ALEXANDRIA TRANSIT COMPANY

ZERO EMISSIONS

ELECTRIC BUS PROGRAM

DASH OVERVIEW

- Local Bus System for the City of Alexandria, VA
- Services City of Alexandria and surrounding areas
- Operates over 3 million miles annually
- Roughly 4 million annual passengers
- Fleet of 115 fixed route buses
- Service area of 15 square miles

STUDIES AND RESEARCH

- ZEB Feasibility Study (Completed 2019) – CTE
- ZEB Implementation Study Phase 1 (Completed 2021) - WSP
- ZEB Implementation Study Phase 2 (In Progress - WSP)
- Future studies to evaluate performance of vehicles, driver habits, and other metrics from the fleet

ZERO EMISSIONS FLEET PROGRAM OVERVIEW

- Total fleet of 115+ heavy duty buses
- Purchase only Zero Emissions Buses by 2027 for all new bus orders
- Full Zero Emissions fleet by 2037

CURRENT DEPLOYMENT BUSES

Proterra

- (7) 40’ ZX5, 440kWh
- Requirement for interoperability with ABB Chargers

New Flyer of America

- (3) 40’ XE40, 466kWh
- (4) 60’ XE60, 524 kWh
- Requirement for interoperability with Proterra Chargers

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FACILITY REQUIREMENTS

- Fleet growth to 115+ buses
- Assuming today's technology and tomorrow's service requirement – requires at minimum 40 charge points
- Higher than 1:1 Charger to Bus Ratio = Platooning is Necessary

CURRENT FACILITY LAYOUT

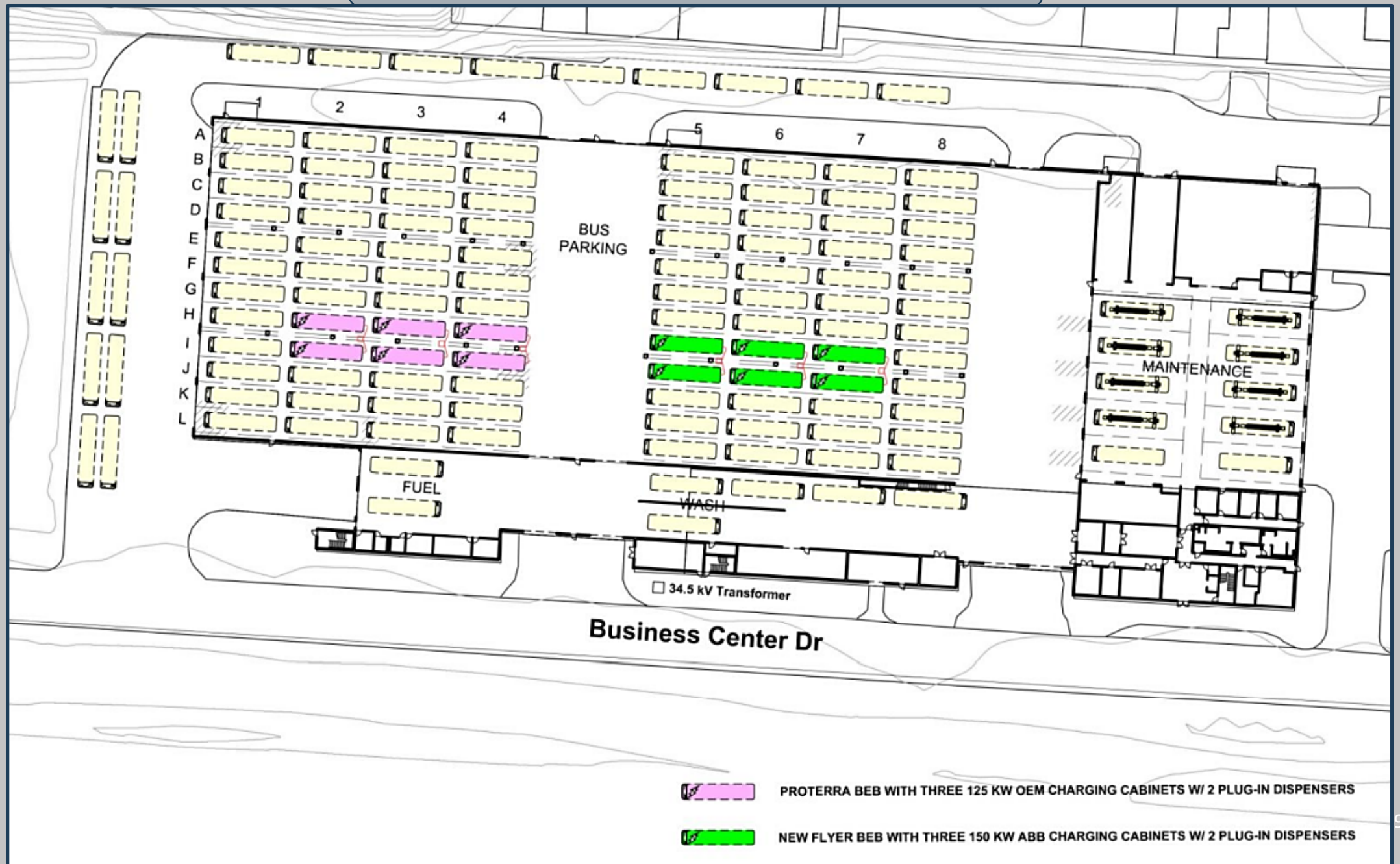
- Capacity of 96 Buses
- 6 Depot Chargers/12 Dispensers – Max Charging Available
- 3 Proterra, 3 New Flyer

