

Light Rail Vehicle Fleet Expansion Project

System Expansion Committee

11/12/2020

Why we are here

- Light Rail Vehicle Fleet Expansion Project Update
 - Scope
 - Budget
 - Path to revenue service
 - Recovery Schedule
 - Project Risks
- Briefing only, no action required



1st Car Delivered, June 2019

Light Rail Vehicle (LRV) Fleet Expansion



*Vehicles staged for testing at OMF East
August 2020*

- 152 new light rail vehicles to support expansion of Link service through 2024
 - Northgate, East Link, Lynnwood, Downtown Redmond and Federal Way Link Extensions
- On budget
- Manufacturing on/ahead of target
- Commissioning behind schedule, recovery strategies underway
- Covid-19 challenges being monitored

LRV Fleet Expansion Financial Snapshot

Project Baseline Budget	\$740.7 million
Committed	\$671.7 91%
Incurred	\$240.6 32%

As of Sept. 2020

Year of expenditure dollars

~1,100,000 labor hours to-date

- 32% complete
- Contingency status: \$64.3 million
- Project Baseline established September 2015
- April 2017 exercised 30-car option to support ST3
- Project Complete in September 2024

Path to Revenue Service

8-year duration

- Notice to proceed with Siemens issued September 2016
- Multiple interim milestones based on rate of delivery and acceptance

Update on phases of work managed to-date:

1. Design
2. Manufacturing
3. Transport and On-site Inspection
4. Testing and safety certification
5. Conditional Acceptance

LRV Design phase – complete

21 packages and 283 design-related deliverables

- On-board control systems, passenger information, more efficient lighting, heating, power supply, wayside signal and operator interfaces

Preliminary design

- ~10 month effort, major focus on: new crash-worthiness standard, interiors, propulsion system design for ST's unique 1500V power supply

Final design

- ~2 years detailed review, factory tests and first-article inspections



Center Car Interior

LRV Manufacturing

68 new LRVs assembled by Siemens in California to-date

- 196 suppliers, located in 27 states
- ~1.1M labor hours
- Quality oversight by two full-time, ST inspectors

Challenges addressed:

- Covid-19 work conditions
- Supply chain delays
- Re-work due to unacceptable quality
- Concurrence on qualitative standard



Transport and On-Site Inspection

26 LRVs on-site in Seattle

- Delivered by truck, 1st car arrived June 2019
- Receiving inspections
- Static tests, pre-mainline preparation
- Large volume of work, on 3 shifts

Challenges addressed:

- Recruiting technicians and inspectors
- Initial number of “field modifications”; **97% complete**
- Safety plan adherence and Siemens coordination with ST maintenance



Testing & Commissioning

Purpose:

- Ensure safe and reliable fleet, validate LRV performance
- Phase began 15 months ago
- Location: off-site tests before shipping, OMF Central yard, mainline track access during non-revenue hours

Qualification Tests – Siemens led

- 84% complete
- Ends after reliability test, 1000-mile “burn-in”

Systems Integration Tests – ST led

- 83% complete

Brake tests, Fall 2019



Challenges during Testing

Technical and coordination issues

- Potential signal interference identified between sub-systems
 - Normal operations not impacted, root cause has been diagnosed
 - Solutions to mitigate tested, results being reviewed and validated
- Availability of team members worldwide to update software, provide electromagnetic fields and propulsion system expertise
- Repeat tests to fully document passing results on all safety-critical items
- Concurrent projects & Covid-19 constraints

Routine tests continue through remainder of contract

- Balancing demands of commissioning ~ 4 cars / month for next three years

Safety & Security Certification

Safety & Security Certification – 70 % complete

- Documentation review to verify compliance with requirements

Readiness to Operate and Maintain

- Parts, tools & manuals, database required for preventative maintenance
- Training
- Rulebook & procedure updates
- Infrastructure modification projects
- Emergency preparedness

Challenges addressed:

- Training during Covid-19
- Delay in shipping parts & tools



LRV Lift

Conditional Acceptance

LRV verified as safe and reliable for passenger service

- Milestone for each car delivered
- ST accepts ownership
- Warranty period begins

