



FEDERAL TRANSIT ADMINISTRATION

**Forecasting Asset Conditions
with Decay Curves
April 16, 2012**

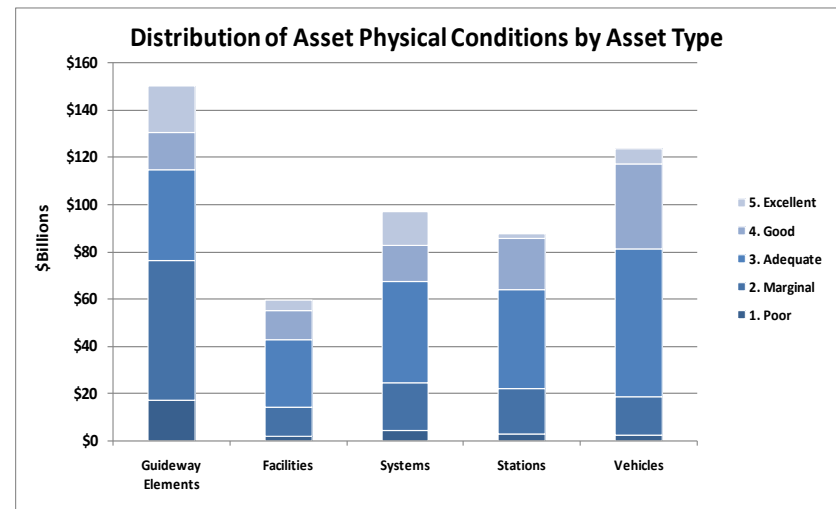
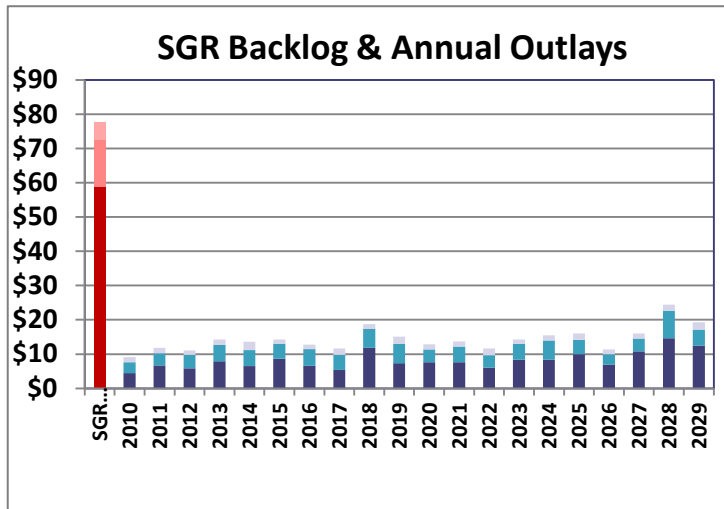
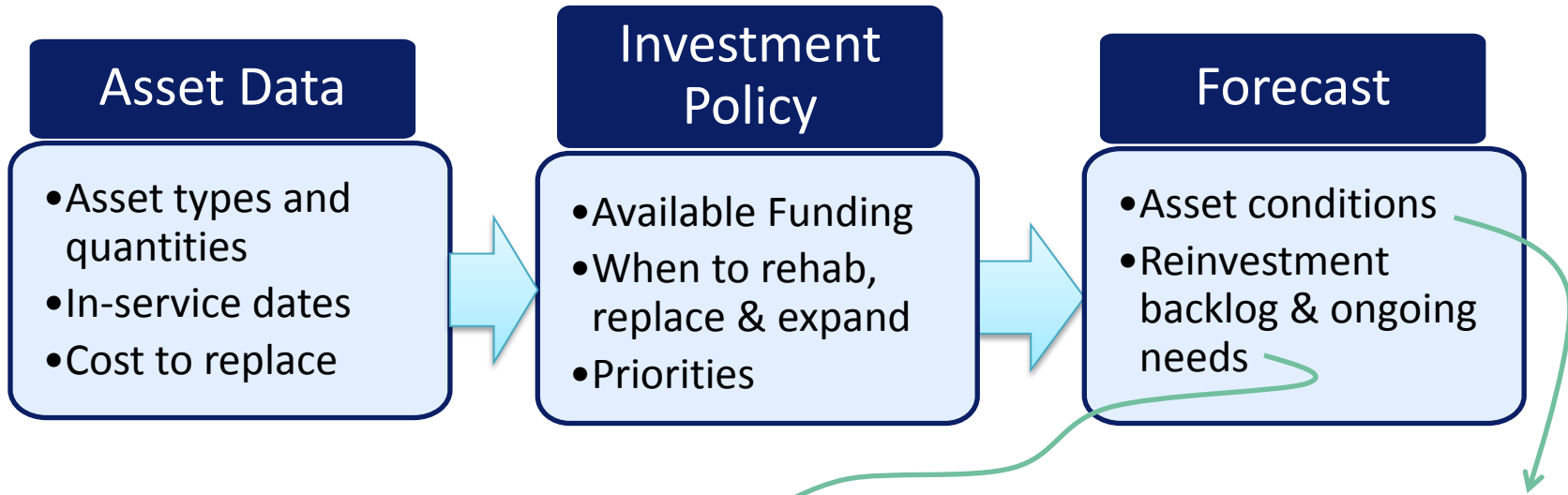
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9th National Conference on Transportation Asset
Management San Diego, California