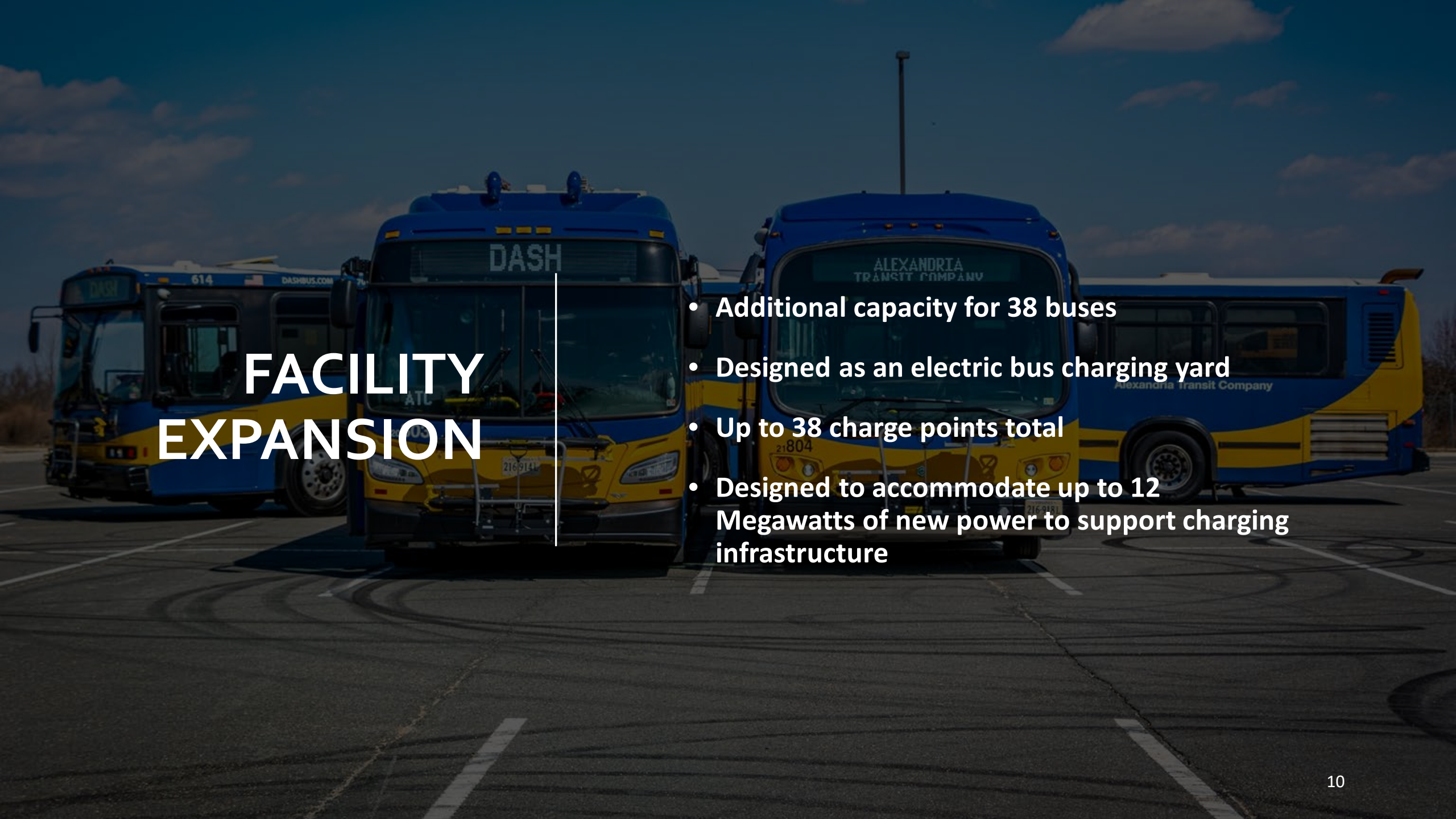
CURRENT FACILITY AND CHARGERS

- ABB
- (3) 150 KW Chargers
- 6 Dispensers Total
- Sequential Charging

- Proterra (Rhombus)
- (3) 125 KW Chargers
- 6 Dispensers Total
- Sequential Charging

