FTA

FEDERAL TRANSIT ADMINISTRATION

2021 Virtual Transit Asset Management Roundtable

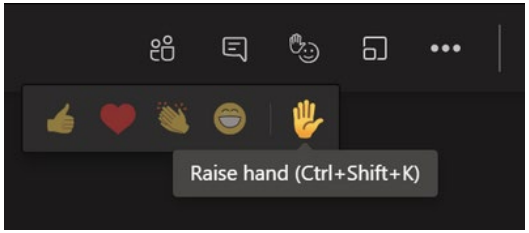
Day 3: TAM & Technology

June 24, 2021

U.S. Department of Transportation
Federal Transit Administration

Teams Logistics

- There is no private chat pod.
- Keep yourself muted unless you're speaking.
- Use the "raise hand" feature to speak during the Q&A.



If anyone is in attendance but hasn't registered, email TAMRoundtable@dot.gov with your name, title, and agency.

FTA RESEARCH
FEDERAL TRANSIT ADMINISTRATION

Technology Advancements in Transit Asset Management (TAM)

June 24, 2021

Mohammed Yousuf
Director, Office of Infrastructure, Safety & Asset Innovation/TRI.

U.S. Department of Transportation
Federal Transit Administration

Transit Asset Management (TAM) Improves

Courtesy: Traffic Technology Today

Asset inventory & condition assessment	Reporting performance targets	Life cycle costs, maintenance and operations

Real-Time Transit Infrastructure and Rolling Stock Condition Assessment Program

Research Program Goals:

- **Explore** advanced technologies for real-time condition assessment of transit capital and facilities.
- **Assess**, detect, monitor and track deficiencies and defects of rail systems in real-time.
- **Evaluate** the cost-effectiveness and practicality of proposed solutions.

Reimagining TAM through Advanced Technologies

Artificial Intelligence – smart sensors to track the health of rail tracks

Advanced scanning technologies - light detection and ranging technologies, optical imaging, and overhead catenary automated scanning to assess track conditions in real-time

Digital Twins Simulation and Modeling – real-time infrastructure maintenance through virtual representation of assets and predictive modeling

Projects Selected

Applicants	Project Title	Proposed Scalable Funding
Board of Trustees of the University of Illinois	Real Time Track and Vehicle Health Monitoring through Rail-mounted Load Quantification Smart Sensors	$395,000
Maryland MTA	Mobile LiDAR: Modernizing Condition Assessments An innovative approach to data acquisition	$150,000
Regional Transportation Commission of Southern Nevada	The Digital Twin Paradigm for Real-Time Transit Infrastructure Maintenance	$131,661
Dallas Area Rapid Transit Authority	DART Real-time Infrastructure and Asset Digital Condition Assessment Project	$184,000
Southeastern Pennsylvania Transportation Authority	SEPTA Regional Rail Automated Wire Scan	$170,000
Utah Transit Authority	Polarized Infrared and Optical Imaging System for Transit Infrastructure Condition Assessment	$338,155
	Total Funding Amount	**$1,368,816**

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Dan Hofer and
Hal Johnson
Utah Transit Authority

Susan Mwangi
and Jeff Hiott
Capital Metro

Danny Ilioiui
King County Metro

Real-Time Transit Infrastructure and Rolling Stock Condition Assessment Demonstration Program. Infrared scanning or rail