U.S. Department of Transportation
Federal Transit Administration

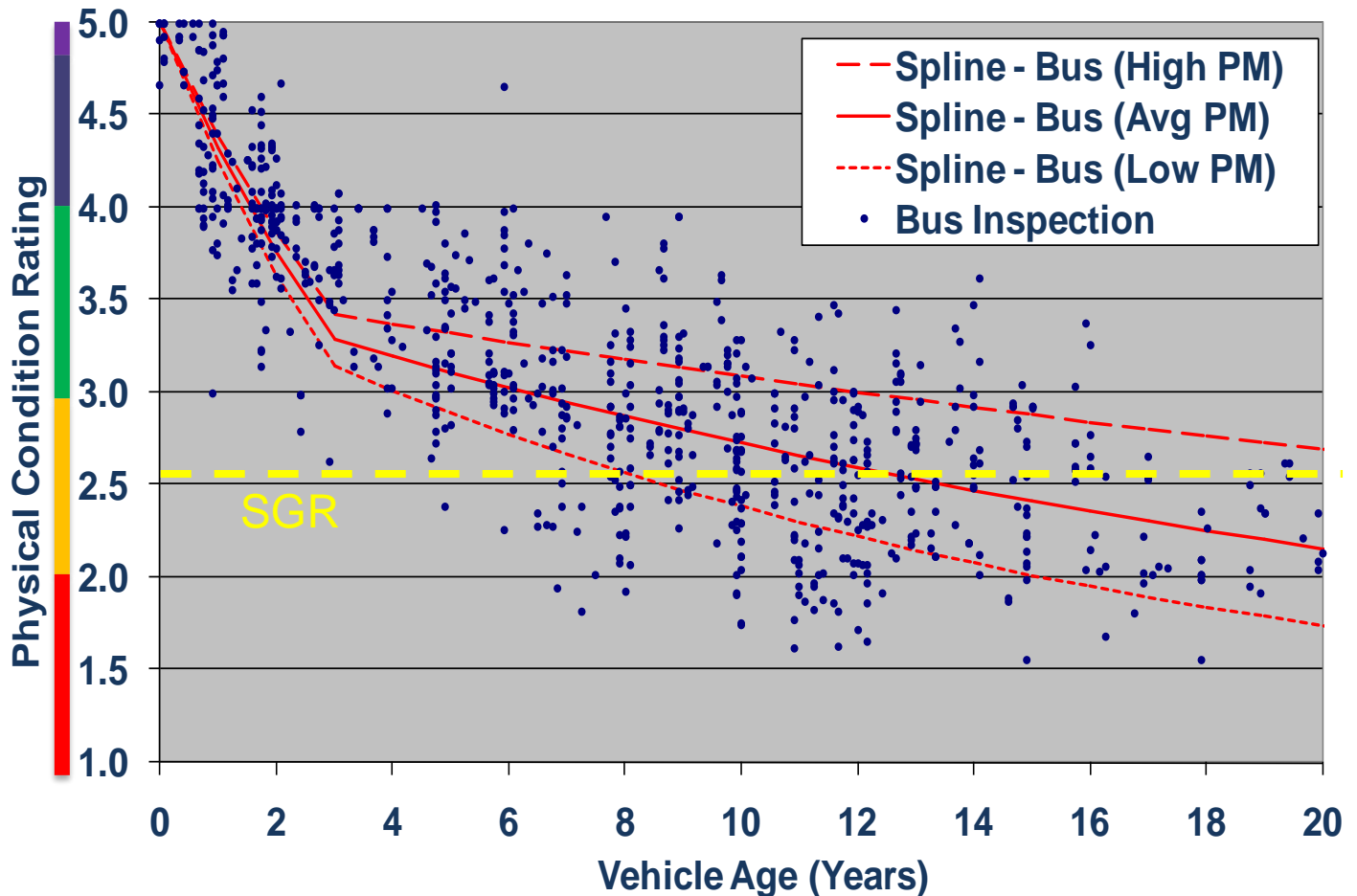
FTA Capital Investment Needs Analysis



Asset Conditions Decay over Time

Observed Physical Condition Versus Age:
40 Foot Buses

- 4.8-5.0
Excellent
- 4.0-4.7
Good
- 3.0-3.9
Adequate
- 2.0-2.9
Marginal
- 1.0-1.9
Poor



