



The Evolution of Mobility: Zero-Emission Buses and The Need For Smart Solutions

Thomas Small

Director, New Product Development

NEW FLYER®





Advancing Innovation in Transit

Pre-1993:

Low Floor bus; Conventional Fossil Fuels (Diesel, Gas); Early electric trolleys (1960s and 1970s); Early diesel-hybrid

1993: Electric Trolley

Delivered to San Francisco MUNI

1994: Compressed Natural Gas

Delivered to San Diego Transit Commission

2001: Diesel-Electric Hybrid

Delivered to Orange County

2008: Hydrogen Fuel Cell Buses

Delivered to BC Transit

2012: e-Accessories

Delivered to Minneapolis Metro

2014: Launch of the Xcelsior® XE40 Electric Bus

Delivered to Chicago Transit Authority

Delivered to Winnipeg Transit

2015: Launch of the Xcelsior® XHE60 Fuel Cell Bus (Ballard)

2016: Launch of the Xcelsior® XHE40 Fuel Cell Bus (Hydrogenics & Ballard)

2017: Xcelsior CHARGE™ Launch including Long Range Batteries, High Grade Package, Interoperable Depot and On-Route Charging

2017: Opened the Vehicle Innovation Center in Anniston, AL

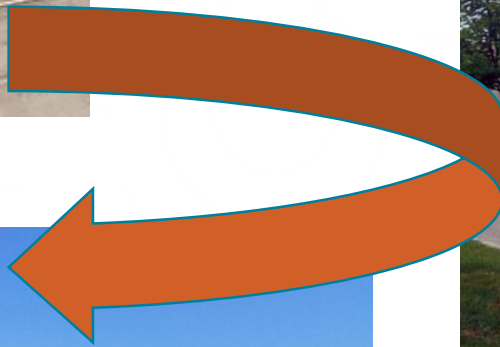
2018: Delivered our 10,000th Xcelsior transit bus

2018: First bus manufacturer in the world to sign the Shared Mobility Principles for Livable Cities

2018: Launched the Xcelsior CHARGE™ sixty foot, and Xcelsior CHARGE H2™ 40 and 60-foot models

2019: Launched Connect 360™, New Flyer Infrastructure Solutions™ and New Flyer's AV Program.







PHOTOGRAPHER UNKNOWN (1971); TRANSIT TORONTO COLLECTION (2016)



41 Union Jefferson Loop

5300

41 UNION

GOUGH

123

5300

PO



Fuel Cell Electric: A Variant of a Battery Electric Bus



xcelsior CHARGE™

- Eco Friendly
- Robust Design
- Up to 220 miles Range*
- 4 Hour Overnight Charge
- Range decreases over the life of the Batteries*
- One charger per 2-3 buses
- Diesel Aux heater recommended for cold climates

