

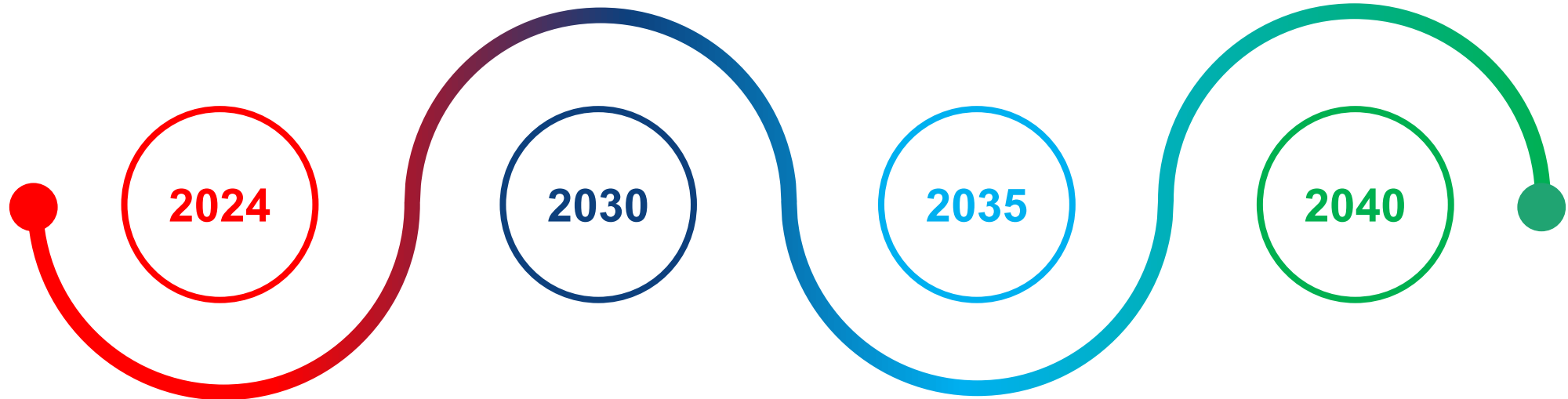


Electric Bus Fleet Charging Infrastructure

Riders Advisory Committee
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Deputy Chief Mechanical Officer

MARTA has committed to transitioning away from traditional fuels to environmentally-responsible vehicles



MILESTONE

7 depot and 1 on-route charger are completed

MILESTONE

25% of transit bus fleet transitioned to Battery Electric Buses

MILESTONE

63% of transit bus fleet transitioned to Zero Tailpipe Emissions vehicles

MILESTONE

“Fleet of the Future” – environmentally responsible and sustainably-fueled bus fleet

Path to Electrification:

- Type of charging
- Determine locations
- Planning, design, engineering
- Construction of infrastructure
- Budgetary impacts
- Fleet transition as chargers are installed



● **Affects the Entirety of Bus Operations** ●

Types of Charging Infrastructure

Depot Plug-In Charging

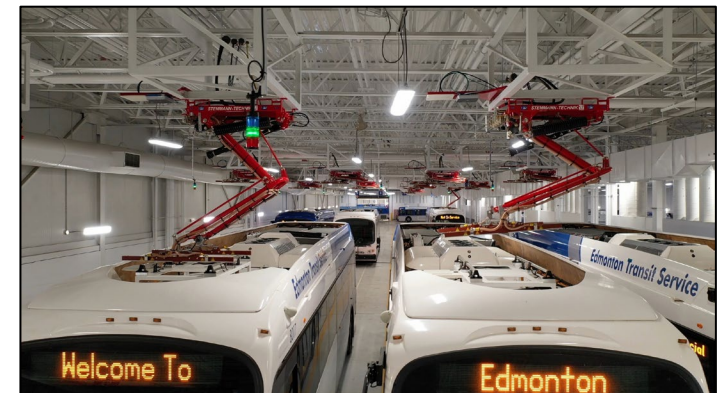
- Adopted by many peer agencies due to initial installation cost
- Limited to 120kW to each bus due to cable connection
- Power requirements – 20MW(Perry), 30MW (Laredo), 40MW (Clayton)
- Buses would need to be plugged in for 3.5 – 4 hours for full charge from 20% SOC
- Software would be required to determine SOC for each bus, range and compatible routes



