ELECTRIC HEIL RAPID RAIL

GOAL

Battle Motors' objective was to acquire real-time data regarding route information and vehicle performance under demanding conditions.

SUMMARY

The organization harnessed the capabilities of the Battle Motor's proprietary RevolutionOS™ (RevOS™) platform data to gather a comprehensive dataset from the routes ran in City of Santa Maria, CA on September 12 – 16, 2023, with a temperature range between 55 – 71 degrees Fahrenheit.

APPLICATION

Residential Refuse

OVERVIEW

The City of Santa Maria and Battle Motors, with the support of Velocity Truck Centers, conducted a rigorous operational test of the Battle Motors BEV LET2-40 HEIL RR ASL equipped with a 400-kWh battery pack. This assessment took place within the city, subjecting the vehicle to the demands of a typical workday.

Throughout the 6.5-hour day, during which temperatures reached a maximum of 65 degrees Fahrenheit, the Battle Motors BEV undertook residential refuse pickups, navigating the narrow streets and alleys in the City of Santa Maria with agility. The ability to remotely monitor the truck's performance in real-time proved to be of paramount importance during this testing phase.

The RevOS™ platform emerged as an indispensable tool, tracking and gathering data on key performance metrics of the vehicle, as well as capturing comprehensive route data. This robust data collection and analysis process formed the foundation for the evaluation of Battle Motors BEV's performance within the urban environment of Santa Maria.

MATERIALS

BEV (Battery Electric Vehicle) LET2 (Low Entry Tilt 2) – Heil 26CY Rapid Rail Automated Side Loader – Weight (empty) is 34,920 lbs.

TRUCK DATA AT HIGH LEVEL

The information provided pertains to data collected from a single truck over one day. It is important to clarify that these data collections did not occur on consecutive days.

Farthest Distance Traveled in One Day	43.74 Miles
Highest Speed	70 MPH
Maximum Battery Required Recommendation	400 kWh
Type of pick up - Residential or Commercial	Residential
Cans / Stops	775*

