspective and for charging availability. Table F-6 identifies the percent utilization of the vehicle considering all days used during the study period. Since most travel occurred during weekdays, only the 45 weekdays in the 63-day study period are considered. In the event that the vehicle was used for more than these 45 days, the percent utilization is considered 100%.

The average daily usage of each vehicle is identified in the Appendix B data sheets. It is also shown here for completeness.

Table F-6. Vehicle utilization.

Logger	Vehicle	Mission	Vehicle Class	Percent Days Used	Avg Daily Travel Time (Hrs)
82	G61-0546L	PL	SUV	73%	1.2
86	G61-0689A	PL	Pickup	53%	1.2
103	G41-5433B	PL	Minivan	80%	1.1
			Average	69%	1.2

In general, the vehicles are used on frequent days but average usage per day is quite low.

F.5 6th MP Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the 6th MP Group. The study indicates that PEVs offer alternatives to vehicles in the existing fleet 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 in this study included one SUV, one minivan, and one pickup truck. Based on the travel data, Intertek suggests that replacing these three vehicles with one PHEV and two BEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix J provides specific recommendations. While daily usage is quite low, the vehicles are used on frequent days so a reduction in the number of these vehicles is not recommended.

The 6th MP Group fleet of vehicles contains 20 vehicles, all but one of which have possible PEV replacement opportunities. Intertek suggests retaining the passenger van for now and also suggests a fleet of 12 BEVs and seven PHEVs conservatively meet the balance of vehicle travel requirements.

With the potential replacement by PEVs established, Section 5 and Appendix J 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 6th MP Group. Those observations will be addressed in Task 4 of this project.

Appendix G

DCA Support Group Vehicle Analysis

G.1 DCA Support Group Vehicle Summary

The Directorate of Community Activities (DCA) support group fleet contains 52 vehicles. Table G-1 provides a summary of the all vehicles in the DCA Support Group fleet. Table G-2 provides a summary of all vehicles monitored for this report. Table G-3 provides the details of each of the vehicles monitored.

Table G-1. DCA Group total fleet summary.

Mission	Sedan Compact/ Sub Com	Sedan Midsize	Sedan Large	SUV	Mini -van	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool					1	2	2	3	3	1	12
Support	8	2				6	6	16	2		40
Total	8	2			1	8	8	19	5	1	52

Table G-2. DCA Group vehicle logger summary.

Mission	Sedan Compact	Sedan Midsize	Sedan Large	SUV	Mini -van	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool						1			1		2
Support							1	1			2
Total						1	1	1	1		4

Table G-3. DCA Group monitored vehicle details.

Vehicle Index						
Log	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
83	G41-74299	Ford	Ranger	2004	Pickup Truck	Support
94	G71-0684A	Chevrolet	C6500 Stake	2005	Stake Truck	Pool
96	G43-1195H	Chevrolet	15 Pas Van	2011	Passenger Van	Support
99	G42-0289G	Chevrolet	G1300	2008	Cargo Van	Pool

These vehicles are referenced by Logger number or Fleet Vehicle ID in the following analyses.

JBLM DCA Group data collection took place from March 5, 2013 through May 7, 2013. Vehicle data sheets (presented in Appendix C) detail the collected data for each vehicle.

Of the data collected, validation occurred for 99.5% of the data, while null values exist for the balance. Table G-4 shows this information by mission type.

Table G-4. Vehicle data logger reporting summary.

Vehicle Data Logger Reporting Summary			
Mission	% Valid	% Null Values	Total
Pool	100%	0%	100%
Support	98.6%	1.4%	100%
All Vehicles	99.5%	0.5%	100%

Grouping the vehicles by mission creates an aggregated view of mission requirements to provide observations related to PEV replacement. Analysis by mission type follows.

G.2 DCA Pool Vehicles Analysis

Pool vehicles are typically light-duty motor vehicles for use in passenger transportation, with not more than 10 passengers. Pool missions can vary by agency, location, and jurisdiction and for DCA Support Group, the pool vehicles are a cargo van and a heavy-duty truck. Although there are currently no PEVs available to replace the heavy-duty truck, it is assumed that the usage of these pool vehicles can be of value in considering the remaining pool vehicles in the larger DCA fleet. PEVs are currently available to replace the balance of vehicles.

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.

G.2.1 Summary for DCA Pool Vehicles

Appendix C provides the vehicle data sheets for each of the pool vehicles monitored. This section aggregates data for both pool vehicles. Table G-5 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0800 and 1500 hours daily. The vehicles traveled 409 miles, logged 32 hours, and idled for 7 hours during the 63-day study period.

Table G-5. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	8.5/53.5	6.1/53.5	1.8/20.2	408.7
Travel Time (Minutes)	40.1/123.0	28.7/133.0	8.3/55.0	1,926.0
Idle Time (Minutes)	9.1/NA	6.5/NA	1.9/NA	435.0

Figure G-1 shows the travel summary for pool vehicles: by vehicle, by daily mileage, and daily usage time. Figure G-2 shows the composite history for all pool vehicles. In the stacked bar charts of Figure G-2, the contribution of each vehicle is indicated by a different color.

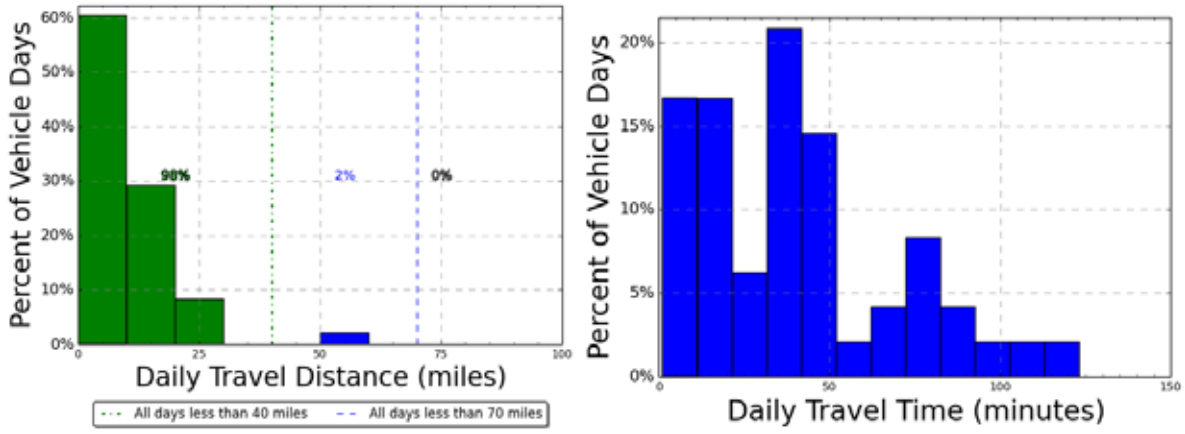


Figure G-1. Pool vehicle daily travel miles and time (all vehicles).

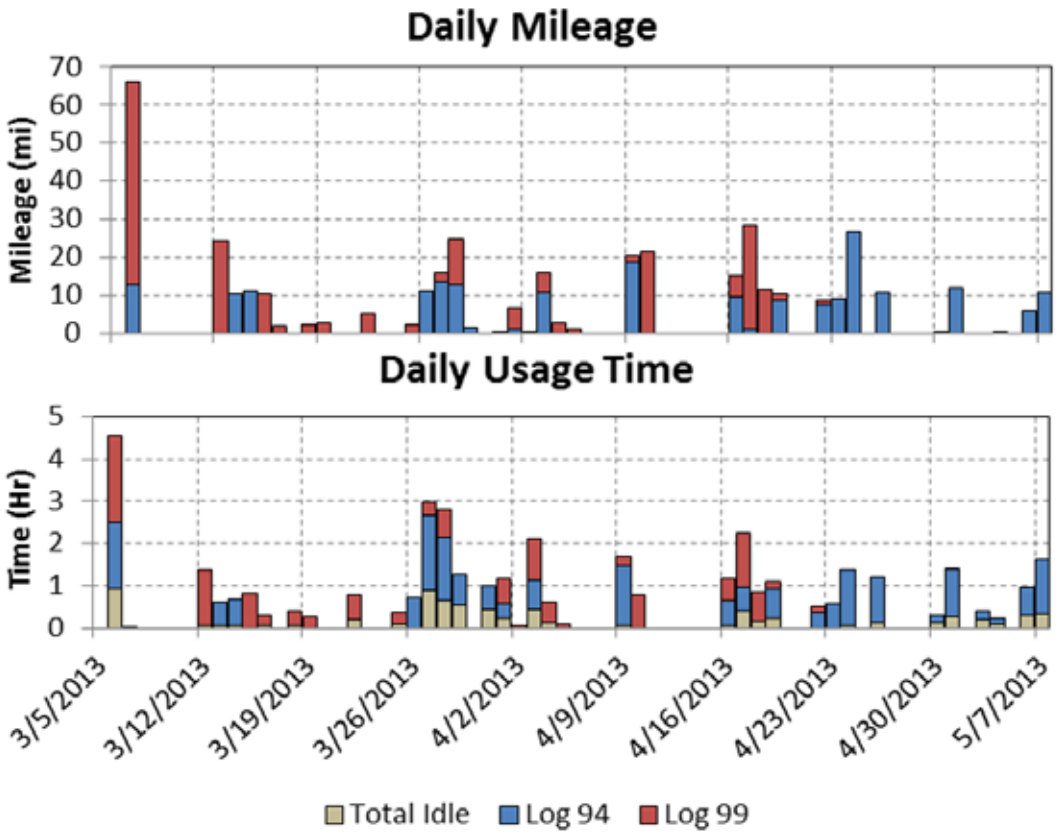


Figure G-2. Pool vehicles travel history (all vehicles).

G.2.2 Pool Vehicles Daily Summary

The average travel distance per day when driven for pool vehicles is 8.5 miles. On all vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure G-1). That is, while BEV range can vary based on several factors; most BEVs provide at least 70 miles of vehicle range on a single battery charge. Meanwhile, 98% of vehicle travel days are less than 40 miles considered to be within the battery only range of a PHEV (green bars of Figure G-1).

Figure G-2 shows that vehicles are used rather infrequently. Vehicle G71-0684A traveled 40% of the days monitored and G42-0289G traveled 36% of the days. However, there are periods where each vehicle operated several days in a row and days that both vehicles are in use.

Figure G-3 displays the summary of use by time of day for all pool vehicles. Figure G-4 shows the outings for all vehicles.

Appendix C provides the details of each of the pool vehicle's outings. Neither vehicle exceeded 70 miles in a single outing.

The average travel outing when driven for pool vehicles is 6.1 miles. All outings were less than the 70 miles considered to be within the BEV safe range. Furthermore, 99% percent of pool outings are less than 40 miles considered to be within the CD range of a PHEV.

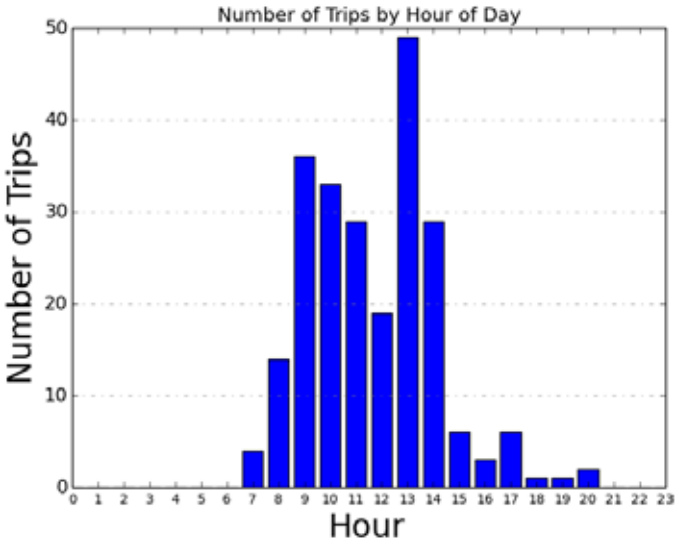


Figure G-3. Pool vehicles hourly usage.

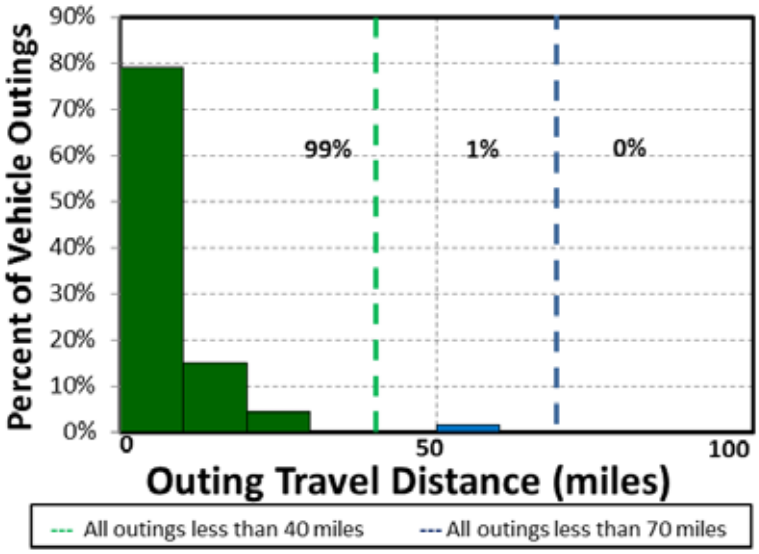


Figure G-4. Pool vehicle combined outings.

G.2.3 Pool Vehicle Observations/Summary

There appear to be three choices for JBLM in implementing PEVs into the DCA Support Group pool fleet. There are no current PEV replacements for heavy-duty trucks. However, the full DCA fleet does contain one minivan, two cargo vans, and three pickup trucks for which suitable PEVs may be found. The observations here relate to these six vehicles assuming the travel of the monitored vehicles is typical.

As noted before, the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, all daily travel and outings were within the capabilities of a BEV and consideration of cargo carrying capabilities may be the only deterrent.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances because the PHEV's gasoline engine can provide motive power when the battery has been depleted. The data reveal that on 98% of all vehicle travel

days, the total daily travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. This represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Furthermore, 99% of the outings are less than 40 miles and could be completed in CD mode with certain PHEVs if the battery is fully charged prior to the outing.

A mixed fleet requires fleet manager attention to assign vehicles appropriately for the anticipated use on that day.

3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current pool requirements. Data show that for up to 98% of all travel days, the PHEV will operate in a CD mode. As above, this represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Intermediate charging opportunities provide additional benefit, enhancing the CD mode. Data show significant charging opportunities throughout the day during stop times.

While it would appear that PEVs are suitable replacements for these six pool vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Fleet managers typically desire greater conservatism in maintaining vehicle capabilities. Thus, it is assumed that one monitored vehicle may be replaced by a suitable style BEV and the other by a PHEV. A less conservative approach for the full pool fleet would be to use 75% BEV and 25% PHEV. See Section 5 for these suggestions.

The total DCA Support pool fleet of 12 vehicles then could consist of 4BEVs, two PHEVs, two conventional passenger vans, three conventional heavy-duty trucks, and one conventional bus.

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.

G.2.4 Pool Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of the full DCA Support Group pool fleet with four BEVs and two PHEVs while retaining the conventional heavy-duty truck, passenger vans, and bus for now.

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

Intertek's experience suggests that each vehicle should 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. For the entire fleet of pool vehicles, four BEVs require four AC Level 2 EVSE units for overnight charging and two PHEVs require two AC Level 1 outlets for home base. 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 benefit from using public charging infrastructure. Figure 18 displays the availability of public charging at the time of this writing for the JBLM area. Since all travel was within the JBLM base there may be little benefit in using public charging for the DCA Support Group pool vehicles.

G.3 DCA Support Group 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, vehicles G41-74299 (logger 83) and G43-1195H (logger 96) were the support vehicles monitored.

G.3.1 Summary for DCA Support Group Support Vehicles

Appendix C provides the vehicle data sheets for each of the two support vehicles monitored. This section aggregates the data for both support vehicles.

Table G-6 summarizes support vehicle travel during the study period. Vehicle use occurred primarily between 0800 and 1600 hours daily. Support vehicles traveled 4,677 miles, logged 136 hours, and idled for 14 hours during the study period.

Table G-6. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	61.5/354.1	30.6/354.1	12.3/129.4	4,677
Travel Time (Minutes)	108.0/544.0	53.6/544.0	21.7/222.0	8,208
Idle Time (Minutes)	11.5/NA	2.3/NA	2.3/NA	872

Figure G-5 shows the travel summary for support vehicles by vehicle, by daily mileage and daily usage time. Figure G-6 shows the composite history for both support vehicles.

The history graphs identify when several support vehicles may be in use at the same time as well as the total miles driven on a daily basis.

G.3.2 DCA Support Group Support Vehicle Daily Summary

The average travel distance per day when driven for support vehicles is 61.5 miles. On 76% of these vehicle days, the daily travel is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 24% percent of support vehicle daily travel is greater than 70 miles. Furthermore, 75% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV.

Figure G-6 shows that the vehicles are not used every day. Vehicle G41-74299 is unused 30% of the days and vehicle G43-1195H is unused 49% of the days monitored. However, there are periods where both vehicles operated several days in a row and days that both vehicles are in use at the same time. Figure G-7 displays the summary of use by time of day for all support vehicles combined. Figure G-8 shows the outings for all support vehicles combined.

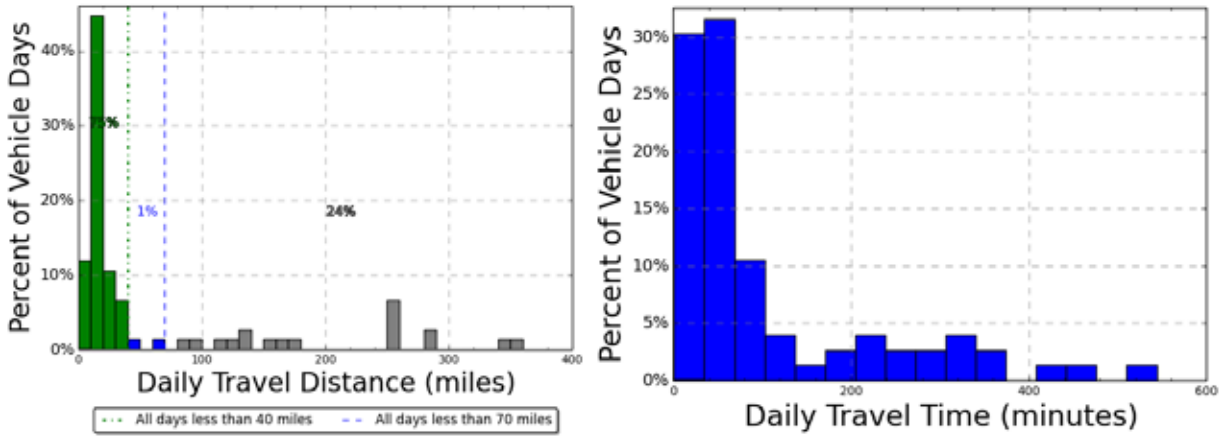


Figure G-5. Support vehicle daily travel miles and usage time (all vehicles).

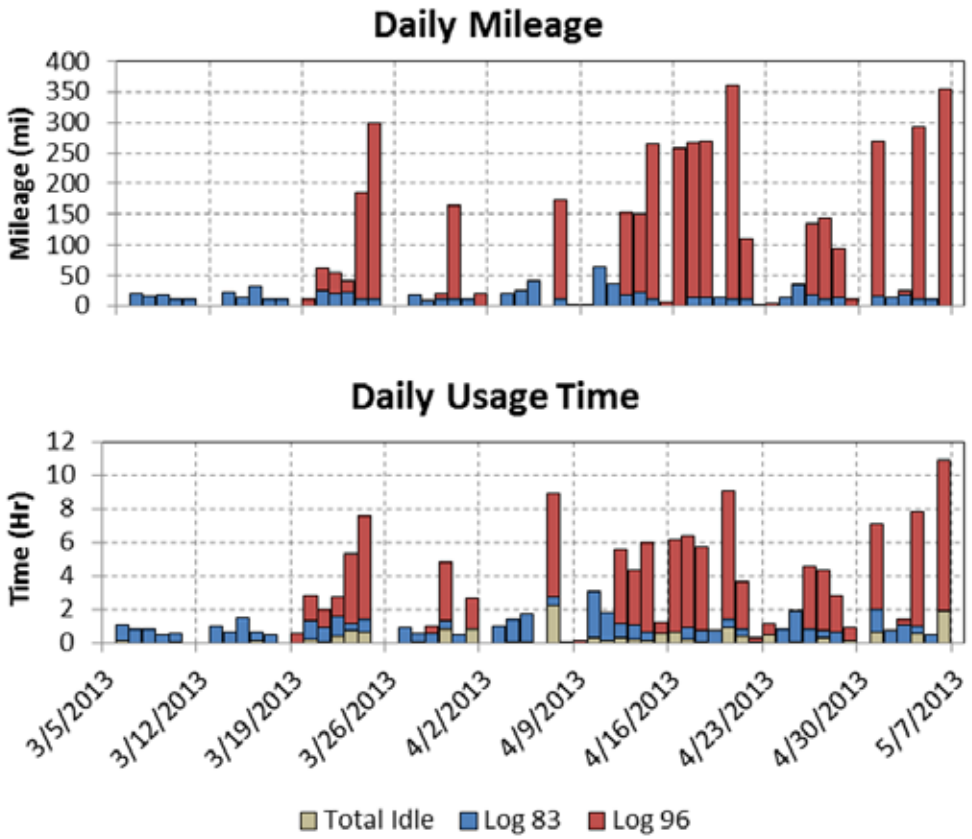


Figure G-6. Support vehicle history (all vehicles).

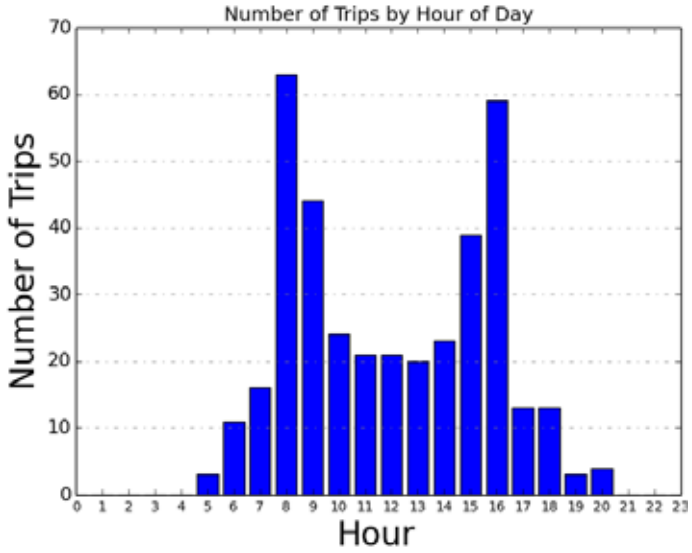


Figure G-7. Support vehicles hourly usage.