CURRENT FACILITY

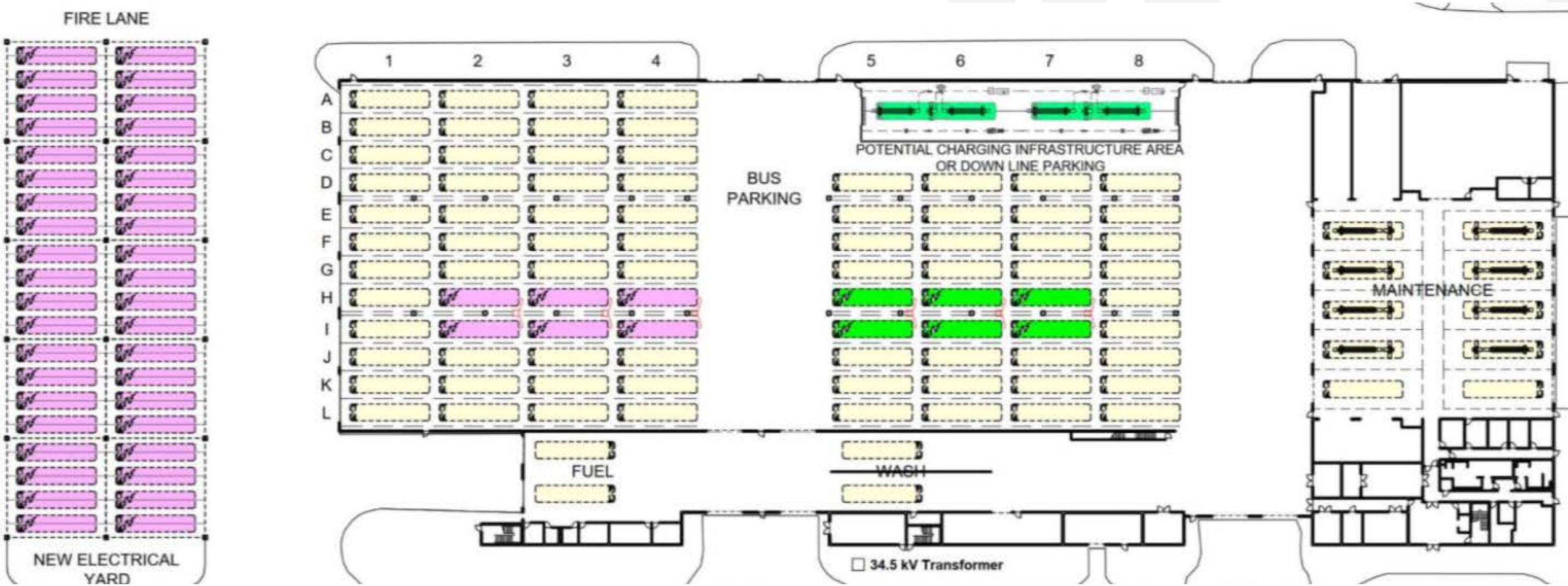




FACILITY EXPANSION

- Additional capacity for 38 buses
- Designed as an electric bus charging yard
- Up to 38 charge points total
- Designed to accommodate up to 12 Megawatts