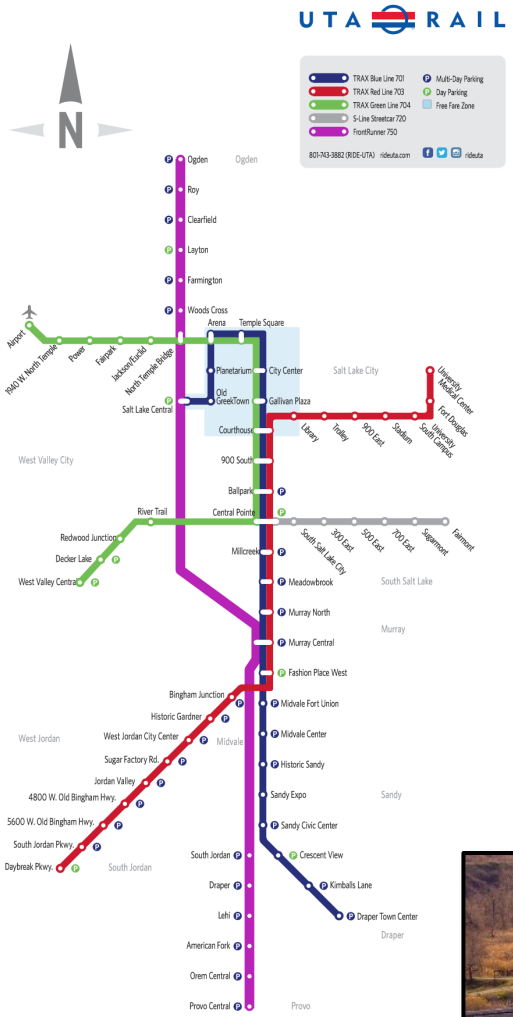
Dan Hofer and Hal Johnson

June 2021

About UTA

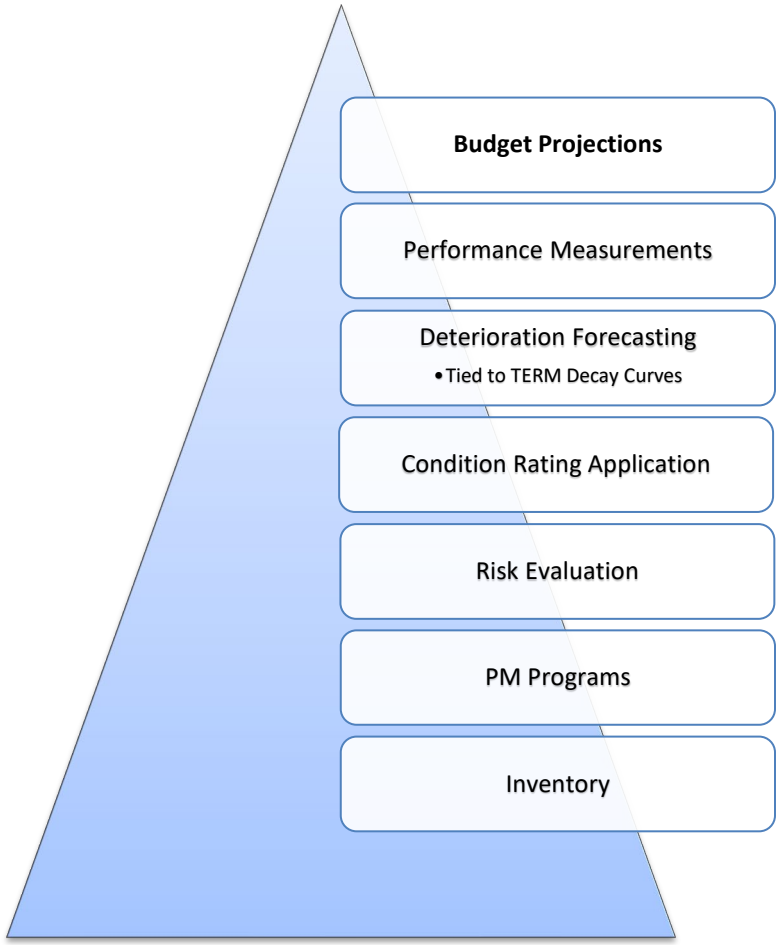
- **Population** – approx. 2.3 million
- **Linear Geographic Area** – 108 miles long by 50 miles wide
- **Currently Employs** - approx. 2400
- **Operate** – 700+ Buses, 450+ Vans, approx. 120 LRVs, and approx. 70 Commuter Rail Vehicles

UTA Rail System



- 90 miles of commuter rail
- 50 miles of light rail
- System built between 1999 and 2013

TAM at UTA

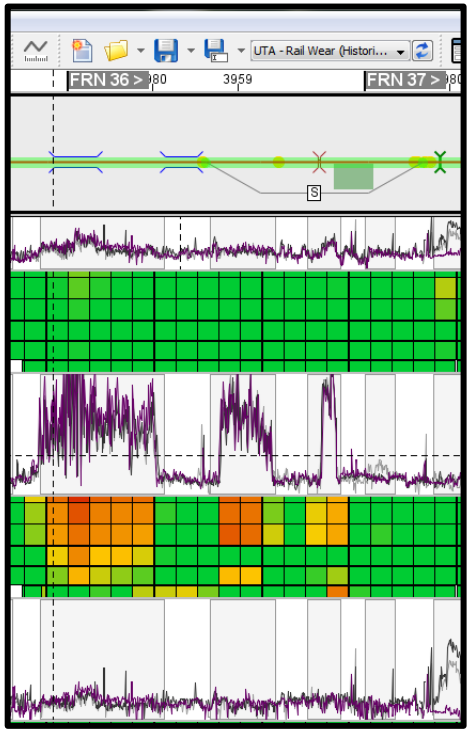


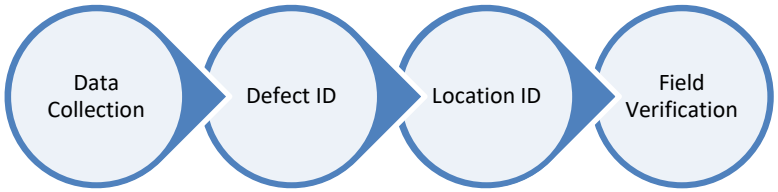
- Condition Rating Application and Deterioration Forecasting are most difficult
- Time-consuming
- Often difficult to justify on a large scale

Benefits of this Project

Provides key benefits:

- Third-party verification
- Severity of defects
  - internal
- Advanced detection
- Precise location id
- Quick data processing & turnaround time





Polarized Infrared & Optical Imaging System for Transit Infrastructure Condition Assessment: WHAT

The project is a collaboration/public private partnership between UTA, the University of Utah and Autofill

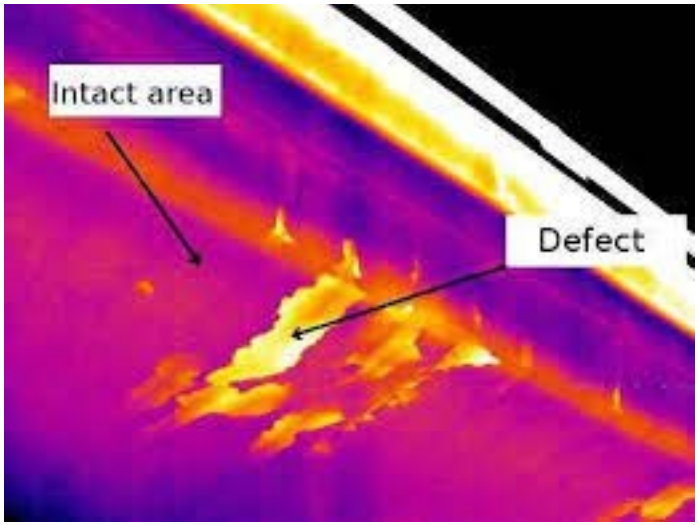
- The project will develop and demonstrate a system that can identify, quantify, and monitor both the internal and external

