Fleet Engineering

Review of "San Francisco Muni Electrification Alternatives Analysis"

To: **CAC Engineering, Maintenance, and Safety Committee**

Through: **Julie Kirschbaum** September 26, 2023

From: **Bhavin Khatri** September 26, 2023

Date: **September 26, 2023**

Subject: **Review of "San Francisco Muni Electrification Alternatives Analysis"**

We are aware that a study on the SFMTA's trolley buses, developed by the Climate and Community Project in partnership with several university researchers, the San Francisco Electrical Construction Industry, and IBEW Local 6, is scheduled to be presented to the SFMTA CAC's Engineering, Maintenance, and Safety Committee (EMSC) on October 25, 2023. The study advocates for the SFMTA to replace its entire rubber tire bus fleet with In-Motion-Charging (IMC) trolley buses, arguing that IMC trolley buses are more economically, environmentally, and operationally efficient than battery buses. In advance of that meeting, we wanted to share with you our fleet engineering team's review of the study. Bhavin Khatri will also be available on October 25 to answer any questions you might have.

The SFMTA agrees with many of the findings of the study and recognizes that IMC trolley buses are an important part of the SFMTA's ZEV Program. IMC trolley buses can be thought of as the next generation of trolley bus technology, offering significantly greater off-wire range and faster charging over conventional trolley buses. This added capability grants greater flexibility in operation and allows for the expansion of our trolley bus coverage area. The SFMTA is currently conducting a pilot program for IMC trolley buses and plans to convert our existing trolley buses to IMC trolley buses, and all the SFMTA's future procurements of trolley buses will be IMC trolley buses.

While we share in the Climate and Community Project's enthusiasm for adopting IMC trolley buses, we believe that the modelling exercise conducted in this study is oversimplified, and that the study does not account for the difficulties surrounding the procurement and operational limitations of trolley buses. While we are excited about keeping trolley buses as part of the SFMTA fleet, we disagree with the recommendation that trolley buses should comprise 100% of the SFMTA's rubber tire fleet.

- **Trolley buses are only offered by a single bus manufacturer in North America**, and due to the historically small market share of the vehicles, there is a risk that this manufacturer could stop providing trolley buses at any time. The small market share can also make it challenging to source parts, tools, and support. The SFMTA has formed a consortium of trolley operators in North America to expand and promote the usage of trolley buses, but currently we are not aware of any new agencies that plan to adopt trolley buses as part of their zero-emission transition.

- **State of good repair needs for our trolley overhead network are extensive and should be prioritized** over expanding the network. For example, most of our substations are past their useful life and need renovation/replacement, and we would have to invest in additional substations across the city. The expansion of our trolley network would likely mirror or exceed the cost of battery bus charging infrastructure. Additionally, the expansion of our trolley wire network would likely be met with

some public resistance. The cost of new trolley infrastructure varies widely internationally but is very high in San Francisco.

- **There are several operational difficulties that prevent the SFMTA from making greater use of trolley buses.** There is more intervention required by operations and planning staff to execute on-wire/off-wire operations, which degrades the customer experience. We are still working on a reliable and quick process for reconnecting to overhead lines after off-wire operation, but our current overhead pans have a success rate of only 60-70% for independent rewiring with the operator remaining inside their bus. Additionally, it is unclear to the SFMTA how trolley buses would travel on freeways or on trips requiring long durations off-wire. Trolley buses are also expected to have a higher up-front cost and be more difficult and expensive to maintain due to additional complexities over battery electric buses. Lastly, battery buses provide greater flexibility in operation than IMC trolley buses, especially during construction, rerouting, and special events.

The SFMTA has met with the sponsor of the study to discuss key operational constraints and challenges not addressed in the study, and we look forward to collaborating with the researchers who contributed to the study to help further shape this work. The SFMTA welcomes assistance from all interested parties in advocating for the operation of trolley buses in North America.