**An estimate of cans collected on the longest day.*

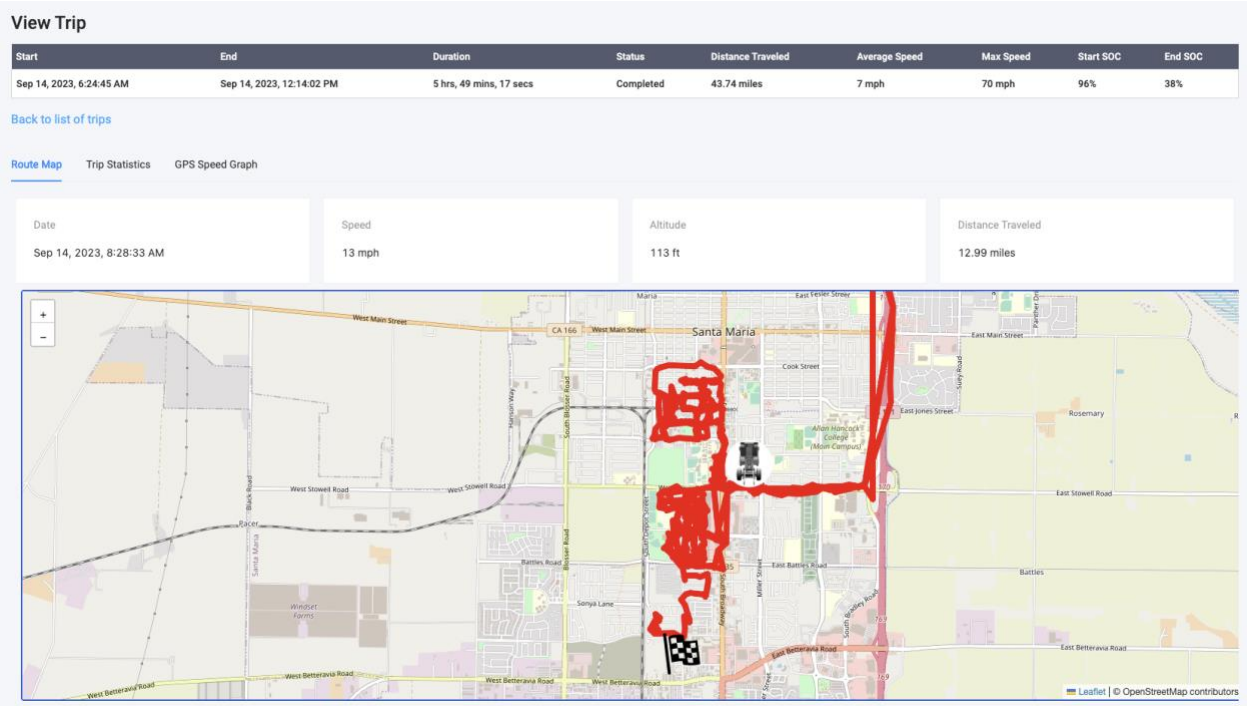
DATA REVIEW

During a 6.5-hour workday, the truck covered 78 miles, encompassing both back-road and freeway driving. The lowest point the "EV (Electric Vehicle) state of charge" (battery percentage) reached was 10%.

A selection of routes was examined and collected by the City of Santa Maria truck during the data harvesting process. Subsequently, Battle Motors processed the data acquired from the RevOS system and transferred it into the Battle Motors electric reporting tools.

This data includes:

- Location
- Latitude
- Longitude
- Altitude
- Speed
- Bearing
- Route Driven
- Total Vehicle Distance



BEV EFFICIENCY REVIEW

The truck achieved an average of 2.6 kWh per mile, demonstrating strong electric performance for demanding routes. The driver not only extended the route, but also completed it 20 minutes faster than usual, surpassing expectations and outperforming a conventional Internal Combustion Engine (ICE) truck.

The data demonstrates that a Zero Emissions Vehicle (ZEV) can successfully complete extended routes in a shorter time frame, all while operating at a significantly lower decibel level compared to its ICE counterpart.

DUMP SCALES (12 HOURS)

