Examination of State-of-Good-Repair Funding Needs Using Asset Inventory-Based SGR Analysis

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Agenda

1. VTA context
2. Asset inventory
3. State-of-good-repair needs
4. Identifying projects
5. How the MBTA SGR model works
6. Application of Decision Lens prioritization of capital projects
7. Funding scenarios
8. SGR analysis performance measures and results
9. Implications for VTA financial plan, next steps, lessons learned

1. VTA Context

Santa Clara Valley Transportation Authority
System Statistics

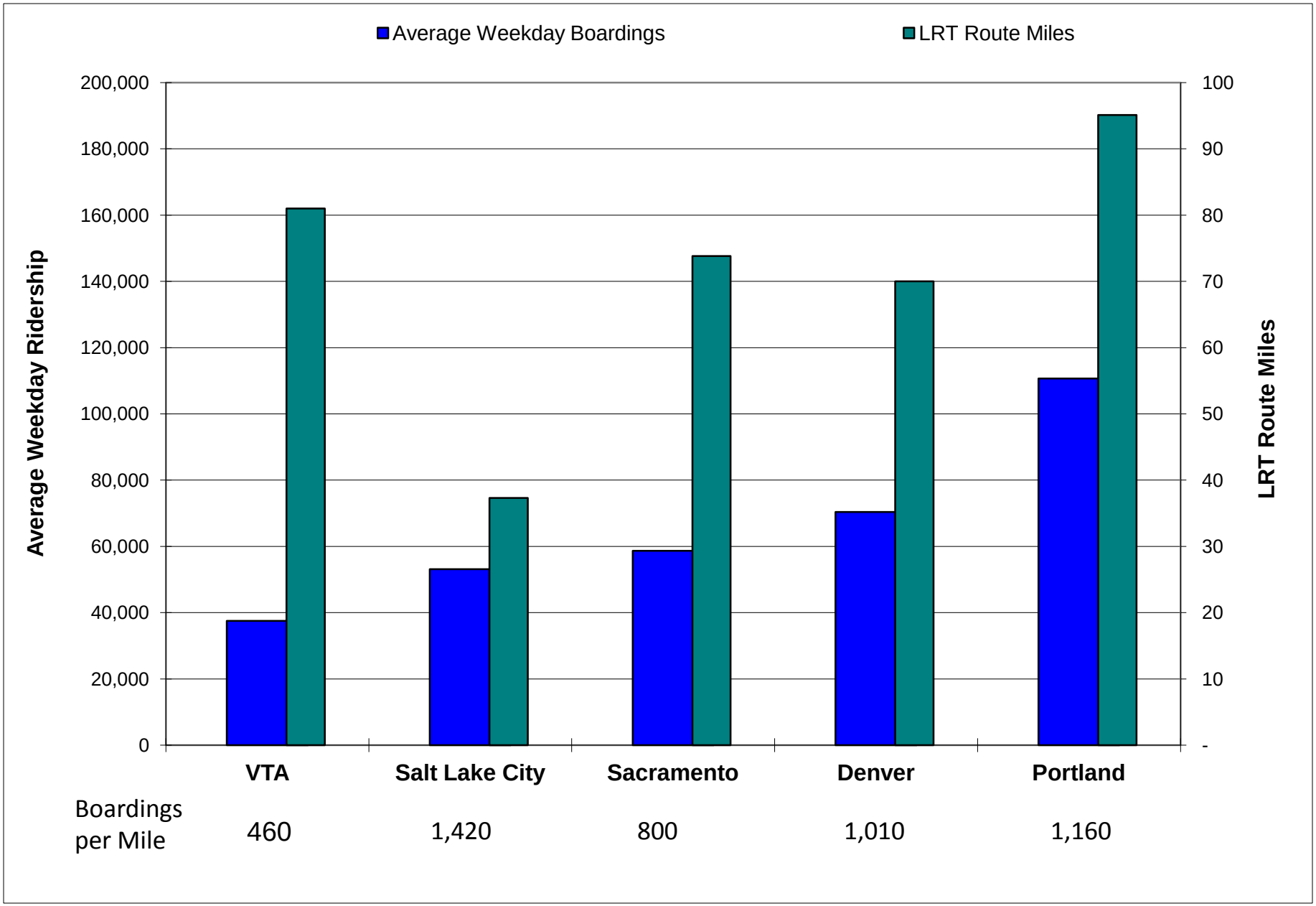
- Active Buses: 450
- Average Bus Age: 7.5 years
- Local Routes: 58
- Express & Limited Routes: 17
- Route Miles: 1,235
- Ridership FY08: 33.1 million
- Avg Weekday riders: 106,673
- Riders per Hour: 23.8
- Total Bus Stops: 3,814
- Bus Stops with Shelters or Benches: 2,728
- Number of Bus Park & Ride Lots: 41 lots with 560 spaces
- 32 Traction Power Substations
- Three Bus Divisions (1975)
- Rail Started in 1987
- 5 Regional Transit Centers (1980)

“Middle -Aged”

Santa Clara Valley Transportation Authority
Rail System Statistics

- Fleet: 99 light rail vehicles and 4 Historic Trolleys
- Length: 42.2 miles
- Capital Cost: Fixed Plant = $1.6 billion; vehicles = $297 million
- Max Speeds: in freeway median: 55 mph; Downtown Center Plaza: 10 mph

Peer Comparison – Boardings and Route Miles



For those with Attention Focus Challenges: - The Bottom Line

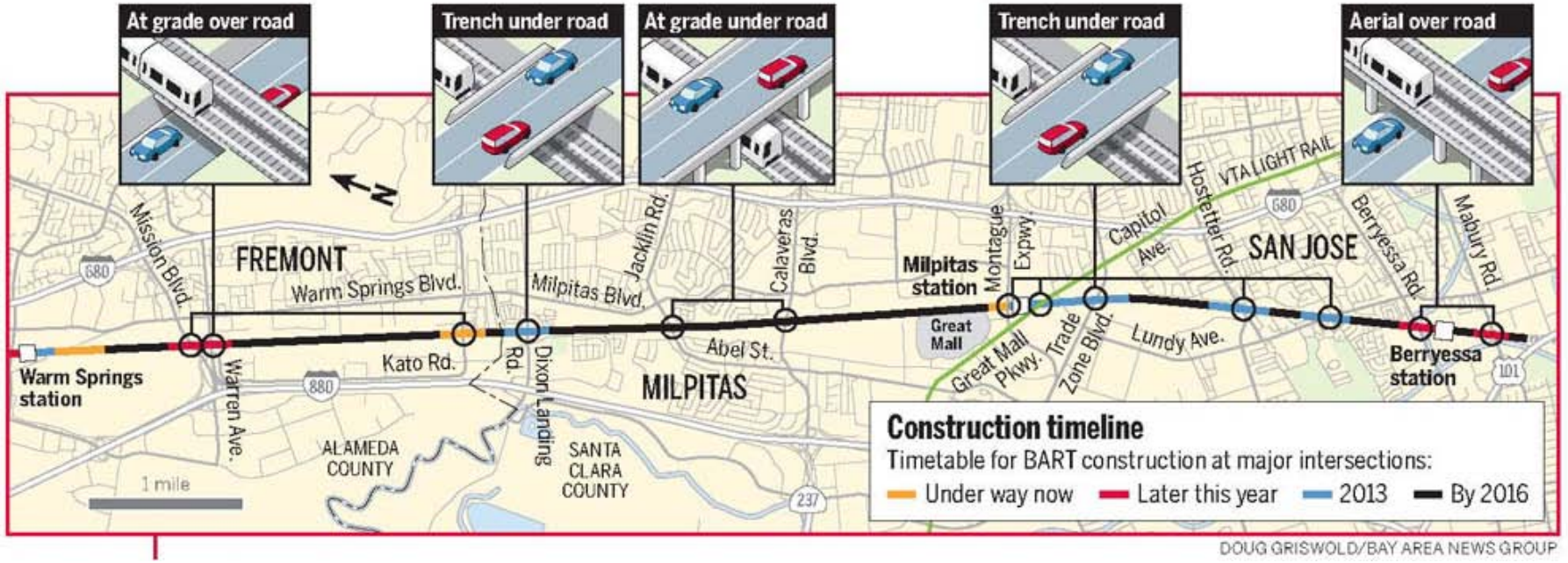
- SGR analysis addressed stakeholder critique:

  "The extrapolation of 2010-2019 capital costs to the period 2020-2030 may understate long-term capital replacement needs, which have not been documented" …

- Less than optimal SGR spending still results in acceptable asset condition:
  - While SGR dollar backlog may increase, asset condition overall remains above the condition threshold that FTA finds unacceptable
  - For assets that might otherwise fall below acceptable condition, relatively little additional funding is required to keep these assets in acceptable condition
- Painful process that resulted in the best possible understanding of SGR needs.

For those with Attention Focus Challenges: - The Bottom Line

- BART Project was major catalyst to complete the analysis
  - Full Funding Grant Agreement
    - $900M



2. Asset Inventory

Primary Asset Data Source is MTC Regional Transit Capital Inventory

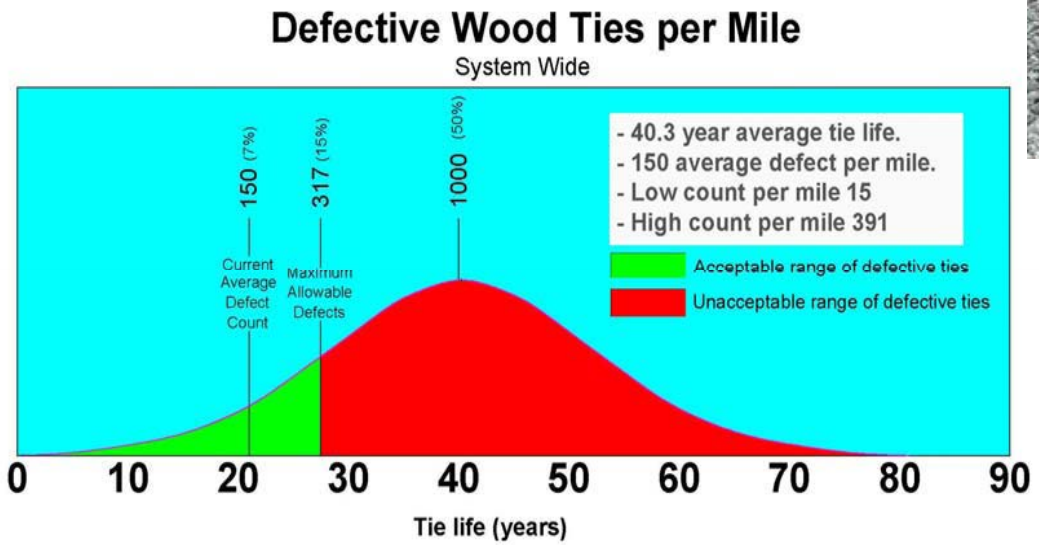
AssetID	ProjectID	ModDate	SuperAs	AssetType	Asset	Line	Mode	Quantity	Units	ServiceDate	UsefulLife	OriginalUseful	A
10001	36	4/22/2011 9:48:47 AM	Track	Track	Special - Direct Fixation Tangent - Diridon Tunnel	Track	Systemwide	2,745.60	Track Feet	2005	50		
10002	36	4/22/2011 9:48:47 AM	Track	Track	Special - Direct Fixation Curve - Diridon Tunnel	Track	Systemwide	528.00	Track Feet	2005	40		
10003	36	4/22/2011 9:48:47 AM	Track	Track	Ballast - wood tie - Tangent - Guadalupe Convention Center to Santa Ter	Track	Systemwide	60,192.00	Track Feet	1991	70		
10004	36	4/22/2011 9:48:47 AM	Track	Track	Ballast - wood tie - Curve - Guadalupe Convention Center to Santa Teres	Track	Systemwide	49,368.00	Track Feet	1991	50		
10005	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Manual Ballasted - Guadalupe Convention Center to Santa Teres	Track	Systemwide	4.00	Each	1991	30		
10006	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Manual Ballasted - Tasman East Baypoint to I-880	Track	Systemwide	11.00	Each	2001	30		
10007	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Motorized Ballasted - Guadalupe Convention Center to Santa Te	Track	Systemwide	18.00	Each	1991	30		
10008	38	4/22/2011 9:48:47 AM	Track	Track	Special - Ballasted Diamond Crossover - Guadalupe Convention Center t	Track	Systemwide	2.00	Each	1991	30		
10009	38	4/22/2011 9:48:47 AM	Track	Track	Special - Single Crossover Embedded - Guadalupe Convention Center to	Track	Systemwide	1.00	Each	1991	30		
10010	38	4/22/2011 9:48:47 AM	Track	Track	Special - Ballasted Single Crossover - Guadalupe Convention Center to S	Track	Systemwide	6.00	Each	1991	30		
10011	36	4/22/2011 9:48:47 AM	Track	Track	Special - Ballasted Turnout - Guadalupe Convention Center to Santa Ter	Track	Systemwide	6.00	Each	1991	40		
10012	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Manual Embedded - Guadalupe Convention Center to Santa Ter	Track	Systemwide	1.00	Each	1991	30		
10013	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Motorized Embedded - Guadalupe Convention Center to Santa T	Track	Systemwide	1.00	Each	1991	30		
10014	36	4/22/2011 9:48:47 AM	Track	Track	Special - 1/2 Grand - Guadalupe Convention Center to Santa Teresa (inc	Track	Systemwide	1.00	Each	1999	30		
10015	36	4/22/2011 9:48:47 AM	Track	Track	Ballast - wood tie - Tangent - Guadalupe Yard	Track	Systemwide	6,864.00	Track Feet	1985	70		
10016	36	4/22/2011 9:48:47 AM	Track	Track	Ballast - wood tie - Curve - Guadalupe Yard	Track	Systemwide	2,640.00	Track Feet	1985	50		
10017	36	4/22/2011 9:48:47 AM	Track	Track	Embedded - Tangent - Guadalupe Yard	Track	Systemwide	3,960.00	Track Feet	1985	40		
10018	36	4/22/2011 9:48:47 AM	Track	Track	Embedded - Curve - Guadalupe Yard	Track	Systemwide	1,584.00	Track Feet	1985	30		
10019	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Manual Ballasted - Guadalupe Yard	Track	Systemwide	39.00	Each	1985	30		
10020	38	4/22/2011 9:48:47 AM	Track	Track	Special - Ballasted Diamond Crossover - Guadalupe Yard	Track	Systemwide	1.00	Each	1985	30		
10021	36	4/22/2011 9:48:47 AM	Track	Track	Special - Turnout Embedded - Guadalupe Yard	Track	Systemwide	2.00	Each	1984	30		
10022	36	4/22/2011 9:48:47 AM	Track	Track	Special - Ballasted Turnout - Guadalupe Yard	Track	Systemwide	39.00	Each	1984	40		
10023	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Manual Embedded - Guadalupe Yard	Track	Systemwide	2.00	Each	1985	30		
10024	36	4/22/2011 9:48:47 AM	Track	Track	Ballast - wood tie - Tangent - Guadalupe Yard Expansion	Track	Systemwide	5,808.00	Track Feet	2002	70		
10025	36	4/22/2011 9:48:47 AM	Track	Track	Ballast - wood tie - Curve - Guadalupe Yard Expansion	Track	Systemwide	1,056.00	Track Feet	2002	50		
10026	36	4/22/2011 9:48:47 AM	Track	Track	Embedded - Tangent - Guadalupe Yard Expansion	Track	Systemwide	316.80	Track Feet	2002	40		
10027	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Manual Ballasted - Guadalupe Yard Expansion	Track	Systemwide	20.00	Each	2002	30		
10028	38	4/22/2011 9:48:47 AM	Track	Track	Switch - Motorized Ballasted - Guadalupe Yard Expansion	Track	Systemwide	1.00	Each	2002	30		
10029	36	4/22/2011 9:48:47 AM	Track	Track	Special - Turnout Embedded - Guadalupe Yard Expansion	Track	Systemwide	1.00	Each	2002	30		
10030	36	4/22/2011 9:48:47 AM	Track	Track	Special - Ballasted Turnout - Guadalupe Yard Expansion	Track	Systemwide	20.00	Each	2002	40		
10031	36	4/22/2011 9:48:47 AM	Track	Track	Embedded - Tangent - Guadalupe Younger to Convention Center	Track	Systemwide	17,767.20	Track Feet	1988	40		