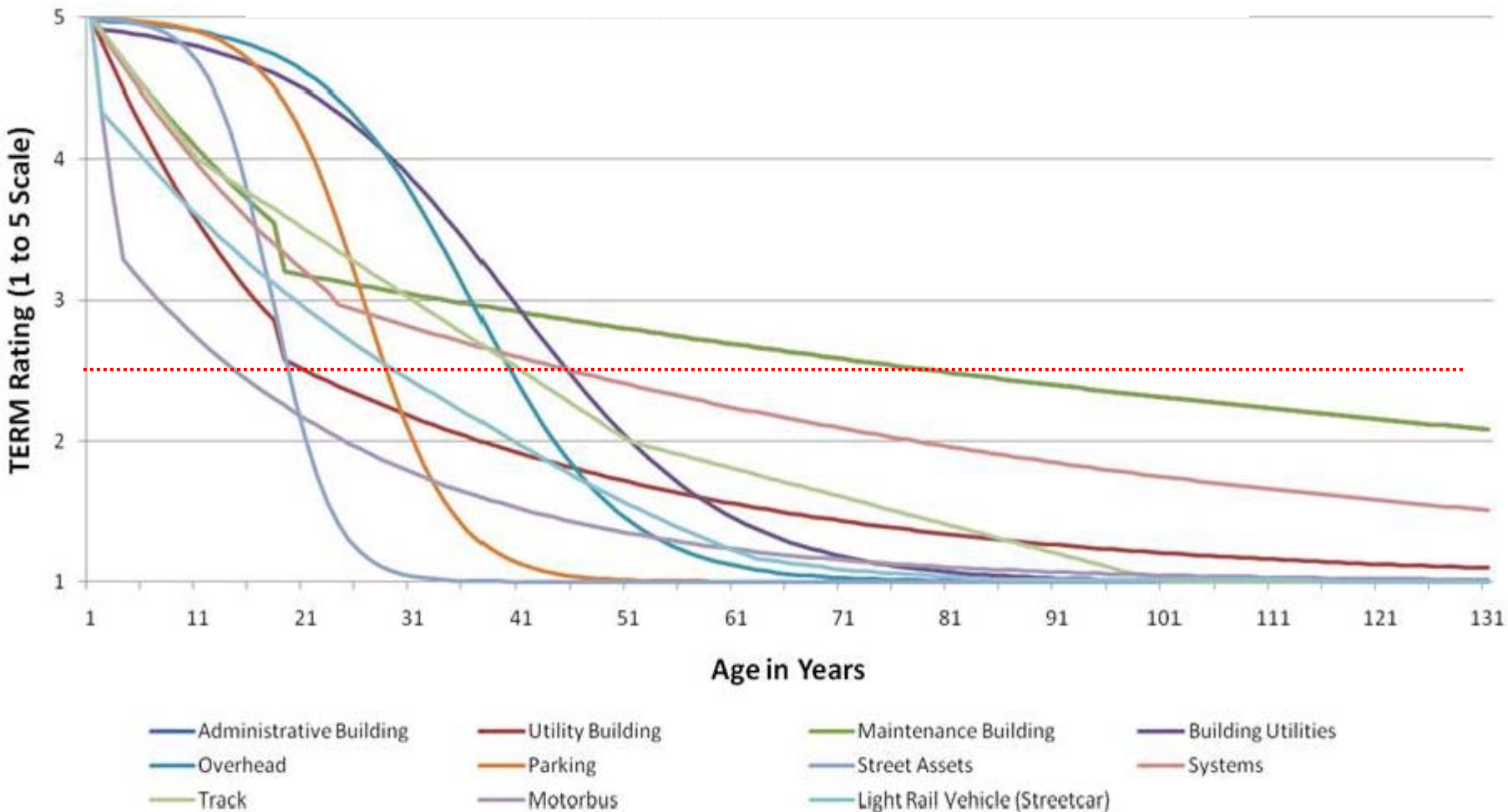
Original Source of TERM Decay Curves

- Chicago Transit Authority's (CTA) 1992 Engineering Condition Assessment
 - This \$20 million study assessed the physical condition of all of CTA's fixed assets
- Used a “reverse logit” functional form to achieve the best statistical fit with the following three variables:
 - Age
 - Utilization Rate
 - Maintenance Rate