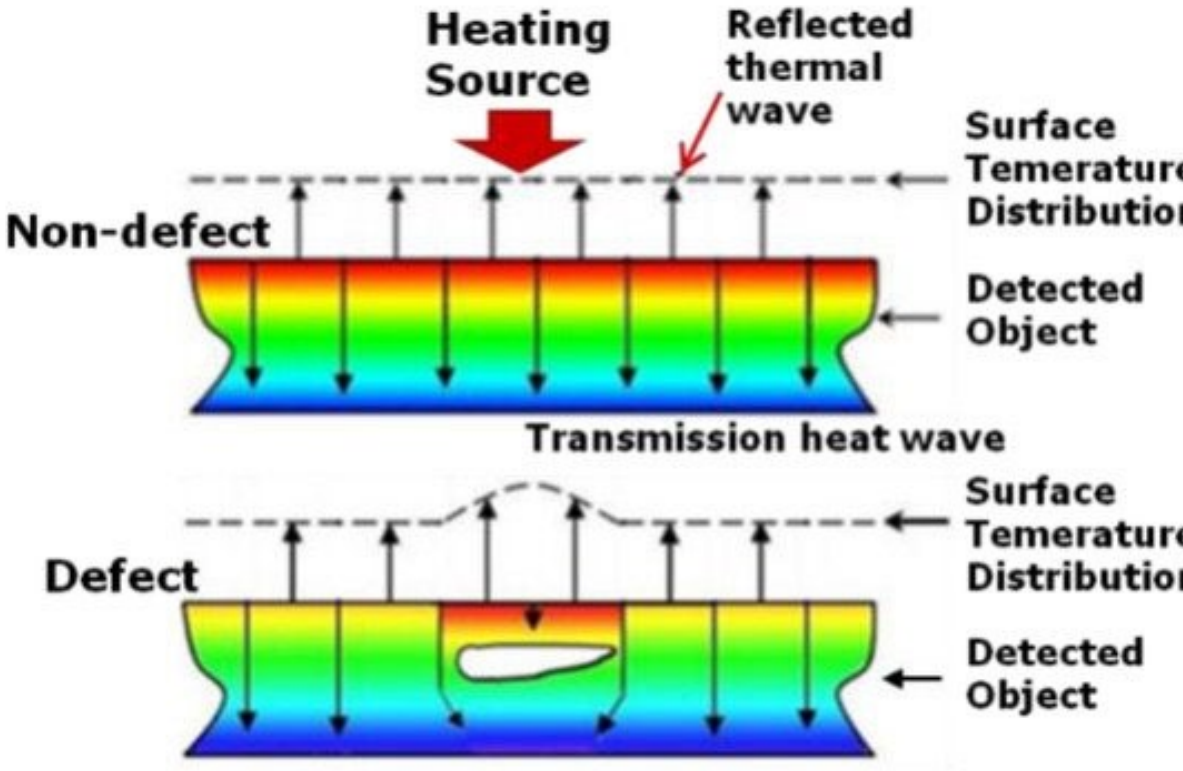
Polarized Infrared & Optical Imaging System for Transit Infrastructure Condition Assessment: HOW

- The system will employ a polarized infrared camera and a polarized optical camera.
- The cameras are envisioned to be mounted on an inspection vehicles or revenue service train and provide early warning and long-term monitoring of track and tie conditions.

Infrared scanning

- **Infrared scanning can see hidden flaws by detecting uneven heating**





How it works

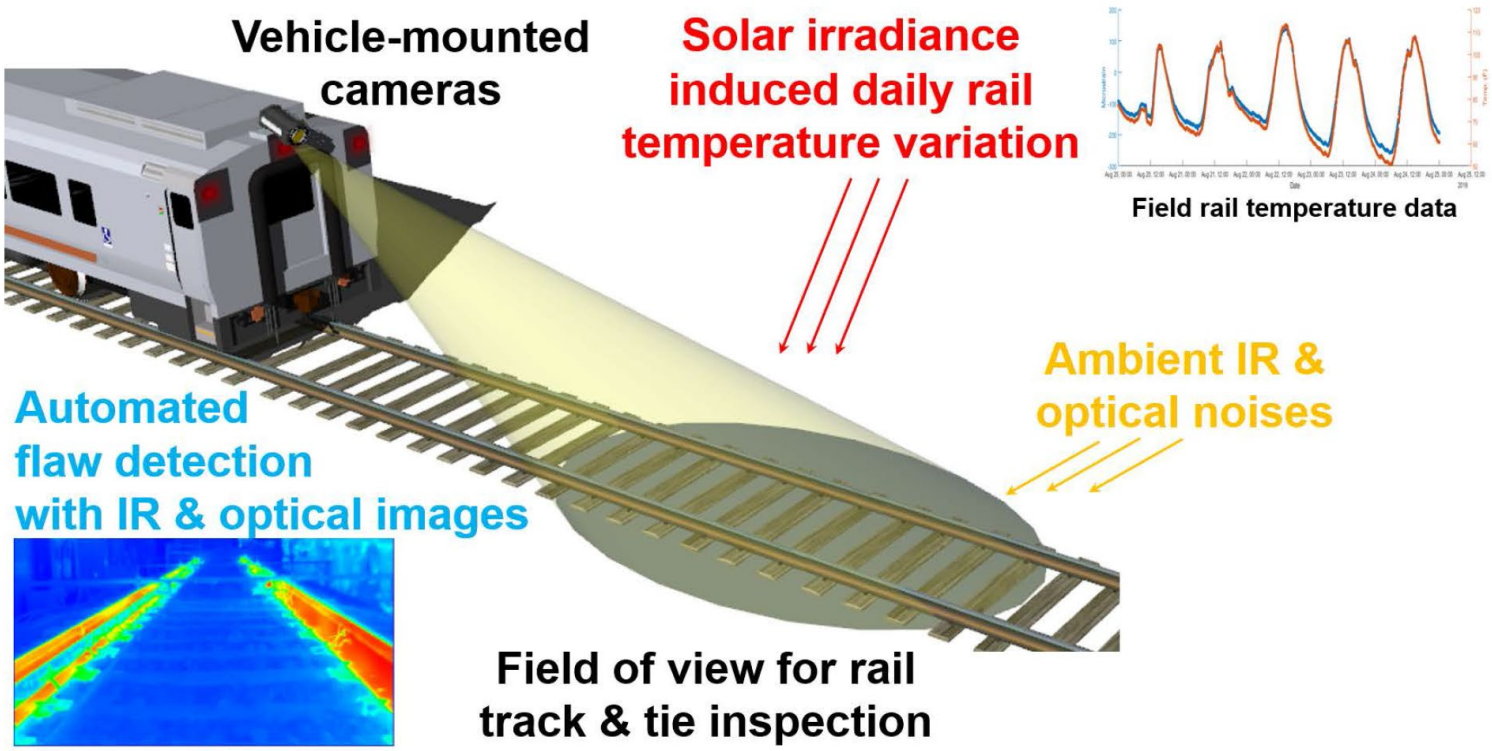


Figure 1- Concept of fully developed system for in-motion rail track and tie inspection

Project Benefits

- Improved safety for UTA's rail system to avoid catastrophic failures.
- Current detection practices require visual or sounding methods which can take days. The proposed system may be able to scan the whole system at operating speed.
- The system will employ a polarized infrared camera and a polarized optical camera which can detect both internal and external defects.
- The cameras are envisioned to be mounted on an inspection vehicles or revenue service train and provide early warning and long-term monitoring of track and tie conditions.
- National applicability.