Track Assessment

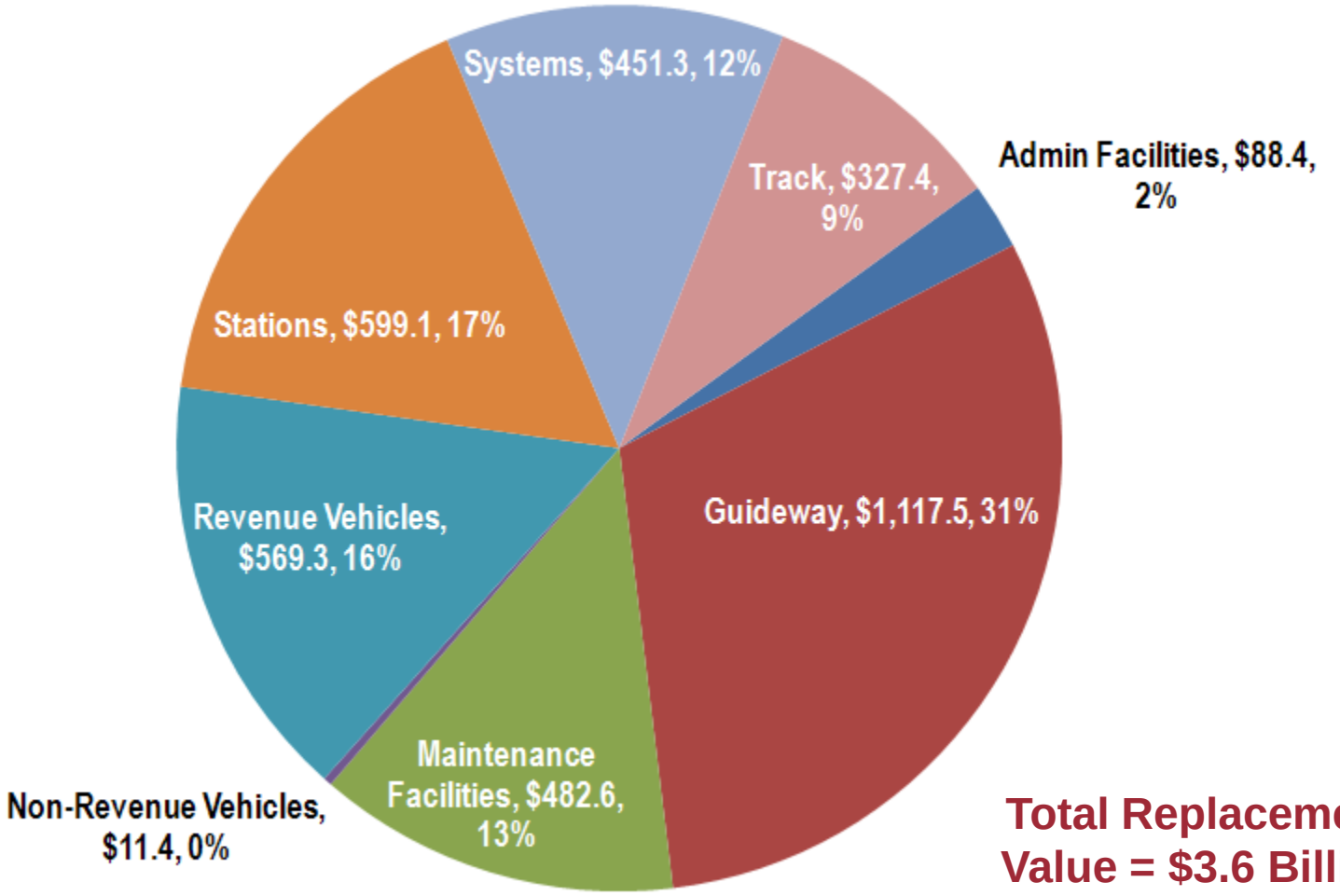
VTA Light Rail Track Assessment

Number of Occurances

Line Segments	Rail	Ballast	Ties	OTM	Alignment	Surface	Trash	Vegetation	Drainage	Fencing	Signage	Other
Guadalupe Line (incl. Lick Spur)	28	32	4534	26	4	22	7	16	11	0	3	64
Tasman West Line	14	6	105	17	3	14	9	4	1	1	2	32
Tasman East & Capitol Line	6	0	4	3	10	9	5	0	1	0	0	15
Vasona Line	3	2	1	5	1	1	2	2	0	2	0	1