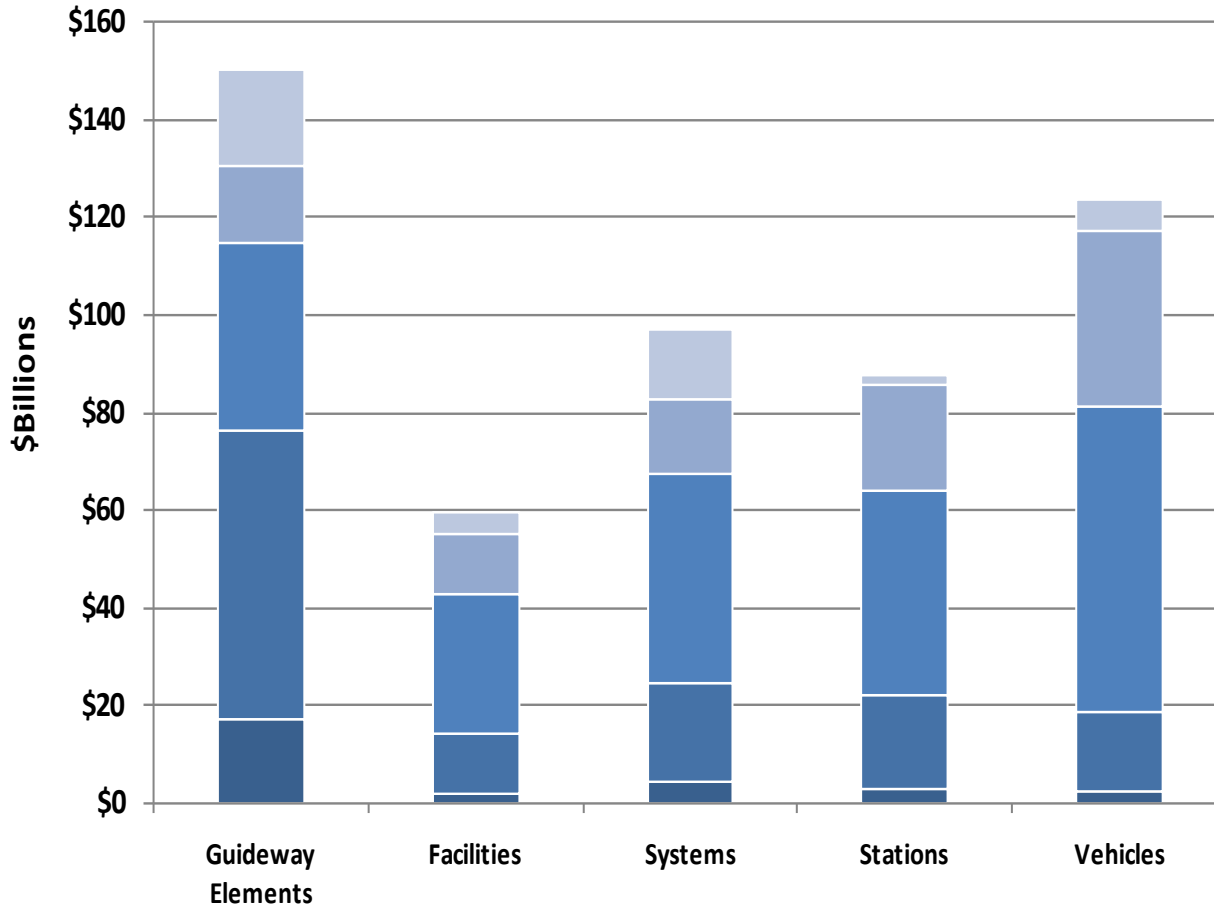
FTA Research on Decay Curves

- Between 1998 and 2006, FTA invested in developing nationally representative decay curves
 - New curves based on detailed, on-site asset condition inspections at 43 US transit agencies
 - Inspections covered more than 1000 buses, 300 rail vehicles, 150 maintenance facilities, 100 rail stations and samples for train control, electrification and communications systems
- These new curves use “spline” regression models, which rely on the same 3 factors

Typical Decay Curves



Distribution of Asset Physical Conditions by Asset Type



Asset Categories

Guideway Elements

- Track
- Tunnels
- Elevated Structure
- Roadway

Facilities

- Admin
- Maintenance

Systems

- Train Control
- Traction Power
- Communications
- ITS
- Fare Collection

Stations

- Structures
- Parking
- Elevators / Escalators
- Bus / Pedestrian Access

Vehicles

- Revenue
- Non-Revenue

(2007 NTD and TERM data, excluding generated assets)

Why the Condition 2.5 Threshold?