Total full	53,960 lbs
Total empty (after dump)	34,920 lbs
Payload	**19,040 lbs**

DUPLICATE TICKET

SANTA MARIA REGIONAL LANDFILL
2065 East Main Street
Santa Maria, CA 93454

Weighed: RAQUEL VILLARD
BILL TO: 99400
RESIDENTIAL COLLECTION
1st

Vehicle ID:
Reference: OVERMAN
Grid: CELL 1
Comment:: 6416//E-TRUCK

Origin: CITY OF SANTA MARIA
DATE IN: 09/12/2023 TIME IN: 11:17:39
DATE OUT: 09/12/2023 TIME OUT: 11:17:39

INBOUND TICKET Number: 02-01571829

MANUAL GROSS WT. 53960 LB
MANUAL TARE WT. 34920 LB
NET WEIGHT 19040 LB

** REPRINTED BY **
RAQUEL VILLARD at 11:17:53

Qty	Description	Amount
9.52	>800 LBS	752.08

TICKET AMOUNT: 752.08

X_____

SANTA MARIA REGIONAL LANDFILL
2065 East Main Street
Santa Maria, CA 93454

Weighed: RAQUEL VILLARD
BILL TO: 99400
RESIDENTIAL COLLECTION 2ND

Vehicle ID:
Reference: OVERMAN
Grid: CELL 1
Comment:: 6416//ETRUCK

Origin: CITY OF SANTA MARIA
DATE IN: 09/12/2023 TIME IN: 12:21:12
DATE OUT: 09/12/2023 TIME OUT: 12:21:12

INBOUND TICKET Number: 02-01571852

SCALE 2 GROSS WT. 48540 LB
MANUAL TARE WT. 34920 LB
NET WEIGHT 13620 LB

Qty	Description	Amount
6.81	>800 LBS	537.99

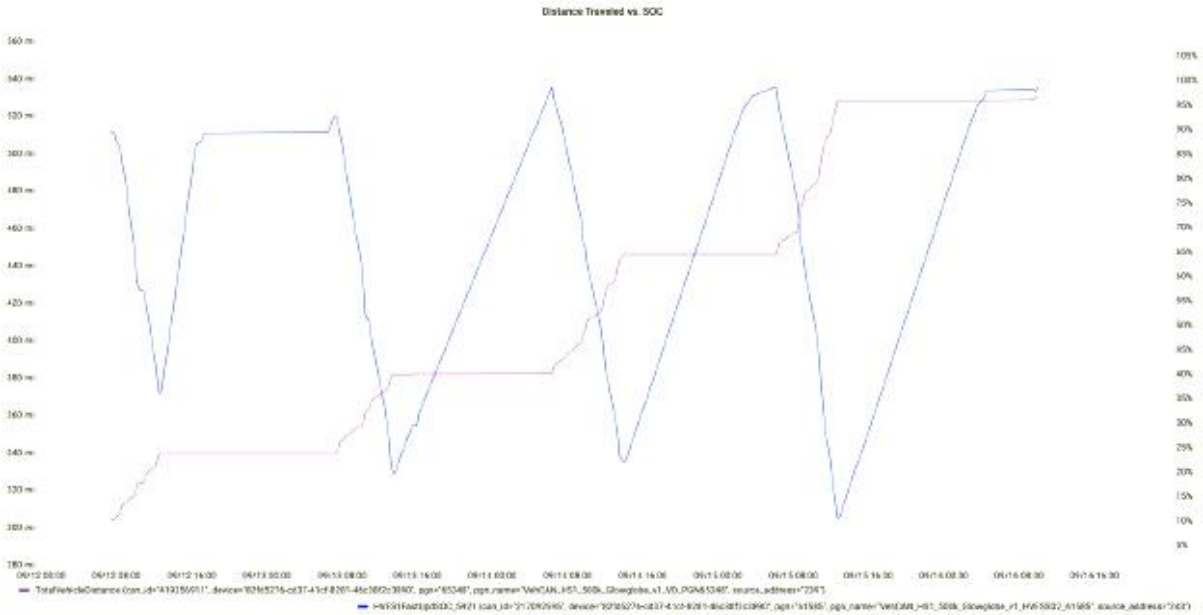
TICKET AMOUNT: 537.99

X_____

Receipt of weigh-in and out at landfill, depicting truck's physical payload capabilities.

EV STATE OF CHARGE (SOC) OVER TIME

September 12 - Sept. 16, 2023



BATTERY RECOMMENDATION

Battle Motors offers two primary battery usage configurations for its trucks, catering to a broad range of usage scenarios in the market. These configuration choices were developed in response to the increasing market demand for greater diversity in usage.

Currently, the following pack configurations are available in 240 kWh and 400 kWh.

Truck	kWh*
City of Santa Maria_Truck_1	400

CONCLUSION

An analysis of the route data revealed that the 400-kWh capacity exceeded customer expectations, particularly for the City of Santa Maria, CA., in September 2023. As the truck continues its tenure with the City of Santa Maria, further insights and advancements will elevate the potential of continued innovative solutions.

BATTERY SPECIFICATIONS

Battery Cell Chemistry	LFP
Operational Temperature Range	-35°C - 60°C
Rated Energy	395kWh
Maximum Continuous Charge Current	346A
Maximum Continuous Charge Power	395kW
Peak Charge Power	480kW
Maximum Continuous Discharge Power	395kW
Peak Discharge Power	556kW
Thermal Management	Cooling: Liquid Cooling Heating: Heating film
Operational Voltage Range	540V - 750V

POWERTRAIN SPECIFICATIONS

Drive Motor	BorgWarner Cascadia Motion HVH410-150
Drive Inverter	BorgWarner Cascadia Motion PM250
Peak Torque	2050Nm
Peak Power	300kW
Maximum Motor Speed	6,000RPM
Transmission	IE drives 2-speed
Cooling Medium	Dexron VI
Motor Assembly Mass (Motor Only)	140kg
Maximum Efficiency	95%