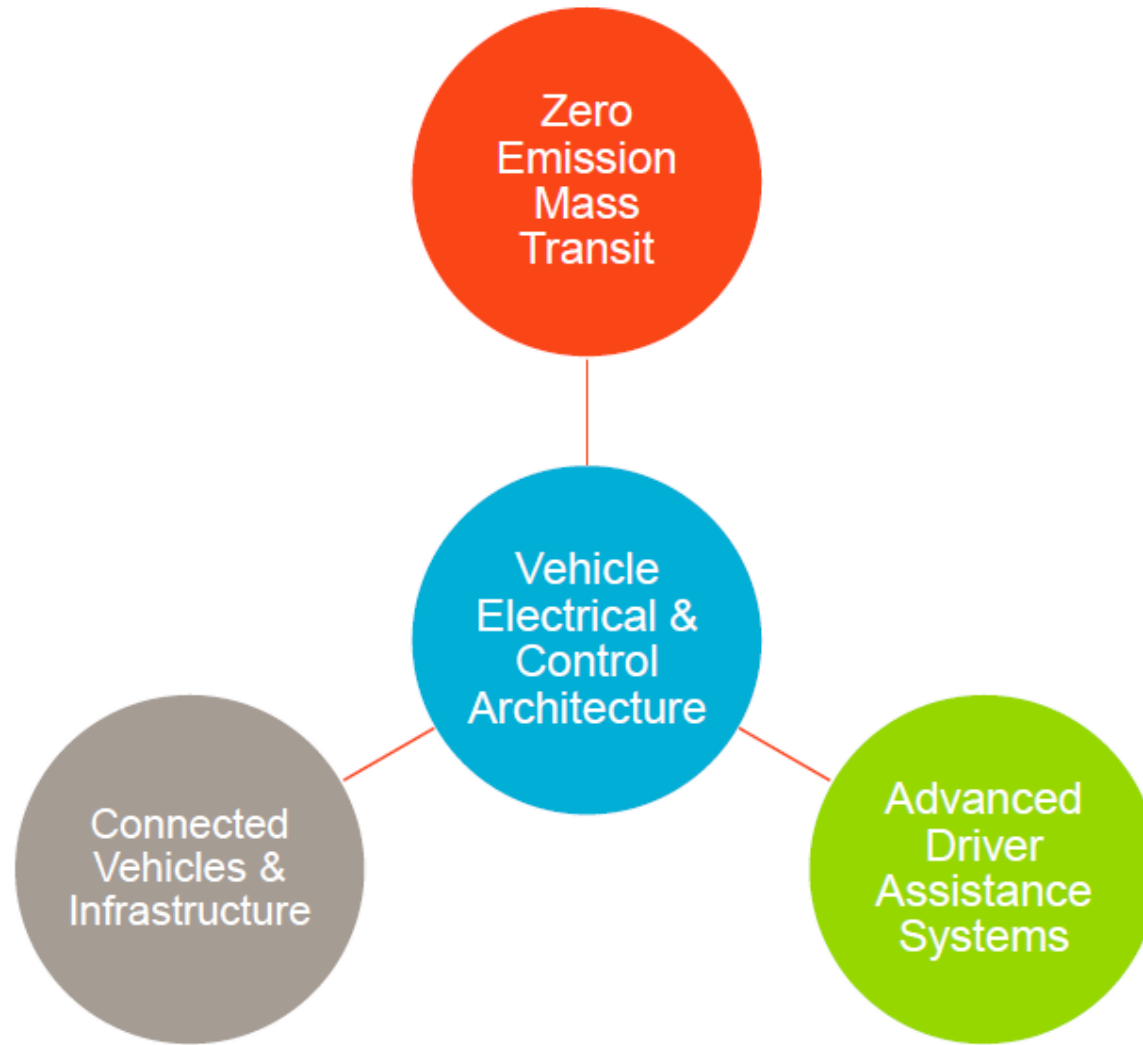


xcelsior CHARGE H2™

- Eco Friendly
- Robust Design
- Up to 350 miles Range*
- 6-20 minutes fill time
- Range consistent over the life of the Batteries & Fuel Cell*
- Fill station scalable by fleet size
- No secondary Aux heater required for cold climates

*40-foot on a APTA transit duty cycle

Smart Mobility Roadmap



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CONNECT*

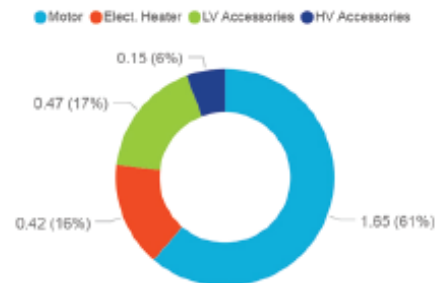
CONNECT **360**

DATE	BUS	MODEL	ESS CAPACITY	TRIP
Mon, Feb 11, 2019	2991	XE40	466 kWh	1

TRIP DETAILS

05:52 am	11:58 pm	18:05:17	40.52	88.93
Start Time	End Time	Duration	Average Temperature (°F)	Mileage (miles)
4.92	94.00	42.80	238.59	2.68
Average Speed (mph)	SOC MAX (%)	SOC MIN (%)	Energy Used (kWh)	Consumption (kWh/mile)

ENERGY CONSUMPTION BY SUB-SYSTEM (kWh/mile)



ROUTE



RANGE

Distance (miles)

Duration (hours)

