

Rail Car Evaluation Project Review

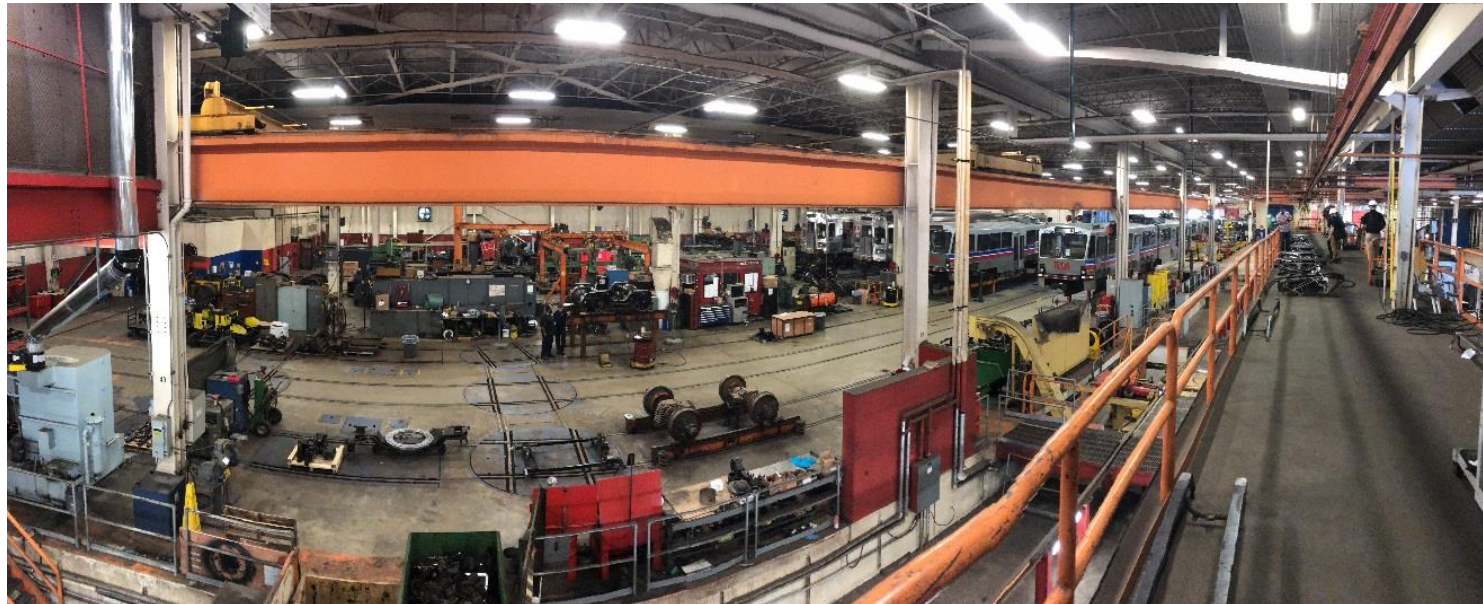


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Project Scope

- LTK was contracted to conduct a rail car evaluation for RTA. The tasks included:
 - Estimate remaining life of each fleet
 - Upgrade/replace recommendations for both fleets
 - Upgrade plan to maintain existing fleets for 10 years



Existing HRV Fleet

- Manufactured by Tokyu Car Corporation
- 60 cars were delivered, 40 remain
- Began service in 1984 (35 years ago)
- 30 year design life



Existing LRV Fleet

- Manufactured by Breda
- 48 cars were delivered, 34 remain
- Began service in 1981 (38 years ago)
- 30 year design life
- Midlife structural overhaul completed in 2007



Phase 1: HRV Inspections

- Generally, in poor condition
- Over the last decade:
 - Work orders have increased by 22%
 - Cost of Maintenance increased by 148%
- Heavy corrosion of the primary structure was identified on all cars inspected
 - Loss of section of up to 50% was found
- Procurement and maintenance of parts has become an issue
 - Brake actuators (7 months between work orders)
 - Propulsion system (2.5 months between work orders)
 - Cab signal equipment (2.5 months between work orders)
- **LTK estimate: remaining useful life 5 years or less**



Corrosion Section Loss

Phase 1: LRV Inspections

- Generally, in fair condition
- Over the last decade:
 - Cost of Maintenance increased by 90%
- Cab equipment is worn to the point that it is unreadable
- Articulated structures have developed corrosion and cracks
- Procurement and maintenance of parts has become an issue
 - Cab signal equipment (3.5 months between work orders)
 - Track brakes (18 months between work orders)
 - Propulsion system (2 months between work orders)
- Overhaul was effective in mitigating corrosion
- **LTK estimate: remaining useful life 10 years or less**