of new power to support charging infrastructure

FACILITY EXPANSION



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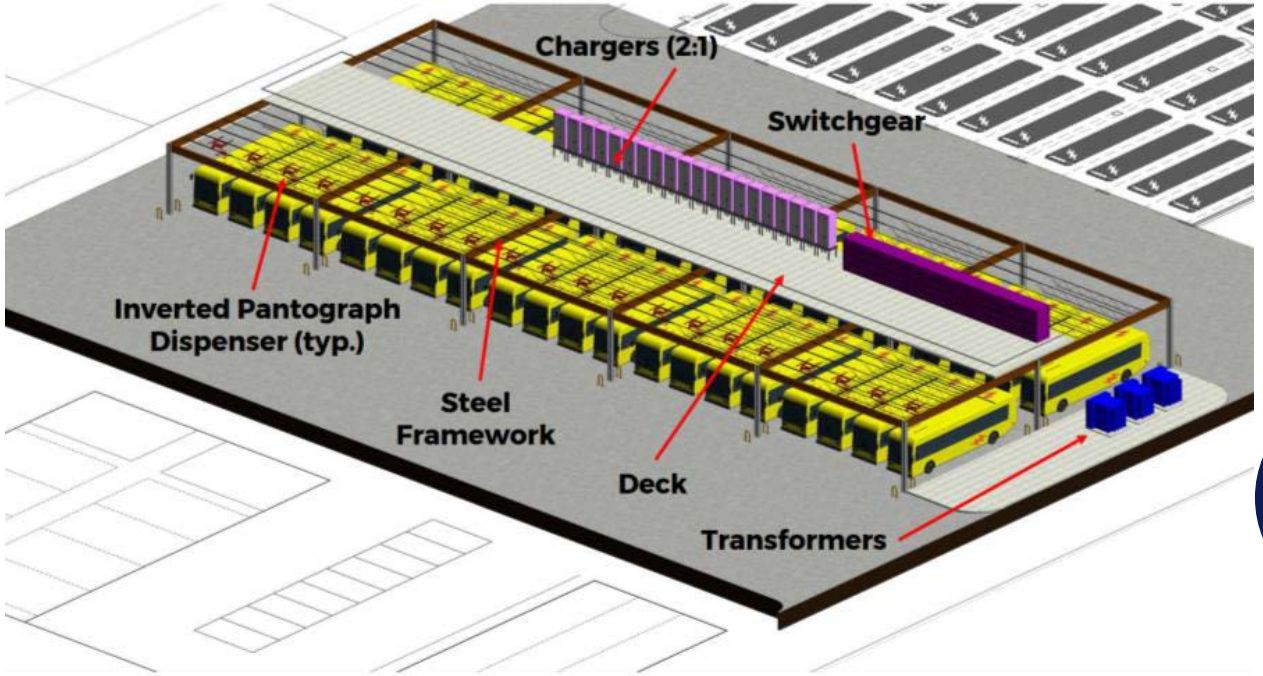
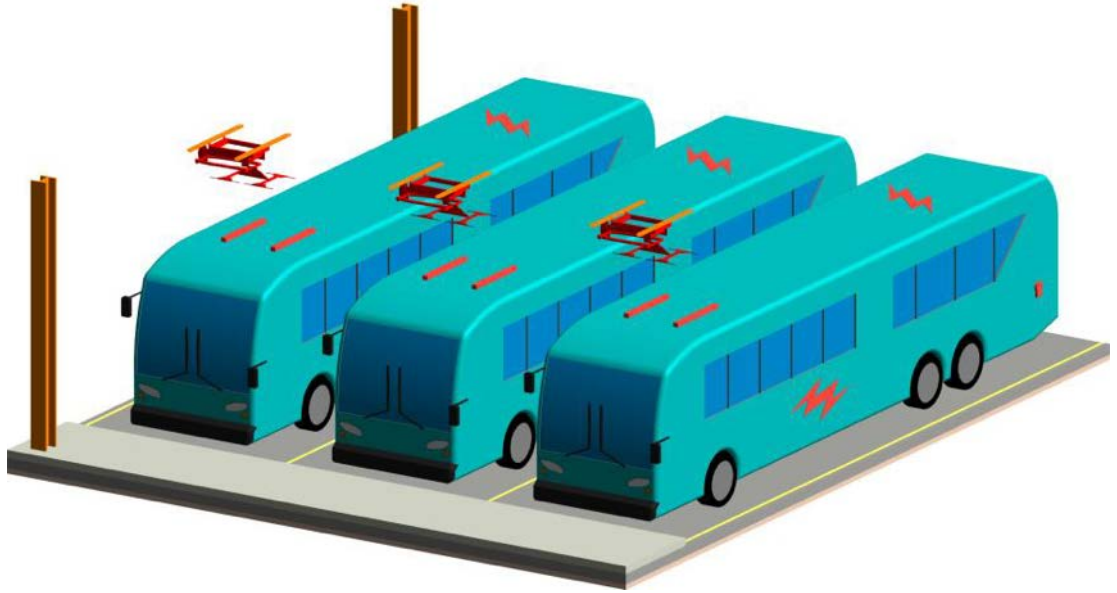
CONCEPT DESIGN FOR NEW FACILITY