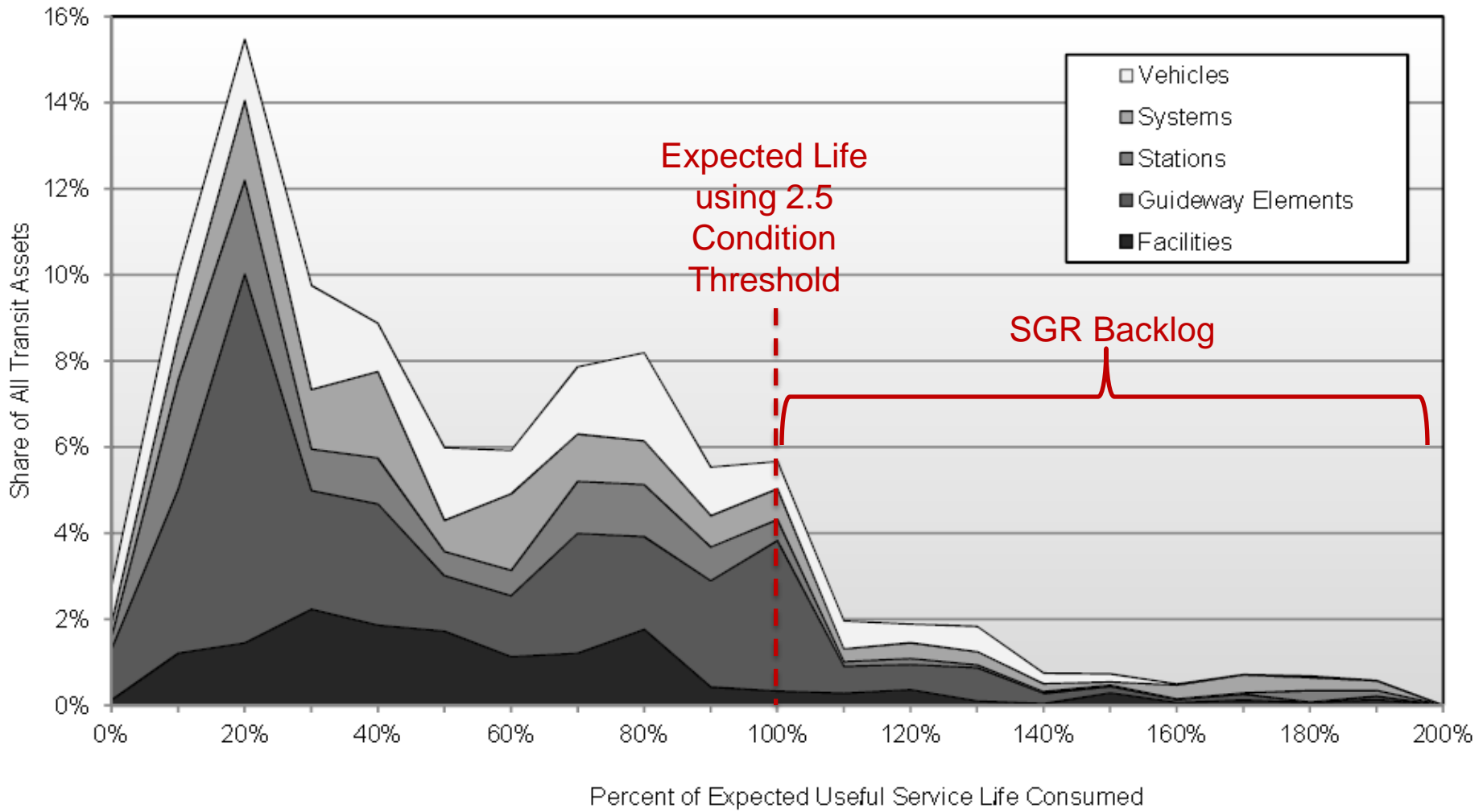
Condition 2.5 is still serviceable but looks bad, provides poor quality service, and is starting to have an unacceptable risk of failure



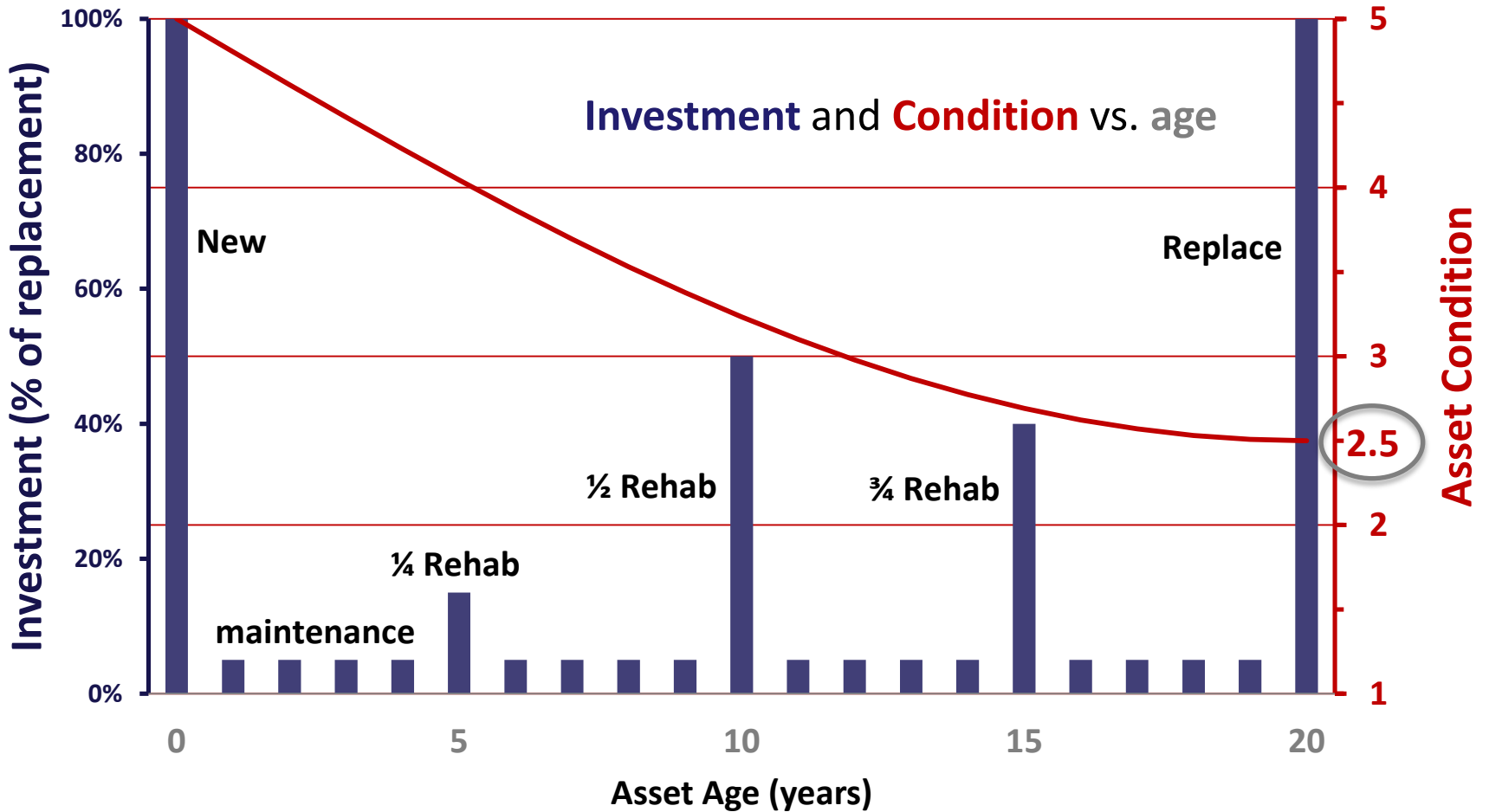
2.5 gives backlogs for major agencies that are close to what they report as their unfunded needs