Asset Inventory Replacement Value by Super Asset Type (2011$ Millions)

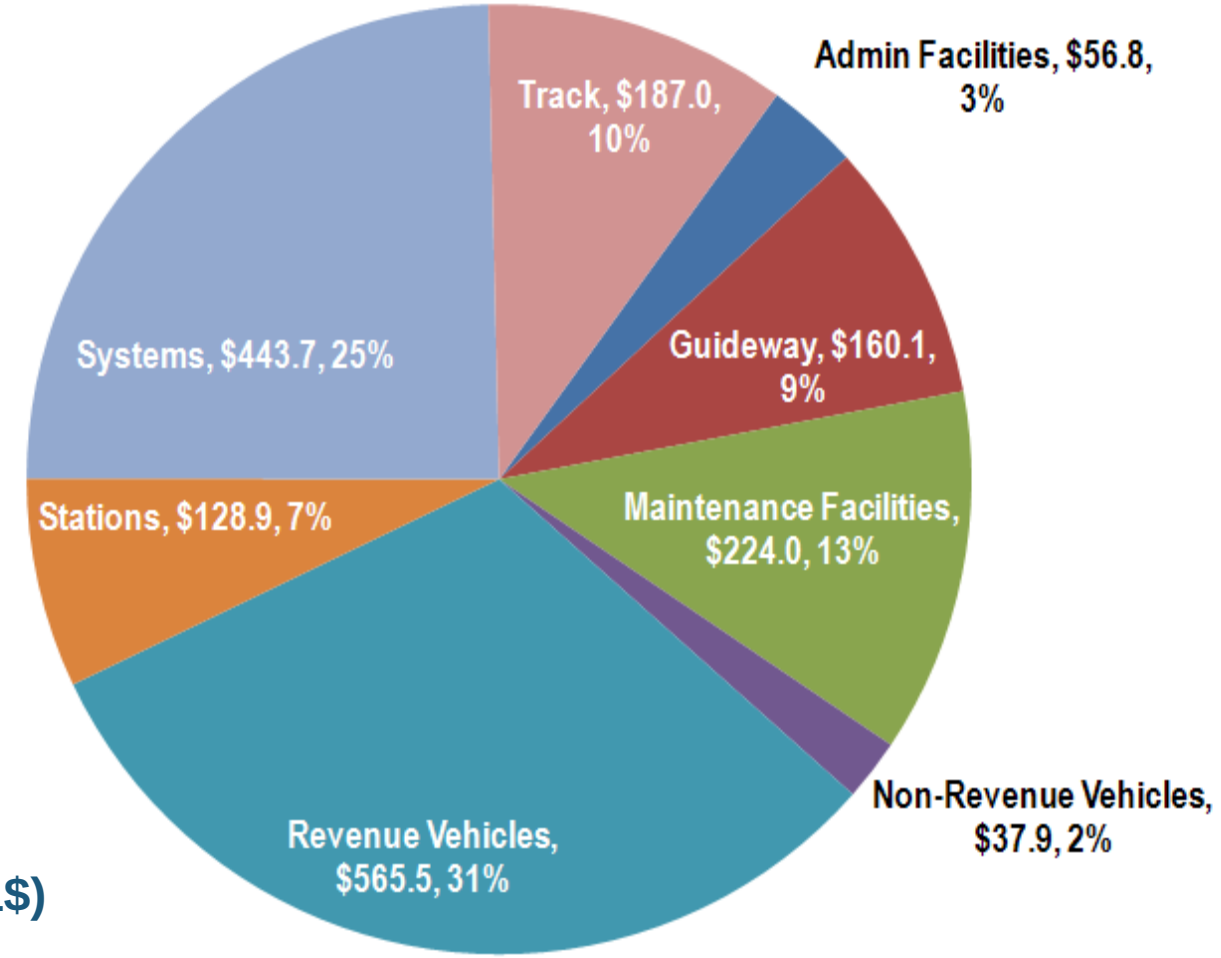


Total Replacement Value = $3.6 Billion (2011$)

VTA Asset Inventory by the Numbers

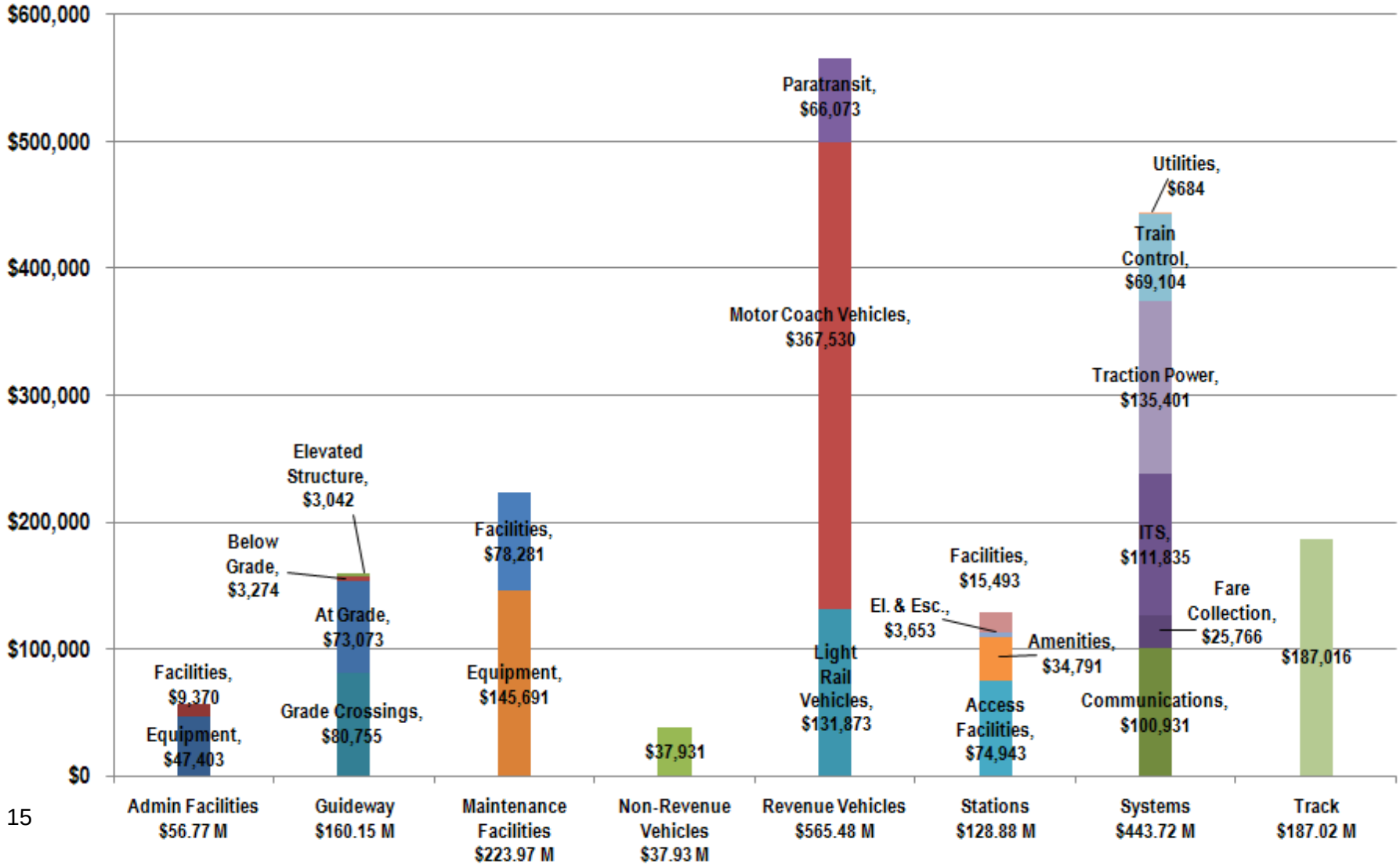
- Asset line items: 938
  - Renewal line items: 607
  - Replacement only items: 331
- Projects: 96
  - Identified by VTA: 26
  - Identified by AECOM: 70
- Unconstrained SGR needs over 20-years:
  - Replacement actions: 1,359
  - Renewal actions: 1,442