Additional Notes

- Both the University of Utah and Autofill are providing financial match for the project.
- The University of Utah team is led by Xuan (Peter)Zhu, Ph.D., who is an assistant professor in Civil Engineering. Dr. Zhu serves as the lead on the project.
- Autofill are a private company based in the Netherlands. They are highly experienced in: 1. ComputerVision, 2. Artificial Intelligence 3. Convolutional Neural Networks and 4. Edge computing.
- The CEO and CTO have extensive experience and have worked with Homeland Security, The London Underground and major telecom companies.

TAM & TECHNOLOGY

Susan Mwangi

Manager, Transit Asset Management & Inventory

Jeff Hiott

VP, Imagination, Research & Industry Benchmarking

CapMetro Overview

- Austin, Texas metro region (544 sq. mile service area)
  - Population served: 1,300,000+
- 83 bus routes, 14 high-frequency routes, 1 regional rail line
- 368 MetroBuses, 12 Battery Electric Buses (BEBs), 55 MetroRapid vehicles, 10 diesel electric trains, 257 van pool vehicles, 213 paratransit/On-Demand Microtransit vehicles
- 2,300 bus stops, 17 Park & Rides/transit centers, 9 commuter rail stations, 162 miles of commuter and freight rail
- MetroBike bikeshare with E-bike expansion*

Sustainability and Climate Initiatives

Agency Strategic Goal: Sustainability

Sustainability Vision Plan & Climate Action Plan (*in development*)

- Plan focuses on clear, integrated and actionable steps towards the goal of becoming the one of the first carbon-neutral transit agency in the country

Focusing on Renewables

- All facilities currently powered by 100% renewable energy sources
- More than 270 public facility amenities are solar powered (shelter lights, security cameras, electronic signs, displays)

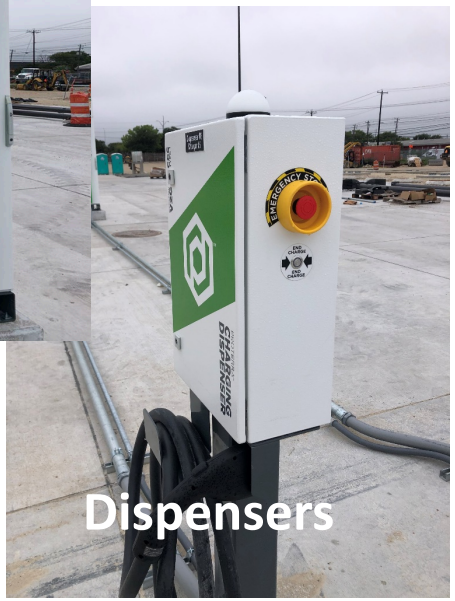
Zero Emission Bus Fleet Transition

Highlighted Strategies

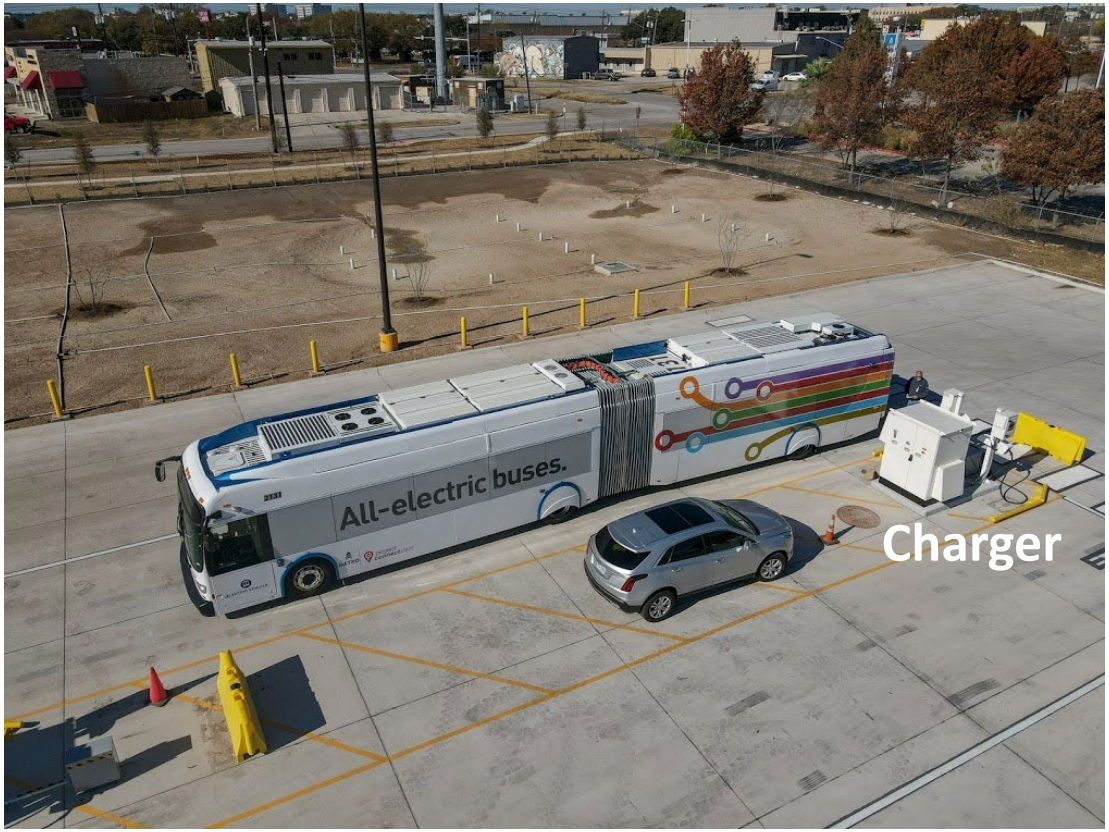
- Fleet Electrification:
  - Zero Emission Vehicle Transition Plan (*underway*)
  - 200 battery electric buses by 2025 (12 in service)
    launched with *LoNo funding 2019/2020*
    - 100% zero emission fleet by 2035
  - North Ops Electric Bus Depot is “E-ready” for 200 buses (*Opened Sept. 2020*)
  - Zero emission rail and paratransit fleets integrated into Project Connect system expansion

