



RFTA Takes Next Big Sustainability Step with Smooth Electric Bus Integrations

Roaring Fork Transportation Authority

EAM

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Danny Knight,
EAM System Administrator

High in the mountains of Aspen, Colorado, Roaring Fork Transportation Authority is a small agency known for big initiatives. While many agencies are piloting electric bus technology, few have taken the next sustainability step of integrating electric vehicle (EV) charging into their asset management system of record like RFTA has. Here’s how RFTA worked with Trapeze to get its battery electric bus program off to a flying start with successful system integrations.

Background

In 2013, Roaring Fork Transportation Authority launched the US’ first rural bus rapid transit system, the dinosaur-branded VelociRFTA. In 2019, RFTA began a pilot electrification program, incorporating eight battery electric buses into its fleet and installing four depot charging stations. Focused on innovation and sustainability, RFTA met the challenges of electrification head on, performing intensive quality assurance testing on the buses (including loading them with 55-gallon drums to mimic maximum passenger load) and working closely with Trapeze to accurately capture charging information and maintain consistency across its preventive maintenance programs.

117
buses
(8 electric)

5.1 M
passengers pre-
COVID

70
mile service region

Challenges

With the electrification initiative, RFTA wanted to test how electric buses perform at Aspen’s high elevation (and cold temperatures), while capturing detailed data to determine whether the program should be expanded.

The RFTA team knew that a high degree of EV data automation and integrity was critical for saving time and effort, ultimately resulting in better decision-making. “We really did not want to have 130 or so buses managed in one manner, with automation, and have this multi-million-dollar (EV) project managed by hand,” explained Craig Dubin, RFTA Special Projects Manager. “We didn’t want a separate PM process.”

Integrating any new bus fleet poses operational challenges but electric buses have the additional complexity of managing EV charging, state of health, and battery charge. To achieve these goals, RFTA’s administration team – Craig Dubin and EAM System Administrator Danny Knight – knew that integrating their charging data into the Trapeze Enterprise Asset Management (EAM) system would be a key to success.

Once the work started, the team encountered several technical interface challenges. For one, the charging information from the buses didn’t include the unique bus ID, an important requirement to automate fuel ticketing in the agency’s EAM system. Second, RFTA learned that measuring energy consumption wasn’t as straightforward as it was for diesel buses - the charging data had to reflect utilization for both peak and off-peak hours for which RFTA had secured locked-in rates from the local energy company. Lastly, instead of utilizing a standard API data exchange mechanism, the charging system had unique interface requirements from a “technical handshake” perspective, resulting in the developers needing to make some technical adjustments midstream.

Solutions

The basic goal of the interfaces was to send the charging data into EAM to update the meter readings and record the electric “fuel” ticket transactions. To achieve this, the team first determined what information to interface into EAM – specifically, battery state of charge, meter readings, battery state of health, and J1939 fault codes. Next, the team undertook two tasks to capture all these data points. They set up communication between the charging infrastructure and the EAM database through a WebSocket protocol. They also created a process to retrieve charging data from the bus API and send the data to EAM.

To solve the problem of identifying specific buses that generate charging information and Internal Fuel Tickets, the team looked to EAM’s external data mapping functionality to tie the MAC address (the unique identifier RFTA uses for their BEB’s) to the bus ID so that this field would be populated first in the Fuel Ticket screen when the charging information came across.

To accurately capture the cost of energy consumption, EAM needed to reflect the charging session data for both peak and off-peak times, which have different rates. To do this, two Fuel Types were created, for Peak and Off-Peak. Transactions would map to the fuel type based on the time of day and would change from one type to the other if the periods traversed.

RFTA also worked with an energy company to develop an equation that could be put in EAM to calculate the charge delta, the difference between the amount of charge received and spent, to help determine the battery state of health. The maximum capacity of brand-new batteries was then stored as a variable in EAM. Logging the state of health for every transaction enabled EAM to monitor battery degradation over time. Reports showing long-term state of health could be pulled for any period and from vehicle to vehicle.

Results



200,000 MILES LOGGED
by 8 electric buses



INCREASE IN ENERGY SAVINGS
in energy savings over
diesel fuel



4 HOURS AVERAGE
recharging time for
each bus



1.6 KILOWATT-HOUR/MILE
average electric bus mileage

The final solution achieves RFTA's goals of ensuring a consistent, automated process of meter and charging/fueling updates while leveraging a common set of EAM reports across their electric and diesel bus fleets.

By tracking EV information in EAM, RFTA can now accurately measure charging events to track energy consumption and expenditure. RFTA is now able to quantify the following savings: it cost 18 cents per mile in fuel/propulsion for an electric bus compared to 82 cents per mile for diesel vehicles, a savings of 64 cents per mile. Analyzing the data gave RFTA valuable insights into bus electrification to inform its sustainability roadmap, data its board needed to justify expanding its electrification programs.

Another priority is evaluating battery health for performance assessment, to enable RFTA to analyze battery trends over time.

RFTA also learned valuable lessons from the integrations needed for the project. "Work on the integration ahead of time," advised Danny Knight, RFTA's EAM System Administrator. "Anything you can do upfront is ideal. Ensure that OEM and charger providers have the data available for integration. These are big steps to make your project go smoother."

Next, RFTA plans to track fault codes to drive service requests and avoid larger issues, especially with regenerative braking, which drivers often turn off when going downhill on Aspen's icy roads. RFTA is looking into getting fault codes into EAM to watch out for brake overheating when operators forget to turn regenerative braking back on. This will involve mapping fault codes into EAM's telematics module, to trigger service requests and work orders.

For Danny Knight, the hard work on integrations and information tracking is paying off in meaningful ways.

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