20-Year State-of-Good-Repair Needs by Super Asset Type (2011$ Millions)



Total 20-Year SGR Need = $1.8 billion (2011$)

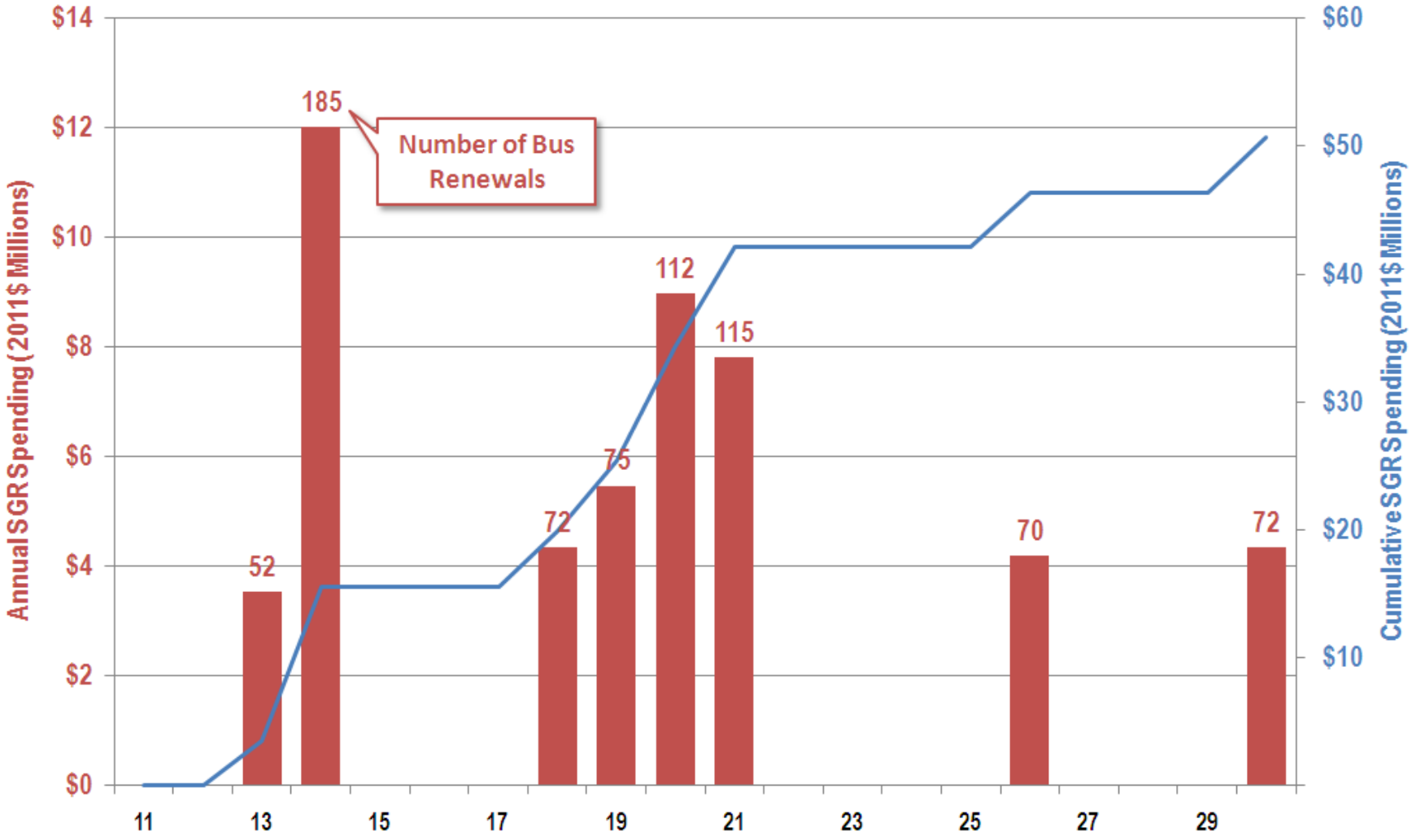
20-Year State-of-Good-Repair Needs (2011$ Thousands)



Bus Vehicle Renewals are Treated as Operating Expense

- Consistent with current practice, costs of bus vehicle renewals not included in $ projections of SGR needs
  - These costs are currently funded out of the operating budget
- Number of renewals are tracked; dummy value of the unit renewal cost is applied (does not count against a budget constraint)
- Dummy value could be replaced with actual unit cost at a later date
  - Will support conversion of these costs to capital, if so desired by VTA

Cost of 753 Bus Vehicle Renewals Needed thru 2030 Treated as an Operating Expense and Excluded from SGR Needs

