Greater Denver Transit
greaterdenvertransit@gmail.com

May 12th, 2023

Debra Johnson, General Manager / CEO
Regional Transportation District
1660 Blake Street
Denver, CO 80202

ATTN: RTD Zero Emission Fleet Transition Plan
Consideration of Trolleybus Technology

Dear General Manager Johnson,

We write regarding the news that RTD is seeking to procure a consultant to produce a 'Zero Emission Fleet Management Plan'. Greater Denver Transit broadly welcomes the idea of a comprehensive plan as transitioning a fleet of over 1,000 buses should not be done piecemeal and there are likely to be significant savings in time and money by looking at the issue holistically.

In preparing RTD's 'Request for Proposal' (RFP) documents for the consultants, we would like to recommend that you include language in the scope that covers studying both (a) trolleybus and (b) overheard wire technology for the core bus routes, most likely those in Downtown Denver and future BRT corridors. We have evidence that the overall cost of a hybrid trolleybus / battery-electric bus approach can be cheaper and offer more flexible operations over battery-electric bus (BEB).

While more common in Europe and Asia, trolleybuses operate domestically in San Francisco, Seattle, Boston, Philadelphia and Dayton, OH, but are something of a 'forgotten technology' of transit. In transit circles outside of the coasts, we are often only given the choice between bus and light rail when evaluating modes for a corridor, even though this tried and tested 'third mode' exists which has always been emissions free. Trolleybuses can stay in service all day and be scheduled even more intensively than the current diesel bus fleet as they do not need to recharge or refuel at a depot. For example, there are some trolleybus blocks in Seattle that have the trolleybus out in service for over 24 hours. Today however, new technology has made the trolleybus far more affordable and scalable to be able to run "off-wire", making it sometimes cheaper to build and operate vs. a pure-play battery-electric bus (BEB) solution.

The modern trolleybus can be thought of as a "hybrid" version of a battery-electric bus but with smaller, lighter, and cheaper batteries that are charged while the bus is operating under a wire, in a process known as 'In Motion Charging' (IMC). IMC technology has been developed by Kiepe Electric (part of the Knorr Bremse group). They have supplied the technology to the existing trolleybus fleets and have a USA subsidiary with a factory in Georgia that produces electric traction equipment including that for trolleybuses. In addition, Skoda Transportation is another European manufacturer that has supplied the North American market with traction equipment for trolley buses.

Because IMC equipped trolleybuses do not need to power themselves for the whole day and can be repeatedly recharged when running under the wires, they have relatively small (and much cheaper) batteries which are approximately 10% the size of those found on regular battery-electric buses. The small batteries help the buses cope with obstructions on the route, planned wire maintenance and allow trolleybus routes to be flexibly extended to destinations that don't have wires. As the terrain in Denver is relatively flat, it should be possible to wire as little as 50% of trolleybus route lengths. Put together, this means IMC equipped trolleybuses can offer the best of both worlds: the energy efficiency and high performance of the normal trolleybus but with added flexibility for sections that need to be operated "off-wire".

With this well-established technology, RTD could install wire on the high-traffic trunk sections of overlapping bus routes but operate the outer sections on battery. Battery could also be used to navigate spaces that are difficult to install wires in, such as Denver Union Station's Underground Bus Concourse or the underground platforms of Civic Center Station. Both of RTD's existing transit bus suppliers, Gillig and New Flyer, have proven trolleybus products in daily service across the U.S. The vehicles are based on the 'Low Floor' (Gillig) and 'Xcelsior' (New Flyer) designs that RTD already operates, meaning many parts of any new trolleybus vehicles would already be familiar to RTD maintenance staff.

In terms of construction, the trolleybus overhead wire system is much lighter and simpler than that used on both the commuter and light rail systems of RTD. Firstly it can safely be attached to existing street light poles and buildings, meaning that expensive concrete foundations are not required and costs can be shared with local municipalities. Secondly, and despite the fact there are two contact wires, the system's relatively low speed means it doesn't require the extensive wire tensioning equipment like that found on rail overhead catenary systems. This makes it far cheaper per mile to install.

Most importantly, depending on the extent of the installation, the system may qualify as a 'fixed guideway', allowing RTD to access Federal Transit Administration (FTA) funds for its construction and maintenance that are not available to traditional bus operations.

Greater Denver Transit believes that the increasingly favorable costs to install overhead trolley wire on core parts of the RTD bus network, coupled with the fact that trolleybuses are electrically simpler to operate and maintain, means that trolleybus technology is worth considering as part of the agency's overall Zero Emission Fleet Transition strategy. Such a strategy could ensure RTD meets its emissions targets with less risk and disruption from battery-related supply chain shortages and elevated material costs.

Multiple market experts are projecting that foundational EV battery components such as lithium and cobalt will become and remain more expensive for the foreseeable future. Therefore, an electrification approach that favors cheaper batteries (which in turn require less lithium and less cobalt) could end up saving RTD a considerable amount of cost and help avoid shortage-related delays.

Even before today's inflationary environment with battery material and labor shortages, it was already expected that 10's if not 100's of millions of capital spending dollars would be required to achieve a zero-emission bus fleet, so it would be prudent for RTD to consider all transit technology options that are currently available.

Best Regards,

James Flattum
Greater Denver Transit

Richard Bamber
Greater Denver Transit

CC: Director Bobby Dishell - Zero Emission Vehicle (ZEV) Committee Chair
Director Lynn Guissinger – Zero Emission Vehicle (ZEV) Committee Vice Chair
Director Julien Bouquet - Zero Emission Vehicle (ZEV) Committee
Director Kate Williams - Zero Emission Vehicle (ZEV) Committee

Further Reading:

Bus Electrification: A comparison of capital costs - Urban Transport Magazine
https://www.urban-transport-magazine.com/en/bus-electrification-a-comparison-of-capital-costs/

Infrastructure for In Motion Charging Trolleybus Systems Knowledge Brief - UITP
https://cms.uitp.org/wp/wp-content/uploads/2021/07/Knowledge-Brief-IMC.pdf

The Trouble With Lithium - Bloomberg
https://www.bloomberg.com/news/features/2022-05-25/lithium-the-hunt-for-the-wonder-metal-fueling-evs