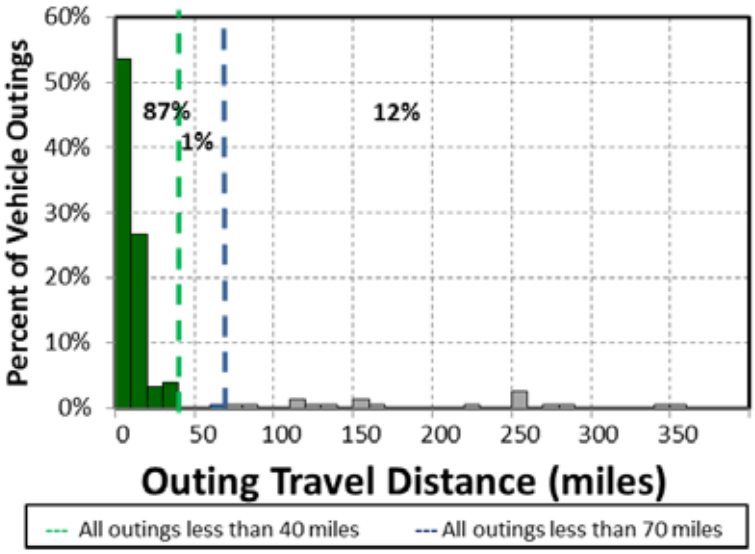


Figure G-8. Support vehicle combined outings.

Appendix C provides the details of each of the support vehicle's daily travel. While vehicle G41-74299 remained below the 70-mile range on all vehicle days and outings, vehicle G43-1195L exceeded this range on 56% of the travel days.

The average travel outing when driven for support vehicles is 30.6 miles. On 88% of these vehicle outings, the distance traveled is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 12% of support outing travel is greater than 70 miles. All of this travel was by vehicle G43-1195L which exceeded this range on 13% of its outings. Some of these outings are significantly longer than this range however, with the longest outing 354 miles. Furthermore, 87% of vehicle travel outings are less than 40 miles considered to be within the CD range of a PHEV.

G.3.3 DCA Support Group Support Vehicle Observations/Summary

There appear to be three choices for JBLM in implementing PEVs into the DCA Support Group support mission fleet. There are no current PEV replacements for heavy-duty trucks or passenger vans. However, the DCA fleet does contain 10 sedans, six cargo vans, and 16 pickups for which suitable PEVs may be found. While a closer evaluation of the use of the vans may also reveal suitable PEV replacements, the observations here relate to these 32 vehicles assuming the travel of the monitored vehicles are typical.

Pickup trucks are a popular choice for support vehicle because they are versatile to support various types of support needed, i.e. special cargo or equipment transport. In some cases, as seen here, SUVs or mini-vans can perform the same mission. Section 4.4 provides information on PEV trucks and vans currently or soon to be available.

As noted before, the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, an all-BEV fleet is not possible for support vehicles due to the long distances experienced by at least one of these vehicles.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances because the PEV's gasoline engine can provide motive power when the battery has been depleted. The data reveal that on 75% of all vehicle travel days the total travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. Thus, the PHEV would be of benefit for this travel.

3. It is noted that 76% of all travel days and 88% of all outings are less than 70 miles. This would support travel by BEVs. For the days where the 70 miles are exceeded, intermediate charging locations typically provide the recharge necessary to increase the all-electric drive. There are significant quantities of public charging stations locally but they cannot be assured to be available when needed. Thus, consideration should be given to home base charging only. Additional charging during the day at the home base between outings would add daily range. Incorporation of BEVs into the fleet will require management attention to ensure appropriate deployment based upon the need and expected distance to be driven.
4. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current support vehicle requirements.

While it would appear that PEVs may be suitable replacements for these 32 support vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Fleet managers typically desire greater conservatism in maintaining vehicle capabilities. Thus, it is assumed that the 10 sedans, six cargo vans, and 16 pickups may be replaced by 20 suitable style BEVs and 12 suitable style PHEVs. See Section 5 for these suggestions.

The total DCA Support pool fleet of 40 vehicles then could consist of 20 BEVs, 12 PHEVs, 6 conventional passenger vans, and 2 conventional heavy-duty trucks. The vehicle summary shows sufficient time for charging at the base location during the course of the day. These stations also provide charging opportunities for the visiting public, whose fees may assist in offsetting operating costs.

Intertek suggests further mission evaluation be given to the balance of the support vehicles when considering the adoption of BEVs and PHEVs. Additional BEVs may be possible with further management or fleet software attention; however, fleet managers typically desire vehicles that support longer trips.

G.3.4 DCA Support Group Support Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of most of the support vehicle fleet with 20 BEVs and 12 PHEVs. No available PHEVs at the time of this writing provide for DC fast charging nor do the data suggest that this would be a significant benefit for PHEVs in the support vehicle fleet. Additional charging of BEVs during the day is not a requirement nor would DCFCs be required. The majority of the support vehicle activity occurs during daytime hours, which leaves significant time during the nighttime hours for recharging.

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 the greater benefits from AC Level 2 EVSE. Most vehicles returned to their home base daily with the exception of long trips lasting several days.

For the entire fleet of support vehicles, 20 BEVs require 20 AC Level 2 EVSE for overnight charging and 12 PHEVs require 12 AC Level 1 outlets for home base charging. Intertek recommends a minimum of two EVSE units at each location to maximize charge capability without a significant increase in installation costs.

Greater management attention provides the possibility of reducing the overall number of AC Level 2 EVSE. 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. JBLM will gain experience in this management as the PEV fleet grows.

G.4 DCA Support Group Vehicles Mileage

The vehicle annual miles factor into the calculations for replacement of vehicles as noted in Section 5 and Appendix G. The actual miles measured during the study are extrapolated to identify calculated annual miles in the study. JBLM has also provided vehicle information that identifies the average monthly miles and vehicle mileage in April 2012. Table G-7 shows these values and calculations with the study-extrapolated miles in the far right column.

Table G-7. DCA Support Group vehicle mileage.

Vehicle Mileage						
Logger No.	Fleet Vehicle Id	Year	Odometer	Monthly Miles	Calculated Annual Miles	Study-Extrapolated Miles
83	G41-74299	2004	20654	250	3,000	4,576
94	G71-0684A	2005	10921	120	1,440	1,193
96	G43-1195H	2011	Not avail.	Not Avail.	Not avail.	22,522
99	G42-0289G	2008	7347	153	1,836	1,175

For the entire DCA Support Group fleet, the average monthly miles traveled are 274 miles for an average annual travel of 3,291 miles. The JBLM-provided mileage information will be used in the fuel cost and GHG emissions calculations, if available.

G.5 DCA Support Group Vehicle Utilization

Vehicle utilization is an important factor in the evaluation of vehicles both from an inventory perspective and for charging availability. Table G-8 identifies the percent utilization of the vehicle considering all days used during the study period. Since most travel occurred during weekdays, only the 45 weekdays in the 63-day study period are considered. In the event that the vehicle was used for more than these 45 days, the percent utilization is considered 100%.

The average daily usage of each vehicle is identified in the Appendix C data sheets. It is also shown here for completeness.

Table G-8. Vehicle utilization.

Logger	Vehicle	Mission	Vehicle Class	Percent Days Used	Avg Daily Travel Time (Hrs)
83	G41-74299	SU	Pickup	98%	0.8
94	G71-0684A	PL	Truck HD	56%	0.8
96	G43-1195H	SU	Van - Pass	71%	3.1
99	G42-0289G	PL	Van - Cargo	51%	0.6
			Average	69%	1.3

In general, the vehicles are used on frequent days but average usage per day is quite low. For example, the pickup truck is used almost every day but for less than an hour each day.

G.6 DCA Support Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the DCA Support Group. The study indicates that PEVs offer alternatives to vehicles in the existing fleet 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 one cargo van, one passenger van, one pickup truck, and one heavy-duty truck. Based on the travel data, Intertek suggests that retaining the conventional

passenger van and replacing three vehicles with two PHEVs and one BEV would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix G provides specific recommendations.

The DCA Support Group full fleet of vehicles contains 52 vehicles. Intertek suggests retaining the conventional bus, eight passenger vans, and five heavy-duty trucks for now and also suggests a fleet of 24 BEVs and 14 PHEVs conservatively meet the balance of vehicle travel requirements.

With the potential replacement by PEVs established, Section 5 and Appendix K 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 DCA Support Group. Those observations will be addressed in Task 4 of this project.

Appendix H

Public Works Group Vehicle Analysis

H.1 Public Works Group Vehicle Summary

The Public Works Group fleet contains 250 vehicles. Table H-1 identifies these vehicles by vehicle type according to site records. The mission assignments identified in Table H-1 are based upon survey responses received and extrapolation to the balance of the fleet. Survey responses received included 32 of these vehicles, or 12.8% of the total. Table H-2 provides a summary of mission types for these survey responses.

Table H-1. Public Works Group total fleet characterization.

Mission	Sedan Compact/ Sub Com	Sedan Midsize/ Large	Mini-van	SUV	Specialty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	5	2	2	7		8	35	48			107
Support			1	4		14	17	65	16		117
Transport								8	17		25
Specialty					1						1
Total	5	2	3	11	1	22	52	121	33		250

Table H-2. Public Works Group survey responses.

Mission	Sedan Compact/ Sub Com	Sedan Midsize/ Large	Mini-van	SUV	Specialty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	3	1	1	3		2		6			18
Support			1	1		3	2	8			13
Transport								1			1
Total	3	1	2	4	0	5	2	15	0	0	32

Table H-3 provides a summary of the vehicles monitored for this report. Survey responses were not received for all vehicles so missions are assumed based upon total survey response percentages.

Table H-3. Public Works Group vehicle logger summary.

Mission	Sedan Compact/ Sub com	Sedan Midsize/ Large	Mini-van	SUV	Specialty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool			2				2	4			8
Support							1	5			6
Total			2				3	9			14

Table H-4 provides the full characterization of the fleet of vehicles monitored in this survey.

Table H-4. Public Works vehicle characterization index.

Vehicle Index						
Logger No.	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
1	G42-0658K	Ford	F150	2010	Pickup Truck	Pool
2	G42-1054F	Ford	F150	2008	Pickup Truck	Pool
3	G71-0133L	Ford	E450	2011	Passenger van	Pool
4	G43-0944G	Chevrolet	G3500	2008	Passenger van	Pool
5	G43-0822G	Ford	F350	2008	Pickup Truck	Support
84	G41-1100K	Dodge	Gr Caravan	2010	Minivan	Pool
87	G42-0619K	Chevrolet	C1500	2010	Pickup Truck	Pool
88	G41-1180K	Dodge	Gr Caravan	2010	Minivan	Pool
90	G43-1892H	Chevrolet	C2500HD	2009	Pickup Truck	Support
91	G43-1961H	Chevrolet	C3500	2009	Pickup Truck	Support
92	G42-0505A	Chevrolet	G1300	2004	Passenger van	Support
95	G43-1155L	Ford	F350	2011	Pickup Truck	Support
98	G41-1605L	Dodge	Dakota	2011	Pickup Truck	Support
100	G42-0610K	Chevrolet	C1500	2010	Pickup Truck	Pool

Reference to these vehicles may be by logger number or fleet vehicle ID.

JBLM data collection took place from March 5, 2013 through May 7, 2013. Vehicle data sheets (presented in Appendix D) detail the collected data for each vehicle.

Of the data collected, validation occurred for 98.1% of the data, while null values exist for the balance. Table H-5 shows this information by mission type.

Table H-5. Vehicle data logger reporting summary.

Vehicle Data Logger Reporting Summary			
Mission	% Collected	% Null Values	Total
Pool	98.8%	1.2%	100%
Support	97.1%	2.9%	100%
All Vehicles	98.1%	1.9%	100%

H.2 Public Works Pool Vehicles Analysis

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

H.2.1 Summary for Public Works Pool Vehicles

Appendix D provides the vehicle data sheets for each of the pool vehicles monitored. This section aggregates data for all pool vehicles. Table H-6 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0700 and 1500 hours daily. They traveled 3,620 miles, logged 259 hours, and idled for 76 hours during the 63-day study period.

Table H-6. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	13.8/270.7	5.3/168.6	2.2/132.0	3,621.3
Travel Time (Minutes)	59.2/297.0	23.0/247.0	9.3/139.0	15,563
Idle Time (Minutes)	17.5/NA	6.9/NA	2.7/NA	4,595

Figure H-1 shows the travel summary for pool vehicles: by vehicle, by daily mileage, and daily usage time. Figure H-2 shows the composite history for all pool vehicles. In the stacked bar charts of Figure H-2, the contribution of each vehicle is indicated by a different color.

H.2.2 Pool Vehicles Daily Summary

The average travel distance per day when driven for pool vehicles is 13.8 miles. On 99% of the vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure H-1). That is, while BEV range can vary based on several factors; most BEVs provide at least 70 miles of vehicle range on a single battery charge. Meanwhile, 95% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure H-1).

The pool vehicles were used on average 52% of the study days. However, there are periods where each vehicle operated several days in a row and days that several vehicles are in use. Figure H-3 displays the summary of use by time of day for all pool vehicles. Figure H-4 shows the outings for all vehicles.

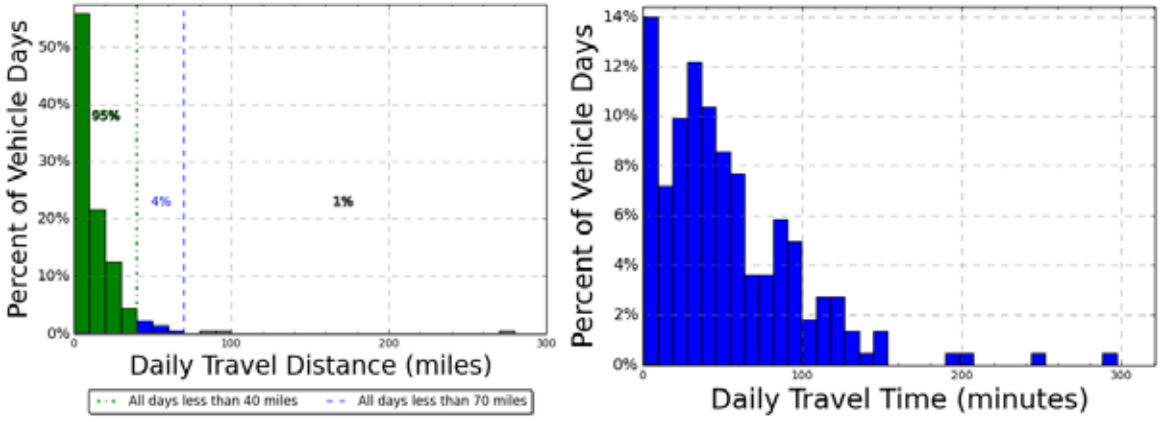


Figure H-1. Pool vehicle daily travel miles and time (all vehicles).

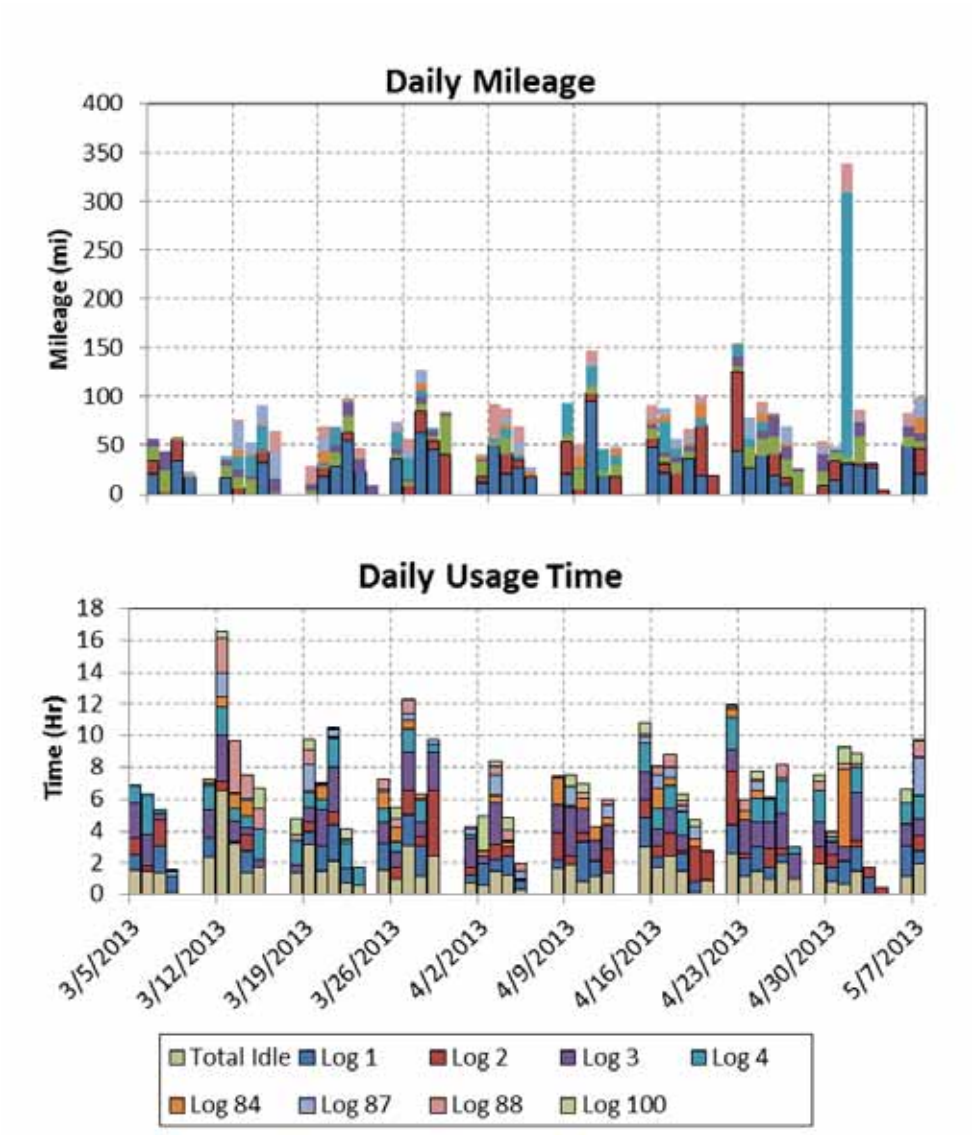


Figure H-2. Pool vehicles travel history (all vehicles).

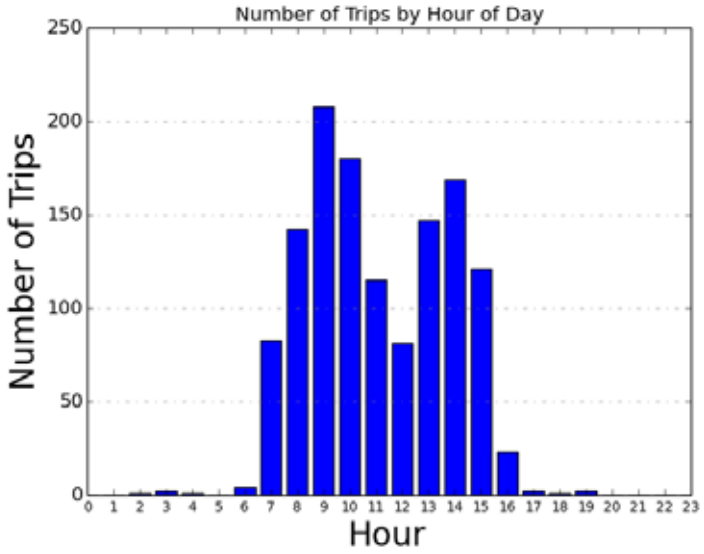


Figure H-3. Pool vehicles hourly usage.

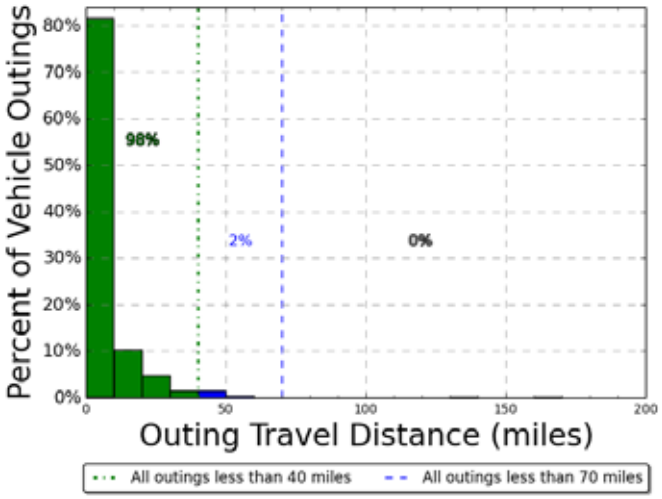


Figure H-4. Pool vehicle combined outings

Appendix D provides the details of each of the pool vehicle's outings. Vehicle 84 exceeded 70 miles in a single outing twice during the study period, which was still less than 0.5% of all pool outings.

The average travel outing when driven for pool vehicles is 5.2 miles. All outings (except 2) or 100% were less than the 70 miles considered to be within the BEV safe range. Furthermore, 98% percent of pool outings are less than 40 miles considered to be within the CD range of a PHEV.

H.2.3 Pool Vehicle Observations/Summary

There appears to be three choices for JBLM in implementing PEVs into the Public Works pool fleet. There are no current PEV replacements for the two conventional passenger vans. However, the monitored Public Works pool fleet also contains two conventional minivans and four conventional pickups for which suitable PEVs may be found. The observations here relate to these six vehicles, assuming the travel of the monitored vehicles is typical.

As noted before the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, a small percentage of daily travel and outings exceeded the capabilities of a BEV and an all-BEV fleet is not possible.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. The data reveal that on 95% of all vehicle travel days, the total daily travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. This represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Furthermore, 98% of the outings are less than 40 miles and could be completed in CD mode with certain PHEVs if the battery is fully charged prior to the outing.

   At the same time, 99% of daily travel and virtually 100% of all outings are within the capabilities of BEVs thus making a mixed fleet a possibility. A mixed fleet requires fleet manager attention to assign vehicles appropriately for the anticipated use on that day.
3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current pool requirements. Data show that for 95% of all travel days, the PHEV will operate in a CD mode. As above, this represents a significant operating cost savings opportunity while retaining the ability to go

longer distances when needed. Intermediate charging opportunities provide additional benefit, enhancing the CD mode. Data show significant charging opportunities throughout the day during stop times.

While it would appear that PEVs are suitable replacements for these six pool vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Fleet managers typically desire greater conservatism in maintaining vehicle capabilities. Thus, it is assumed that the two minivans and four pickups may be replaced by four suitable styled BEV and two PHEV. See Section 5 for these suggestions.

With no PEV available for passenger vans, the balance of 72 vehicles may have suitable PEVs for replacement. Assuming these 72 vehicles operate in a manner similar to the monitored vehicles, the 72 vehicles could consist of 57 BEVs and 15 PHEVs.

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.

H.2.4 Pool Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of the Public Works pool fleet with 57 BEVs and 15 PHEVs while retaining the 35 passenger vans for now.

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. For the entire fleet of pool vehicles, 57 AC Level 2 EVSE units for overnight charging and 15 AC Level 1 outlets for home base are required. 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 EV Mode.

At times, fleet vehicles obtain benefit from using public charging infrastructure. Figure 18 displays the availability of public charging at the time of this writing for the JBLM area. Since all travel was within the JBLM base there may be little benefit in using public charging for the DCA Support Group pool vehicles.

H.3 Public Works 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, Public Works support vehicles monitored included five conventional pickup trucks and one conventional passenger van.

H.3.1 Summary for Public Works Support Vehicles

Appendix D provides the vehicle data sheets for each of the six support vehicles monitored. This section aggregates the data for all support vehicles.

Table H-7 summarizes support vehicle travel during the study period. Vehicle use occurred primarily between 0700 and 1500 hours daily. The six support vehicles traveled 5,244 miles, logged 300 hours, and idled for 62 hours during the study period.