Proterra (6) 40’ buses with Proterra chargers

Chargers


Dispensers

New Flyer 40’ (4) & 60’ (2) with Siemens Chargers

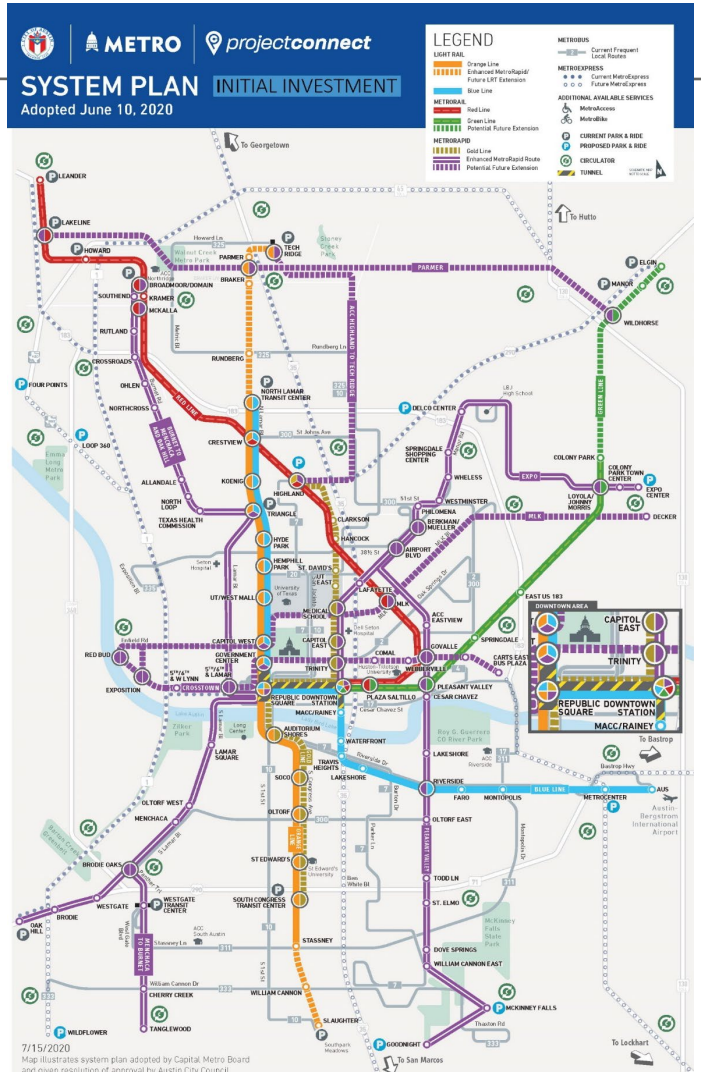


Future On Route Charging for MetroRapid BRT lines

- End of Line (EOL) for revenue service
- 4 fast chargers
- Buses with pantograph down & plug in

Project Connect

- Orange Line Light Rail
  - 21 miles
  - 22 stations
- Blue Line Light Rail
  - 15 miles
  - 20 stations
- Green Line Regional Rail
  - 27 miles
  - 6 stations
- BRT (all lines)
  - 74 miles
  - 193 stations
  - Approximately 65 new zero emission buses



Lifecycle Planning

- Range: Battery Electric bus vs Diesel bus
  - Replacement schedule ratio
- CapMetro Useful Life (as part of our LRFP)
  - Diesel buses - 14 years
  - BEB - 12 years
  - Chargers - 20 years
- Consultant
  - Data support and analyses to help inform decisions
  - Planning, operations, and maintenance
  - Charging strategies – on-route vs depot or both

Facility Modifications for New Fleet

- Modernize and expanded existing garage with electric infrastructure
- Designed for future expansion without clear answers to the unknowns:
  - *When?*
  - *How many?*
  - *What kind of electric buses to buy*
    - *plug in, overhead, wireless ??*

North Operations Bus Garage Expansion Project

Serta Mattress Factory Building

Bus Yard Expansion Project

Phase I: Serta Building Demolition

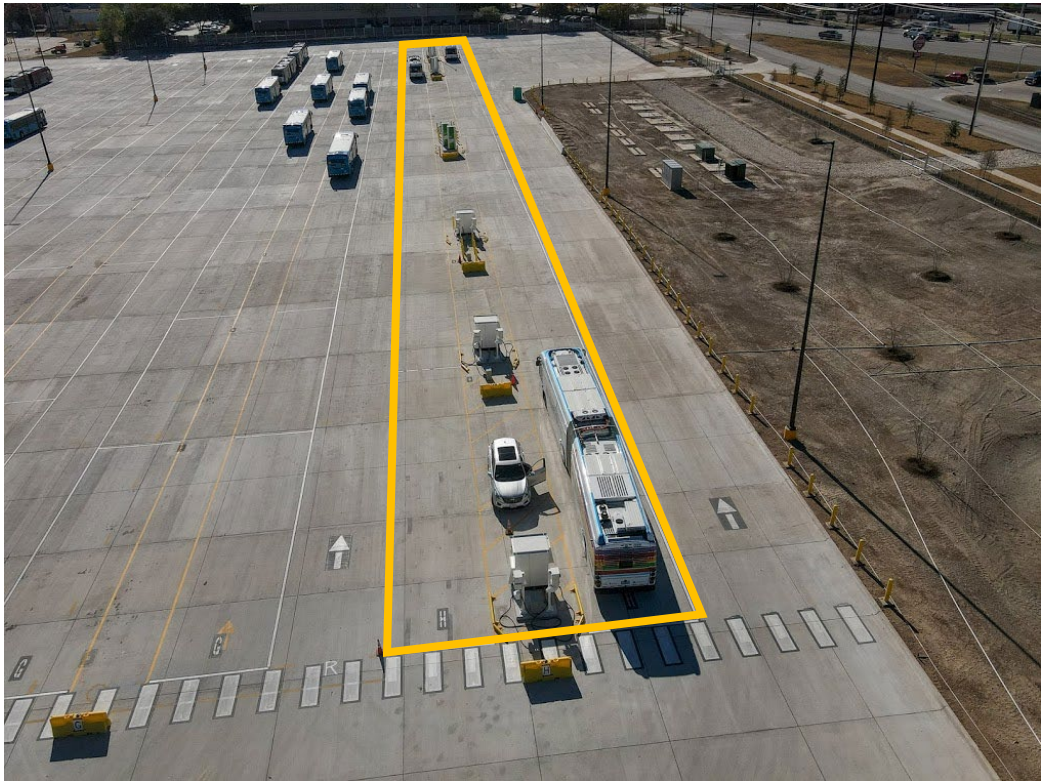
Phase II: Build Bus Yard Expansion

Phase III: Electric Infrastructure for First 12 Battery Electric Buses

Future Phases: Add Electric Infrastructure in Phases as Additional Buses are Delivered