Corrosion Hole/Crack in Articulated Structure



Master Controller Worn vs. New

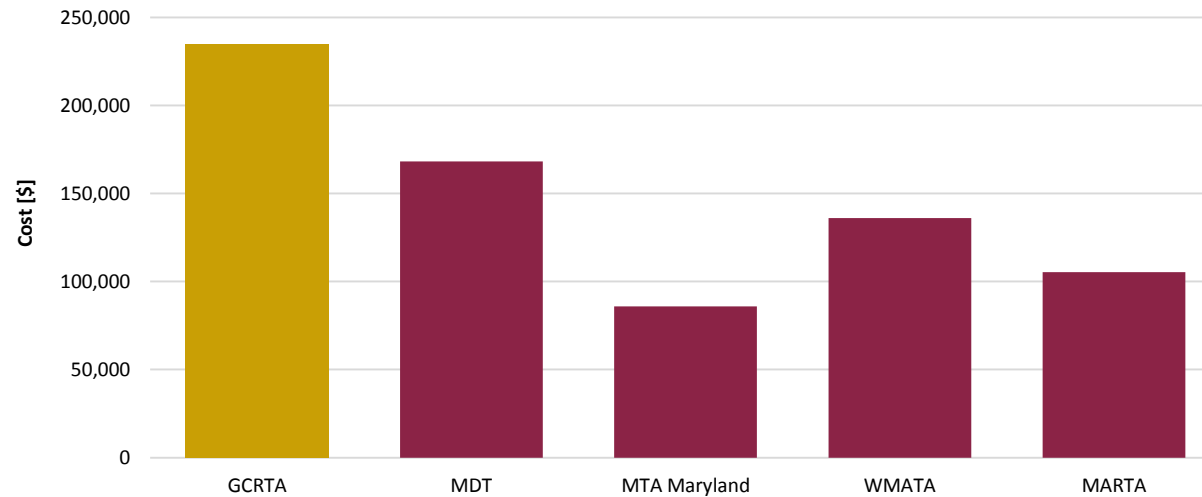


Overhaul Repairs

Phase 1: HRV Peer Review

- LTK utilized the published FTA's data to compare RTA's rail service with peer agencies
 - RTA spends more to maintain each car than any of their peers
 - The four other agencies shown have all initiated new car orders

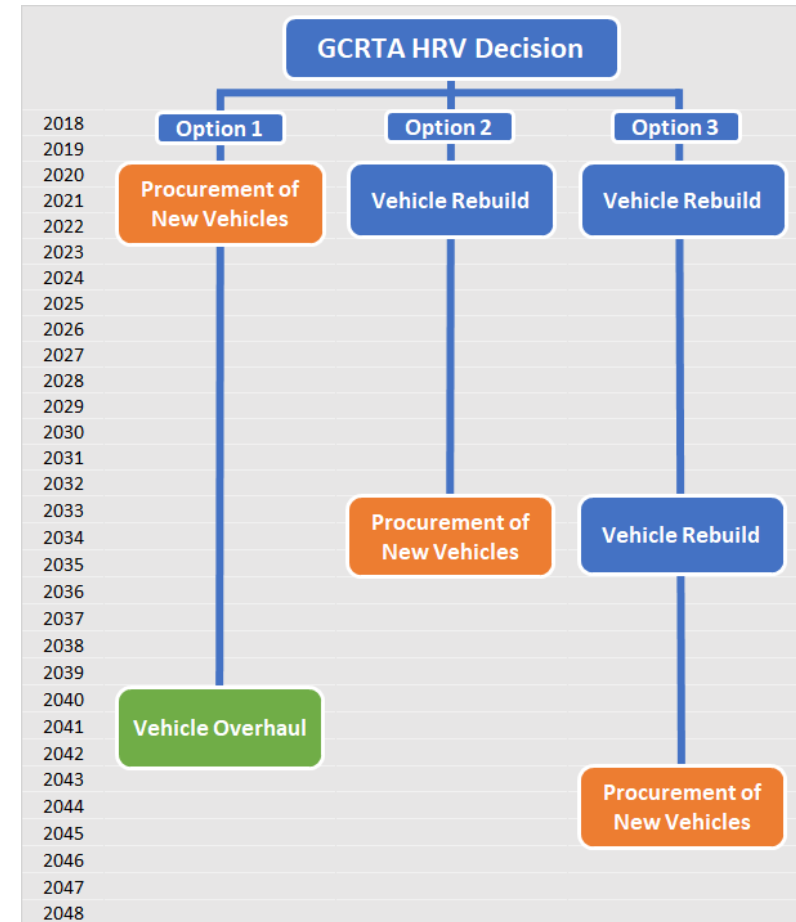
HRV ANNUAL MAINTENANCE COST PER ACTIVE VEHICLE VS PEER FLEETS



HRV Cost Estimates

- Option 1: new car delivery at the end of estimated life (5 years)
 - Begin procurement next year
 - Overhaul vehicles in 2040 at midlife (15 years)
 - Total 30-year lifecycle cost \$398 M
- Option 2: overhaul vehicles at end of estimated life
 - New car procurement at the end of extended estimated life (2033)
 - Total 30-year lifecycle cost \$410 M
- Option 3: overhaul the vehicles twice
 - New car procurement at the end of extended estimated life (2042)
 - Total 30-year lifecycle cost \$475 M