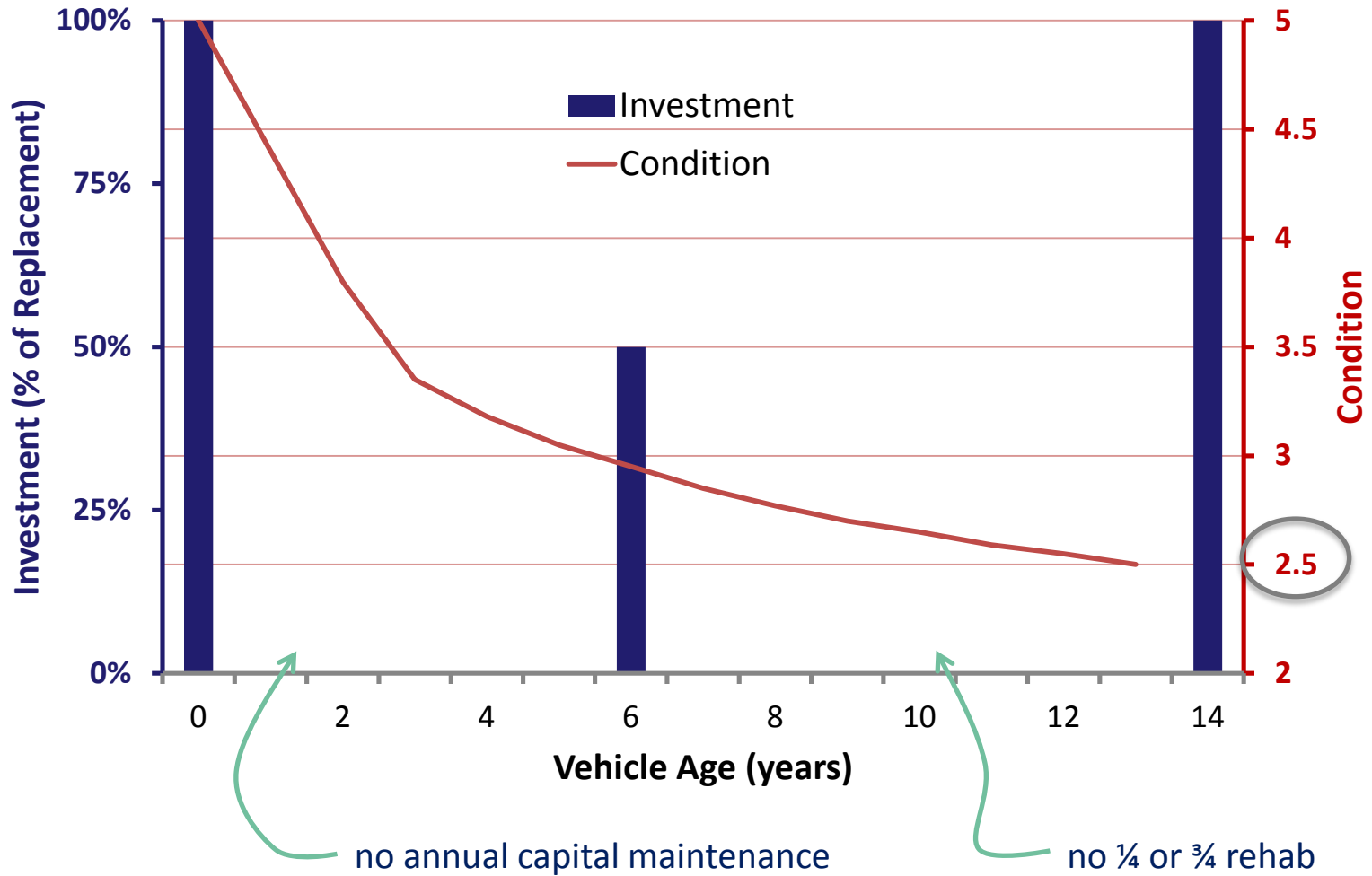
Useful Service Life Consumed for all Transit Assets