ST requires six cars conditionally accepted to put new fleet in-service

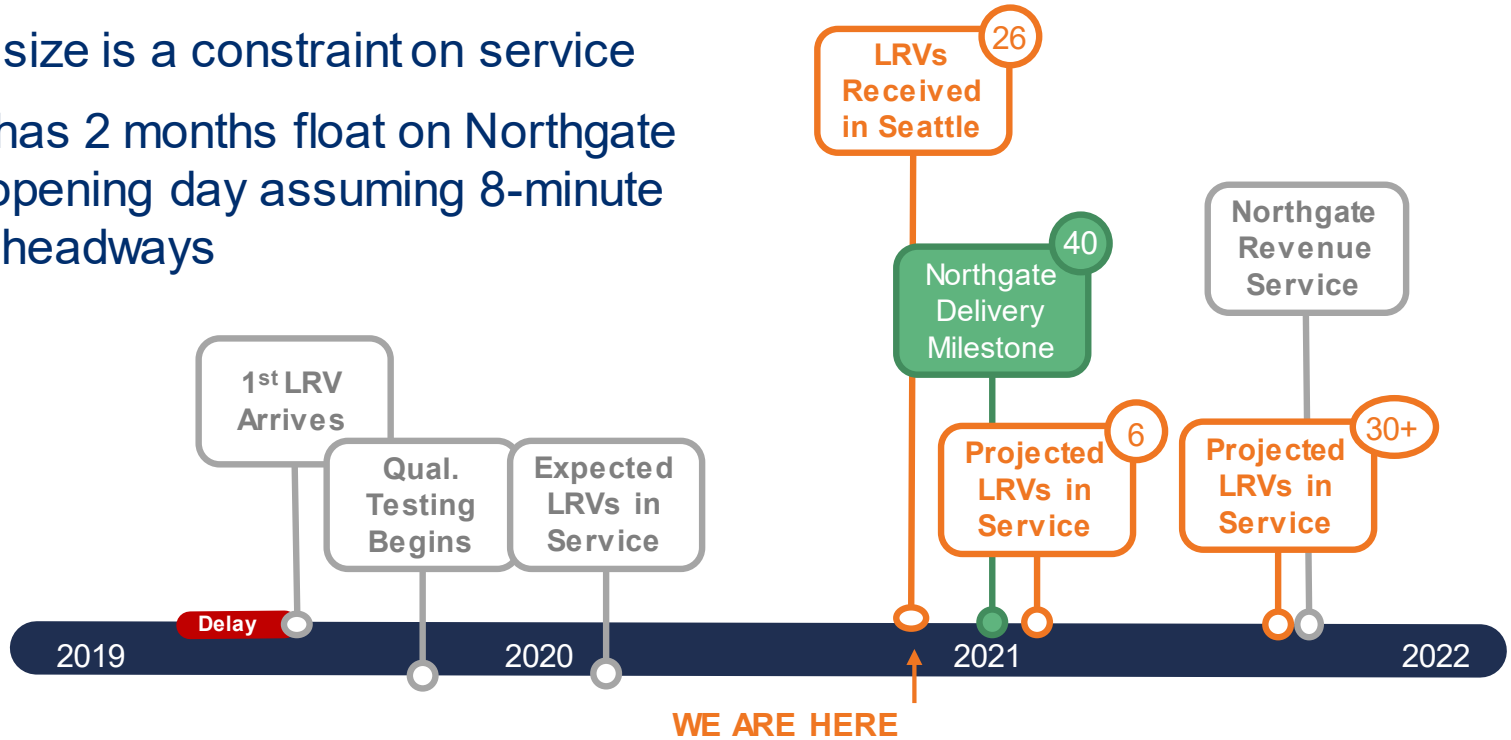
- 26 cars in Seattle, 12 mainline ready



Cars staged at OMF Central, Fall 2020

Schedule Recovery

- Recovery plan implemented
- Fleet size is a constraint on service
- Plan has 2 months float on Northgate Link opening day assuming 8-minute peak headways



Key Takeaways

Budget

- Sufficient to manage foreseeable issues

Schedule

- Limited float on interface between expanded fleet size and Northgate Link extension opening day

Top Risks

- Qualification of on-board systems takes more time
- Resurgence of COVID-19 presents new, unexpected delays
- Competing demands for resources impact rate of recovery

February 2021 return to Board with evaluation of:

- Ridership demand
- Need to mitigate impacts of slower than expected fleet expansion



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