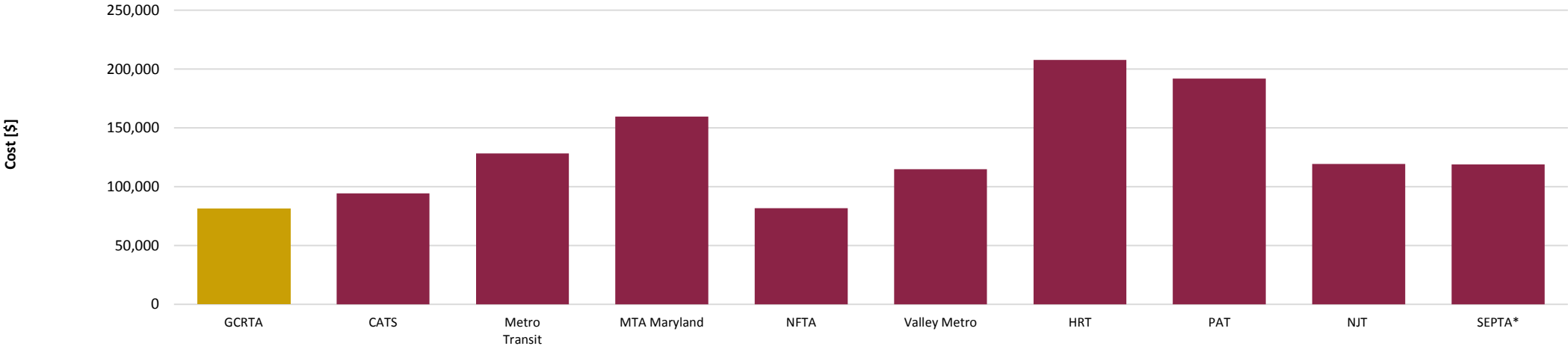
Note: 2018 dollars



Phase 1: LRV Peer Review

- RTA's fleet is the second oldest major LRV fleet in the country
 - SEPTA operates the oldest fleet, and has begun new car planning process
- RTA's annual maintenance costs are 18% lower than peer average
 - RTA is in the top 10 amongst peer agencies for maintenance costs

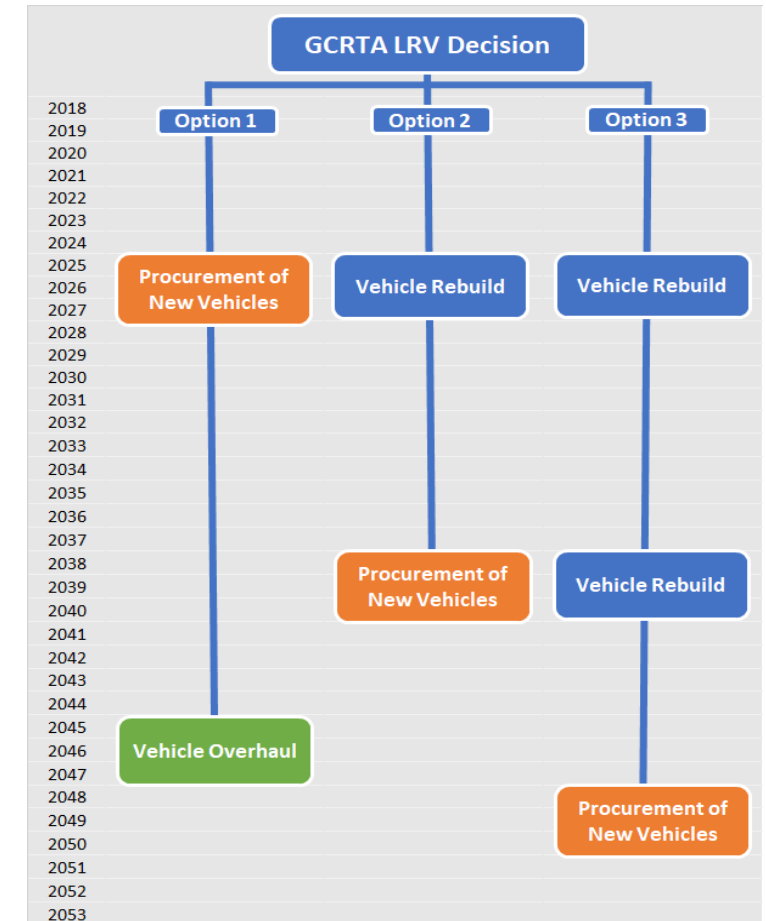
LRV ANNUAL MAINTENANCE COST PER ACTIVE VEHICLE VS PEER FLEETS, FROM NTD 2016 DATA