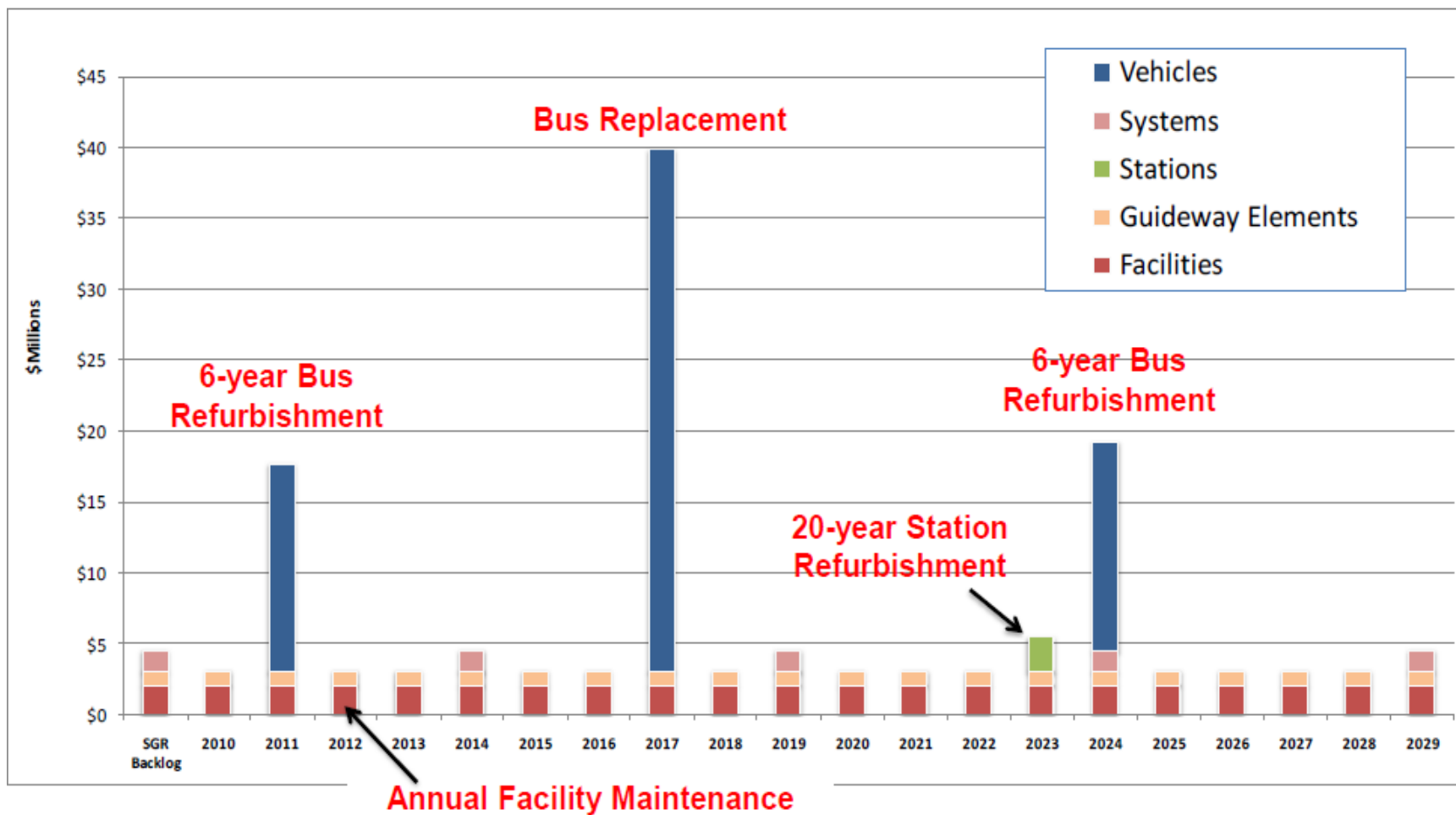
Reinvestment Policy Determined by Asset Conditions



TERM 40-foot Bus Investment Strategy



Example: New 100 Bus Agency Started in 2004

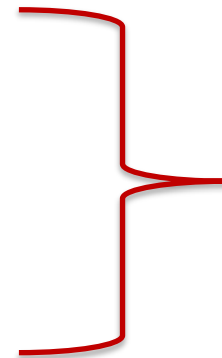


Recap

- TERM produces asset condition distributions and investment need forecasts
- Decay curves based on extensive asset condition assessments
 - represent national averages
- Investment strategies
 - use expected life from decay curves
 - simplified models of typical industry practice

Going Beyond TERM

- Goal is to minimize overall cost of providing safe, comfortable, reliable service
- Costs – not condition should be the primary drivers of reinvestment decisions
 - Cost of maintenance
 - Safety priority
 - Cost of in-service failures
 - Cost of customer time
 - Cost of money / financing



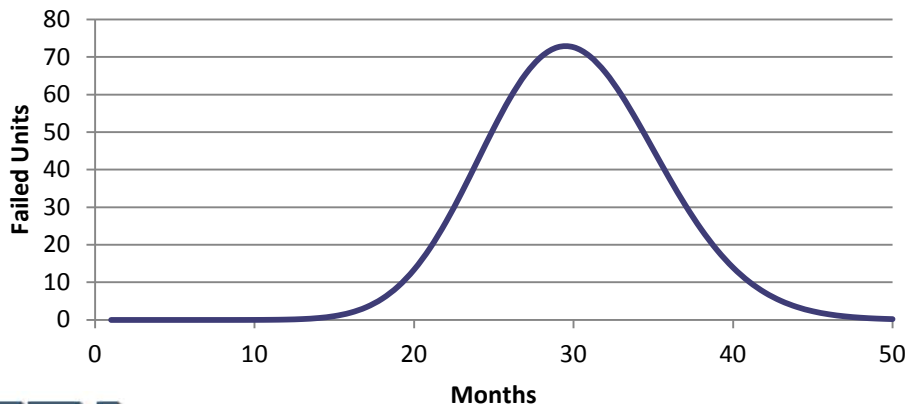
Not explicit in
TERM analysis

Most cost-effective service life?