Table H-7. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	25.6/598.5	7.6/608.8	3.4/236.9	5,244
Travel Time (Minutes)	88.1/585	26.2/628	11.6/215	18,053
Idle Time (Minutes)	18.2/NA	5.4/NA	2.4/NA	3,722

Figure H-5 shows the travel summary for support vehicles by vehicle, by daily mileage and daily usage time. Figure H-6 shows the composite history for both support vehicles. In the stacked bar charts of Figure H-6, the contribution of each vehicle is indicated by a different color.

The history graphs identify when several support vehicles may be in use at the same time as well as the total miles driven on a daily basis. The single multiple-day outing by vehicle G43-1892H (logger 90) is evident by its unusual distance.

H.3.2 Public Works Support Vehicle Daily Summary

The average travel distance per day when driven for support vehicles is 25.6 miles. On 96% of these vehicle days, the daily travel is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 4% percent of support vehicle daily travel is greater than 70 miles. Furthermore, 88% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV.

Figure H-6 shows that the vehicles are used nearly every day. There are periods where several vehicles operated several days in a row and days that several vehicles are in use at the same time. Figure H-7 displays the summary of use by time of day for all support vehicles combined. Figure H-8 shows the outings for all support vehicles combined.

Appendix D provides the details of each of the support vehicle's daily travel. Again, the extended outage of vehicle G43-1892H dominates the highest distance with the single outing of 608 miles. All other outings remained below the 70-mile range on all vehicle days and outings.

The average travel outing when driven for support vehicles is 7.6 miles. On 99% of these vehicle outings, the distance traveled is less than the 70 miles considered to be within the BEV safe range. Furthermore, 98% of vehicle travel outings are less than 40 miles considered to be within the CD range of a PHEV.

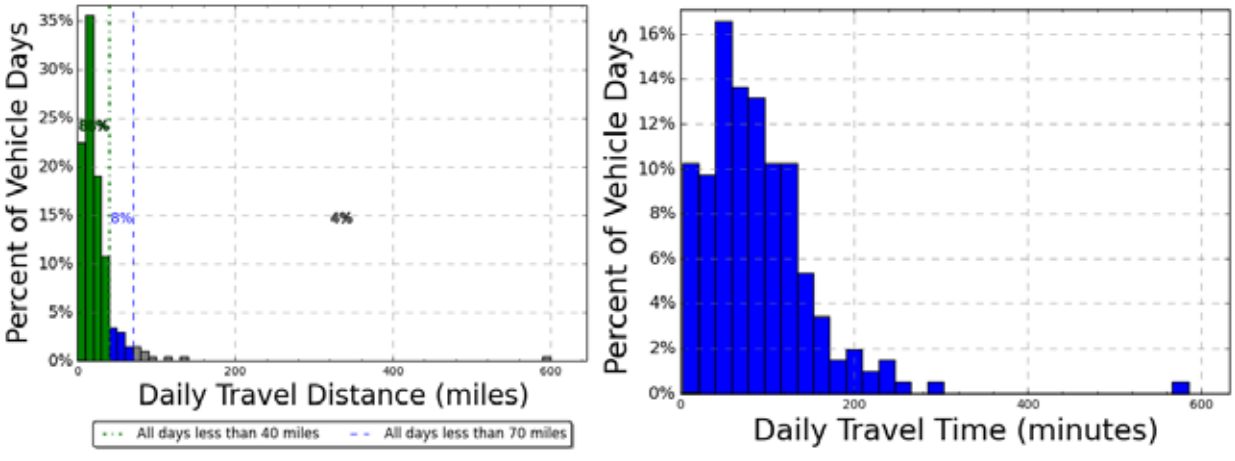


Figure H-5. Support vehicle daily travel miles and usage time (all vehicles).

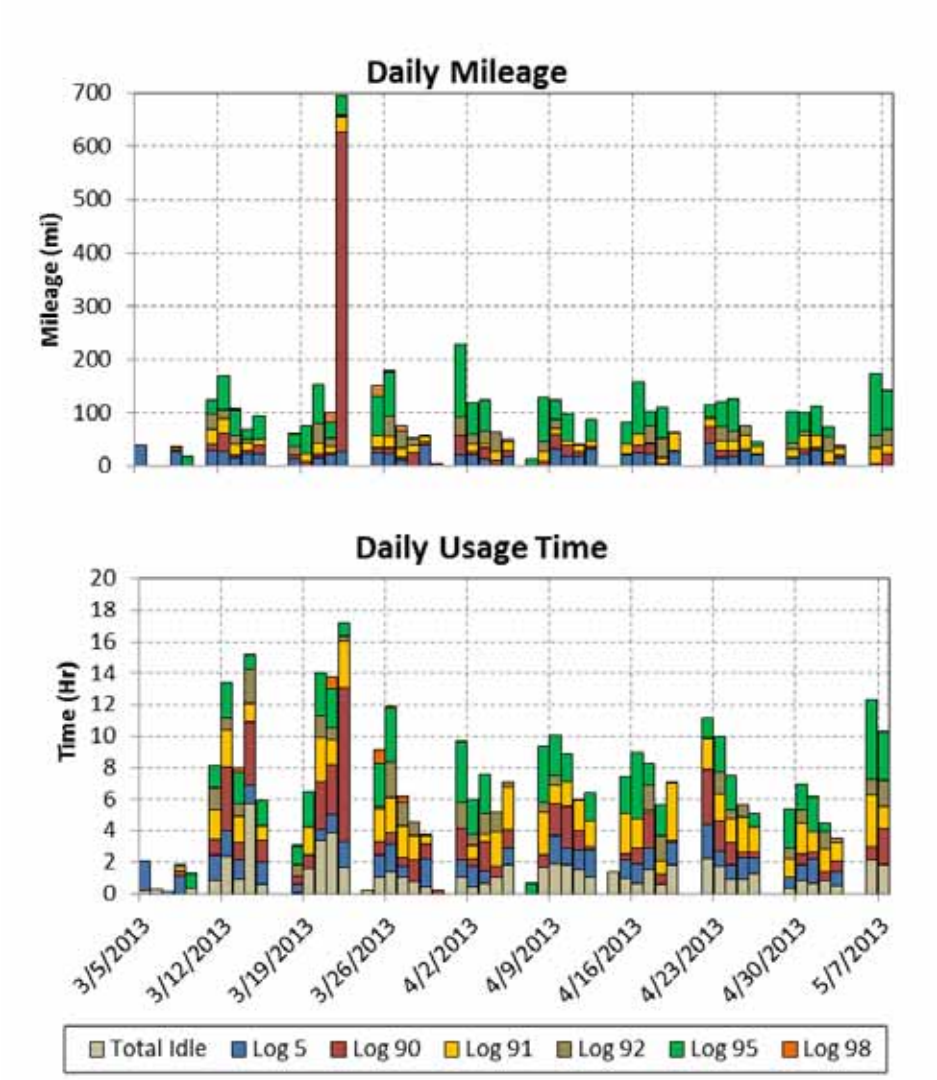


Figure H-6. Support vehicle history (all vehicles).

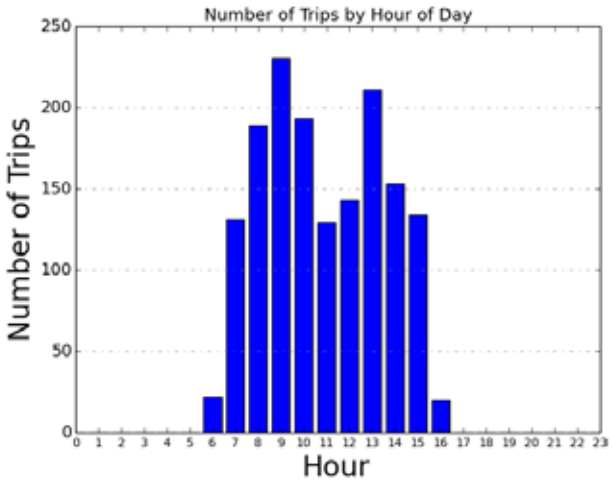


Figure H-7. Support vehicle hourly usage.

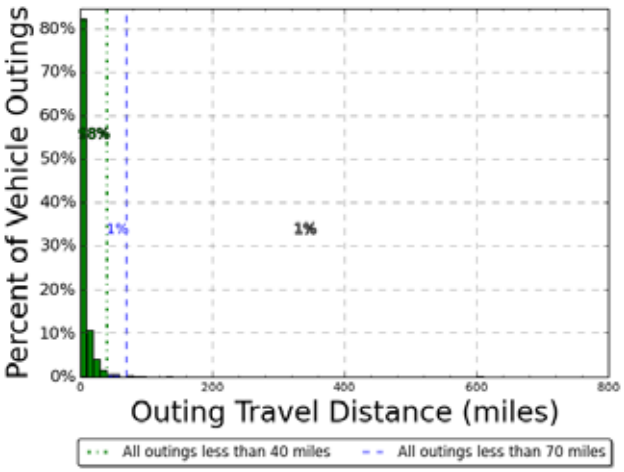


Figure H-8. Support vehicle combined outings.

H.3.3 Public Works Support Vehicle Observations/Summary

There appears to be three choices for JBLM in implementing PEVs into the Public Works support mission fleet. There are no current PEV replacements for the passenger van. However, the Public Works fleet does contain 5conventinoal pickup trucks for which suitable PEVs may be found. While a closer evaluation of the use of the van may also reveal suitable PEV replacements (such as a SUV), the observations here relate to these five pickup trucks assuming the travel of the monitored vehicles are typical.

Pickup trucks are a popular choice for support vehicle because they are versatile to support various types of support needed, i.e. special cargo or equipment transport. In some cases, as seen here, SUVs or mini-vans can perform the same mission. Section 4.4 provides information on PEV trucks and vans currently or soon to be available.

As before, there appears to be three choices for JBLM in implementing PEVs into the Public Works' support vehicle fleet. Keep in mind that the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, an all-BEV fleet is not possible for support vehicles due to the long distances experienced by at least one of these vehicles.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. The data reveal that on 88% of all vehicle travel days the total travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. Thus, the PHEV would be of benefit for this travel.

   It is noted that 96% of all travel days and 99% of all outings are less than 70 miles. This would support travel by BEVs. For the days where the 70 miles are exceeded, intermediate charging locations typically provide the recharge necessary to increase the all-electric drive. There are significant quantities of public charging stations locally but they cannot be assured to be available when needed. Thus, consideration should be given to home base charging only. Additional charging during the day at the home base between outings would add daily range. Incorporation of BEVs into the fleet will require management attention to ensure appropriate deployment based upon the need and expected distance to be driven.
3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current support vehicle requirements.

While it would appear that PEVs may be suitable replacements for these five support vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Fleet managers typically desire greater conservatism in maintaining vehicle capabilities. Thus, it is assumed that the five pickup may be replaced by four suitable style BEVs and one suitable style PHEVs. See Section 5 for these suggestions.

The total Public Works support fleet of 117 vehicles then could consist of 67 BEVs, 17 PHEVs, 17 conventional passenger vans, and 16 conventional heavy-duty trucks. The vehicle summary shows sufficient time for charging at the base location during the course of the day. These stations also provide charging opportunities for the visiting public, whose fees may assist in offsetting operating costs.

Intertek suggests further mission evaluation be given to the balance of the support vehicles when considering the adoption of BEVs and PHEVs. Additional BEVs may be possible with further management or fleet software attention; however, fleet managers typically desire vehicles that support longer trips. Some of the vans may find suitable replacements in PEVs as well.

H.3.4 Public Works Support Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of most of the support vehicle fleet with 67 BEVs and 17 PHEVs. No available PHEVs at the time of this writing provide for DC fast charging nor do the data suggest that this would be a significant benefit for PHEVs in the support vehicle fleet. Additional charging of BEVs during the day is not a requirement nor would DCFCs be required. The majority of the support vehicle activity occurs during daytime hours, which leaves significant time during the nighttime hours for recharging.

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 the greater benefits from AC Level 2 EVSE. Most vehicles returned to their home base daily with the exception of long trips lasting several days.

For the entire fleet of support vehicles, 67 BEVs require 67 AC Level 2 EVSE for overnight charging and 17 PHEVs require 17 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.

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. JBLM will gain experience in this management as the PEV fleet grows.

H.4 Public Works Group Vehicles Mileage

The vehicle annual miles factor into the calculations for replacement of vehicles as noted in Section 5 and Appendix H. The actual miles measured during the study are extrapolated to identify calculated annual miles in the study. JBLM has also provided vehicle information thFigure H-1at identifies the average monthly miles and vehicle mileage in April 2012. Table H-8 shows these values and calculations with the study-extrapolated miles in the far right column.

Table H-8. Public Works Group vehicle mileage.

Vehicle Mileage						
Logger No.	Fleet Vehicle Id	Year	Odometer	Monthly Miles	Calculated Annual Miles	Study-Extrapolated Miles
1	G42-0658K	2010	11,073	389	4,668	6,276.84
2	G42-1054F	2008	34,940	Not avail.	Not avail.	3,130.31
3	G71-0133L	2011	8,720	347	4,164	2,725.33

Vehicle Mileage						
Logger No.	Fleet Vehicle Id	Year	Odometer	Monthly Miles	Calculated Annual Miles	Study-Extrapolated Miles
4	G43-0944G	2008	7,992	148	1,776	1,573.56
5	G43-0822G	2008	26,318	477	5,724	5,824.36
84	G41-1100K	2010	Not avail.	Not avail.	Not avail.	3,320.34
87	G42-0619K	2010	5,217	163	1,956	762.44
88	G41-1180K	2010	7,120	215	2,580	1,635.55
90	G43-1892H	2009	11,362	306	3,672	6,175.45
91	G43-1961H	2009	15,649	410	4,920	4,059.61
92	G42-0505A	2004	28,838	391	4,692	3,605.97
95	G43-1155L	2011	10,153	517	6,204	10,418.14
98	G41-1605L	2011	3,175	148	1,776	300.11
100	G42-0610K	2010	8,255	262	3,144	1,556.17

For the entire Public Works Group fleet, the average monthly miles traveled are 335 miles for an average annual travel of 4,024 miles. In general, there is good correlation between the JBLM provided averages and the study calculated annual mileage. The JBLM provided mileage information will be used in the calculations when available.

H.5 Public Works Group Vehicle Utilization

Vehicle utilization is an important factor in the evaluation of vehicles both from an inventory perspective and for charging availability. Table H-9 identifies the percent utilization of the vehicle considering all days used during the study period. Since most travel occurred during weekdays, only the 45 weekdays in the 63-day study period are considered. In the event that the vehicle was used for more than these 45 days, the percent utilization is considered 100%.

The average daily usage of each vehicle is identified in the Appendix D data sheets. It is also shown here for completeness.

Table H-9. Vehicle utilization.

Logger	Vehicle	Mission	Vehicle Class	Percent Days Used	Avg Daily Travel Time (Hrs)
1	G42-0658K	PL	Pickup	82%	1.2
2	G42-1054F	PL	Pickup	78%	1.0
3	G71-0133L	PL	Van - Pass	91%	1.6
4	G43-0944G	PL	Van - Pass	76%	1.3
5	G43-0822G	SU	Pickup	100%	1.3
84	G41-1100K	PL	Minivan	62%	0.7
87	G42-0619K	PL	Pickup	67%	0.5
88	G41-1180K	PL	Minivan	84%	0.6
90	G43-1892H	SU	Pickup	96%	1.5
91	G43-1961H	SU	Pickup	91%	1.7
92	G42-0505A	SU	Van - Pass	78%	0.9
95	G43-1155L	SU	Pickup	78%	2.2
98	G41-1605L	SU	Pickup	13%	0.4
100	G42-0610K	PL	Pickup	44%	0.7
			Average	74%	1.1

In general, the vehicles are used on frequent days but average usage per day is quite low. For example, the average vehicle is used on three out of four days but just over an hour each day.

H.6 Public Works Group Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the Public Works Group. The study indicates that PEVs offer alternatives to vehicles in the existing 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 three conventional passenger vans, nine conventional pickup trucks, and two conventional minivans. Based on the travel data, Intertek suggests that retaining the passenger vans and replacing the remaining vehicles with three PHEVs and eight BEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix H provides specific recommendations.

The Public Works Group full fleet of vehicles contains 250 vehicles. Intertek suggests retaining the conventional specialty vehicle, 52 conventional passenger vans, and 33 conventional heavy-duty trucks for now, and suggests a fleet of 128 BEVs and 36 PHEVs conservatively meet the balance of vehicle travel requirements.

With the potential replacement by PEVs established, Section 5 and Appendix L 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 Public Works Group. Those observations will be addressed in Task 4 of this project

Appendix I

Motor Transport Branch Vehicle Analysis

I.1 Motor Transport Branch Vehicle Summary

The Motor Transport Branch fleet contains 1060 vehicles, not including the LSVs and non-powered vehicles. Table I-1 identifies these vehicles by vehicle type according to site records. The mission assignments identified in this table are based upon survey responses received and extrapolation to the entire fleet. Table I-2 provides a summary of mission types for these survey responses. Survey responses received included 76 of these vehicles or 7% of the total.

Table I-1. Motor Transport Branch fleet vehicles by type and mission.

Mission	Sedan Compact/ Sub Com	Sedan Midsize/ Large	Mini -van	SUV	Speci alty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	20	36	59	23		72	168	117			495
Support	3	60	29	92		6	18	93			301
Transport	3		10			32	16	70	73		204
Specialty					4						4
Bus										56	56
Total	26	96	98	115	4	110	202	280	73	56	1060

Table I-2. Motor Transport Branch survey responses.

Mission	Sedan Compact/ Sub Com	Sedan Midsize/ Large	Mini -van	SUV	Speci alty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	6	6	12	2		3	5	5			39
Support	1	10	6	8				4			29
Transport	1		2			1	1	3			8
Total	8	16	20	10		4	6	12			76

Table I-3 provides a summary of the vehicles monitored for this report. Survey responses were not received for all vehicles so missions are assumed based upon total survey response percentages.

Table I-3. Motor Transport Branch fleet vehicle logger summary.

Mission	Sedan Compact/ Sub Com	Sedan Midsize/ Large	Mini -van	SUV	Speci alty	Cargo Van	Pass. Van	Pickup or LD Truck	MD or HD Truck	Bus	Total
Pool	3	2	3	1		3	7	4			23
Support	1	2	2	2		1		3			11
Transport						2		2	2		6
Total	4	4	5	3		6	7	9	2		40

Table I-4 provides the full characterization of the fleet of vehicles monitored in this survey.

Table I-4. Motor Transport Branch vehicle characterization index.

Vehicle Index						
Logger No.	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
6	G43-0875K	Ford	E350	2010	Cargo Van	Pool
7	G41-1288A	Ford	Sport Trac	2004	Pickup Truck	Pool
8	G43-4937A	Ford	E350	2004	Cargo Van	Pool
9	G10-7664F	Dodge	Avenger	2008	Compact Sedan	Pool
10	G41-65991	Dodge	Dakota	2002	Pickup Truck	Pool
11	G11-2676G	Chevrolet	Impala	2008	Large Car	Pool
12	G43-3717A	Ford	E350	2004	Cargo Van	Pool
13	G11-0678K	Chevrolet	Impala	2010	Large Car	Support
14	G62-4526H	Chevrolet	Tahoe	2009	SUV	Support
15	G42-0698K	Chevrolet	C1500	2011	Pickup Truck	Support
16	G11-0493L	Chevrolet	Impala	2012	Large Car	Support
17	G71-0062G	Ford	F750	2008	Stake Truck	Transport
18	G62-1094L	Chevrolet	Avalanche	2011	SUV	Support
19	G41-1395G	Chevrolet	Uplander	2008	Minivan	Pool
20	G61-1155D	Ford	Escape HYB	2006	SUV	Pool
81	G10-2878L	Chevrolet	Malibu	2011	Midsize Sedan	Pool
84	G41-1100K	Dodge	Gr Caravan	2010	Minivan	Pool
85	G62-0979G	Dodge	1500	2008	Pickup Truck	Pool
89	G71-0674A	Ford	F650 18'BO	2004	Delivery Van	Transport
93	G41-1373G	Dodge	Dakota	2008	Pickup Truck	Support
97	G41-1367G	Dodge	Dakota	2008	Pickup Truck	Pool
101	G43-0792K	Chevrolet	CG3300	2010	Passenger Van	Pool
102	G43-0801K	Chevrolet	CG3300	2010	Passenger Van	Pool
104	G42-0988F	Chevrolet	Express 13	2007	Cargo Van	Support
105	G43-0860G	Chevrolet	CG3300	2008	Passenger Van	Pool
106	G43-1389K	Chevrolet	CG3300	2010	Passenger Van	Pool
107	G41-1180G	Chevrolet	Uplander	2008	Minivan	Support
108	G11-2675G	Chevrolet	Impala	2008	Large Sedan	Pool
109	G43-1191L	Chevrolet	CG3300	2011	Passenger Van	Pool
110	G12-0662H	Ford	Fusion HEV	2010	Midsize Sedan	Pool
111	G63-0271A	Ford	F350 Stake	2004	Stake Truck	Transport
112	G41-1392G	Chevrolet	Uplander	2008	Minivan	Support
113	G43-3881H	Ford	E350	2009	Passenger Van	Pool
114	G43-25839	Ford	F350	2003	Pickup Truck	Transport
115	G41-1376G	Dodge	Dakota	2008	Pickup Truck	Support
116	G41-1161G	Chevrolet	Uplander	2008	Minivan	Pool

Vehicle Index						
Logger No.	Fleet Vehicle Id	Make	Model	Year	EPA Class	Mission
117	G43-0790K	Chevrolet	CG3300	2010	Passenger Van	Pool
118	G82-0509A	Ford	F650 Stake	2004	Stake Truck	Transport
119	G10-6379L	Dodge	Avenger	2011	Midsize Sedan	Support
120	G42-3471A	Chevrolet	G2300	2005	Cargo Van	Transport

The following may reference specific vehicles by logger number or Fleet Vehicle ID.

JBLM data collection took place from March 5, 2013 through May 7, 2013. Vehicle data sheets (presented in Appendix E) detail the collected data for each vehicle.

Of the data collected, validation occurred for 99.7% of the data, while null values exist for the balance. Table I-5 shows this information by mission type.

Table I-5. Vehicle data logger reporting summary.

Vehicle Data Logger Reporting Summary			
Mission	% Collected	% Null Values	Total
Pool	96.5	3.4	100%
Support	95.8	4.2	100%
Transport	98.7	1.3	100%
All Vehicles	97.4	2.6	100%

Grouping the vehicles by mission creates an aggregated view of mission requirements to provide observations related to PEV replacement. Analysis by mission type follows.

I.2 Motor Transport Branch Pool Vehicles Analysis

Pool vehicles are typically light-duty motor vehicles for use in passenger transportation, with not more than 10 passengers. Pool missions can vary by agency, location, and jurisdiction, and for Motor Transport Branch, the pool vehicles include minivans, sedans, pickup trucks, cargo and passenger vans, and a SUV. Although there are currently no PEVs available to replace the passenger van vehicle, it is assumed that the usage of all these pool vehicles can be of value in considering the remaining pool vehicles in the Motor Transport fleet. The other vehicles 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.

I.2.1 Summary for Motor Transport Branch Pool Vehicles

Appendix E provides the vehicle data sheets for each of the 23 pool vehicles monitored. This section aggregates data for all pool vehicles. Table I-6 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred at all hours of the day but primarily between 0700 and 1800 hours. They traveled 23,746 miles, logged1,158 hours, and idled for 312 hours during the 63-day study period.

