

## **TTC eBus Update, April 2021**

### **“Lessons Learned and Next Steps”**

Extracted from *TTC’s Green Bus Program: Preliminary Results of TTC’s Head-to-Head eBus Evaluation*

#### **System Compatibility**

1. A maximum bus length specification of 40 feet is required in order to preserve bus storage density at existing maintenance facilities; and
2. Bus specifications to require DC charging capability using SAE communication standards to allow for maximum charge rates, competitive procurement, and interoperability between buses and chargers and maintenance facilities.

#### **Vehicle Performance**

1. Continue to monitor eBus reliability performance, mature product with vendors and prioritize retrofit campaigns that will yield reliability improvements.
2. Include reliability metrics to be achieved by the eBus OEM in future procurement contracts. Failure to meet the reliability targets will result in liquidated damages.

#### **Fleet Availability**

1. Continue to monitor eBus availability performance, mature product with vendors and prioritize retrofit campaigns that will yield reliability and availability improvements.
2. BYD to hire a second field service technician in Q2 2021.
3. Include availability metrics to be achieved by the eBus OEM in future procurement contracts. Failure to meet the availability targets will result in liquidated damages.

#### **Energy Consumption**

1. Predictable and reliable range is more important than achieving the lowest energy consumption.
2. Proterra has started a campaign to retrofit a convector in the operator area and is 30% complete.
3. Exploring defroster programming opportunities to further alleviate winter energy consumption concerns.
4. For future procurements, the TTC will avoid a pure-electric defroster unit without fully understanding the energy efficiency performance.
5. For future procurements, the TTC will continue to specify a diesel-fired heater requirement until heat pump technology is viable.

#### **Regenerative Braking**

1. Evaluate Proterra braking and traction control software calibration update and if successful pursue a similar mitigation with BYD.
2. Evaluate benefits of winter tires with respect to winter regenerative braking rates.

## **Battery Capacity and Range**

1. Evaluate Proterra battery capacity increase benefits;
2. Investigate lowering interior temperature set points without adversely affecting customer comfort;
3. Investigate early activation of diesel-fired heaters and disabling electric heat;
4. Future procurement specification to specify minimum useable battery capacity target and not advertised battery capacity; and
5. Future procurement specification to seek opportunities to improve efficiency, such as through the use of light-weight materials, heat pump, etc.

## **Manufacturing Facility Quality Audit**

1. Facility audits of selected vendors for future bus procurements will be completed in advance of bus production start.

## **Quality Defects**

1. While the TTC contracts full-time quality assurance inspectors at manufacturing and final assembly sites, additional process controls and resources will be considered to better control eBus manufacturing quality and minimize TTC cost and disruption upon vehicle delivery.

## **Duration to Final Acceptance**

1. Through a comprehensive review of commercial terms against industry peers and across modes (i.e. bus, subway and streetcar), the TTC is restructuring its milestone payments. Included in this restructure is a higher milestone payment percentage due at FAC in order to motivate vendors to improve quality and responsiveness during the acceptance process.

## **30-Day Reliability**

1. The TTC is restructuring its milestone payments. Included in this restructure is a larger percentage due upon achievement of the 30-Day Reliably requirement.

## **Maintainability**

1. Time studies to be performed on all planned maintenance work to identify time savings when compared to a diesel and hybrid-electric buses.
2. For future procurements, a carbon steel frame coupled with an annual rust proofing program is not recommended.