Current Buses and Chargers

- 12 electric buses (BEBs)
- 9 plug in chargers
- 3 duplex chargers (cascade)



N. Ops Yard

- Conduit for future wiring
- All underground for flexibility
- 8 arrays & charger spines

Power Equipment

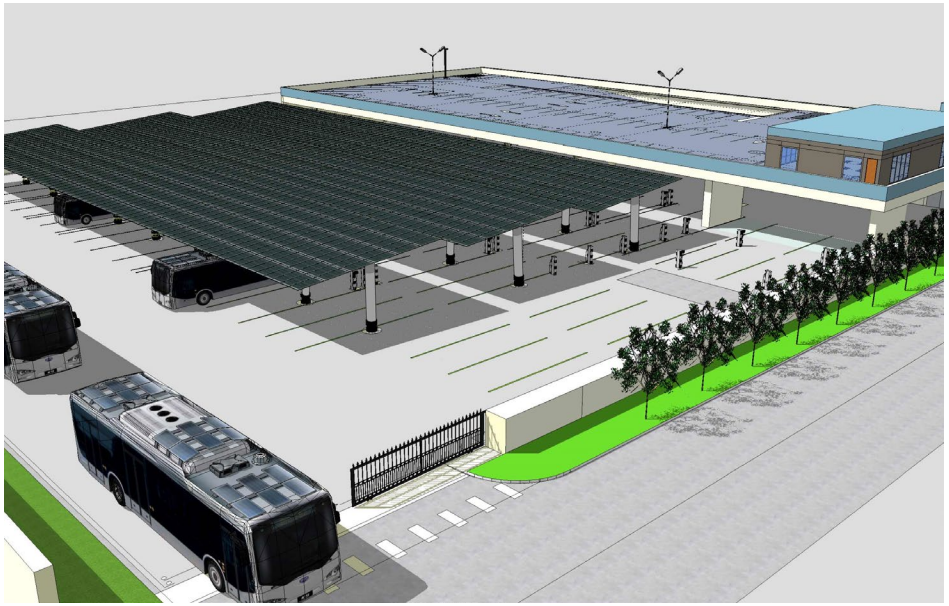
- 2 AE service drops
- 8 AE transformer
- 8 AE meter
- 2 AE switchgear
- 8 CapMetro switchboard
- Second feed at 50%, adds resiliency

N. Ops Yard

- ~175 electric
- Space constraints to expand

Future: Solar Canopy with Pantographs

- Shade & solar panels
- Connect to AE grid
- Connect to admin building
- Flatten peak demand curve
- Solar on buildings?
- Battery storage?



Next Steps/Challenges

- Complete a Facility Master Plan (underway)
- Manage TAMP to maintain current assets in an SGR while rapidly expanding the system with new assets to add to our inventory
- Update procurement process with asset management integration
- Remain committed to innovation
- Train staff to manage and maintain assets, especially new technologies

METRO

THANK YOU!

King County Metro Battery Electric Bus Program

Danny ILIOIU
Zero-Emissions Fleet / Program Manager

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1600 Buses Total (100% of the fleet is Diesel-Electric Hybrid, ETB or BEB), in addition we operate Ferry, Light Rail. Streetcar, Access, Van Pool…

- **185 Zero-Emissions Buses**
  - **174** Electric Trolley Buses (ETBs or Trolleys)
  - **11** Fast Charge 40’ Battery Electric Buses (BEBs)
    - 10 Extended-Range 40’ & 60’ Battery Electric Buses (2018-2020) – Leased/Test Completed/Buses returned
  - 40 Extended-Range BEBs (2021-2022)
  - 260 BEBs (2024-2027)
  - 30 ETBs (2027)

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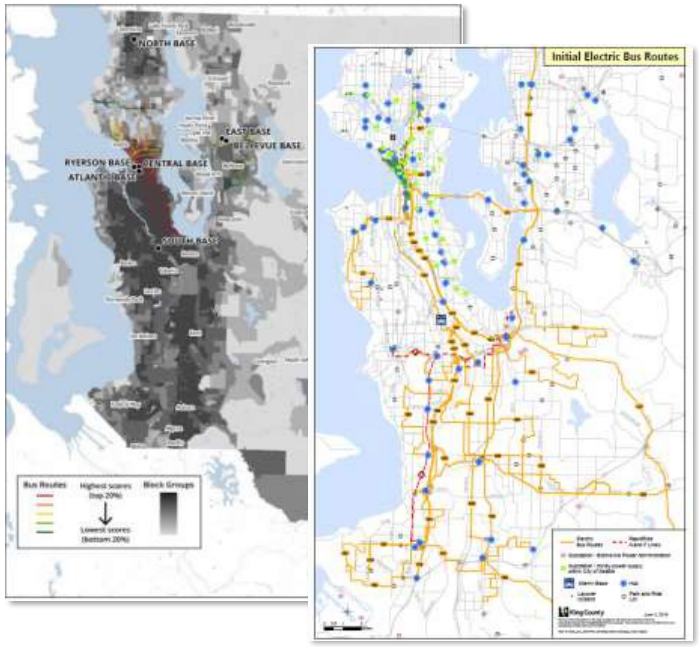
Zero-Emissions by 2040 (or 2035) ?