Types of Charging Infrastructure

Pantograph Charging

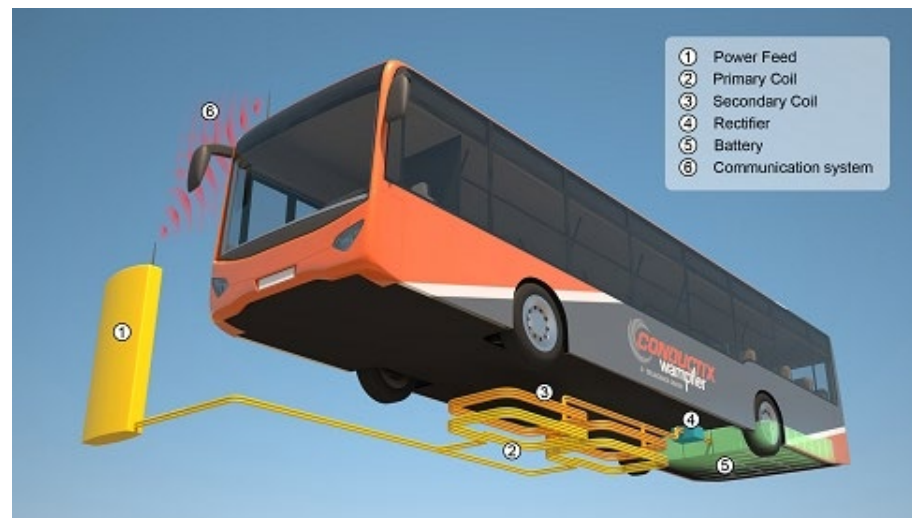
- Retractable pantograph extends to contact charge rails on roof of each bus
- Limited to 220kW for each bus due to bus battery type
- Power requirements – 30MW (Perry), 40MW (Laredo), 50MW (Clayton)
- Buses would need to remain connected for 2 – 3 hours
- Overhead structures required
- Useable for **On-Route Charging** (dependent on battery type)



Types of Charging Infrastructure

Inductive Charging

- In-ground inductive pad(s)
- Advertised charge ratings of up to 500kW
- No moving parts – very low maintenance
- Not yet incorporated into bus design(s)
- SAE standard under development



Battery Types – Long Range

- High **ENERGY** Batteries – 525kWh (Currently) - Future will have increased capacity
- Charge Time (90% SOC) – 128-182 minutes @220kW – 210-240 minutes @120kW
- **Maximum Daily Range – 190 miles-35-ft. bus, 180 miles 40-ft. bus, 150 miles 60-ft. bus**
- Lower Initial Cost – routes not dependent on chargers
- Limited Range – Less than “one service day”
- High power requirement at bus facilities – Clayton Co. Facility requirement equivalent to 10,000 average-sized homes (50MW, est. \$18M sub-station required)



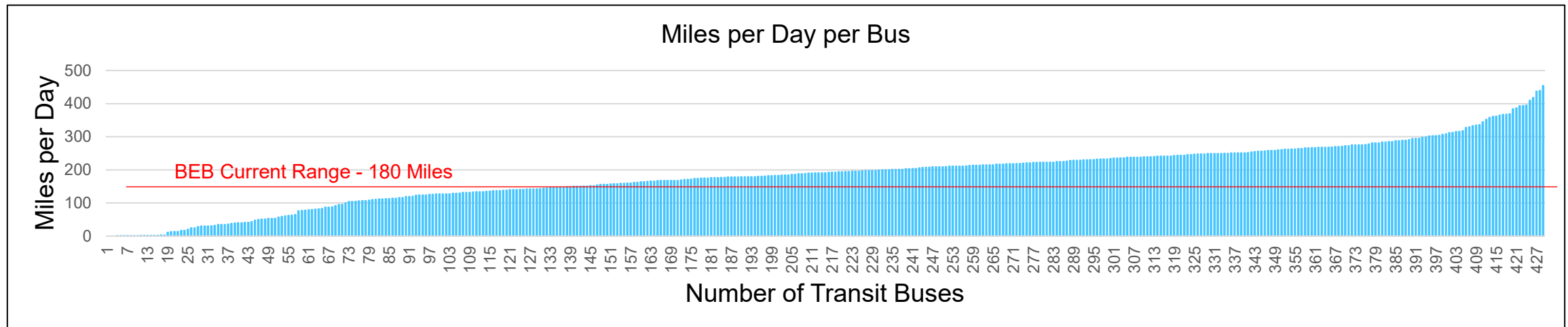
Battery Types – Fast Charging

- High **POWER** Batteries – 320kWh (Currently) – Future will have increased capacity
- Charge Time (90% SOC) – 10-15 minutes @ 450kw
- **Maximum Range – 120 miles-35-ft. bus, 110 miles 40-ft. bus, 90 miles - 60-ft. bus**
- Higher Initial Cost – chargers throughout service area and facilities
- Unlimited Range – Buses Charge at Bus Facilities and During Layovers
- Low Power Requirement at Bus Facilities – Clayton Co. Facility Requirement Equivalent to 800 average-sized homes