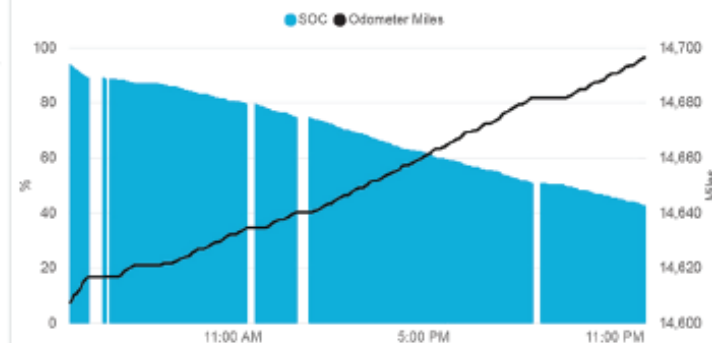
88.9

65.7

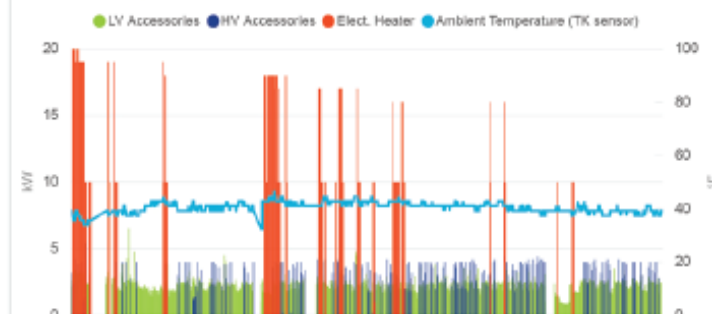
18.1

13.4

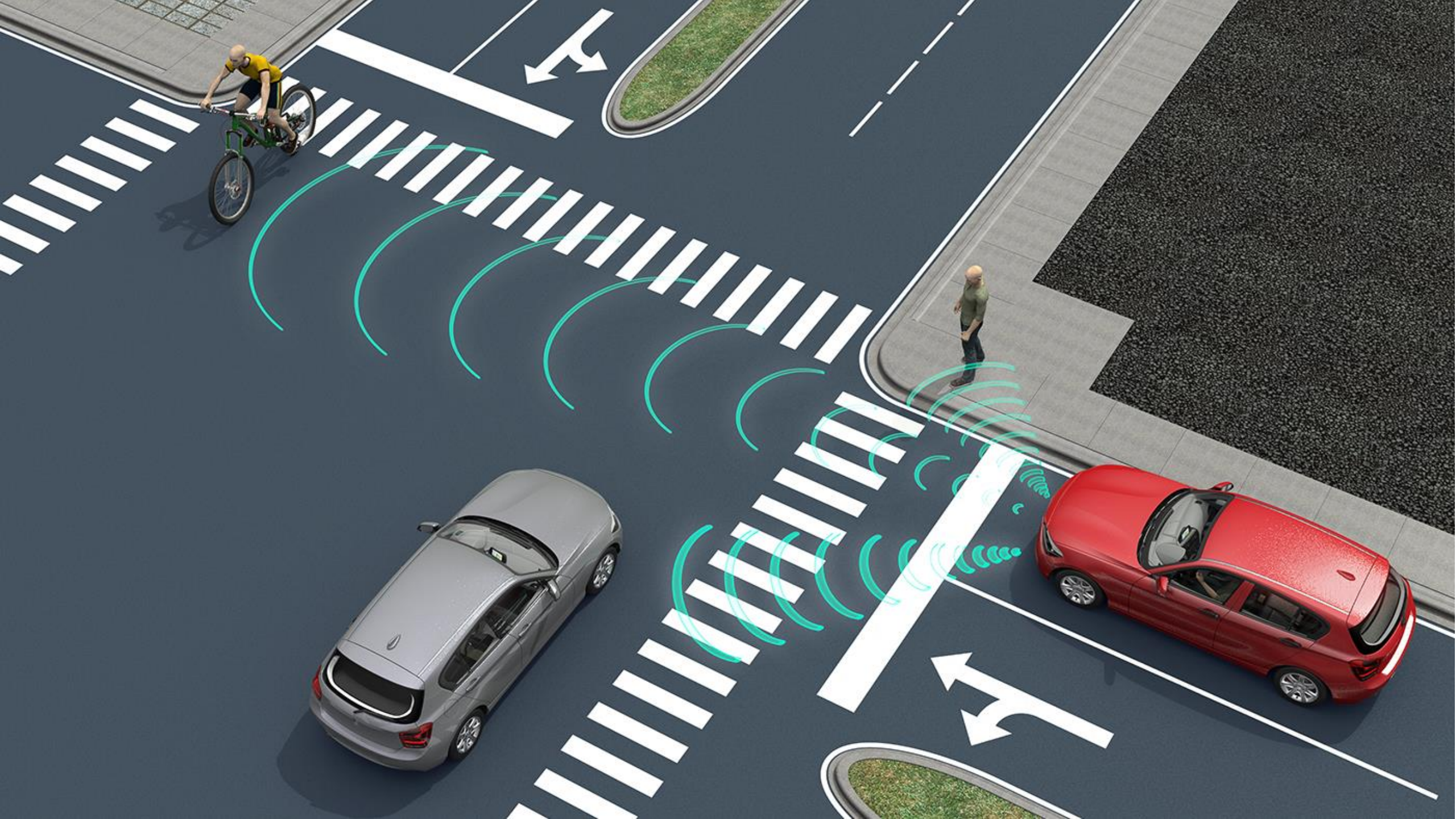
STATE OF CHARGE AND ODOMETER MILES



SUB-SYSTEMS POWER AND AMBIENT TEMPERATURE



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