Figure I-1 shows the travel summary for pool vehicles: by vehicle, by daily mileage, and daily usage time. Figure I-2 shows the composite history for all pool vehicles. In these stacked bar charts of Figure I-2, the contribution of each vehicle is indicated by a different color.

Table I-6. Pool vehicles travel summary.

Pool Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	35.2/571.2	11.9/1566.9	4.4/202.5	23,746
Travel Time (Minutes)	103.1/777.0	34.8/1897	12.7/257.0	69,499
Idle Time (Minutes)	27.8/NA	9.4/NA	3.4/NA	18,748

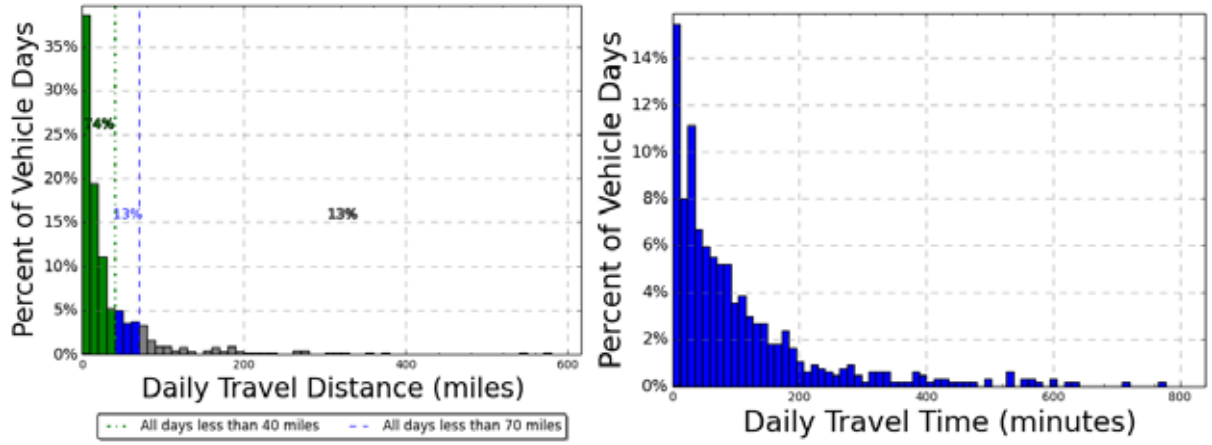


Figure I-1. Motor Transport Branch pool vehicle daily travel miles and time (all vehicles).

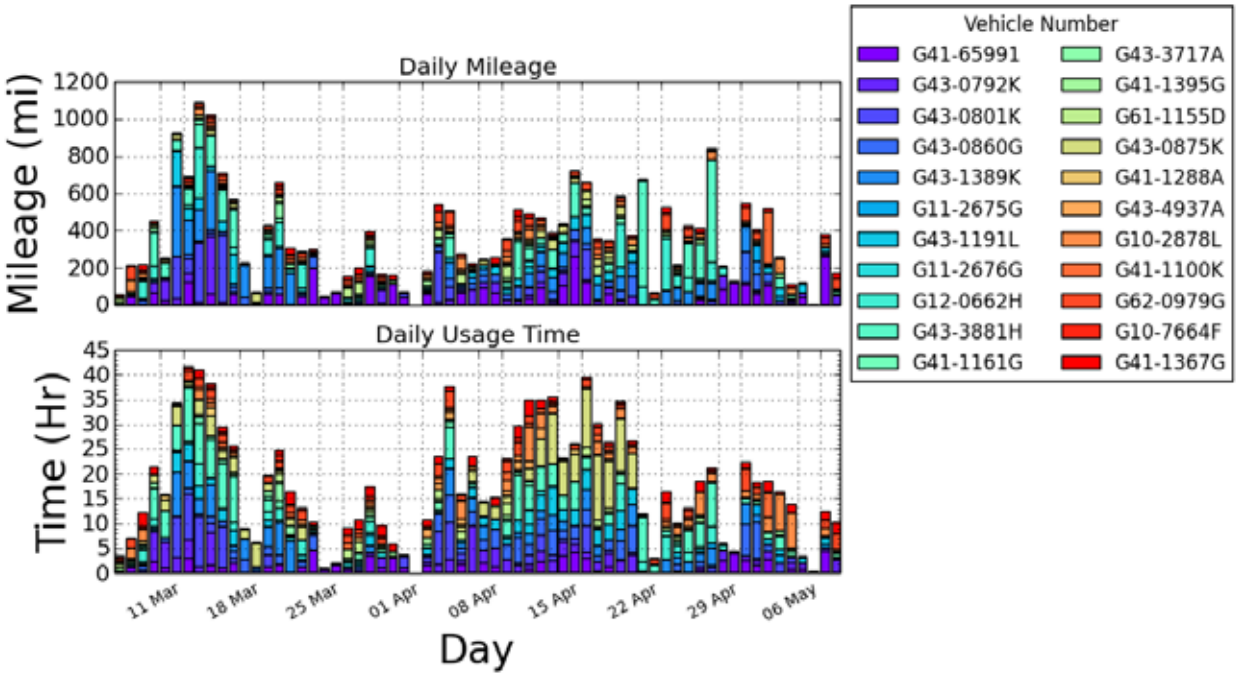


Figure I-2. Motor Transport Branch pool vehicles travel history (all vehicles).

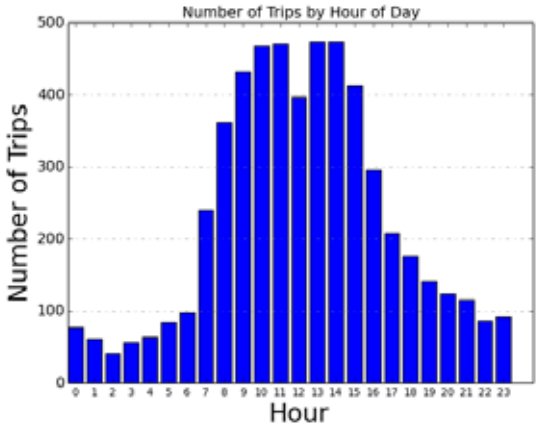


Figure I-3. Motor Transport Branch pool vehicles hourly usage.

Because there were 23 vehicles in this pool mission for Motor Transport Branch, the vehicles are split into three groups for clarity of daily use. These groups are sedans and minivans, pickup trucks and cargo vans and passenger vans. Figure I-4 shows the outings for all sedans and minivans.

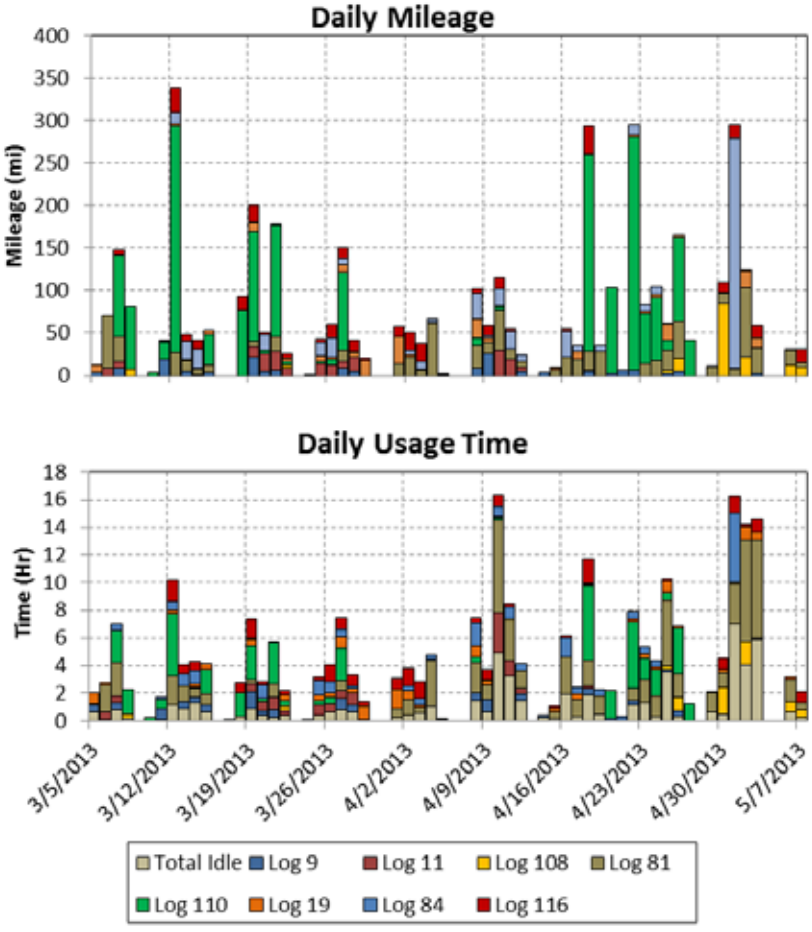


Figure I-4. Motor Transport Branch pool sedan and minivan combined daily travel.

Within this group, two vehicles stand out for exceptional travel distances compared to the others in their vehicle class. Sedan 110 (Vehicle G12-0662H) had a maximum daily travel of 275 miles while all other sedans had a maximum daily travel less than 85 miles. Minivan 84 (Vehicle G41-1100K) had a maximum daily travel of 271 miles while the other two maximum daily travels were less than 32 miles.

Figure I-5 shows the daily travel for all pickup trucks, the SUV, and cargo vans.

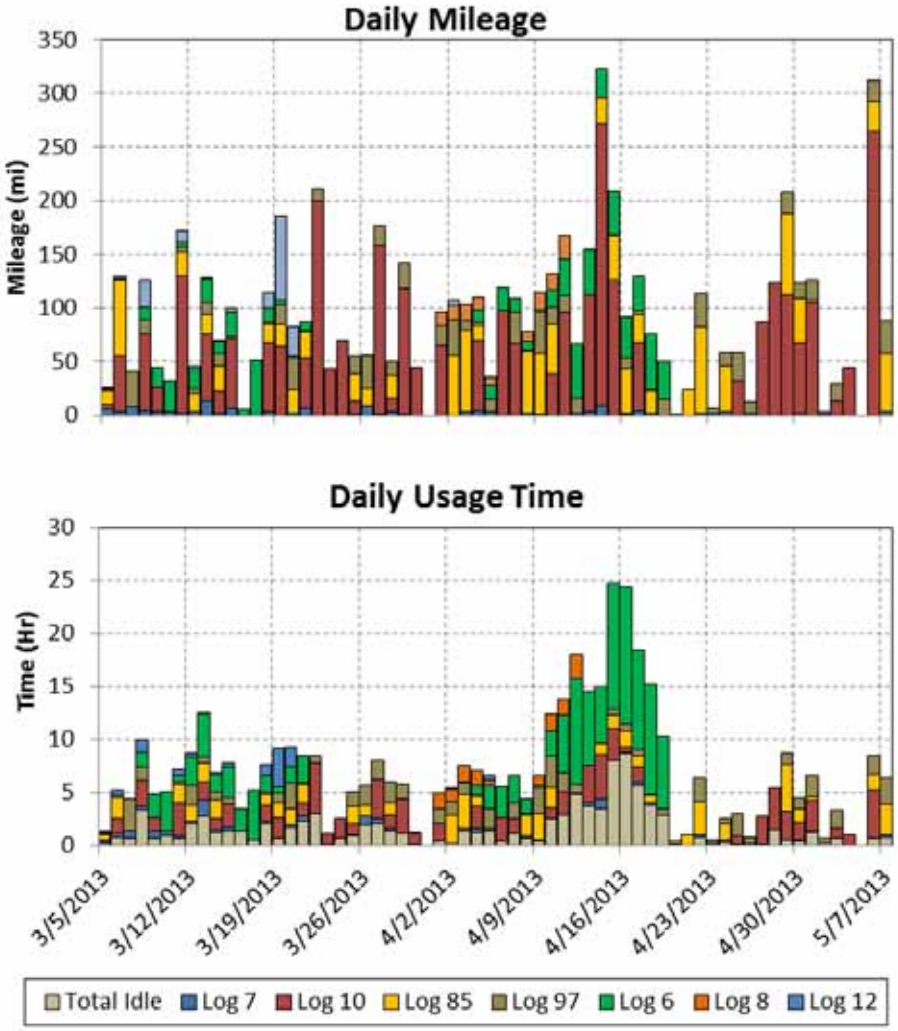


Figure I-5. Motor Transport Branch pool pickup truck, SUV, and cargo van combined daily travel.

Within this group, pickup truck #10 (Vehicle G41-65991) had significantly higher daily miles than the other vehicles with 264 miles compared to 85 miles or less for all the other vehicles in this group. Vehicle 6 (cargo van) had significantly more travel time but such travel was of shorter distances. Cargo van #6 (Vehicle G43-0875K) contributed most of the idle time seen around April 16. For the study period, this van averaged more than one hour per day idling on those days driven. For the days from April 12 to 18, the vehicle averaged approximately 5 hours per day idling although no significant travel off-base was recorded.

Figure I-6 shows the combined daily travel for passenger vans.

Within this group, passenger van #113 (Vehicle G43-3881H) had the highest travel day although all vehicles in this category exhibited significant travel. It is noted that passenger van #117 (Vehicle G43-0790K) provided insufficient data to evaluate.

All these graphs reveal the extensive use that the Motor Transport Group pool vehicles experience. They are used nearly every day and many vehicles at the same time.

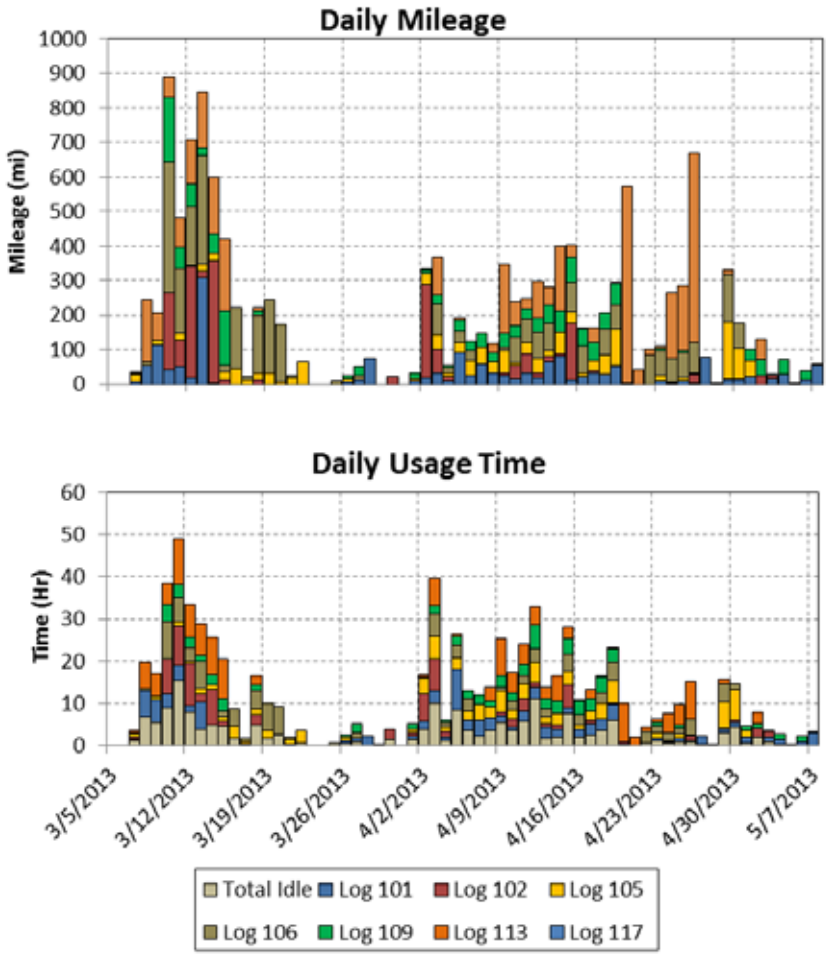


Figure I-6. Motor Transport Branch pool passenger van combined daily travel.

I.2.2 Motor Transport Branch Pool Vehicles Daily Summary

The average travel distance per day when driven for pool vehicles is 35.2 miles. On 87% of the vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure I-1). That is, while BEV range can vary based on several factors; most BEVs provide at least 70 miles of vehicle range on a single battery charge. Meanwhile, 74% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure I-1). However, 13% of daily travel exceeds the 70-mile range. As noted above, most of this higher travel was by vehicles 110, 10 and 84 as well as most of the passenger vans.

Figure I-4, I-5, and I-6 show that vehicles are used extensively. As a group, the vehicles were used approximately half the days of the study period.

Figure I-7 displays the summary of outings for all pool vehicles.

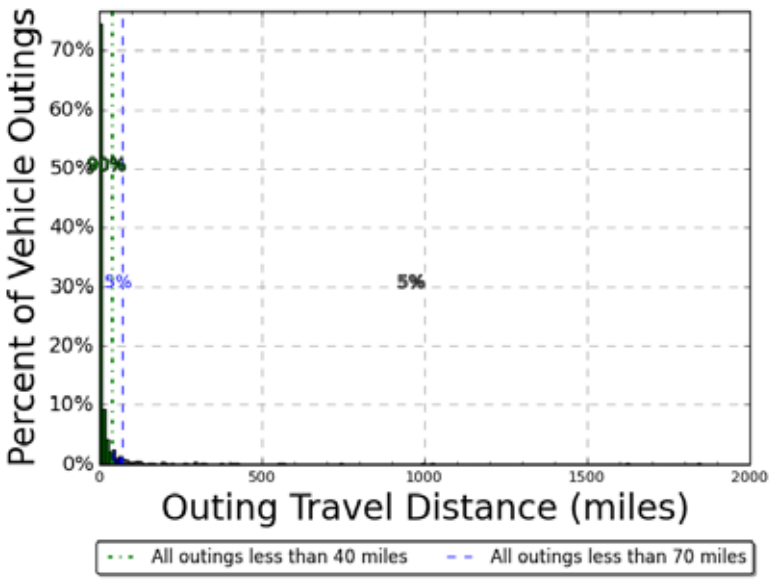


Figure I-7. Motor Transport Branch pool vehicle outings (all vehicles).

The outings graph is dominated by the highest outing recorded of 1599.9 miles by passenger van #113 (vehicle G43-3881H) during an April excursion to Idaho and Washington. Appendix E shows this vehicle having several of the outings exceeding 70 miles. The majority of high-distance outings were experienced by minivan #84, sedan #110, pickup #10, and most of the passenger vans in a manner similar to the daily travel maximums noted above. The other pool vehicles experienced 85 miles or less in their maximum outings. Truncating the graph at 150 miles provides a clearer view of the left side of the above graph. Figure I-8 provides this graph.

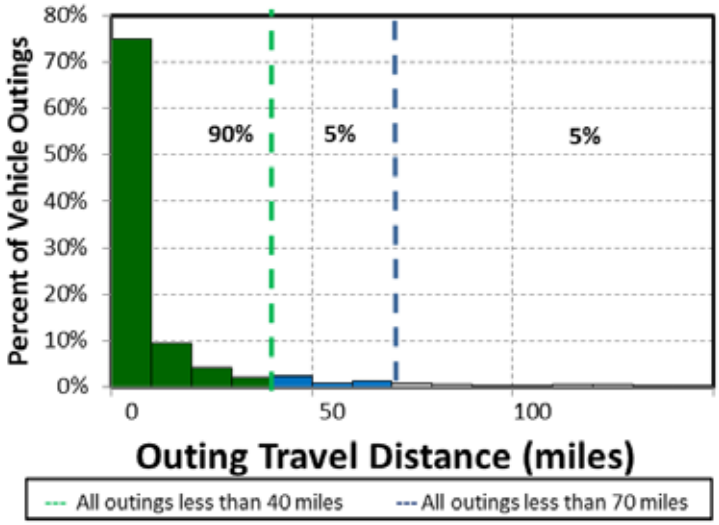


Figure I-8. Motor Transport Branch pool vehicle outings (all vehicles) truncated at 150 miles.

Appendix E provides the details of each of the pool vehicle's outings.

The average travel outing when driven for pool vehicles is 11.9 miles. Meanwhile, 75% of all outings for all 23 vehicles in the pool mission are less than 10 miles. Furthermore, 95% of all outings were less than the 70 miles considered to be within the BEV safe range. However, 90% percent of pool vehicle outings are less than 40 miles considered to be within the CD range of a PHEV.

I.2.3 Motor Transport Branch Pool Vehicle Observations/Summary

There appear to be three choices for JBLM in implementing PEVs into the Motor Transport Branch pool fleet. There are no current PEV replacements for passenger vans. However, the Motor Transport fleet with the pool mission does contain three minivans, four pickups, five sedans, one SUV, and three cargo vans for which suitable PEVs may be found. The observations here relate to these 16 vehicles assuming the travel of the monitored vehicles is typical.

As noted before, the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, an all-BEV fleet is not possible for support vehicles due to the long distances experienced by some of these vehicles.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. The data reveal that on 74% of all vehicle travel days, the total daily travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. This represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Furthermore, 90% of the outings are less than 40 miles and could be completed in CD mode with certain PHEVs if the battery is fully charged prior to the outing.

   It is noteworthy that 87% of the travel days are less than 70 miles and 95% of the vehicle outings are less than 70 miles indicating a BEV may be advantageous in the fleet. A mixed fleet requires fleet manager attention to assign vehicles appropriately for the anticipated use on that day.
3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current pool requirements. Data show that for 74% of all travel days, the PHEV will operate in a CD mode. As above, this represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Intermediate charging opportunities provide additional benefit, enhancing the CD mode. Data show significant charging opportunities throughout the day during stop times.

While it would appear that PEVs are suitable replacements for these 16 conventional pool vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Fleet managers typically desire greater conservatism in maintaining vehicle capabilities. While strict percentages might suggest 13% of the fleet requires PHEV because of the travel greater than 70 miles, a conservative approach for these 16 vehicles would be to suggest 40% PHEV and 60% BEV. See Section 5 for these suggestions.

The Motor Transport pool fleet of 23 vehicles monitored then could consist of 7conventional passenger vans, 10 BEVs, and 6 PHEVs. There are 168 conventional passenger vans in the entire Motor Transport Branch fleet identified in Table I-1 for which no PEV currently exists as a replacement vehicle. Thus, the resulting fleet could consist of 168 conventional passenger vans, 196 BEVs and 131 PHEVs.

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.

I.2.4 Motor Transport Branch Pool Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of the Motor Transport Branch pool fleet monitored in this study with 10 BEVs and 6 PHEV while retaining the conventional passenger vans unchanged for now. The entire fleet could consist of 196 BEVs and 131 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. For the monitored fleet of pool vehicles, 10 BEVs require 10 AC Level 2 EVSE units for overnight charging and six PHEVs require 6AC Level 1 outlets for home base. 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 benefit from using public charging infrastructure. Figure 18 displays the availability of public charging at the time of this writing for the JBLM area. Significant travel occurs off base by several vehicles that may find benefit in increased range for these vehicles.

I.3 Motor Transport Branch 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, vehicles G41-74299 (logger 83) and G43-1195H (logger 96) were support vehicles monitored.

I.3.1. Summary for Motor Transport Branch Support Vehicles

Appendix E provides the vehicle data sheets for each of the eleven support vehicles monitored. This section aggregates the data for all support vehicles.

Table I-7 summarizes support vehicle travel during the study period. Vehicle use may occur at any hour but primarily occurred between 0700 and 1500 hours daily. Support vehicles traveled 19,336 miles, logged 1,886 hours, and idled for 989 hours during the study period.

Table I-7. Support vehicle travel summary.