- Eight to Ten Bases
- Layover Chargers
- Align with ESJ plan
- Eliminate local emissions
- 70% of work blocks can be satisfied by current BEB technology
- Mix of Trolley and BEB to reach zero-emissions goals
- Expand trolley system where the TCO supports

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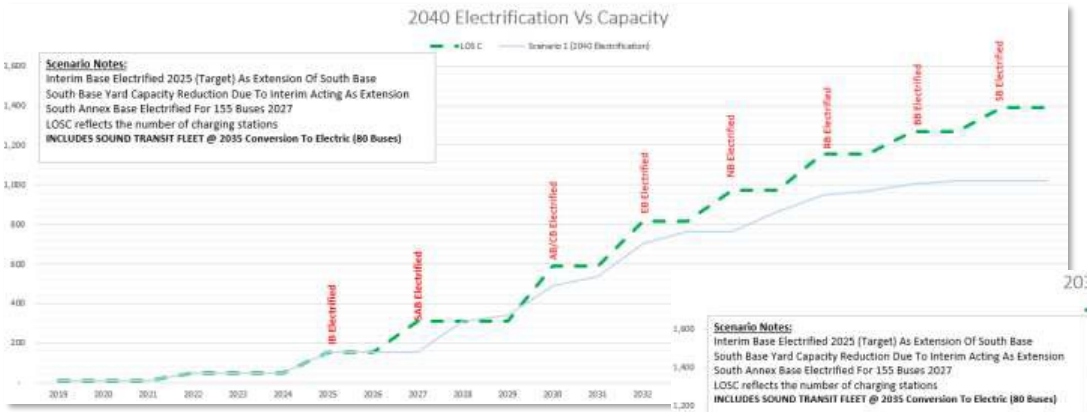
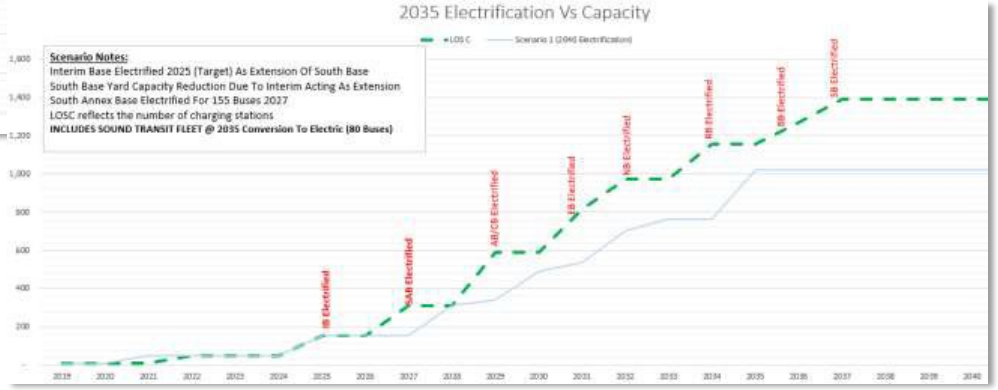
Zero-Emissions by 2040 (or 2035) ?





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Eastgate Park & Ride

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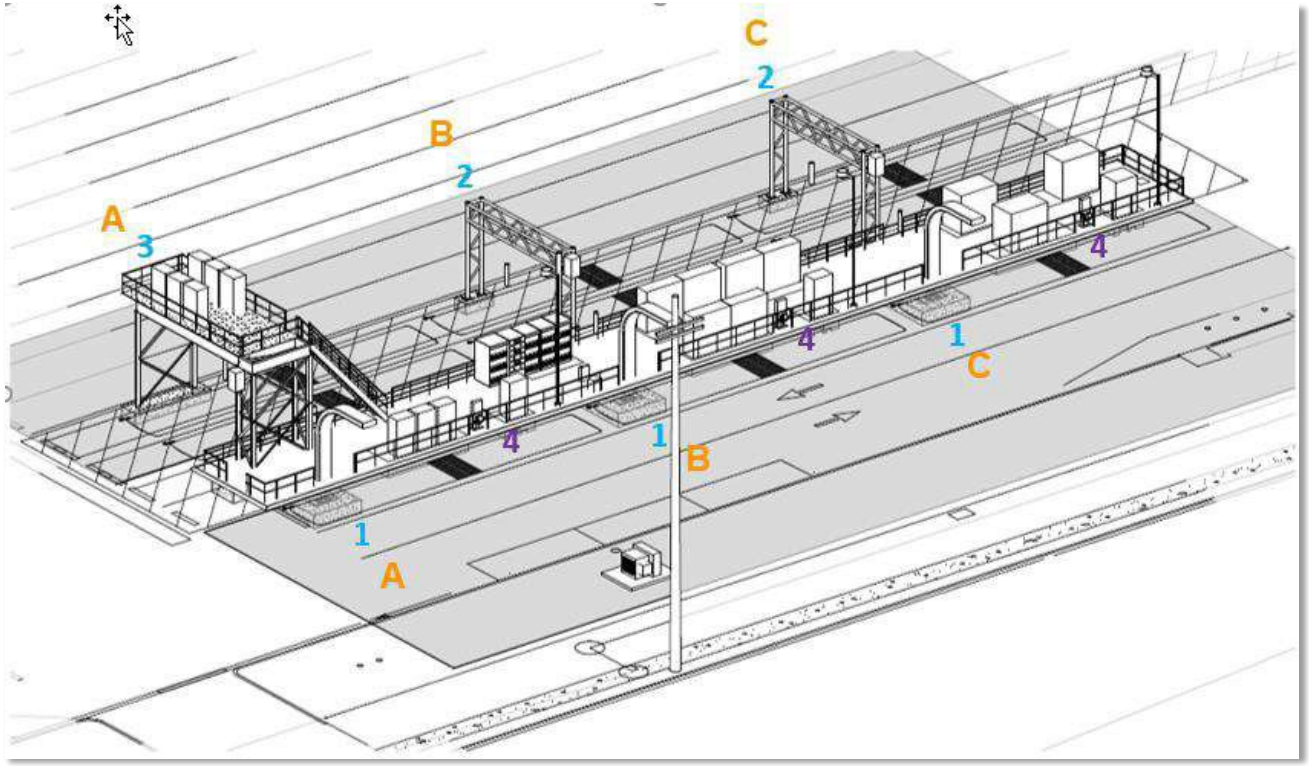
South Base Test Facility