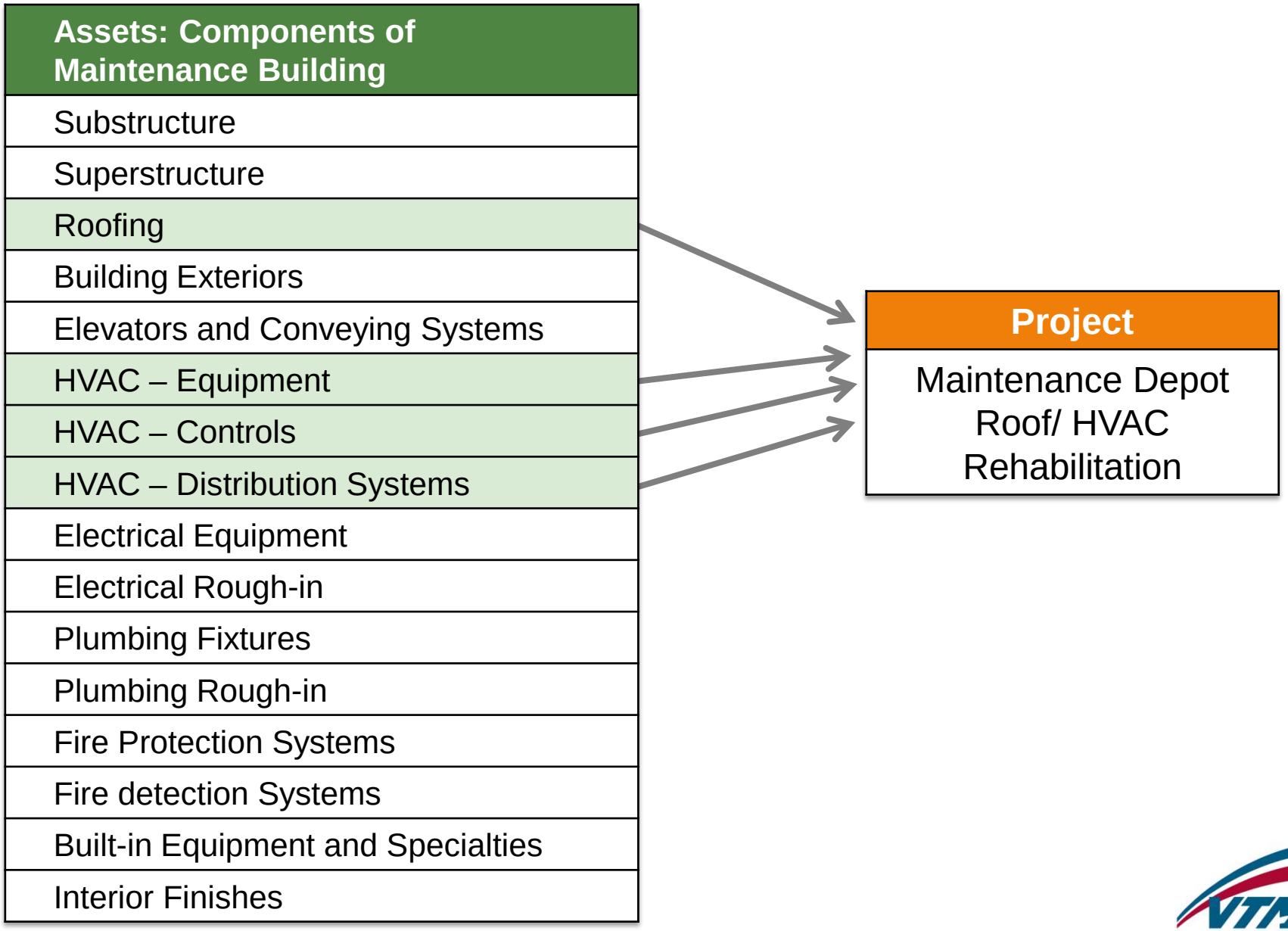


4. Identifying Projects

Identifying Capital Projects Addressed in SGR Analysis

- Based on VTA Short Range Transit Plan
- Supplemented with needs identified in SGR analysis
- Easier for VTA and the public to relate priorities to capital ***projects*** rather than ***assets***
  - Assets: too much detail
  - Projects: easier to evaluate and prioritize, more *constructible*
- Each asset is mapped to a project and vice versa
- Decision Lens process generates revised priorities for each project