Support Vehicle Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	46.9/555.0	13.3/1236	5.3/245.6	19,336
Travel Time (Minutes)	274.8/1502	78.0/1440	30.8/512.0	113,202
Idle Time (Minutes)	58.2/NA	16.5/NA	6.5/NA	59,355

Figure I-9 shows the travel summary for support vehicles by vehicle, by daily mileage and daily usage time. Figure I-10 shows the composite history for all support vehicles.

Sedans #119 and #16 (Vehicles G10-6379 L and G11-0493 L) and minivan #112 (Vehicle G41-1392G) dominate the maximum daily travel with maximums of 1,236 miles, 237 miles and 253 miles respectively. All other vehicles in this group had maximum daily travel less than 92 miles. Pickup #15 (Vehicle G42-0698K) was used most frequently, experiencing travel 92% of the study days.

The history graphs identify when several support vehicles may be in use at the same time as well as the total miles driven on a daily basis.

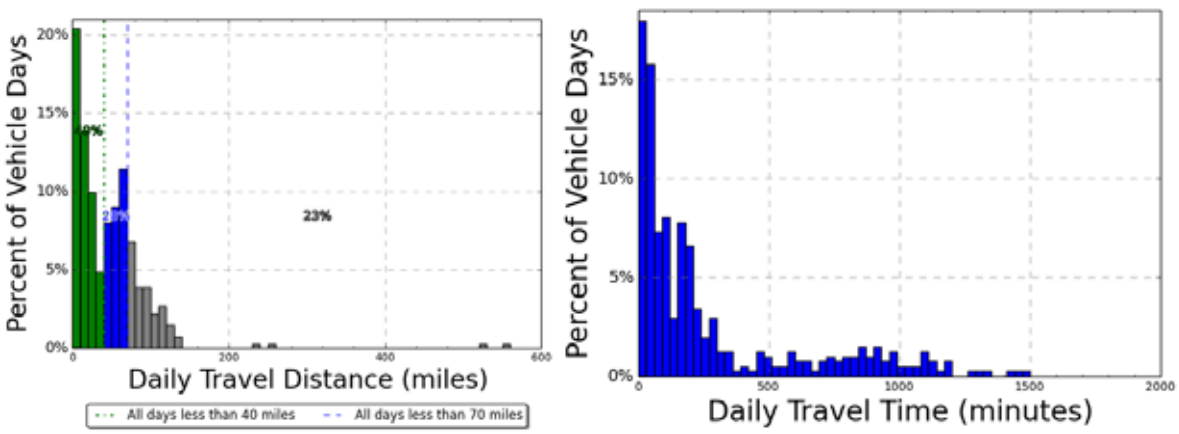


Figure I-9. Motor Transport Branch support vehicle daily travel miles and usage time (all vehicles).

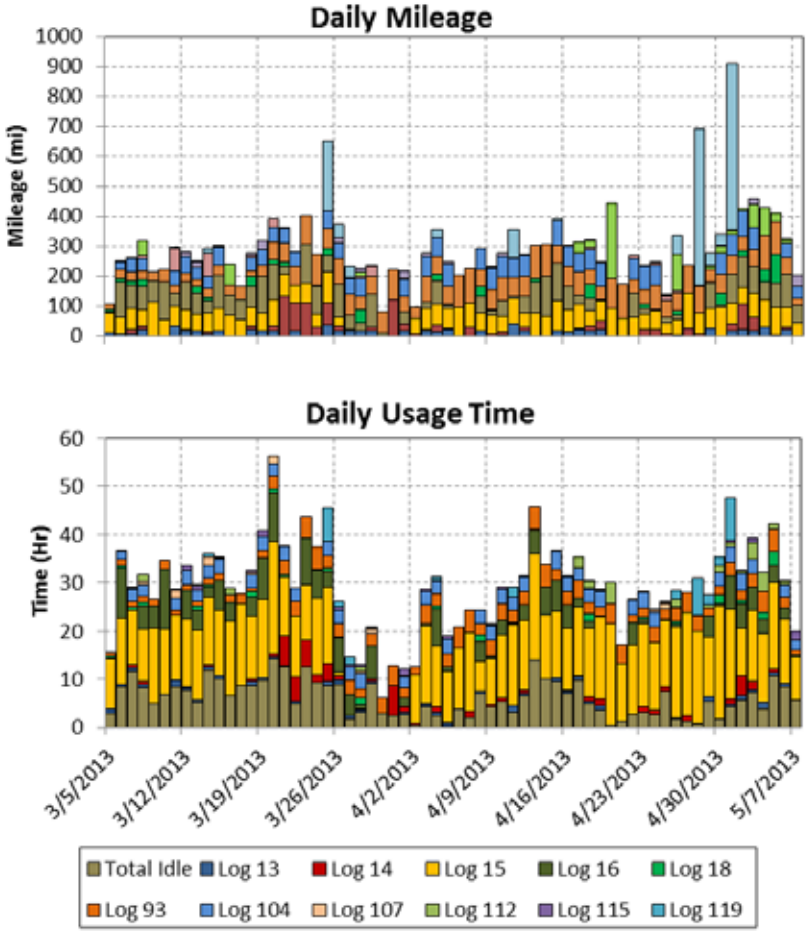


Figure I-10. Motor Transport Branch support vehicle history (all vehicles).

I.3.2 Motor Transport Branch Support Vehicle Daily Summary

The average travel distance per day when driven for support vehicles is 46.9 miles. On 77% of these vehicle days, the daily travel is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 23% percent of support vehicle daily travel is greater than 70 miles. Furthermore, 49% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV.

Figure I-11 displays the summary of use by time of day for all support vehicles combined.

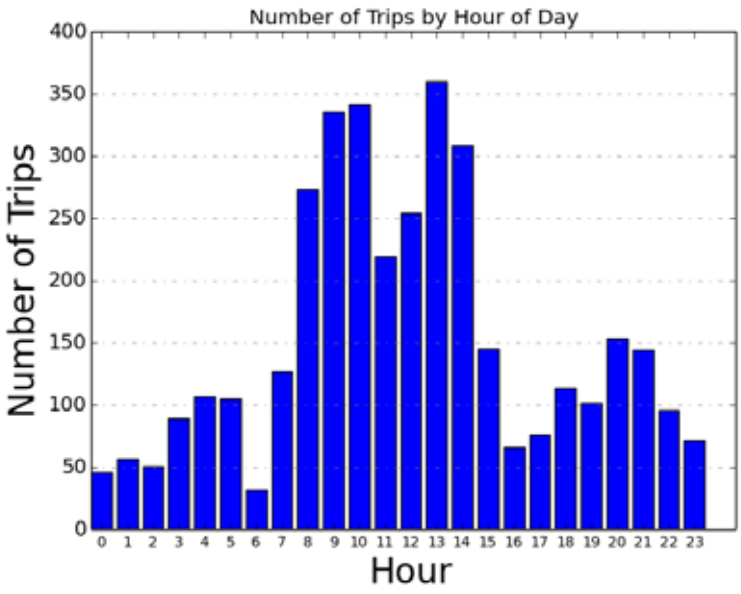


Figure I-11. Motor Transport Branch support vehicles hourly usage.

Figure I-12 shows the outings for all support vehicles combined.

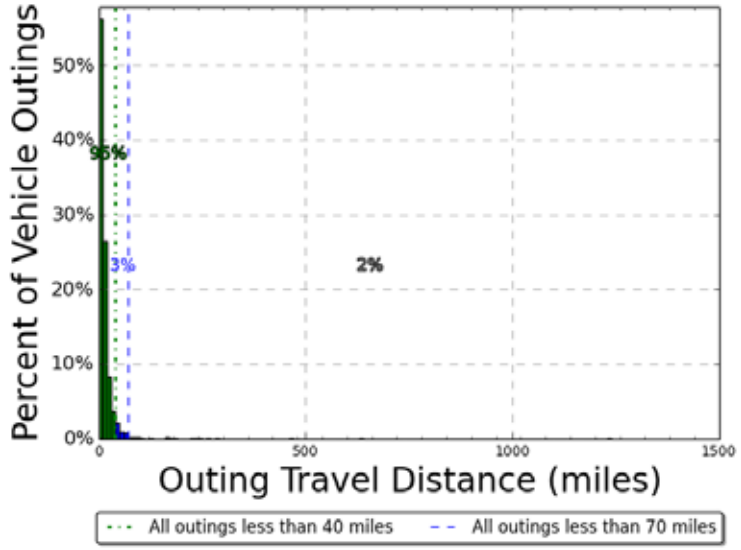


Figure I-12. Motor Transport Branch support vehicle combined outings.

As above, sedans #119 and #16 (Vehicles G10-6379 L and G11-0493 L) and minivan #112 (Vehicle G41-1392G) dominate the maximum outings traveled with maximums of 1,236 miles, 237 miles and 253 miles respectively. All other vehicles in this group had maximum outings less than 92 miles. Although used extensively, pickup #15 (Vehicle G42-0698K) traveled a maximum of 71.5 miles in an outing. Because the single highest travel of sedan #119 sets the upper limit of distance in Figure I-13, the figure is duplicated below but truncated at 200 miles to more clearly show the lower outing distances.

The average travel outing when driven for support vehicles is 13.3 miles. On 98% of these vehicle outings, the distance traveled is less than the 70 miles considered to be within the BEV safe range. Meanwhile, 2% of support outing travel is greater than 70 miles. Furthermore, 95% of vehicle travel outings are less than 40 miles considered to be within the CD range of a PHEV.

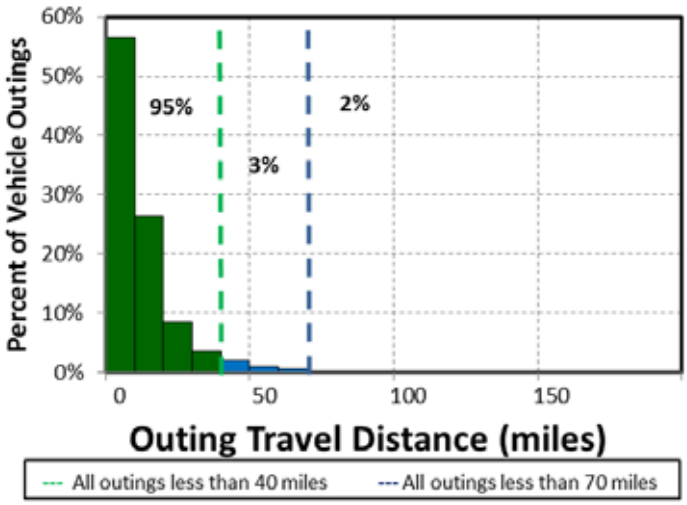


Figure I-13. Motor Transport Branch support vehicle outings (all vehicles) truncated to 200 miles.

I.3.3 Motor Transport Branch Support Vehicle Observations/Summary

There appear to be three choices for JBLM in implementing PEVs into the Motor Transport Branch support mission fleet. The vehicles monitored in the study include two minivans, three pickup trucks, three sedans, two SUVs, and one cargo van for which suitable PEVs may be found. The observations here relate to these 11 vehicles and to the full fleet of vehicles identified in Table I-1 assuming the travel of the monitored vehicles are typical.

Pickup trucks are a popular choice for support vehicle because they are versatile to support various types of support needed, i.e. special cargo or equipment transport. In some cases, SUVs or mini-vans can perform the same mission. Section 4.4 provides information on PEV trucks and vans currently or soon to be available.

As before, it should be noted that the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, an all-BEV fleet is not possible for support vehicles due to the long distances experienced by some of these vehicles.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. The data reveal that on 49% of all vehicle travel days the total travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. Thus, the PHEV would be of benefit for this travel.

   It is noted that 77% of all travel days and 98% of all outings are less than 70 miles. This would support travel by BEVs. For the days where the 70 miles are exceeded, intermediate charging locations typically provide the recharge necessary to increase the all-electric drive. There are significant quantities of public charging stations locally but they cannot be assured to be available when needed. Thus, consideration should be given to home base charging only. Additional charging during the day at the home base between outings would add daily range. Incorporation of BEVs into the fleet will require management attention to ensure appropriate deployment based upon the need and expected distance to be driven.
3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current support vehicle requirements.

While it would appear that PEVs may be suitable replacements for these 11 conventional support vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. Fleet managers typically desire greater conservatism in maintaining vehicle capabilities. Because a PHEV is required for only 23% of daily travel, the 11 vehicles monitored may be replaced by eight suitable style BEVs and three suitable style PHEVs. Because fleet managers may desire a more conservative approach with more PHEVs, it is suggested that these 11 vehicles be replaced by six BEVs and five PHEVs. See Section 5 for these suggestions.

The total Motor Transport Branch support fleet of 301 vehicles (Table I-1) then could consist of 18 conventional passenger vans, 155 BEVs, and 128 PHEVs. The vehicle summary shows sufficient time for charging at the base location during the course of the day. These stations also provide charging opportunities for the visiting public, whose fees may assist in offsetting operating costs.

Intertek suggests further mission evaluation be given to the balance of the support vehicles when considering the adoption of BEVs and PHEVs. Additional BEVs may be possible with further management or fleet software attention; however, fleet managers typically desire vehicles that support longer trips.

I.3.4 Motor Transport Branch Support Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of the Motor Transport Branch support vehicle fleet with 155 BEVs and 128 PHEVs. No available PHEVs at the time of this writing provide for DC fast charging nor do the data suggest that this would be a significant benefit for PHEVs in the support vehicle fleet. Additional charging of BEVs during the day is not a requirement nor would DCFCs be required. The majority of the support vehicle activity occurs during daytime hours, which leaves significant time during the nighttime hours for recharging.

As noted above, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs can be accomplished using AC Level 1 charging. Opportunity charging at intermediate stops obtains the 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. 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. JBLM will gain experience in this management as the PEV fleet grows.

I.4 Motor Transport Branch Transport Vehicles Analysis

Transport vehicles are typically light- or heavy-duty motor vehicles for use in cargo transportation and typically not for personnel transport. Transport missions can vary by agency, location, and jurisdiction and for Motor Transport Branch, the transport vehicles include pickup trucks, heavy-duty trucks, passenger vans, and cargo vans. Although there are currently no PEVs available to replace heavy-duty trucks and passenger vans, it is assumed that the usage of all these transport vehicles can be of value in considering the remaining transport vehicles in the Motor Transport Branch fleet. The other vehicles may be replaced by currently available PEVs.

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

I.4.1 Summary for Motor Transport Branch Transport Vehicles

Appendix E provides the vehicle data sheets for each of the transport vehicles monitored. This section aggregates data for all transport vehicles. Table I-8 summarizes pool travel during the study period for those days in which the vehicle was driven. Vehicle use occurred primarily between 0600 and 1700 hours

daily. They traveled 1,803 miles, logged 148 hours, and idled for 77 hours during the 63-day study period.

Table I-8. Pool vehicles travel summary.

Transport Vehicles Travel Summary				
	Per Day Average/Peak	Per Outing Average/Peak	Per Trip Average/Peak	Total
Travel Distance (Miles)	53.0/393.8	22.9/393.8	6.5/142.5	1,803
Travel Time (Minutes)	237.9/669.0	102.5/673.0	29.2/218.0	8,090
Idle Time (Minutes)	136.6/NA	58.8/NA	16.8/NA	4,643

Figure I-14 shows the travel summary for transport vehicles: by vehicle, by daily mileage, and daily usage time. Figure I-15 shows the composite history for all transport vehicles. In these stacked bar charts, the contribution of each vehicle is indicated by a different color. Note that vehicles G71-0062G (logger 17), G71-0674A (logger 89), G43-25839 (logger 114), and G82-0509A (logger 118) failed to report sufficient data for analysis.

I.4.2 Transport Vehicles Daily Summary

The average travel distance per day when driven for transport vehicles is 53.0 miles. On 72% of vehicle travel days, the daily travel is less than the 70 miles considered to be within the BEV safe range (blue and green bars in Figure 31). That is, while BEV range can vary based on several factors; most BEVs provide at least 70 miles of vehicle range on a single battery charge. Meanwhile, 69% of vehicle travel days are less than 40 miles considered to be within the CD range of a PHEV (green bars of Figure 31).

Figure I-15 suggests that vehicles are used rather infrequently but it is noted that four of the six transport vehicles failed to provide sufficient data for analysis. This is most likely due to infrequent use because there were a few data points logged.

Figure I-16 displays the summary of use by time of day for all transport vehicles. Figure I-17 shows the outings for all vehicles.

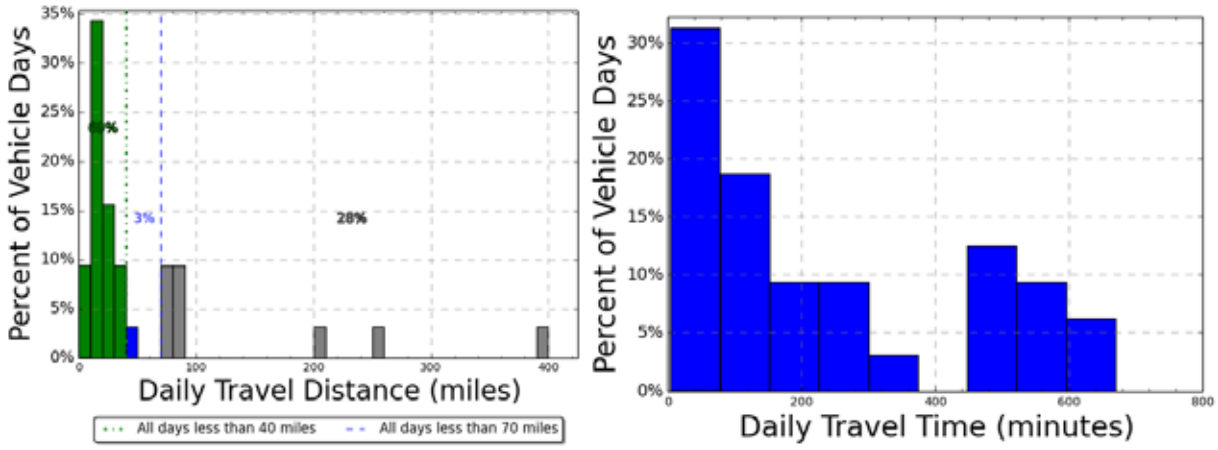


Figure I-14. Motor Transport Branch transport vehicle daily travel miles and time (all vehicles).

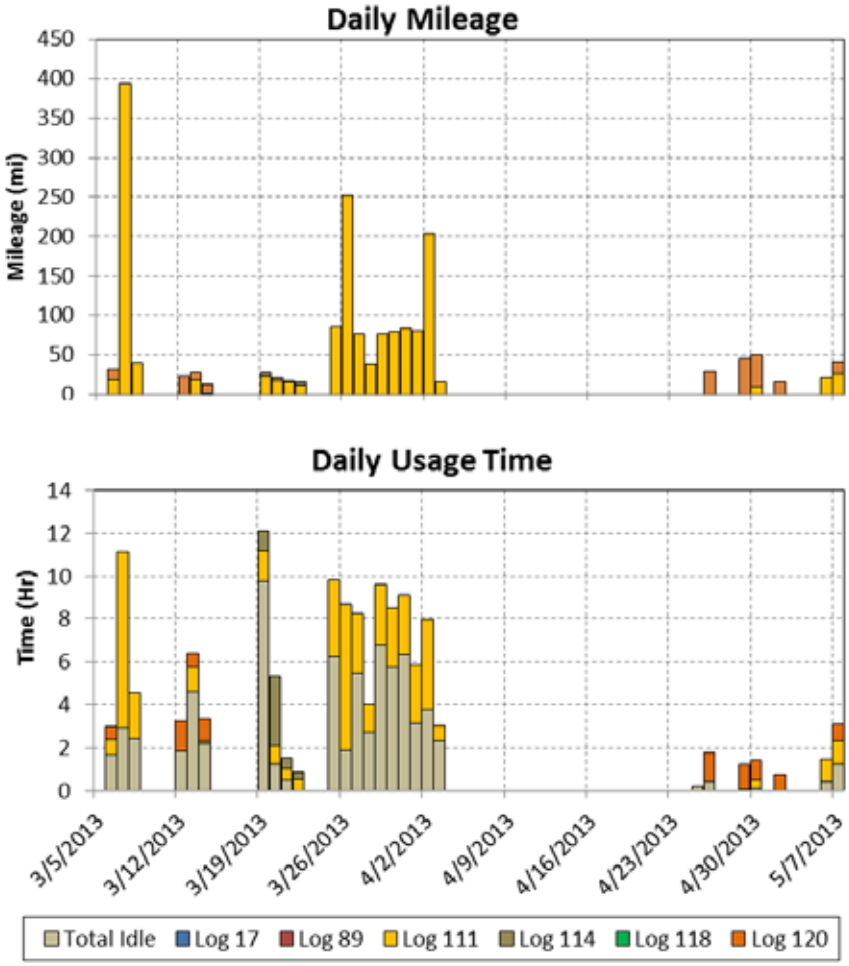


Figure I-15. Motor Transport Branch transport vehicles travel history (all vehicles).

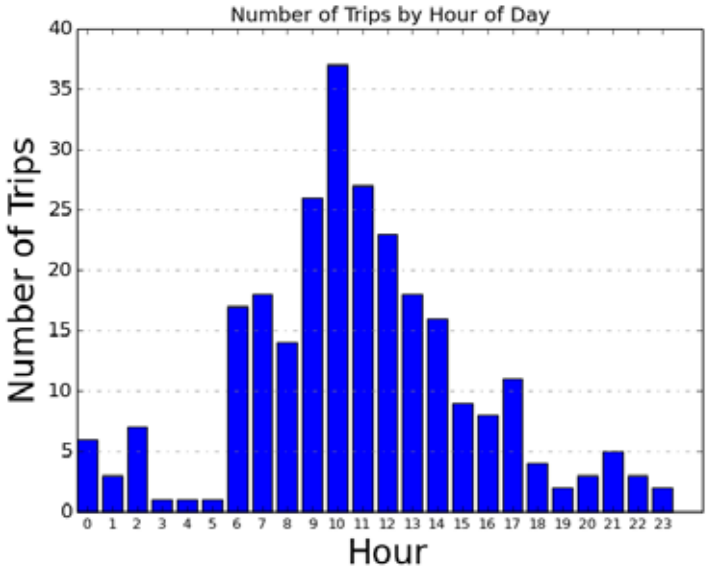


Figure I-16. Motor Transport Branch transport vehicles hourly usage.

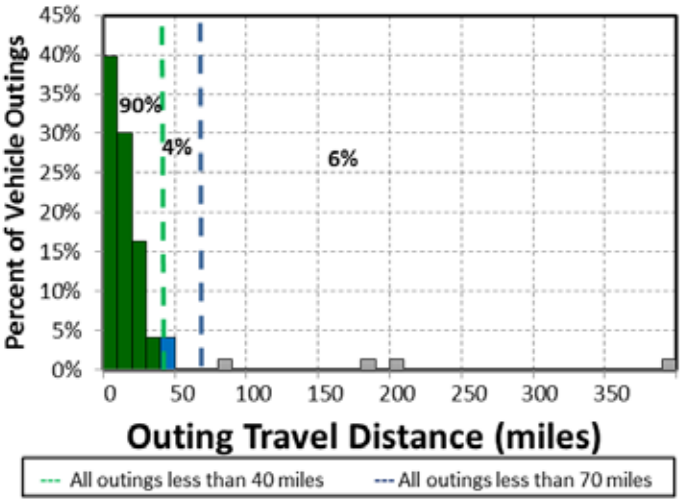


Figure I-17. Motor Transport Branch transport vehicle combined outings.