Framework for Equipment Real Estate





Pantograph Dispensers

FACILITY PROGRAM

APPROACHES AND OPTIONS

- Initial Scale-Up of up to 6 MW of power
- Expandable to up to 12 MW of power
- Coordination with Utility
- Different Charging Configurations Considered
  - 20+ 150 KW Standard Chargers (2:1 Ratio)
  - Up to 20 450 KW Fast Chargers (2:1 Ratio)
  - Lesser amounts of 1.5 MW Megachargers (up to 10:1 Ratio)

GOALS AND REQUIREMENTS

- Need to support ultimately 130+ Buses using no more than 12 MW of power
- Need to support 24/7 Service Profile
- Planning for Clean Energy and Resiliency
- Less chargers at faster output?
- More chargers at slower output?
- How much on-route charge opportunity?

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ECONOMIES OF BATTERY ELECTRIC BUSES

- One depot charger costs roughly $150,000 per unit. (Assumes drop-in conditions)
- A Typical Battery Electric Bus costs $1.2 million compared to $600,000 for a diesel equivalent
- On average, the energy cost per mile is $0.42/mile on a Battery Electric Bus vs. $0.92/mile on a comparable Diesel bus
- DASH pays on average $0.14 per kWh of electricity
- Total Cost of Ownership needs to consider battery degradation, midlife overhauls, infrastructure.

SOME CAVEATS…

- It is difficult to quantify and measure quality of life improvements of battery electric buses
- We are working on improving our visibility into the energy consumption of the chargers
- Bus side data and telemetry needs to be vastly improved
- We have yet to implement and practice Smart Charging

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NEXT STEPS

- ZEB Implementation Study Phase II
- Pre-design of DASH Facility Expansion / Electric Bus Charging Yard
- Charge Management/Smart Charging
- Assisted Dispatch
- On-Route Opportunity Charging
- Inductive Charging?

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QUESTIONS?

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