Mapping Assets to Projects

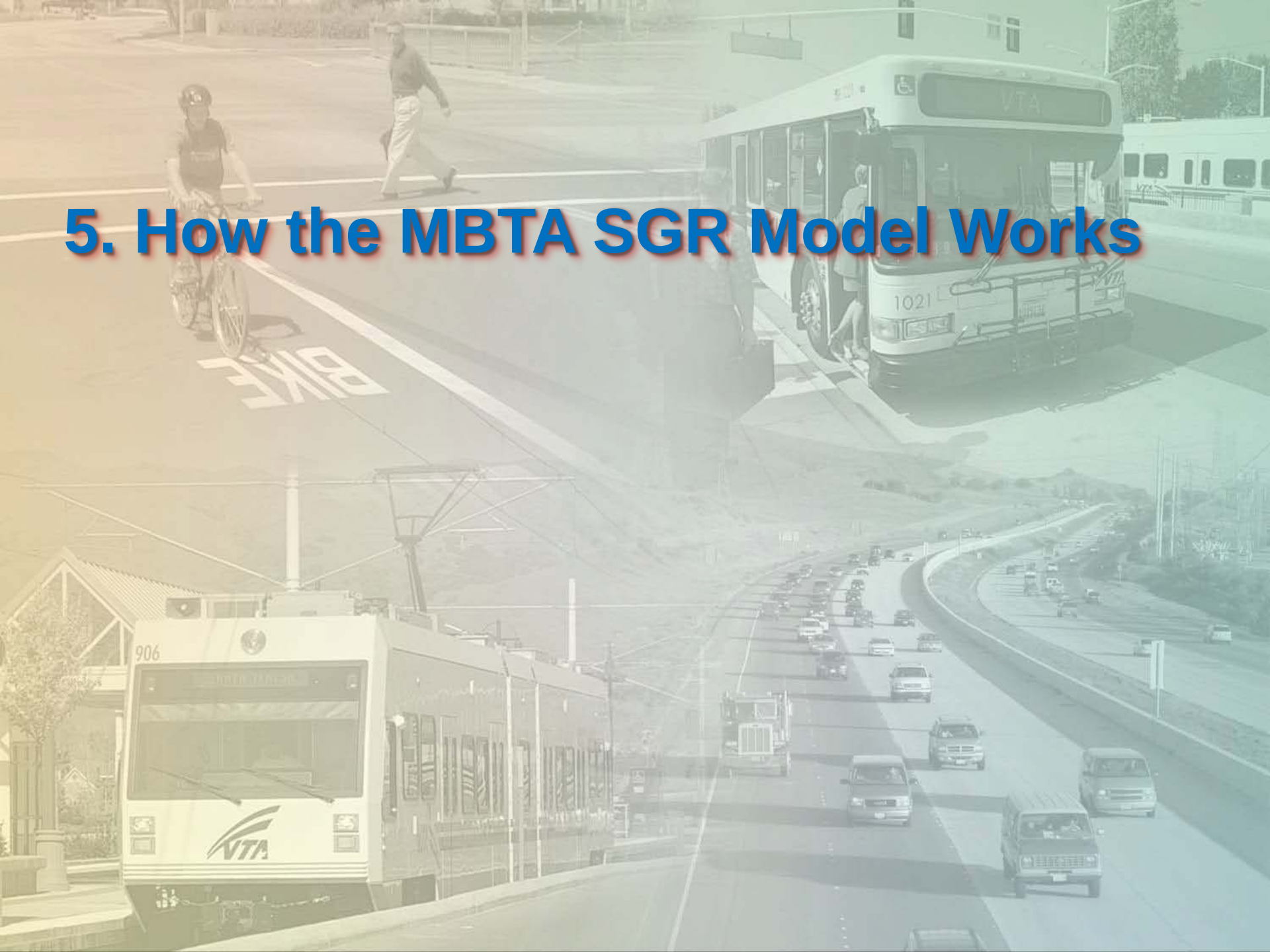


Projects Considered in SGR Analysis

Rank	Project Name	Replacement Value (millions 2011$)	Cumulative Replacement Value	Priority Score
1	Hamilton Structure Stabilization	$21.1	$21.1	0.7635
2	Express Bus Vehicle Purchase	$33.1	$54.2	0.7635
3	Replace centralized control for train control	$18.2	$72.5	0.7497
4	Replace trackmiles of fixed wayside for the light rail network	$80.6	$153.0	0.7497
5	Replace bar (traffic) signals for train control	$1.8	$154.8	0.7497
6	Replace gates/crossing protection - Gated crossings	$22.0	$176.9	0.7497
7	Replace guideway on elevated structures	$84.1	$260.9	0.7428
8	Replace central revenue software, revenue counting equipment, and vault receiver	$0.8	$261.7	0.7221
9	Replace ticket vending machines at light rail stations	$16.2	$278.0	0.7221
10	Rail Rehabilitation and Replacement	$309.6	$587.6	0.7221
11	Multi-Pocket Currency Sorter	$0.1	$587.6	0.7221
12	Kiss & Ride at Bayshore NASA LRT	$1.2	$588.8	0.7221
13	Replace fareboxes on vehicles	$7.2	$596.1	0.7221
14	Transit Center Park & Ride Upgrades	$13.3	$609.4	0.7221
15	Guadalupe Signalization Assessment/SCADA System Replace	$15.2	$624.5	0.7221
16	LRT Crossovers and Switches	$17.8	$642.4	0.7221
17	Replace Access Facilities - Auto Park Lots at LRT stations	$42.6	$685.0	0.7221
18	Overhead Catenary System (OCS) Rehabilitation	$154.1	$839.0	0.7221
19	Bridge & Structures SGR Repairs	$211.6	$1,050.6	0.7221
20	Guadalupe Corridor 12 TPSS Replacement Program	$24.0	$1,074.6	0.7221