Appendix E provides the details of each of the transport vehicle's outings. Pickup truck #111 (Vehicle G63-3881H) was used on the three longest outings noted above.

The average travel outing when driven for transport vehicles is 22.9 miles. Meanwhile, 90% percent of transport outings are less than 40 miles considered to be within the CD range of a PHEV.

I.4.3. Motor Transport Branch Transport Vehicle Observations/Summary

There appear to be three choices for JBLM in implementing PEVs into the Motor Transport Branch transport fleet. There are no current PEV replacements for heavy-duty trucks. However, the monitored Motor Transport Branch transport fleet does contain two conventional pickup trucks and two conventional cargo-vans for which suitable PEVs may be found. The observations here relate to these four vehicles monitored and to the balance of the transport fleet (Table I-1) assuming the travel of the monitored vehicles is typical.

As noted before, the optimum goal would be to incorporate as many BEVs as possible to realize the advantages of reduced petroleum usage and reduced emissions of GHG.

1. All BEV fleet: While some BEV manufacturers report vehicle range exceeding 70 miles, Intertek recommends careful evaluation of experienced range to ensure vehicle missions are accomplished. Nevertheless, assuming the 70-mile safe range for a BEV, an all-BEV fleet is not possible for transport vehicles due to the long distances experienced by some of these vehicles.
2. Mixed BEV/PHEV fleet: Certainly, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. The data reveal that on 69% of all vehicle travel days, the total daily travel is less than 40 miles, which typically is the maximum distance a PHEV will travel in CD mode. This represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Furthermore, 90% of the outings are less than 40 miles and could be completed in CD mode if the battery is fully charged prior to the outing.

   It is noted that 72% of all travel days and 94% of all outings are less than 70 miles. This would support travel by BEVs. For the days where the 70 miles are exceeded, intermediate charging locations typically provide the recharge necessary to increase the all-electric drive. There are significant quantities of public charging stations locally but they cannot be assured to be available when needed. Thus, consideration should be given to home base charging only. Additional charging during the day at the home base between outings would add daily range. Incorporation of BEVs into the fleet will require management attention to ensure appropriate deployment based upon the need and expected distance to be driven.

3. All PHEV fleet: As noted above, PHEVs can accomplish the same mission as the current fleet when only considering travel times and distances. Replacing all current vehicles with PHEVs only requires an evaluation of the individual vehicle capabilities of currently available PHEVs to meet current transport requirements. Data show that for up to 69% of all travel days, the PHEV will operate in CD mode. As above, this represents a significant operating cost savings opportunity while retaining the ability to go longer distances when needed. Intermediate charging opportunities provide additional benefit, enhancing the pure-electric mode. Data show significant charging opportunities throughout the day during stop times.

While it would appear that PEVs are suitable replacements for these four transport vehicles, additional mission analysis and management input is required. The missions of these vehicles likely include considerations other than mileage, such as cargo demands placed on the vehicle. While the data show only 28% of daily travel requires the longer-range capabilities of a PHEV, fleet managers typically desire greater conservatism in maintaining vehicle capabilities. Thus, it is assumed that of the vehicles monitored, the two heavy-duty trucks remain ICE vehicles and the remaining 4conventional vehicles be replaced by two suitable styled BEV and two PHEVs. See Section 5 for these suggestions.

The total Motor Transport Branch transport fleet of 204 vehicles (Table I-1) then would retain the 73 conventional heavy-duty trucks and 16 conventional passenger vans with the balance consisting of 58 BEVs and 57 PHEVs.

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.

I.4.4 Motor Transport Branch Transport Vehicle Charging Needs

Upon review of these data, Intertek suggests replacement of the Motor Transport Branch transport fleet with 58 BEVs and 57 PHEVs is possible while retaining the heavy-duty trucks and passenger vans unchanged for now.

As noted previously, AC Level 2 overnight charging of BEVs is typical, whereas overnight charging of PHEVs uses the AC Level 1 outlet.

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. 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 EV Mode.

At times, fleet vehicles obtain benefit from using public charging infrastructure. Figure 18 displays the availability of public charging at the time of this writing for the JBLM area. This may be of benefit for local travel but availability of public EVSE cannot be assured and is not considered as part of this evaluation.

I.5 Motor Transport Branch Vehicles Mileage

The vehicle annual miles factor into the calculations for replacement of vehicles as noted in Section 5 and Appendix I. The actual miles measured during the study are extrapolated to identify calculated annual miles in the study. JBLM has also provided vehicle information that identifies the average monthly miles and vehicle mileage in April 2012. Table I-9 shows these values and calculations with the study-extrapolated miles in the far right column.

Table I-9. Motor Transport Branch vehicle mileage.

Vehicle Mileage						
Logger No.	Fleet Vehicle Id	Year	Odometer	Monthly Miles	Calculated Annual Miles	Study-Extrapolated Miles
6	G43-0875K	2010	22,120	1,271	15,252	3,848
7	G41-1288A	2004	14,988	57	684	699
8	G43-4937A	2004	32,153	320	3,840	682
9	G10-7664F	2008	13,532	118	1,416	904
10	G41-65991	2002	25,797	618	7,416	17,935
11	G11-2676G	2008	36,779	641	7,692	1,092
12	G43-3717A	2004	42,046	633	7,596	1,009
13	G11-0678K	2010	6,142	511	6,132	4,129
14	G62-4526H	2009	42,820	1,002	12,024	6,246
15	G42-0698K	2011	24,958	8	96	23,110
16	G11-0493L	2012	16,394	1,168	14,016	20,806
17	G71-0062G	2008	8,825	157	1,884	9,160
18	G62-1094L	2011	10,898	544	6,528	3,237
19	G41-1395G	2008	17,133	304	3,648	1,287
20	G61-1155D	2006	35,868	436	5,232	3,094
81	G10-2878L	2011	8,387	484	5,808	4,331
84	G41-1100K	2010	6,618	161	1,932	3,320
85	G62-0979G	2008	33,544	329	3,948	6,474
89	G71-0674A	2004	39,319	358	4,296	9,160
93	G41-1373G	2008	53,689	917	11,004	22,879
97	G41-1367G	2008	24,556	337	4,044	3,951
101	G43-0792K	2010	30,768	963	11,556	9,173
102	G43-0801K	2010	29,320	898	10,776	10,323
104	G42-0988F	2007	39,860	758	9,096	13,870
105	G43-0860G	2008	44,561	810	9,720	7,970
106	G43-1389K	2010	21,661	730	8,760	18,648
107	G41-1180G	2008	54,615	947	11,364	1,696
108	G11-2675G	2008	6,079	106	1,272	926
109	G43-1191L	2011	14,450	682	8,184	8,652
110	G12-0662H	2010	Not avail.	Not avail.	Not avail.	10,701
111	G63-0271A	2004	50,997	318	3,816	9,164
112	G41-1392G	2008	33,655	556	6,672	4,876
113	G43-3881H	2009	27,665	595	7,140	20,682
114	G43-25839	2003	25,189	401	4,812	9,160
115	G41-1376G	2008	24,197	257	3,084	1,437
116	G41-1161G	2008	8,333	143	1,716	1,877
117	G43-0790K	2010	25,231	813	9,756	NA
118	G82-0509A	2004	6,416	15	180	NA
119	G10-6379L	2011	12,953	632	7,584	9,743
120	G42-3471A	2005	27,858	269	3,228	1,170

For the entire Motor Transport Branch fleet, the average monthly miles traveled are 527 miles for average annual travel of 6,328 miles. In general, there is good correlation between the JBLM provided averages and the study calculated annual mileage. The JBLM provided mileage information will be used in the calculations when available except for logger #15 where the study information appears more reasonable. JBLM information shows extremely low utilization but this vehicle logged more time and miles than any other vehicle in the study. The vehicle data sheet for this vehicle in Appendix E identifies some data issues with respect to travel and idle time but miles recorded appear to be accurate.

I.6 Public Works Group Vehicle Utilization

Vehicle utilization is an important factor in the evaluation of vehicles both from an inventory perspective and for charging availability. Table I-10 identifies the percent utilization of the vehicle considering all days used during the study period. Since most travel occurred during weekdays, only the 45 weekdays in the 63-day study period are considered. In the event that the vehicle was used for more than these 45 days, the percent utilization is considered 100%.

The average daily usage of each vehicle is identified in the Appendix E data sheets. It is also shown here for completeness.

In general, the vehicles are used on frequent days but average usage per day is quite low. For example, the average vehicle is used on two out of three days but only two hours, 20 minutes each day. As above, the pickup truck with logger 15 showed very high utilization. The vehicle data sheet in Appendix E identifies potential issues with the time data but mileage appeared to be correct.

I.7 Motor Transport Branch Summary

This study provides observations for both the vehicles monitored and for the entire non-tactical fleet of vehicles identified with the Motor Transport Branch. The study indicates that PEVs offer alternatives to vehicles in the existing 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 eight sedans, five minivans, Three SUVs, six cargo vans, seven passenger vans, nine pickup trucks, and two heavy-duty trucks, all conventional ICE based. Based on the travel data, Intertek suggests that retaining the passenger vans and heavy-duty trucks and that replacing the remaining vehicles with 13 PHEVs and 18 BEVs would meet current mission requirements. Section 5 identifies potential replacement PEVs and Appendix M provides specific recommendations.

The Motor Transport Branch full fleet of vehicles contains 1060 vehicles. Intertek suggests retaining the 4 conventional specialty vehicles, 202 conventional passenger vans, 56 conventional buses, and 73 conventional heavy-duty trucks for now and also suggests a fleet of 409 BEVs and 316 PHEVs conservatively meets the balance of vehicle travel requirements.

With the potential replacement by PEVs established, Section 5 and Appendix I 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 Motor Transport Branch. Those observations will be addressed in Task 4 of this project.

Table I-10. Vehicle utilization.

Logger	Vehicle	Mission	Vehicle Class	Percent Days Used	Avg Daily Travel Time (Hrs)
6	G43-0875K	PL	Van - Cargo	76%	3.7
7	G41-1288A	PL	Pickup	98%	0.3
8	G43-4937A	PL	Van - Cargo	20%	1.4
9	G10-7664F	PL	Sedan - Compact	56%	0.4
10	G41-65991	PL	Pickup	89%	2.0
11	G11-2676G	PL	Sedan - Large	33%	0.7
12	G43-3717A	PL	Van - Cargo	29%	0.8
13	G11-0678K	SU	Sedan - Large	87%	1.0
14	G62-4526H	SU	SUV	91%	1.8
15	G42-0698K	SU	Pickup	100%	15.5
16	G11-0493L	SU	Sedan - Large	100%	7.9
17	G71-0062G	TR	Truck HD	No Data	No Data
18	G62-1094L	SU	SUV	67%	0.8
19	G41-1395G	PL	Minivan	82%	0.4
20	G61-1155D	PL	SUV	53%	0.8
81	G10-2878L	PL	Sedan - Midsize	82%	1.9
84	G41-1100K	PL	Minivan	62%	0.7
85	G62-0979G	PL	Pickup	73%	1.6
89	G71-0674A	TR	Van - Cargo	No Data	No Data
93	G41-1373G	SU	Pickup	100%	2.9
97	G41-1367G	PL	Pickup	100%	1.2
101	G43-0792K	PL	Van - Pass	98%	2.1
102	G43-0801K	PL	Van - Pass	76%	2.4
104	G42-0988F	SU	Van - Cargo	89%	3.1
105	G43-0860G	PL	Van - Pass	91%	2.3
106	G43-1389K	PL	Van - Pass	76%	3.0
107	G41-1180G	SU	Minivan	36%	0.7
108	G11-2675G	PL	Sedan - Large	18%	0.8
109	G43-1191L	PL	Van - Pass	82%	2.0
110	G12-0662H	PL	Sedan - Midsize	60%	1.6
111	G63-0271A	TR	Pickup	49%	5.2
112	G41-1392G	SU	Minivan	44%	1.8
113	G43-3881H	PL	Van - Pass	76%	4.3
114	G43-25839	TR	Pickup	No Data	No Data
115	G41-1376G	SU	Pickup	67%	0.5
116	G41-1161G	PL	Minivan	64%	0.7
117	G43-0790K	PL	Van - Pass	No Data	No Data
118	G82-0509A	TR	Truck HD	No Data	No Data
119	G10-6379L	SU	Sedan - Midsize	42%	2.1
120	G42-3471A	TR	Van - Cargo	22%	1.7
			Average	68%	2.3

Appendix J

Greenhouse Gas Emissions Avoided and fuel Cost Reduction Analysis – 6th MP Group

J.1 Replacement PEVs for 6th MP Group

Section 4.1 provided the analysis results for the 6th MP Group vehicles monitored during the study period based upon the data recorded and reported in the vehicle data sheets found in Appendix B. The pool vehicles in this study included one SUV, one minivan, and one pickup truck. Section 3 identifies PEVs currently or soon to be available as potential replacements. For the study, PEV replacements are based upon vehicle class. The observations of Section 4.1.2.3 suggest that replacing these three vehicles with one PHEV and two BEVs would meet current mission requirements. Specific vehicle cargo requirements have not been specified and thus were not considered in these replacement suggestions.

Table J-3. JBLM 6th MP Group PEV replacements.

Vehicle Replacements						
	Current Vehicle			PEV Replacement		
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model	Mission
82	GMC	Terrain	SUV	Toyota	RAV4 EV	Pool
86	Ford	Ranger	Pickup Truck	Via Motors	VTRUX PU	Pool
103	Dodge	Grand Caravan	Minivan	Nissan	Leaf	Pool

Section 5 provides the methodology and assumptions for the calculations for the reduction in GHG and fuel costs. The miles recorded by vehicles during the 63-day study are 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 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 the ICE.

J.2 Monitored Vehicle Fuel Cost Reduction

Table J-2 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions. As noted in Section 5, both the local cost of fuel and the national average are used for comparisons.

Because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Section 5 summarizes these values.

An example calculation for logger 86 follows: The JBLM reported annual miles for this vehicle is 2,388 miles. The suggested replacement PEV is a PHEV. The Appendix B daily travel percentage for this vehicle less than 40 miles is 92% so annual miles CD mode is 2,197 miles. EPA fuel economy for this vehicle is 23 MPG implying 96 gallons of gasoline are unused. Washington State cost for gasoline is $4.009/gallon for an annual cost of $383. The replacement PEV requires 475 Wh/mi so 1,044 kWh are required for recharging the battery. Local power cost is $0.02783/kWh, resulting in annual electric cost of $29. The savings are $354 for a 92% reduction in fuel cost.

Table J-4. Monitored vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
82	G61-0546L	Rav4	100%	7,392	389	$ 1,560	$ 91	$ 1,469	94%
86	G61-0689A	VTRUX PU	92%	2,197	96	$ 383	$ 29	$ 354	92%
103	G41-5433B	Leaf	100%	7,476	374	$ 1,499	$ 62	$ 1,436	96%
Total				17,065	859	$ 3,442	$ 182	$ 3,259	95%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red Nat %
82	G61-0546L	Rav4	100%	7392	389	$ 1,431	$ 423	$ 1,008	70%
86	G61-0689A	VTRUX PU	92%	2197	96	$ 351	$ 136	$ 216	61%
103	G41-5433B	Leaf	100%	7476	374	$ 1,375	$ 292	$ 1,084	79%
Total				17,065	859	$ 3,157	$ 851	$ 2,308	73%

J.3 Monitored Vehicle GHG Reduction

Table J-3 identifies the reduction in GHG projected when replacing the current vehicles with PEVs. The calculated miles in CD mode are also used in the calculation of GHG reduction. As noted in Section 5, the emissions from burning gasoline is known and the emissions from the use of electricity is dependent upon the power generation mix that is used to recharge the PEV battery. As before, both the local power production emission figures and the national average are used for comparisons.

Because Tacoma Power 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 J-5. Monitored vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
82	G61-0546L	SUV	Rav4	7,820	567	7,253	93%
86	G61-0689A	Pickup	VTRUX PU	1,920	182	1,738	91%
103	G41-5433B	Minivan	Leaf	7,513	391	7,122	95%
Total				17,253	1,140	16,113	93%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
82	G61-0546L	SUV	Rav4	7,820	4,976	2,844	36%
86	G61-0689A	Pickup	VTRUX PU	1,920	1,597	323	17%
103	G41-5433B	Minivan	Leaf	7,513	3,432	4,082	54%
Total				17,253	10,005	7,249	42%

An example calculation for logger 86 follows: As shown above, the annual miles CD mode is 2,388 miles and 95.5 gallons of gasoline are unused. Internal combustion vehicles produce 20.1 lb-CO2e/gallon so the annual emissions for the monitored vehicle are 1,920 lb-CO2e. Tacoma Power produces 0.1743 lb-CO2e/kWh. As above, 1,044 kWh are required for recharging the battery, resulting in 182 lb-CO2e. The savings are 1,738 lb-CO2e for a 91% reduction in GHG emission.

J.4 6th MP Group full Fleet Evaluation

Table 8 in Section 4.1.1 identifies 20 vehicles in the 6th MP Group fleet. Aside from the passenger van for which no PEV replacement is currently available, Intertek suggests a fleet of 12 BEVs and seven PHEVs conservatively meet vehicle travel requirements.

4 Nissan Leafs, 4 RAV4 EVs and 4 Ford Focus Electric vehicles are assumed to be appropriate BEVs and 2 Mitsubishi Outlander PHEVs, 1 Chevrolet Volt and 4 Via Motors VTRUX pickups are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Table J-4 below and summarized in Section 5.

Table J-6. 6th MP Group full fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red Nat %
87,191	$ 17,779	$ 936	$ 16,843	95%	$ 16,316	$ 4,374	$ 11,941	73%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction Nat %
87,191	58,658	3,995	54,663	93%	35,065	23,593	40%

J.5 6th MP Group Summary

Table J-5 provides the average values for all monitored vehicles belonging to the 6th MP Group.

Table J-7. 6th MP Group monitored vehicles average values.

Average Logged Vehicles	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
	5,688	286	$ 1,147	$ 61	$ 1,086	95%

Average Logged Vehicles	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
	5,751	380	5,371	93%

Table J-5 shows that there is a significant opportunity for savings not only in fuel costs but also in GHG emissions with the deployment of PEVs in this fleet.

Appendix K

Greenhouse Gas Emissions Avoided and fuel Cost Reduction Analysis – DCA Support Group

K.1 Replacement PEVs for DCA Support Group

Section 4.2 provided the analysis results for the DCA Support Group vehicles monitored during the study period based upon the data recorded and reported in the vehicle data sheets found in Appendix C. Both pool and support missions are identified for these vehicles.

The vehicles in this study included one pickup truck, one heavy-duty pickup truck, one passenger van and one cargo van. Section 3 identifies PEVs currently or soon to be available as potential replacements. There are currently no PEV replacement suggestions for heavy-duty pickup trucks or passenger vans. However, as noted in Section 4.2.1.3, the results for the HD truck can apply for other vehicles in the fleet so a replacement PHEV cargo van is suggested. For the study, PEV replacements are based upon vehicle class. The observations of Section 4.2.1.3 suggest that replacing these three vehicles with two PHEVs and one BEV would meet current mission requirements. Specific vehicle cargo requirements have not been specified and thus were not considered in these replacement suggestions.

Section 5 provides the methodology and assumptions for the calculations for the reduction in GHG and fuel costs. The miles recorded by vehicles during the 63-day study are extrapolated into annual miles. If the PEV replacing the monitored vehicle is a BEV, all annual miles are powered from the battery. If the PEV is a PHEV, the percentage of miles that are less than 40 miles per day recorded by the monitored vehicles (Appendix C) 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 the ICE.

Table K-8. JBLM DCA Support Group PEV replacements.

	Vehicle Replacements					
	Current Vehicle			PEV Replacement		
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model	Mission
83	Ford	Ranger	Pickup Truck	Via Motors	VTRUX PU	Support
94	Chevrolet	C6500 Stake	Pickup HD	Via Motors	VTRUX Van	Pool
96	Chevrolet	15 Pas Van	Passenger Van	NA	NA	Support
99	Chevrolet	G1300	Cargo Van	Nissan	eNV200	Pool

K.2 Monitored Pool Mission Vehicle Reductions

K.2.1 Monitored Pool Mission Vehicle Fuel Cost Reduction

Table K-2 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the pool vehicles. As noted in Section 5, both the local cost of fuel and the national average are used for comparisons.

Because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Table K-9. Monitored pool vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
94	G71-0684A	VTRUX Van	100%	1,440	103	$ 412	$ 19	$ 393	95%
99	G42-0289G	eNV200	100%	1,836	131	$ 525	$ 20	$ 505	96%
Total				3,276	234	$ 937	$ 39	$ 898	96%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red Nat %
94	G71-0684A	VTRUX Van	100%	1,440	103	$ 378	$ 89	$ 289	77%
99	G42-0289G	eNV200	100%	1,836	131	$ 482	$ 95	$ 387	80%
Total				3,276	234	$ 860	$ 184	$ 676	79%

Section 5 summarizes these values.

An example calculation for logger 94 follows: The JBLM reported annual miles for this vehicle is 1,440 miles. The suggested replacement PEV is a PHEV. The Appendix C daily travel percentage for this vehicle less than 40 miles is 100% so annual miles CD mode is 1,440 miles. EPA fuel economy for this vehicle is 14 MPG implying 102.9 gallons of gasoline are unused. Washington State cost for gasoline is $4.009/gallon for an annual cost of $412.35. The replacement PEV requires 475 Wh/mi so 684 kWh are required for recharging the battery. Local power cost is $0.02783/kWh, resulting in annual electric cost of $19. The savings are $393 for a 95% reduction in fuel cost.

K.2.2 Monitored Pool Mission Vehicle GHG Reduction

Table K-3 identifies the reduction in GHG projected when replacing the current pool vehicles with PEVs. The calculated miles in CD mode are also used in the calculation of GHG reduction. As noted in Section 5, the emissions from burning gasoline is known and the emissions from the use of electricity is dependent upon the power generation mix that is used to recharge the PEV battery. As before, both the local power production emission figures and the national average are used for comparisons.

Because Tacoma Power 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 K-10. Monitored vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
94	G71-0684A	Truck HD	VTRUX Van	2,067	119	1,948	94%
99	G42-0289G	Van - Cargo	eNV200	2,636	128	2,508	95%
Total				4,703	247	4,456	95%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction Nat %
94	G71-0684A	Truck HD	VTRUX Van	2,067	1,046	1,021	49%
99	G42-0289G	Van - Cargo	eNV200	2,636	1,124	1,512	57%
Total				4,703	2,170	2,533	54%

Section 5 summarizes these figures.

An example calculation for logger 94 follows: As shown above, the annual miles CD mode is 1,440 miles and 102.9 gallons of gasoline are unused. Internal combustion vehicles produce 20.1 lb-CO2e/gallon so the annual emissions for the monitored vehicle are 2,067 lb-CO2e. Tacoma Power produces 0.1743 lb-CO2e/kWh. As above, 684 kWh are required for recharging the battery, resulting in 119 lb-CO2e. The savings are 1,948 lb-CO2e for a 94% reduction in GHG emission.

K.2.3 DCA Support Group full Pool Mission Fleet Evaluation

Table 12 in Section 4.2 identifies 12 vehicles in the DCA support Group pool fleet. Aside from the passenger vans, heavy-duty trucks and the bus for which no PEV replacement is currently available, Intertek suggests a fleet of four BEVs and two PHEVs conservatively meet the other vehicle travel requirements.

Two RAV4 EVs and two eNV200s are assumed to be appropriate BEVs while one Via Motors VTRUX pickup and one VTRUX Van are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Table K-4 below.