LRV Cost Estimates

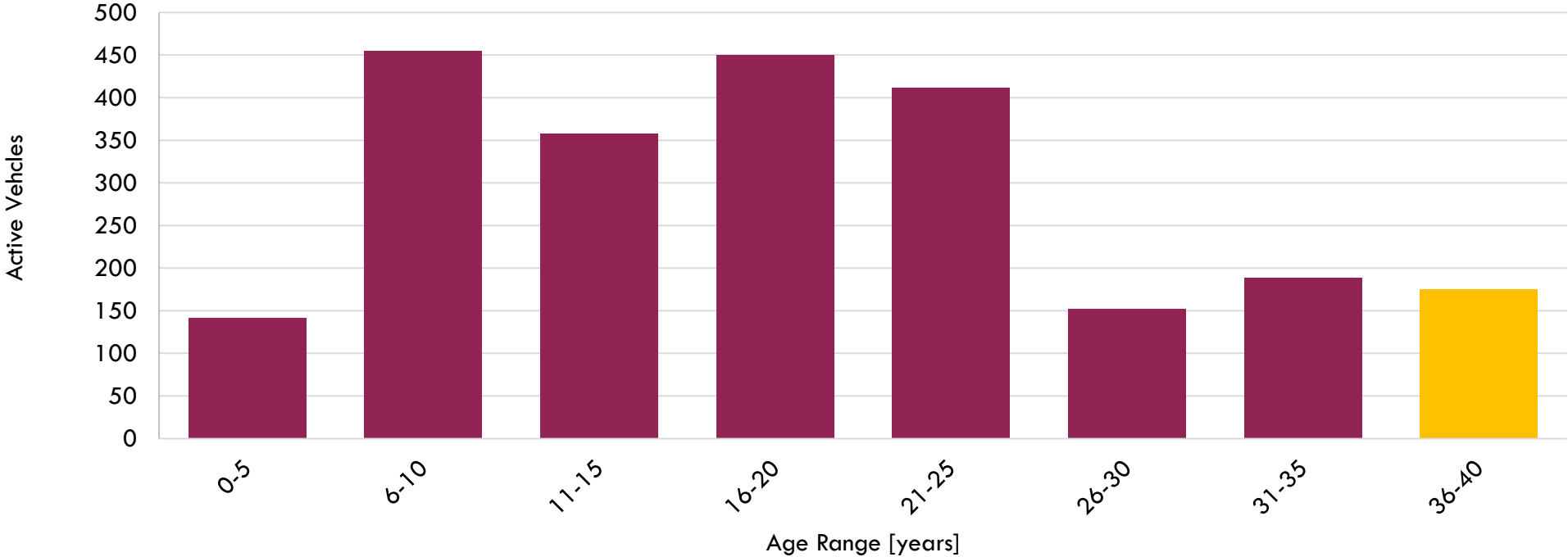
- Option 1: new car delivery at the end of estimated life (10 years)
 - Begin procurement in 2025
 - Overhaul vehicles in 2045 at midlife (15 years)
 - Total 30-year lifecycle cost \$317 M
- Option 2: overhaul vehicles at end of estimated life
 - New car procurement at the end of extended estimated life (2038)
 - Total 30-year lifecycle cost \$339 M
- Option 3: overhaul the vehicles twice
 - New car procurement at the end of extended estimated life (2048)
 - Total 30-year lifecycle cost \$413 M

Note: 2018 dollars



Phase 1: LRV Peer Review

RTA LRV FLEET AGE VS. PEER AGENCIES



Risk Associated with Aging Fleets

- In-service failures increase
- Customer service degrades
- Service reliability and on-time performance suffers
- Parts obsolescence increases
- Maintenance costs and frequency increases
- Gap widens between current standards and as-built standards



Recommendations

- Based on the results of the vehicle inspections and life cycle cost analysis, LTK recommends the following
 - Do not invest major capital into the existing fleets
 - Begin the procurement process for new HRV's in the near future
 - Begin the process of procuring new LRV's in the next 5 years
 - Hire Firm to assist with new HRV procurement including specification, procurement, quality assurance and facility upgrades.
- LTK recommends the procurement of two different fleets (HRV and LRV) rather than a single, common car to serve both high and low platforms.
 - A single, common car fleet would require significant infrastructure work at rail stations
 - A single, common car fleet eliminates the ability to phase in vehicle purchase and delivery