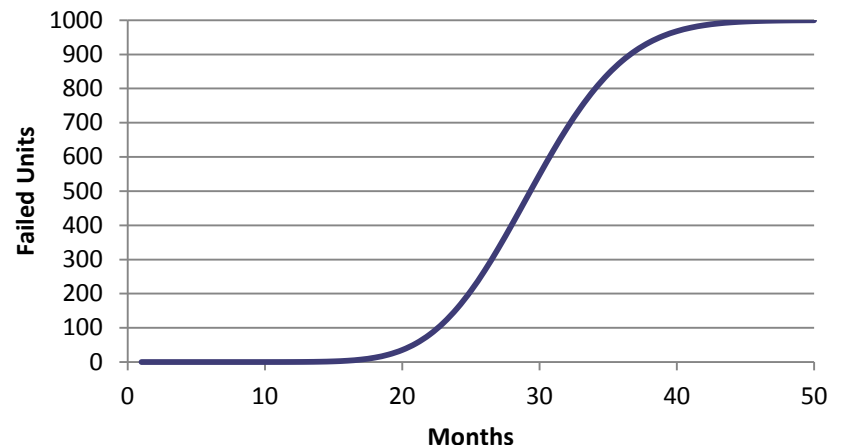
- 1000 windshield wiper blades
- Mean life expectancy is 30 months
- In-shop cost to replace is \$10
- In-service cost to replace is \$50
- Interest rate is 1.5% per year

Hypothetical Example

Time to Failure



Total Failures



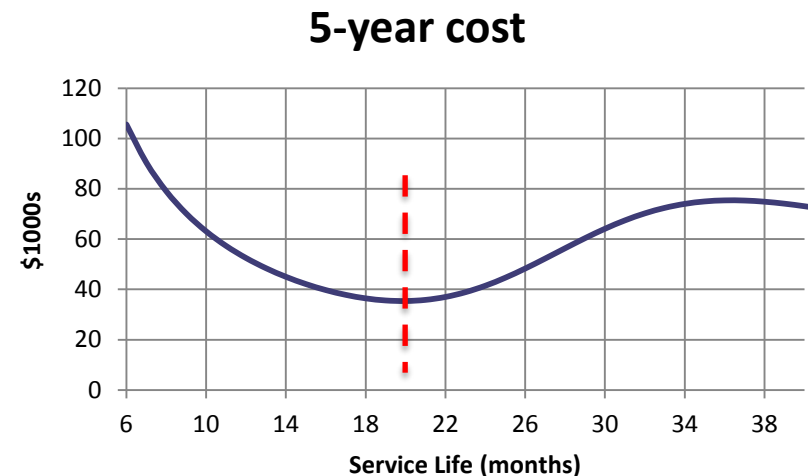
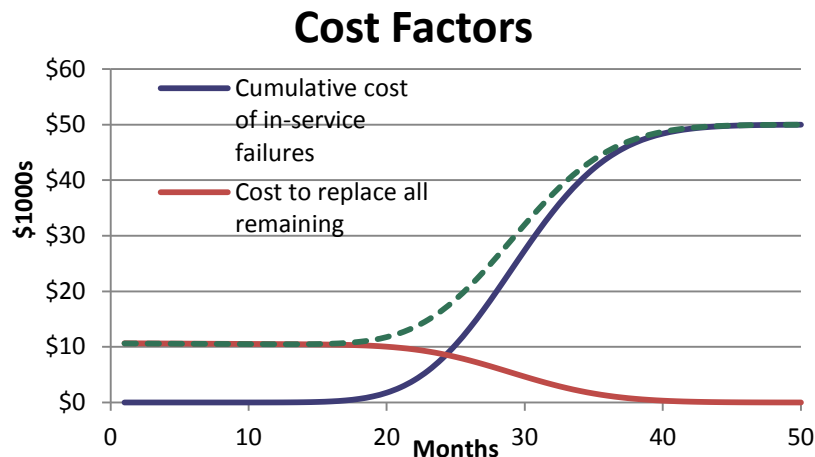
Proactive or Reactive?

Windshield wiper cost factors

- Cost to replace units that fail in service (reactive)
- Cost to replace all units still in service that have not yet failed (proactive)
- Adjustment for number of replacements needed over time

Minimizing costs

- 5-year cost curve has a minimum of \$35,000 at 20 months
- Waiting until all units fail in service costs \$75,000



Questions?

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