Table K-11. DCA Support Group full pool fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction National %
14,926	$ 3,766	$ 182	$ 3,583	95%	$ 3,456	$ 852	$ 2,604	75%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction Nat %
14,926	18,880	1,142	17,738	94%	10,024	8,856	47%

Section 5 also summarizes these values.

K.3 Monitored Support Mission Vehicle Reductions

K.3.1 Monitored Support Mission Vehicle Fuel Cost Reduction

Table K-5 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the support vehicles.

As before, because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Table K-12. Monitored support vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
83	G41-74299	VTRUX PU	98%	2940	128	$ 512	$ 39	$ 474	92%
96	G43-1195H	NA	0%	0	0	$ -	$ -	$ -	0%
Total				2,940	128	$ 512	$ 39	$ 474	93%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red Nat %
83	G41-74299	VTRUX PU	98%	2940	128	$ 470	$ 182	$ 289	61%
96	G43-1195H	NA	0%	0	0	$ -	$ -	$ -	0%
Total				2,940	128	$ 470	$ 182	$ 289	61%

Section 5 summarizes these values.

K.3.2 Monitored Support Mission Vehicle GHG Reduction

Table K-6 identifies the reduction in GHG projected when replacing the current support mission vehicles with PEVs.

As before, because Tacoma Power 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 K-13. Monitored support vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
83	G41-74299	Pickup	VTRUX PU	2,569	243	2,326	91%
96	G43-1195H	Van - Pass	NA	0	0	0	0%
Total				2,569	243	2,326	91%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction Nat %
83	G41-74299	Pickup	VTRUX PU	2,569	2,137	432	17%
96	G43-1195H	Van - Pass	NA	0	0	0	0%
Total				2,569	2,137	432	17%

Section 5 summarizes these figures.

K.3.3 DCA Support Group Full Support Fleet Evaluation

Table 12 in Section 4.2 identifies 40 vehicles in the DCA support Group support mission fleet. Aside from the passenger vans and heavy-duty trucks for which no PEV replacement is currently available, Intertek suggests a fleet of 20 BEVs and 12 PHEVs conservatively meet the other 32 vehicle travel requirements.

Seven RAV4 EVs, four Focus Electrics, four Leafs, and five eNV200s are assumed to be appropriate BEVs while 2 Volts, 4 Via Motors VTRUX pickups, 3 Outlander PHEVs, and three VTRUX Vans are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Table K-7 below.

Table K-14. DCA Support Group full support fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction National %
127,545	$ 29,564	$ 1,431	$ 28,134	95%	$ 27,131	$ 6,683	$ 20,447	75%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction Nat %
127,545	148,227	8,961	139,266	94%	78,657	69,570	47%

Section 5 also summarizes these values.

K.4 Full DCA Support Group Full Fleet Summary

The full DCA Support Group fleet includes the above two missions. The projected results for both mission groups are shown in Table K-8 below and summarized in Section 5.

Table K-15. DCA Support Group full fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost National	Annual Fuel Savings National	Annual Fuel Reduction National %
142,471	$ 33,330	$ 1,613	$ 31,717	95%	$ 30,587	$ 7,535	$ 23,051	75%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction Nat %
142,471	167,107	10,103	157,004	94%	88,681	78,426	47%

K.5 DCA Support Group Summary

Table K-9 provides the average values for all monitored vehicles belonging to the DCA Support Group.

Table K-16. DCA Support Group monitored vehicles average values.

Average Logged Vehicles	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
	2,072	121	$ 483	$ 26	$ 457	95%

Average Logged Vehicles	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
	2,424	163	2,261	93%

Table K-9 shows that there is a significant opportunity for savings not only in fuel costs but also in GHG emissions with the deployment of PEVs in this fleet.

Appendix L

Greenhouse Gas Emissions Avoided and fuel Cost Reduction Analysis – Public Works Group

L.1 Replacement PEVs for Public Works Group

Section 4.3 provided the analysis results for the Public Works Group vehicles monitored during the study period based upon the data recorded and reported in the vehicle data sheets found in Appendix D. Both pool and support missions are identified for these vehicles. Transport functions are identified for the whole fleet although no vehicles with this mission were monitored.

The vehicles in this study included nine pickup trucks, two minivans, and three passenger vans. Section 3 identifies PEVs currently or soon to be available as potential replacements. There are currently no PEV replacement suggestions for passenger vans. For the study, PEV replacements are based upon vehicle class. Specific vehicle cargo requirements have not been specified and thus were not considered in these replacement suggestions.

Section 5 provides the methodology and assumptions for the calculations for the reduction in GHG and fuel costs. The miles recorded by vehicles during the 63-day study are extrapolated into annual miles. If the PEV replacing the monitored vehicle is a BEV, all annual miles are powered from the battery. If the PEV is a PHEV, the percentage of miles that are less than 40 miles per day recorded by the monitored vehicles (Appendix D) 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 the ICE.

Table L-17. JBLM Public Works Group PEV replacements.

Vehicle Replacements						
	Current Vehicle			PEV Replacement		
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model	Mission
1	Ford	F150	Pickup	Via Motors	VTRUX PU	Pool
2	Ford	F150	Pickup	Toyota	Rav4	Pool
3	Ford	E450	Van - Pass	NA	NA	Pool
4	Chevrolet	G3500	Van - Pass	NA	NA	Pool
5	Ford	F350	Pickup	Toyota	Rav4	Support
84	Dodge	GR Caravan	Minivan	Mitsubishi	Outlander	Pool
87	Chevrolet	C1500	Pickup	Toyota	Rav4	Pool
88	Dodge	GR Caravan	Minivan	Nissan	Leaf	Pool
90	Chevrolet	C2500HD	Pickup	Nissan	eNV200	Support
91	Chevrolet	C3500	Pickup	Toyota	Rav4	Support
92	Chevrolet	G1300	Van - Pass	NA	NA	Support
95	Ford	F350	Pickup	Via Motors	VTRUX PU	Support
98	Dodge	Dakota	Pickup	Toyota	Rav4	Support
100	Chevrolet	C1500	Pickup	Nissan	eNV200	Pool

NOTE: Vehicle 84 was reported as part of both the Public Works and Motor Transport Branch fleets. The analysis here includes this vehicle for completeness with this appendix but omits this vehicle from the Motor Transport Branch in fleet totals of Section 5.

L.2 Monitored Pool Mission Vehicle Reductions

The monitored vehicles with the pool mission contain four pickup trucks, two minivans and two passenger vans. As above, no replacement is suggested for the passenger vans. However, the observations of Section 4.3.2.3 suggest that replacing the other six vehicles with two PHEVs and four BEVs would meet current mission requirements.

L.2.1 Monitored Pool Mission Vehicle Fuel Cost Reduction

Table L-2 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the pool vehicles. As noted in Section 5, both the local cost of fuel and the national average are used for comparisons.

Because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Table L-18. Monitored pool vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
1	G42-0658K	VTRUX PU	78%	3641	228	$ 912	$ 48	$ 864	95%
2	G42-1054F	Rav4	100%	3130	196	$ 784	$ 38	$ 746	95%
3	G71-0133L	NA	0%	0	0	$ -	$ -	$ -	0%
4	G43-0944G	NA	0%	0	0	$ -	$ -	$ -	0%
84	G41-1100K	Outlander	96%	3187	168	$ 672	$ 39	$ 633	94%
87	G42-0619K	Rav4	100%	1956	115	$ 461	$ 24	$ 437	95%
88	G41-1180K	Leaf	100%	2580	136	$ 544	$ 22	$ 523	96%
100	G42-0610K	eNV200	100%	3144	185	$ 741	$ 35	$ 706	95%
Total				17,638	1,027	$ 4,116	$ 206	$ 3,910	95%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red Nat %
1	G42-0658K	VTRUX PU	78%	3641	228	$ 837	$ 224.83	$ 612	73%
2	G42-1054F	Rav4	100%	3130	196	$ 720	$ 179.04	$ 541	75%
3	G71-0133L	NA	0%	0	0	$ -	$ -	$ -	0%
4	G43-0944G	NA	0%	0	0	$ -	$ -	$ -	0%
84	G41-1100K	Outlander	96%	3187	168	$ 617	$ 182.31	$ 435	70%
87	G42-0619K	Rav4	100%	1956	115	$ 423	$ 111.88	$ 311	74%
88	G41-1180K	Leaf	100%	2580	136	$ 500	$ 100.62	$ 399	80%
100	G42-0610K	eNV200	100%	3144	185	$ 680	$ 163.49	$ 517	76%
Total				17,638	1,027	$ 3,777	$ 962	$ 2,815	75%

Section 5 summarizes these values.

An example calculation for logger 1 follows: The JBLM reported annual miles for this vehicle is 4,668 miles. The suggested replacement PEV is a PHEV. The Appendix D daily travel percentage for this vehicle less than 40 miles is 78% so annual miles CD mode is 3,641 miles. EPA fuel economy for this vehicle is 16 MPG implying 227.6 gallons of gasoline are unused. Washington State cost for gasoline is $4.009/gallon for an annual cost of $912. The replacement PEV requires 475 Wh/mi so 1,729 kWh are required for recharging the battery. Local power cost is $0.02783/kWh, resulting in annual electric cost of $48. The savings are $864 for a 95% reduction in fuel cost.

L.2.2 Monitored Pool Mission Vehicle GHG Reduction

Table L-3 identifies the reduction in GHG projected when replacing the current pool vehicles with PEVs. The calculated miles in CD mode are also used in the calculation of GHG reduction. As noted in Section 5, the emissions from burning gasoline is known and the emissions from the use of electricity is dependent upon the power generation mix that is used to recharge the PEV battery. As before, both the local power production emission figures and the national average are used for comparisons.

Because Tacoma Power 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 L-19. Monitored vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
1	G42-0658K	Pickup	VTRUX PU	4,574	301	4,273	93%
2	G42-1054F	Pickup	Rav4	3,932	240	3,692	94%
3	G71-0133L	Van - Pass	NA	0	0	0	0%
4	G43-0944G	Van - Pass	NA	0	0	0	0%
84	G41-1100K	Minivan	Outlander	3,372	244	3,127	93%
87	G42-0619K	Pickup	Rav4	2,313	150	2,163	94%
88	G41-1180K	Minivan	Leaf	2,729	135	2,594	95%
100	G42-0610K	Pickup	eNV200	3,717	219	3,498	94%
Total				20,637	1,290	19,347	94%
Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
1	G42-0658K	Pickup	VTRUX PU	4,574	2,646	1,928	42%
2	G42-1054F	Pickup	Rav4	3,932	2,107	1,825	46%
3	G71-0133L	Van - Pass	NA	0	0	0	0%
4	G43-0944G	Van - Pass	NA	0	0	0	0%
84	G41-1100K	Minivan	Outlander	3,372	2,146	1,226	36%
87	G42-0619K	Pickup	Rav4	2,313	1,317	996	43%
88	G41-1180K	Minivan	Leaf	2,729	1,184	1,545	57%
100	G42-0610K	Pickup	eNV200	3,717	1,924	1,793	48%
Total				20,637	11,324	9,313	45%

Section 5 summarizes these figures.

An example calculation for logger 1 follows: As shown above, the annual miles CD mode is 3,641 miles and 227.6 gallons of gasoline are unused. Internal combustion vehicles produce 20.1 lb-CO2e/gallon so the annual emissions for the monitored vehicle are 4,574 lb-CO2e. Tacoma Power produces 0.1743 lb-CO2e/kWh. As above, 1,729 kWh are required for recharging the battery, resulting in 301 lb-CO2e. The savings are 4,273 lb-CO2e for a 93% reduction in GHG emission.

L.2.3 Public Works Group full Pool Mission Fleet Evaluation

Table 18 in Section 4.3 identifies 107 vehicles in the Public Works Group pool fleet. Aside from the passenger vans, Intertek suggests a fleet of 57 BEVs and 15 PHEVs conservatively meet the other vehicle travel requirements.

A mix of 27 RAV4 EVs, 3 Leafs, 3 Focus Electrics, and 24 eNV200s are assumed to be appropriate BEVs while six Via Motors VTRUX pickups, four Outlander PHEVs, one Volt, and four VTRUX Vans are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the replacements offer the potential fuel cost reductions and GHG reductions shown in Table L-4 below.

Table L-20. Public Works Group full pool fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction National %
207,009	$ 49,821	$ 2,439	$ 47,382	95%	$ 45,720	$ 11,391	$ 34,329	75%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
207,009	249,788	15,273	234,515	94%	134,067	115,721	46%

Section 5 also summarizes these values.

L.3 Monitored Support Mission Vehicle Reductions

The monitored vehicles with the support mission contain five pickup trucks and one passenger van. As above, no replacement is suggested for the passenger van. However, the observations of Section 4.3.2.3 suggest that replacing the other five vehicles with one PHEV and four BEVs would meet current mission requirements.

L.3.1 Monitored Support Mission Vehicle Fuel Cost Reduction

Table L-5 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the support vehicles.

As before, because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Section 5 summarizes these values.

L.3.2 Monitored Support Mission Vehicle GHG Reduction

Table L-6 identifies the reduction in GHG projected when replacing the current support mission vehicles with PEVs.

As before, because Tacoma Power 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 L-21. Monitored support vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
5	G43-0822G	Rav4	100%	5724	358	$ 1,434	$ 70	$ 1,364	95%
90	G43-1892H	eNV200	100%	3672	230	$ 920	$ 41	$ 879	96%
91	G43-1961H	Rav4	100%	4920	308	$ 1,233	$ 60	$ 1,173	95%
92	G42-0505A	NA	0%	0	0	$ -	$ -	$ -	
95	G43-1155L	VTRUX PU	40%	2482	146	$ 585	$ 33	$ 552	94%
98	G41-1605L	Rav4	100%	1776	111	$ 445	$ 22	$ 423	95%
Total				18,574	1,152	$ 4,617	$ 226	$ 4,392	95%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red National %
5	G43-0822G	Rav4	100%	5724	358	$ 1,316	$ 327	$ 989	75%
90	G43-1892H	eNV200	100%	3672	230	$ 844	$ 191	$ 653	77%
91	G43-1961H	Rav4	100%	4920	308	$ 1,131	$ 281	$ 850	75%
92	G42-0505A	NA	0%	0	0	$ -	$ -	$ -	
95	G43-1155L	VTRUX PU	40%	2482	146	$ 537	$ 153	$ 384	71%
98	G41-1605L	Rav4	100%	1776	111	$ 408	$ 102	$ 307	75%
Total				18,574	1,152	$ 4,237	$ 1,055	$ 3,183	75%

Table L-22. Monitored support vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
5	G43-0822G	Pickup	Rav4	7,191	439	6,752	94%
90	G43-1892H	Pickup	eNV200	4,613	256	4,357	94%
91	G43-1961H	Pickup	Rav4	6,181	377	5,803	94%
92	G42-0505A	Van - Pass	NA	0	0	0	
95	G43-1155L	Pickup	VTRUX PU	2,934	205	2,729	93%
98	G41-1605L	Pickup	Rav4	2,231	136	2,095	94%
Total				23,150	1,414	21,736	94%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
5	G43-0822G	Pickup	Rav4	7,191	3,853	3,337	46%
90	G43-1892H	Pickup	eNV200	4,613	2,247	2,366	51%
91	G43-1961H	Pickup	Rav4	6,181	3,312	2,869	46%
92	G42-0505A	Van - Pass	NA	0	0	0	
95	G43-1155L	Pickup	VTRUX PU	2,934	1,804	1,131	39%
98	G41-1605L	Pickup	Rav4	2,231	1,196	1,035	46%
Total				23,150	12,412	10,738	46%

Section 5 summarizes these figures.

L.3.3 Public Works Group Full Support Fleet Evaluation

Table 18 in Section 4.3 identifies 117 vehicles in the Public Works Group support mission fleet. Aside from the passenger vans and heavy-duty trucks for which no PEV replacement is currently available, Intertek suggests a fleet of 67 BEVs and 17 PHEVs conservatively meet the other 84 vehicle travel requirements.

A mix of 30 RAV4 EVs and 37 eNV200s are assumed to be appropriate BEVs while seven Via Motors VTRUX pickups, seven Outlanders PHEVs, and three VTRUX Vans are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Table L-7 below.

Table L-23. Public Works Group full support fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction National %
331,344	$ 82,310	$ 3,934	$ 78,375	95%	$ 75,534	$ 18,377	$ 57,157	76%

Annual	Annual GHG	Annual PEV	Annual PEV	Annual GHG	Annual PEV	Annual PEV	Annual GHG
331,344	412,677	24,640	388,037	94%	216,286	196,391	48%

Section 5 also summarizes these values.

L.4 Public Works Transport Mission Vehicle Reductions

While no vehicles with the transport mission were monitored, an evaluation based upon other vehicle usage follows.

Table 18 in Section 4.3 identifies 25 vehicles in the Public Works transport mission fleet. Aside from the heavy-duty trucks for which no PEV replacement is currently available, Intertek suggests a fleet of four BEVs and four PHEVs conservatively meet the other eight vehicle travel requirements. Two RAV4 EVs and two eNV200s are assumed to be appropriate BEVs while four Via Motors VTRUX pickups are assumed to be appropriate PHEV replacements. Table L-8 provides the potential reductions from such replacements.

Table L-24. Public Works Group full transport fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost National	Annual Fuel Savings National	Annual Fuel Reduction National %
33,484	$ 9,249	$ 413	$ 8,837	96%	$ 8,488	$ 1,928	$ 6,560	77%

Annual	Annual GHG	Annual PEV	Annual PEV	Annual GHG	Annual PEV	Annual PEV	Annual GHG
33,484	46,374	2,585	43,788	94%	22,694	23,679	51%

L.5 Full Public Works Support Group Full Fleet Summary

The projected reductions for all mission groups in the Public Works fleet are shown in Table L-9 below and summarized in Section 5. This table assumes the specialty vehicle, the 52 passenger vans and 33 heavy-duty trucks remain along with 128 BVEVs and 36 PHEVs.

Table L-25. Public Works Group full fleet PEV replacement potential reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost National	Annual Fuel Savings National	Annual Fuel Reduction National %
571,837	$ 141,380	$ 6,786	$ 134,594	95%	$ 129,742	$ 31,696	$ 98,046	76%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
571,837	708,839	42,498	666,340	94%	373,047	335,791	47%

L.6 Public Works Group Summary

Table L-10 provides the average values for all monitored vehicles belonging to the Public Works Group.

Table L-26. Public Works Group monitored vehicles average values.

Average Logged Vehicles	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
	3,292	198	794	39	755	95%

Average Logged Vehicles	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
	3,981	246	3,735	94%

Table L-10 shows that there is a significant opportunity for savings not only in fuel costs but also in GHG emissions with the deployment of PEVs in this fleet.

Appendix M

Greenhouse Gas Emissions Avoided and fuel Cost Reduction Analysis – Motor Transport Branch

M.1 Replacement PEVs for Motor Transport Branch

Section 4.4 provided the analysis results for the Motor Transport Branch vehicles monitored during the study period based upon the data recorded and reported in the vehicle data sheets found in Appendix E. Pool, support, and transport missions are identified for these vehicles.

Forty vehicles were monitored in this study as identified in the individual sections below. Section 3 identifies PEVs currently or soon to be available as potential replacements. There are currently no PEV replacement suggestions for passenger vans or heavy-duty trucks. For the study, PEV replacements are based upon vehicle class. Specific vehicle cargo requirements have not been specified and thus were not considered in these replacement suggestions.

Section 5 provides the methodology and assumptions for the calculations for the reduction in GHG and fuel costs. The miles recorded by vehicles during the 63-day study are extrapolated into annual miles. If the PEV replacing the monitored vehicle is a BEV, all annual miles are powered from the battery. If the PEV is a PHEV, the percentage of miles that are less than 40 miles per day recorded by the monitored vehicles (Appendix E) 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 the ICE.

M.2 Monitored Pool Mission Vehicle Cost and GHG Reductions

The monitored vehicles with the pool mission contain four pickup trucks, three minivans, one compact sedan, two midsize sedans, two large sedans, one SUV, three cargo vans and seven passenger vans. As above, no replacement is suggested for the passenger vans. However, the observations of Section 4.3.2.3 suggest that replacing the other sixteen vehicles with six PHEVs and ten BEVs would meet current mission requirements.

Table M-27. JBLM Motor Transport Branch PEV replacements for monitored vehicles with pool mission.

	Vehicle Replacements				
	Current Vehicle			PEV Replacement	
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model
6	Ford	E350	Van - Cargo	Nissan	eNV200
7	Ford	Sport Trac	Pickup	Toyota	Rav4
8	Ford	E350	Van - Cargo	Nissan	eNV200
9	Dodge	Avenger	Sedan - Compact	Ford	Focus
10	Dodge	Dakota	Pickup	Via Motors	VTRUX PU
11	Chevrolet	Impala	Sedan - Large	Nissan	Leaf
12	Ford	E350	Van - Cargo	Via Motors	VTRUX Van
19	Chevrolet	Uplander	Minivan	Toyota	Rav4
20	Chevrolet	Escape HYB	SUV	Toyota	Rav4
81	Chevrolet	Malibu	Sedan - Midsize	Nissan	Leaf
84	Dodge	Gr Caravan	Minivan	Mitsubishi	Outlander
85	Dodge	1500	Pickup	Via Motors	VTRUX PU
97	Dodge	Dakota	Pickup	Toyota	Rav4
101	Chevrolet	CG3300	Van - Pass	NA	NA

Vehicle Replacements					
	Current Vehicle			PEV Replacement	
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model
102	Chevrolet	CG3300	Van - Pass	NA	NA
105	Chevrolet	CG3300	Van - Pass	NA	NA
106	Chevrolet	CG3300	Van - Pass	NA	NA
108	Chevrolet	Impala	Sedan - Large	Chevrolet	Volt
109	Chevrolet	CG3300	Van - Pass	NA	NA
110	Ford	Fusion HEV	Sedan - Midsize	Ford	Fusion
113	Ford	E350	Van - Pass	NA	NA
116	Chevrolet	Uplander	Minivan	Toyota	Rav4
117	Chevrolet	CG3300	Van - Pass	NA	NA

NOTE: Vehicle 84 was reported as part of both the Public Works and Motor Transport Branch fleets. The analysis here includes this vehicle for completeness with this Appendix but omits this vehicle in fleet totals of Section 5.

M.2.1 Monitored Pool Mission Vehicle Fuel Cost Reduction

Table M-2 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the pool vehicles. As noted in Section 5, both the local cost of fuel and the national average are used for comparisons.

Because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Section 5 summarizes these values.

An example calculation for logger 10 follows: The JBLM reported annual miles for this vehicle is 7,416 miles. The suggested replacement PEV is a PHEV. The Appendix E daily travel percentage for this vehicle less than 40 miles is 25% so annual miles CD mode is 1,854 miles. EPA fuel economy for this vehicle is 17 MPG implying 109.1 gallons of gasoline are unused. Washington State cost for gasoline is $4.009/gallon for an annual cost of $437. The replacement PEV requires 475 Wh/mi so 880.6 kWh are required for recharging the battery. Local power cost is $0.02783/kWh, resulting in annual electric cost of $25. The savings are $412 for a 94% reduction in fuel cost.

M.2.2 Monitored Pool Mission Vehicle GHG Reduction

Table M-3 identifies the reduction in GHG projected when replacing the current pool vehicles with PEVs. The calculated miles in CD mode are also used in the calculation of GHG reduction. As noted in Section 5, the emissions from burning gasoline is known and the emissions from the use of electricity is dependent upon the power generation mix that is used to recharge the PEV battery. As before, both the local power production emission figures and the national average are used for comparisons.