Current Service Plan


- Current MARTA EV bus range can support 27% of current routes using low or high-power depot charging only
- **73% of current bus routes will require on-route charging**, modified blocks, and/or additional buses to allow for mid-day charging
- Bus Range May Increase as Battery Technology Advances

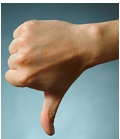


Source: MARTA Trapeze EAM & New Flyer Connect 360

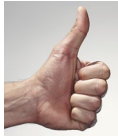
Fleet Transition Priorities – Infrastructure Strategy Pro's and Con's


Fast Charge Strategy

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- Unlimited Service Range
 - Lower Power Requirements at Garage
 - Can Provide Charging During Power Outages (with back-up generator)

- 
- Routes Must Layover at Overhead Charger
 - Higher Cost
 - Multiple Installation Sites
 - On-Route Chargers are Not Secured

Long Range Strategy

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- Lower Initial Cost
 - Construction Limited to Bus Facilities
 - Chargers are in Secure Location
 - Routes Not Dependent on Chargers

- 
- Limited Service Range – Less than One Day
 - Additional Buses May be Required
 - High Power Requirement at Bus Facilities
 - Limited Charging During Power Outages (with back-up generator)

2040 Fleet of the Future

1. An environmentally responsible and sustainably-fueled fleet
2. A reliable and diverse fleet
3. A future-focused fleet

Diverse propulsion types

- Battery-electric
- Fuel cell
- Hydrogen combustion
- Bio and synthetic fuels
- Next-generation clean fuels