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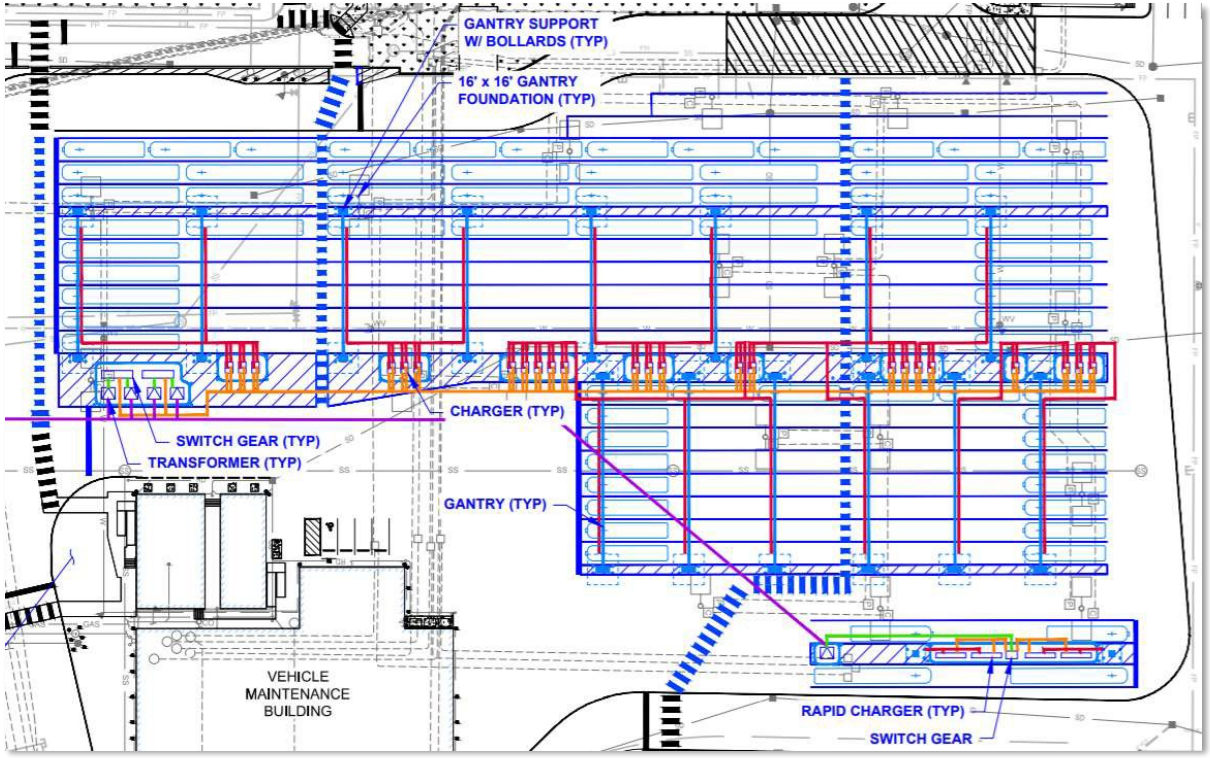
Interim Base



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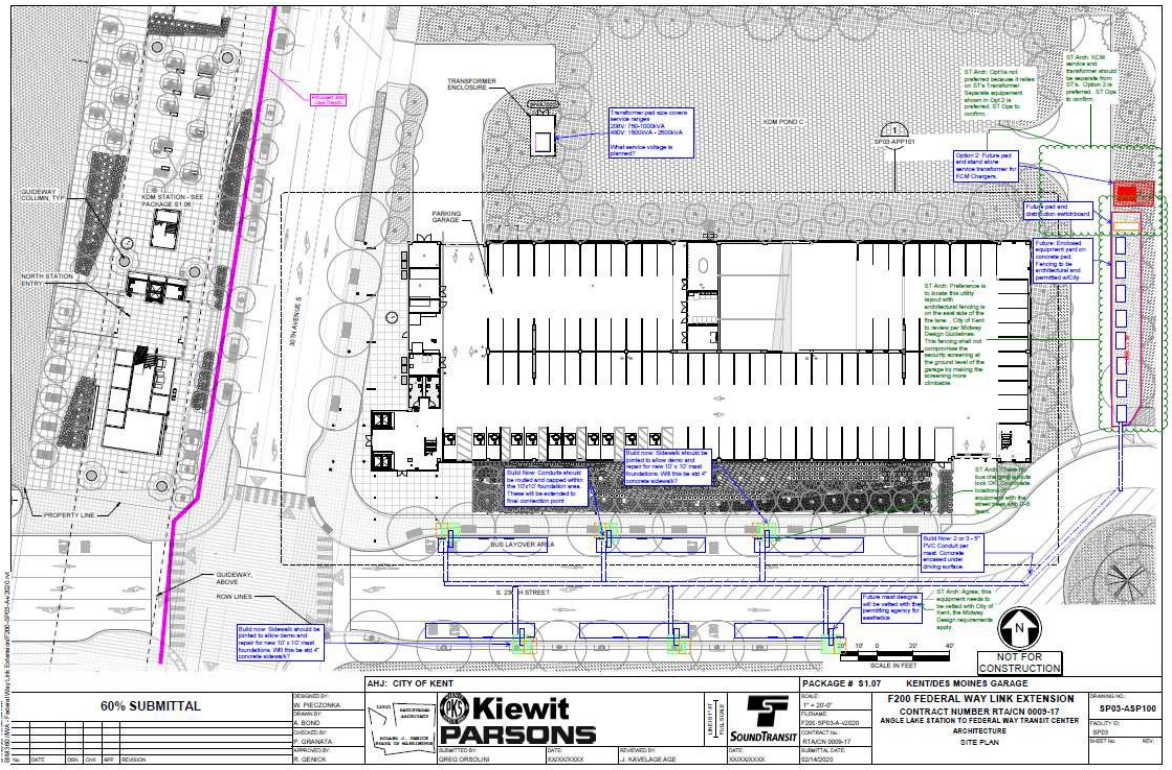
Layover Charging (En-Route)



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Programmatic Considerations

Construction	• Design/Bid/Build vs. Progressive Design Build – alternative delivery methods
Commissioning	• Charger and Bus work with each other? • **J3105-1, 1772, OCPP, Open ADR** compliant?
Charging	• On Base and Layover (aka on route) charging • Smart Charging
Electricity - Utility	• Clean Energy/Green Power • Rate structure – Seattle City Light pilot tariff
Operations	• Employee Training

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Some Challenges

- Costs – varying estimates
- Permitting timing
- Commissioning – Anticipated
- Manufacturer readiness
- Space constraints
- Operational Reliability and Support

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Lessons Learned

- Agency Culture – groups to involve, when and how
- Project Delivery Methods
- Utility Partnerships – SCL and PSE
- Training – Infrastructure Maintenance, Bus Operations, Service Planning
- Manufacturer readiness
- South Base Campus (Interim, Annex) and Strategy for future locations

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Questions?

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Q&A

Thank you!

Thank you for attending the 2021 Virtual TAM Roundtable!