Because Tacoma Power 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 M-28. Monitored pool vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
6	G43-0875K	eNV200	100%	15,252	1,173	$ 4,703	$ 170	$ 4,534	96%
7	G41-1288A	Rav4	100%	684	43	$ 171	$ 8	$ 163	95%
8	G43-4937A	eNV200	100%	3,840	256	$ 1,026	$ 43	$ 984	96%
9	G10-7664F	Focus	100%	1,416	64	$ 258	$ 12	$ 246	95%
10	G41-65991	VTRUX PU	25%	1,854	109	$ 437	$ 25	$ 413	94%
11	G11-2676G	Leaf	100%	7,692	350	$ 1,402	$ 64	$ 1,337	95%
12	G43-3717A	VTRUX Van	92%	6,988	499	$ 2,001	$ 92	$ 1,909	95%
19	G41-1395G	Rav4	100%	3,648	192	$ 770	$ 45	$ 725	94%
20	G61-1155D	Rav4	100%	5,232	194	$ 777	$ 64	$ 713	92%
81	G10-2878L	Leaf	100%	5,808	223	$ 896	$ 48	$ 847	95%
84	G41-1100K	Outlander	96%	3,187	168	$ 672	$ 39	$ 633	94%
85	G62-0979G	VTRUX PU	61%	2,408	161	$ 644	$ 32	$ 612	95%
97	G41-1367G	Rav4	100%	4,044	270	$ 1,081	$ 50	$ 1,031	95%
108	G11-2675G	Volt	88%	1,119	51	$ 204	$ 11	$ 193	95%
110	G12-0662H	Fusion	48%	5,136	132	$ 528	$ 53	$ 475	90%
116	G41-1161G	Rav4	100%	1,716	90	$ 362	$ 21	$ 341	94%
Total				70,025	3,974	$ 15,932	$ 777	$ 15,156	95%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red National %
6	G43-0875K	eNV200	100%	15,252	1,173	$ 4,316	$ 793	$ 3,523	82%
7	G41-1288A	Rav4	100%	684	43	$ 157	$ 39	$ 118	75%
8	G43-4937A	eNV200	100%	3,840	256	$ 942	$ 200	$ 742	79%
9	G10-7664F	Focus	100%	1,416	64	$ 237	$ 57	$ 180	76%
10	G41-65991	VTRUX PU	25%	1,854	109	$ 401	$ 114	$ 287	71%
11	G11-2676G	Leaf	100%	7,692	350	$ 1,286	$ 300	$ 986	77%
12	G43-3717A	VTRUX Van	92%	6,988	499	$ 1,836	$ 432	$ 1,405	77%
19	G41-1395G	Rav4	100%	3,648	192	$ 706	$ 209	$ 498	70%
20	G61-1155D	Rav4	100%	5,232	194	$ 713	$ 299	$ 414	58%
81	G10-2878L	Leaf	100%	5,808	223	$ 822	$ 227	$ 595	72%
84	G41-1100K	Outlander	96%	3,187	168	$ 617	$ 182	$ 435	70%
85	G62-0979G	VTRUX PU	61%	2,408	161	$ 591	$ 149	$ 442	75%
97	G41-1367G	Rav4	100%	4,044	270	$ 992	$ 231	$ 761	77%
108	G11-2675G	Volt	88%	1,119	51	$ 187	$ 51	$ 136	73%
110	G12-0662H	Fusion	48%	5,136	132	$ 484	$ 247	$ 237	49%
116	G41-1161G	Rav4	100%	1,716	90	$ 332	$ 98	$ 234	70%
Total				70,025	3,974	$ 14,621	$ 3,628	$ 10,993	75%

Table M-29. Monitored vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
6	G43-0875K	Van - Cargo	eNV200	23,582	1,063	22,519	95%
7	G41-1288A	Pickup	Rav4	859	52	807	94%
8	G43-4937A	Van - Cargo	eNV200	5,146	268	4,878	95%
9	G10-7664F	Sedan - Compact	Focus	1,294	77	1,217	94%
10	G41-65991	Pickup	VTRUX PU	2,192	153	2,039	93%
11	G11-2676G	Sedan - Large	Leaf	7,028	402	6,625	94%
12	G43-3717A	Van - Cargo	VTRUX Van	10,033	579	9,455	94%
19	G41-1395G	Minivan	Rav4	3,859	280	3,579	93%
20	G61-1155D	SUV	Rav4	3,895	401	3,494	90%
81	G10-2878L	Sedan - Midsize	Leaf	4,490	304	4,186	93%
85	G62-0979G	Pickup	VTRUX PU	3,227	199	3,028	94%
97	G41-1367G	Pickup	Rav4	5,419	310	5,109	94%
108	G11-2675G	Sedan - Large	Volt	1,023	68	954	93%
110	G12-0662H	Sedan - Midsize	Fusion	2,647	331	2,316	87%
116	G41-1161G	Minivan	Rav4	1,815	132	1,684	93%
Total				76,509	4,620	71,889	94%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
6	G43-0875K	Van - Cargo	eNV200	23,582	9,334	14,248	60%
7	G41-1288A	Pickup	Rav4	859	460	399	46%
8	G43-4937A	Van - Cargo	eNV200	5,146	2,350	2,796	54%
9	G10-7664F	Sedan - Compact	Focus	1,294	672	622	48%
10	G41-65991	Pickup	VTRUX PU	2,192	1,347	845	39%
11	G11-2676G	Sedan - Large	Leaf	7,028	3,531	3,497	50%
12	G43-3717A	Van - Cargo	VTRUX Van	10,033	5,079	4,954	49%
19	G41-1395G	Minivan	Rav4	3,859	2,456	1,403	36%
20	G61-1155D	SUV	Rav4	3,895	3,522	373	10%
81	G10-2878L	Sedan - Midsize	Leaf	4,490	2,666	1,824	41%
85	G62-0979G	Pickup	VTRUX PU	3,227	1,750	1,477	46%
97	G41-1367G	Pickup	Rav4	5,419	2,722	2,697	50%
108	G11-2675G	Sedan - Large	Volt	1,023	599	423	41%
110	G12-0662H	Sedan - Midsize	Fusion	2,647	2,907	-260	-10%
116	G41-1161G	Minivan	Rav4	1,815	1,155	660	36%
Total				76,509	40,552	35,957	47%

Section 5 summarizes these figures. It is interesting to note that logger 110 was installed on a Ford Fusion hybrid vehicle. The replacement PEV is suggested to be a Ford Fusion PHEV. The fuel economy on this hybrid vehicle is such that emissions are greater using the national electric generation mix than burning the gasoline would be. However, the generation mix in Washington State is significantly less and thus GHG reduction is observed.

An example calculation for logger 10 follows: As shown above, the annual miles CD mode is 1,854 miles and 109.1 gallons of gasoline are unused. Internal combustion vehicles produce 20.1 lb-

CO2e/gallon, so the annual emissions for the monitored vehicle are 2,192 lb-CO2e. Tacoma Power produces 0.1743 lb-CO2e/kWh. As above, 880.6 kWh are required for recharging the battery, resulting in 153 lb-CO2e. The savings are 2,039 lb-CO2e, for a 93% reduction in GHG emission.

M.2.3 Motor Transport Branch full Pool Mission Fleet Evaluation

Table 25 in Section 4.4 identifies 495 vehicles in the Motor Transport Branch pool fleet. Aside from the passenger vans, PEV replacements may be possible for 327 vehicles. Intertek suggests a fleet of 196 BEVs and 131 PHEVs conservatively meet the other vehicle travel requirements.

A mix of 89 RAV4 EVs, 22 Leafs, 12 Focus Electrics, and 73 eNV200s are assumed to be appropriate BEVs while 47 Via Motors VTRUX pickups, 33 Outlander PHEVs, 8 Volts, 14 Fusion Energis, and 29 VTRUX Vans are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the replacements offer the potential fuel cost reductions and GHG reductions shown in Table M-4 below.

Table M-30. Motor Transport Branch full pool fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction Natonal %
1,719,235	$ 432,061	$ 19,769	$ 412,292	95%	$ 396,496	$ 92,345	$ 304,151	77%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
1,719,235	2,166,233	123,814	2,042,420	94%	1,086,835	1,091,754	50%

Section 5 also summarizes these values.

M.3 Monitored Support Mission Vehicle Cost and GHG Reductions

The monitored vehicles with the support mission contain three pickup trucks, one midsize sedan, two large sedans, two SUVs, two minivans, and one cargo van. The observations of Section 4.4.3.3 suggest that replacing these vehicles with six PHEV and five BEVs would meet current mission requirements. Table M-5 identifies these vehicles and suggested replacement PEVs.

Table M-31. JBLM Motor Transport Branch PEV replacements for monitored vehicles with support mission.

	Vehicle Replacements				
	Current Vehicle			PEV Replacement	
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model
13	Chevrolet	Impala	Sedan - Large	Nissan	Leaf
14	Chevrolet	Tahoe	SUV	Mitsubishi	Outlander
15	Chevrolet	C1500	Pickup	Via Motors	VTRUX PU
16	Chevrolet	Impala	Sedan - Large	Ford	Fusion
18	Chevrolet	Avalanche	SUV	Nissan	Leaf
93	Dodge	Dakota	Pickup	Mitsubishi	Outlander
104	Chevrolet	Express 13	Van - Cargo	Nissan	eNV200
107	Chevrolet	Uplander	Minivan	Mitsubishi	Outlander
112	Chevrolet	Uplander	Minivan	Mitsubishi	Outlander
115	Dodge	Dakota	Pickup	Nissan	eNV200
119	Dodge	Avenger	Sedan - Midsize	Nissan	Leaf

M.3.1 Monitored Support Mission Vehicle Fuel Cost Reduction

Table M-6 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the support vehicles.

As before, because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Table M-32. Monitored support vehicle replacement fuel cost reduction (Washington State and nationally).

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
13	G11-0678K	Leaf	100%	6,132	279	$ 1,117	$ 51	$ 1,066	95%
14	G62-4526H	Outlander	83%	9,980	624	$ 2,501	$ 122	$ 2,378	95%
15	G42-0698K	VTRUX PU	3%	693	41	$ 163	$ 9	$ 154	94%
16	G11-0493L	Fusion	29%	4,065	185	$ 741	$ 42	$ 699	94%
18	G62-1094L	Leaf	100%	6,528	384	$ 1,539	$ 55	$ 1,485	96%
93	G41-1373G	Outlander	23%	2,531	169	$ 676	$ 31	$ 645	95%
104	G42-0988F	eNV200	100%	9,096	650	$ 2,605	$ 101	$ 2,503	96%
107	G41-1180G	Outlander	88%	10,000	526	$ 2,110	$ 122	$ 1,988	94%
112	G41-1392G	Outlander	70%	4,670	246	$ 985	$ 57	$ 928	94%
115	G41-1376G	eNV200	100%	3,084	206	$ 824	$ 34	$ 790	96%
119	G10-6379L	Leaf	100%	7,584	345	$ 1,382	$ 63	$ 1,319	95%
Total				64,364	3,653	$ 14,645	$ 688	$ 13,956	95%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red National %
13	G11-0678K	Leaf	100%	6,132	279	$ 1,025	$ 239	$ 786	77%
14	G62-4526H	Outlander	83%	9,980	624	$ 2,295	$ 571	$ 1,724	75%
15	G42-0698K	VTRUX PU	3%	693	41	$ 150	$ 43	$ 107	71%
16	G11-0493L	Fusion	29%	4,065	185	$ 680	$ 196	$ 484	71%
18	G62-1094L	Leaf	100%	6,528	384	$ 1,413	$ 255	$ 1,158	82%
93	G41-1373G	Outlander	23%	2,531	169	$ 621	$ 145	$ 476	77%
104	G42-0988F	eNV200	100%	9,096	650	$ 2,390	$ 473	$ 1,917	80%
107	G41-1180G	Outlander	88%	10,000	526	$ 1,936	$ 572	$ 1,364	70%
112	G41-1392G	Outlander	70%	4,670	246	$ 904	$ 267	$ 637	70%
115	G41-1376G	eNV200	100%	3,084	206	$ 756	$ 160	$ 596	79%
119	G10-6379L	Leaf	100%	7,584	345	$ 1,268	$ 296	$ 972	77%
Total				64,364	3,653	$ 13,439	$ 3,216	$ 10,223	76%

Section 5 summarizes these values.

M.3.2 Monitored Support Mission Vehicle GHG Reduction

Table M-7 identifies the reduction in GHG projected when replacing the current support mission vehicles with PEVs.

As before, because Tacoma Power 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 M-33. Monitored support vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
13	G11-0678K	Sedan - Large	Leaf	5,602	321	5,282	94%
14	G62-4526H	SUV	Outlander	12,537	765	11,772	94%
15	G42-0698K	Pickup	VTRUX PU	820	57	762	93%
16	G11-0493L	Sedan - Large	Fusion	3,714	262	3,451	93%
18	G62-1094L	SUV	Leaf	7,718	341	7,377	96%
93	G41-1373G	Pickup	Outlander	3,391	194	3,197	94%
104	G42-0988F	Van - Cargo	eNV200	13,059	634	12,425	95%
107	G41-1180G	Minivan	Outlander	10,579	767	9,812	93%
112	G41-1392G	Minivan	Outlander	4,941	358	4,583	93%
115	G41-1376G	Pickup	eNV200	4,133	215	3,918	95%
119	G10-6379L	Sedan - Midsize	Leaf	6,929	397	6,532	94%
Total				73,424	4,312	69,112	94%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
13	G11-0678K	Sedan - Large	Leaf	5,602.4	2,814.6	2,788	50%
14	G62-4526H	SUV	Outlander	12,537.3	6,718.5	5,819	46%
15	G42-0698K	Pickup	VTRUX PU	819.7	503.9	316	39%
16	G11-0493L	Sedan - Large	Fusion	3,713.6	2,301.0	1,413	38%
18	G62-1094L	SUV	Leaf	7,718.4	2,996.4	4,722	61%
93	G41-1373G	Pickup	Outlander	3,391.4	1,703.8	1,688	50%
104	G42-0988F	Van - Cargo	eNV200	13,059.3	5,566.8	7,493	57%
107	G41-1180G	Minivan	Outlander	10,579.3	6,732.2	3,847	36%
112	G41-1392G	Minivan	Outlander	4,940.8	3,144.1	1,797	36%
115	G41-1376G	Pickup	eNV200	4,132.6	1,887.4	2,245	54%
119	G10-6379L	Sedan - Midsize	Leaf	6,929.0	3,481.1	3,448	50%
Total				73,424	37,850	35,574	48%

Section 5 summarizes these figures.

M.3.3 Motor Transport Branch Full Support Fleet Evaluation

Table 25 in Section 4.4 identifies 301 vehicles in the Motor Transport Branch support mission fleet. Aside from the passenger vans for which no PEV replacement is currently available, Intertek suggests a fleet of 155 BEVs and 128 PHEVs conservatively meet the other 283 vehicle travel requirements.

A mix of 82 RAV4 EVs, 2 Focus Electrics, 33 Leafs, and 38 eNV200s are assumed to be appropriate BEVs while 30 Via Motors VTRUX pickups, 67 Outlander PHEVs, 27 Fusion Energis, 1 Volt, and 3 VTRUX Vans are assumed to be appropriate PHEV replacements.

Using averages for these vehicles, the potential replacements offer the fuel cost reductions and GHG reductions shown in Table M-8 below.

Table M-34. Motor Transport Branch full support fleet PEV replacement reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction National %
1,363,016	$ 315,768	$ 15,370	$ 300,399	95%	$ 289,776	$ 71,795	$ 217,981	75%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
1,363,016	1,583,173	96,260	1,486,913	94%	844,973	738,200	47%

Section 5 also summarizes these values.

M.4 Monitored Transport Mission Vehicle Cost and GHG Reductions

The monitored vehicles with the transport mission contain two pickup trucks, two heavy-duty trucks, and two cargo van. The observations of Section 4.4.3.3 suggest that replacing these vehicles with two PHEVs and two BEVs would meet current mission requirements. Table M-9 identifies these vehicles and suggested replacement PEVs.

Table M-35. JBLM Motor Transport Branch PEV replacements for monitored vehicles with transport mission.

	Vehicle Replacements				
	Current Vehicle			PEV Replacement	
Logger No.	Make	Model	EPA Class	PEV Make	PEV Model
17	Ford	F750	Truck HD	NA	NA
89	Ford	F650	Van - Cargo	Via Motors	VTRUX Van
111	Ford	F350	Pickup	Via Motors	VTRUX PU
114	Ford	F350	Pickup	Toyota	Rav4
118	Ford	F650	Truck HD	NA	NA
120	Chevrolet	G2300	Van - Cargo	Nissan	eNV200

M.4.1 Monitored Transport Mission Vehicle Fuel Cost Reduction

Table M-10 identifies the calculated miles in CD mode for each replacement vehicle as well as the projected fuel cost reductions for the support vehicles.

As before, because Washington State fuel costs are higher than the national average, gasoline costs locally are greater than national figures. Also, because Tacoma Power relies more on cheaper hydroelectric power than the average of all national power providers, electrical fuel costs in Washington State are lower.

Section 5 summarizes these values.

M.4.2 Monitored Transport Mission Vehicle GHG Reduction

Table M-11 identifies the reduction in GHG projected when replacing the current support mission vehicles with PEVs.

As before, because Tacoma Power 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 M-36. Motor Transport Branch monitored transport fleet PEV replacement fuel cost reductions.

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
17	G71-0062G	NA	0%	-	-	$ -	$ -	$ -	
89	G71-0674A	VTRUX Van	69%	2,964	228	$ 914	$ 39	$ 875	96%
111	G63-0271A	VTRUX PU	59%	2,251	173	$ 694	$ 30	$ 665	96%
114	G43-25839	Rav4	100%	4,812	370	$ 1,484	$ 59	$ 1,425	96%
118	G82-0509A	NA	0%				$ -	$ -	
120	G42-3471A	eNV200	100%	3,228	215	$ 863	$ 36	$ 827	96%
Total				13,256	987	$ 3,955	$ 164	$ 3,791	96%

Logger	Vehicle	Replacement PEV	% of Travel CD Mode	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings Nat	Annual Fuel Red National %
17	G71-0062G	NA	0%	-	-	$ -	$ -	$ -	
89	G71-0674A	VTRUX Van	69%	2,964	228	$ 839	$ 183	$ 656	78%
111	G63-0271A	VTRUX PU	59%	2,251	173	$ 637	$ 139	$ 498	78%
114	G43-25839	Rav4	100%	4,812	370	$ 1,362	$ 275	$ 1,087	80%
118	G82-0509A	NA	0%		705		$ -	$ -	
120	G42-3471A	eNV200	100%	3,228	215	$ 792	$ 168	$ 624	79%
Total				13,256	1,691	$ 3,630	$ 765	$ 2,864	79%

Table M-37. Monitored transport vehicle replacement GHG reduction (Washington State and nationally).

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
17	G71-0062G	Truck HD	NA	0.0	0.0	0	
89	G71-0674A	Van - Cargo	VTRUX Van	4,583.2	245.4	4,338	95%
111	G63-0271A	Pickup	VTRUX PU	3,481.1	186.4	3,295	95%
114	G43-25839	Pickup	Rav4	7,440.1	369.0	7,071	95%
118	G82-0509A	Truck HD	NA		0.0	0	
120	G42-3471A	Van - Cargo	eNV200	4,325.5	225.1	4,100	95%
Total				19,830	1,026	18,804	95%

Logger	Vehicle	Vehicle Class	Replacement PEV	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
17	G71-0062G	Truck HD	NA	0.0	0.0	0	
89	G71-0674A	Van - Cargo	VTRUX Van	4,583.2	2,154.3	2,429	53%
111	G63-0271A	Pickup	VTRUX PU	3,481.1	1,636.2	1,845	53%
114	G43-25839	Pickup	Rav4	7,440.1	3,239.4	4,201	56%
118	G82-0509A	Truck HD	NA		0.0	0	
120	G42-3471A	Van - Cargo	eNV200	4,325.5	1,975.5	2,350	54%
Total				19,830	9,005	10,824	55%

Section 5 summarizes these values.

M.3.3 Motor Transport Branch Full Transport Mission Fleet Evaluation

Table 25 in Section 4.4 identifies 204 vehicles in the Motor Transport Branch transport mission fleet. Aside from the heavy-duty trucks and passenger vans for which no PEV replacement is currently

available, Intertek suggests a fleet of 58 BEVs and 57 PHEVs conservatively meet the other 115 vehicle travel requirements. Thirty-five RAV4 EVs, one Leaf, six Focus Electrics, and 16 eNV200s are assumed to be appropriate BEVs while 20 Via Motors VTRUX pickups, 20 Outlander PHEVs, one Volt, and 16 VTRUX Vans are assumed to be appropriate PHEV replacements.

The projected reductions for all mission groups are shown in Table M-12 below and summarized in Section 5.

Table M-38. Motor Transport Branch transport fleet PEV replacement potential reductions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost Nat	Annual Fuel Savings National	Annual Fuel Reduction National %
449,872	$ 124,984	$ 5,483	$ 119,500	96%	$ 114,696	$ 25,614	$ 89,081	78%

Annual Miles CD	Annual GHG Emission ICE	Annual PEV GHG WA	Annual PEV GHG Saving WA	Annual GHG Reduction WA %	Annual PEV GHG National	Annual PEV GHG Saving National	Annual GHG Reduction National %
449,872	626,632	34,343	592,289	95%	301,460	325,172	52%

M.5 Full Motor Transport Branch Full Fleet Summary

Table M-13 shows the projected reductions for all mission groups for the full fleet of Motor Transport Branch vehicles. It is also summarized in Section 5. This assumes the entire fleet for Motor Transport Branch consists of 4 specialty vehicles, 56 buses, 202 passenger vans, 73 heavy-duty trucks, 409 BEVs and 316 PHEVs.

Table M-39. Motor Transport Branch full fleet PEV replacement reductions all missions (fuel cost and GHG emissions).

Annual Miles CD	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Reduction WA %	Annual Gas Cost National	Annual Elect Fuel Cost National	Annual Fuel Savings National	Annual Fuel Reduction National %
3,532,123	$ 872,813	$ 40,622	$ 832,191	95%	$ 800,968	$ 189,754	$ 611,213	76%

Annual Miles CD	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %	Annual PEV GHG Nat lb-CO2e	Annual PEV GHG Sav Nat lb-CO2e	Annual GHG Reduction National %
3,532,123	4,376,038	254,417	4,121,622	94%	2,233,268	2,155,126	49%

M.6 Motor Transport Branch Summary

Table M-14 provides the average values for all monitored vehicles belonging to the Motor Transport Branch. Table M-14 shows that there is a significant opportunity for savings not only in fuel costs but also in GHG emissions with the deployment of PEVs in this fleet.

Table M-40. Public Works Group monitored vehicles average values.

Average Logged Vehicles	Annual Miles CD	Gas Gallons Saved	Annual Gas Cost WA	Annual Elect Fuel Cost WA	Annual Fuel Saving WA	Annual Fuel Red WA %
	4,763	278	$ 1,114	$ 53	$ 1,061	95%

Average Logged Vehicles	Annual GHG Emission ICE lb-CO2e	Annual PEV GHG WA lb-CO2e	Annual PEV GHG Sav WA lb-CO2e	Annual GHG Reduction WA %
	$ 5,585	$ 329	$ 5,256	94%