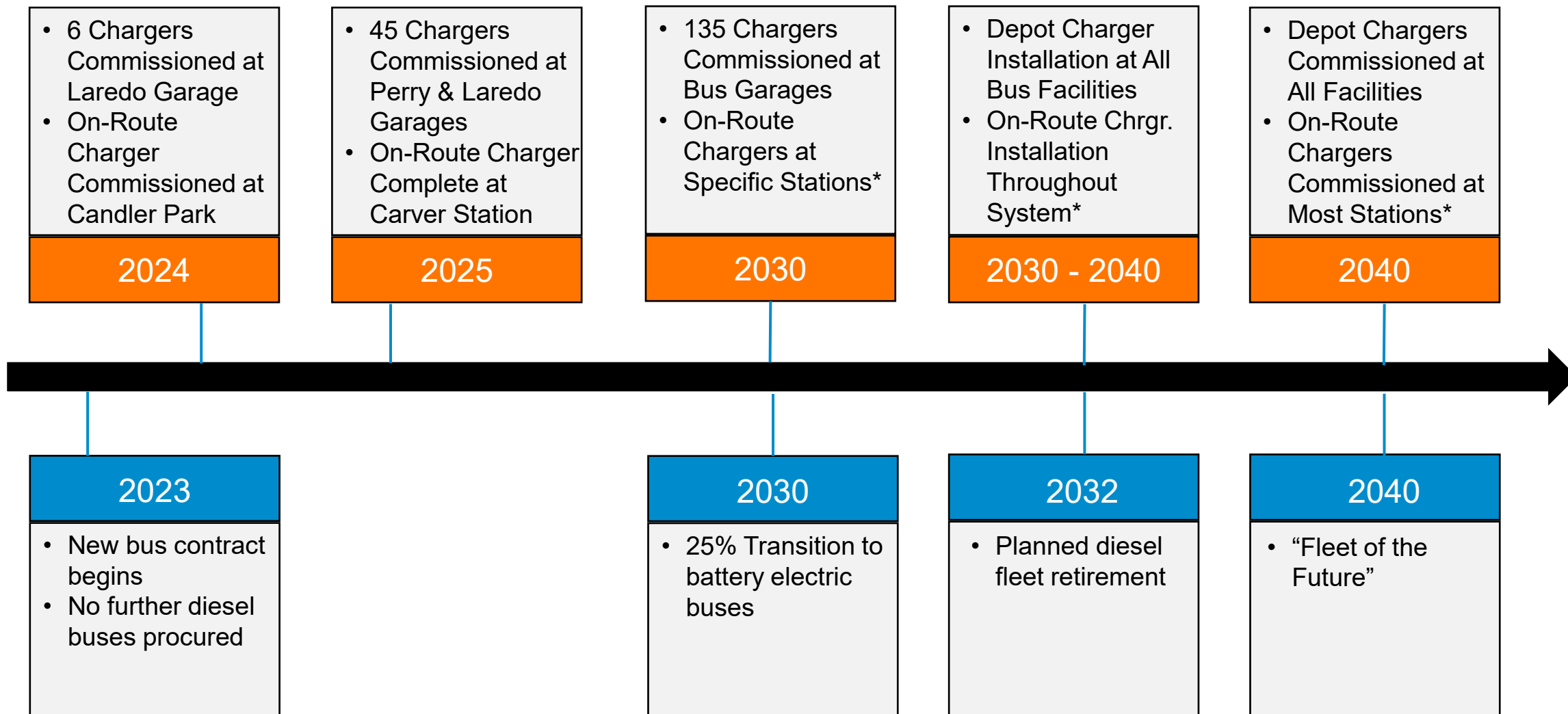


Charging Infrastructure Process

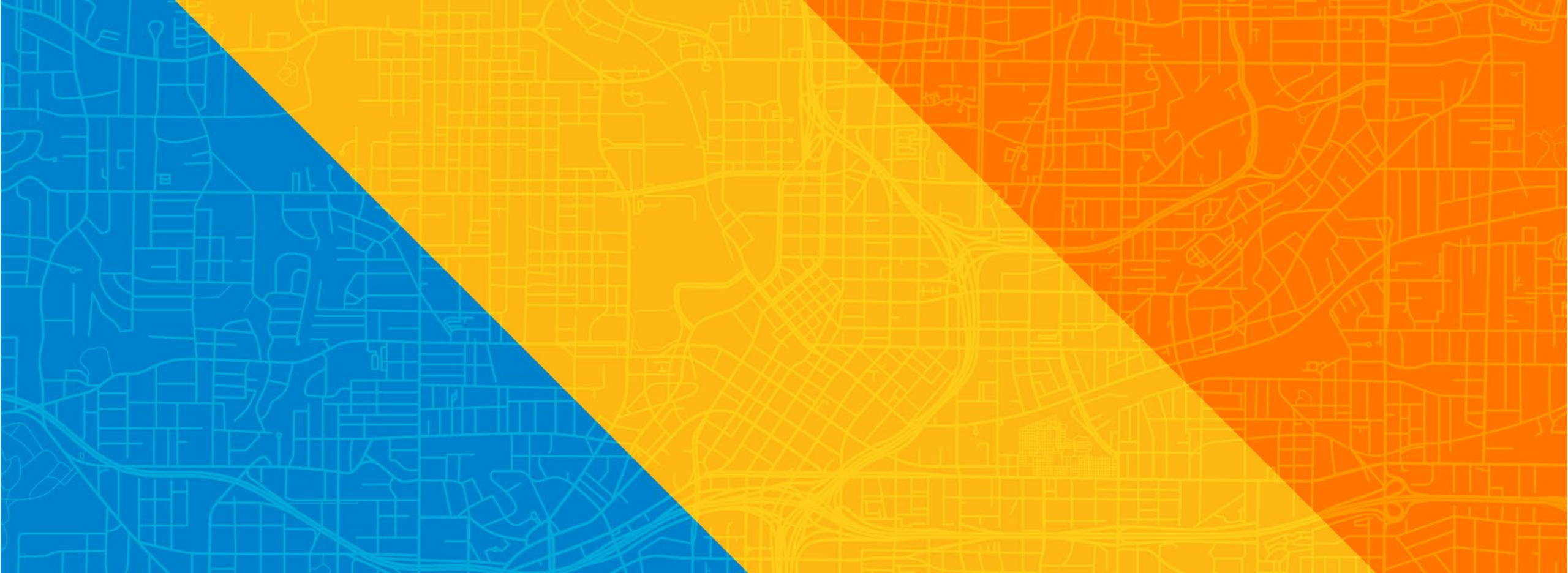
- Site Visit / Scope of Work
- Design Quotation & Construction ROM Cost
- Utility Service Assessment
- Georgia Power Modifications
- Design / Engineering / Construction Documents
- Infrastructure Construction
- Charging System Installation
- Charger Testing/Commissioning



Fleet Transition Priorities – Timeline



* Dependent on Charging Strategy and Fuel Type



Thank You