= VTA-identified Project

= AECOM-identified Project

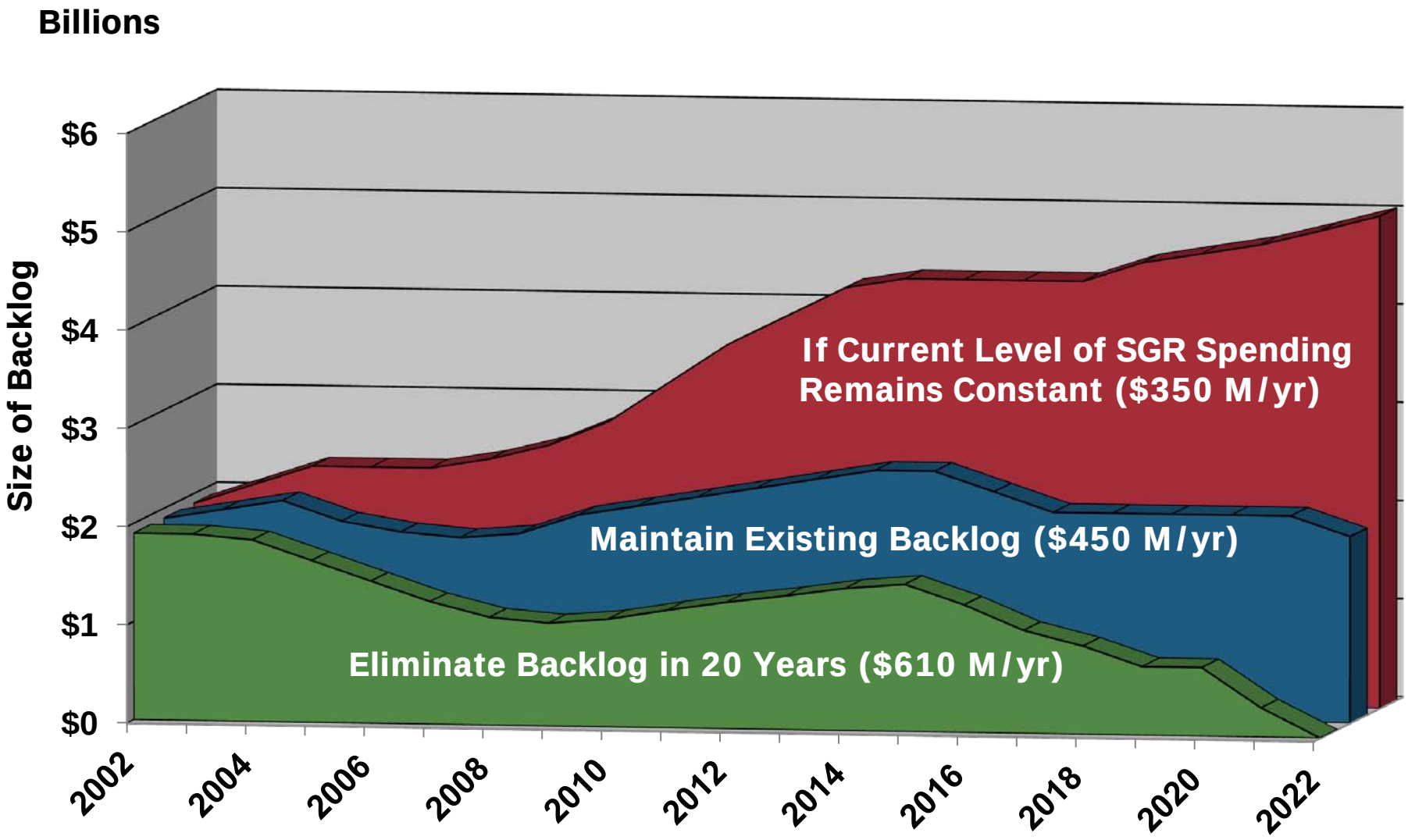


5. How the MBTA SGR Model Works

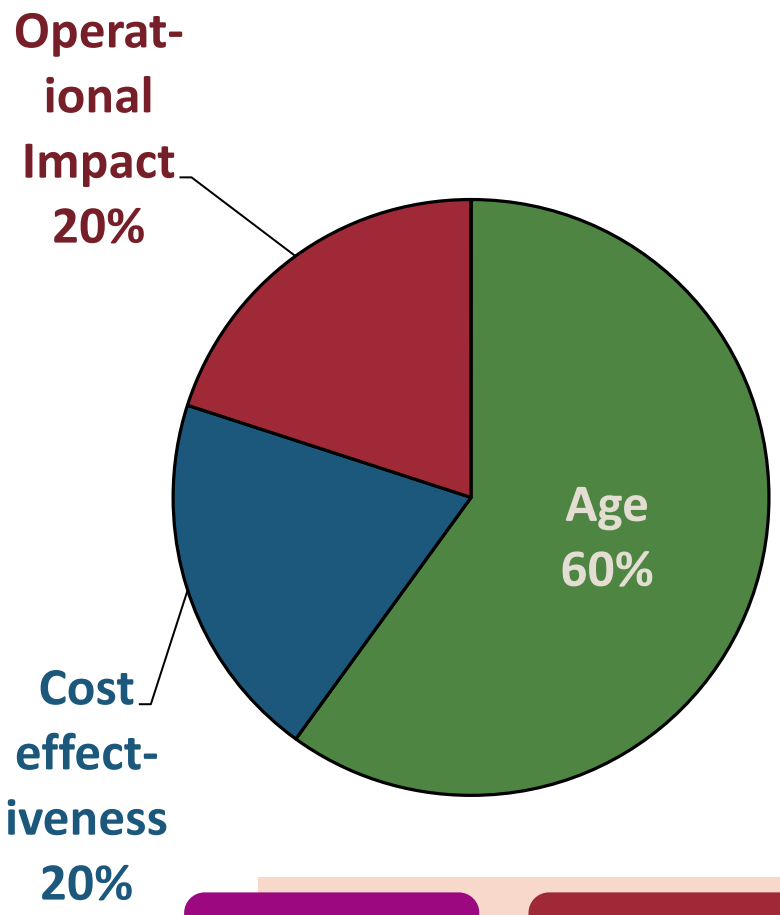
Answers to These Questions Helped Secure Dedicated Funding for MBTA

- What are the system's current SGR needs?
- What would happen to the SGR backlog if current capital funding levels remain the same?
- What level of funding is needed to maintain the current SGR backlog?
- What level of funding would be needed to eliminate the SGR backlog in 20 years?

How MBTA Quantified Its SGR Needs



Project Evaluation Criteria Weighting



- **Age**
  - *Age as % of Service Life*
- **Operational Impact**
  - *Yes/No*
  - *Selected assets are essential to system operations*
- **Cost-Effectiveness**
  - *Ridership/Cost of Action*
  - *Reflects customer service impacts*

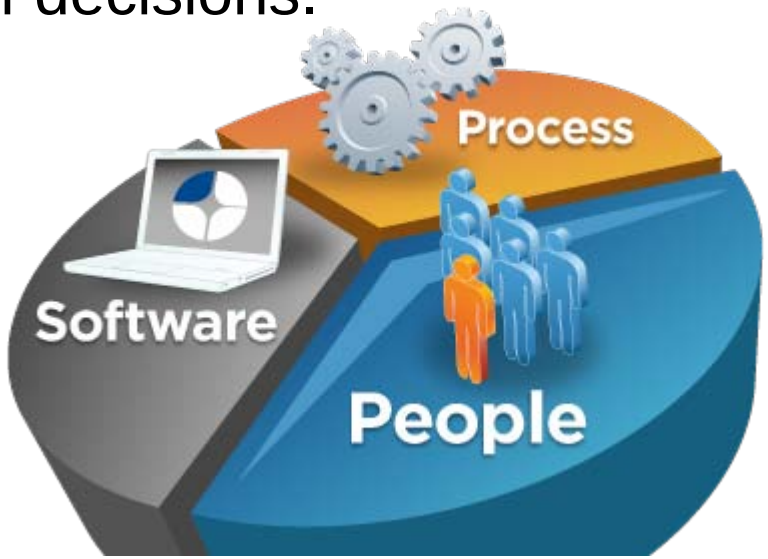
AGE → OPERATIONAL IMPACT → COST-EFFECTIVENESS

60% Weight x Age Score + 20% Weight x Operational Impact Score + 20% Weight x Cost-Effectiveness Score = Priority Ranking

6. Application of Decision Lens Prioritization of Capital Projects

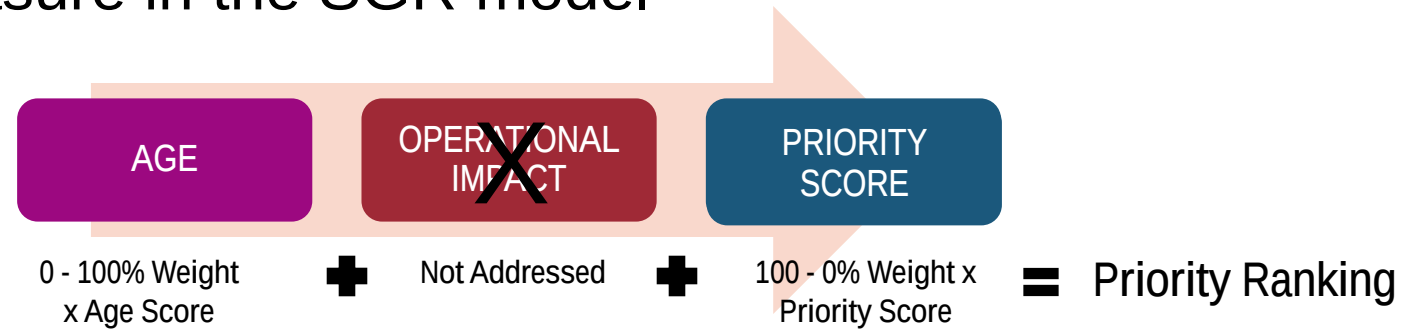
What is Decision Lens

- Decision Lens is a prioritization software solution for decision making in a complex business environment
- Based upon a mathematical theory, the Analytic Hierarchy Process (AHP), placing strategic goals at the center of the decision process. AHP is applied to prioritize and evaluate decision criteria.
- AHP, based on mathematics and psychology, has been successfully applied to thousands of decisions.
  - Corporate budget planning
  - Vendor selection
  - Player selection in the NFL
  - Capital programming by more than a dozen transportation agencies



Leveraging Project Prioritization Supported by Decision Lens

- Decision Lens prioritization process
  - Involved stakeholders from throughout VTA
  - Identified and weighted capital project evaluation criteria
  - Supported scoring (rating) of each project against a comprehensive set of evaluation criteria using a well-defined scoring scale
  - Will result in a scalar priority score for each project
  - Provides a collaborative, transparent, rigorous and repeatable process
- Project priority scores can replace the “cost-effectiveness” measure in the SGR model



Project Evaluation Criteria and Weighting

PRIOR IN-HOUSE-DERIVED CRITERIA	Weight
Maintains Service Network OR Support & Infrastructure	**33%**
Improves Service Network OR Support & Infrastructure	**8%**
Increases Ridership	**17%**
Increases Ridership	**17%**
Special Circumstances	**17%**
Improves Cost Efficiency	**17%**

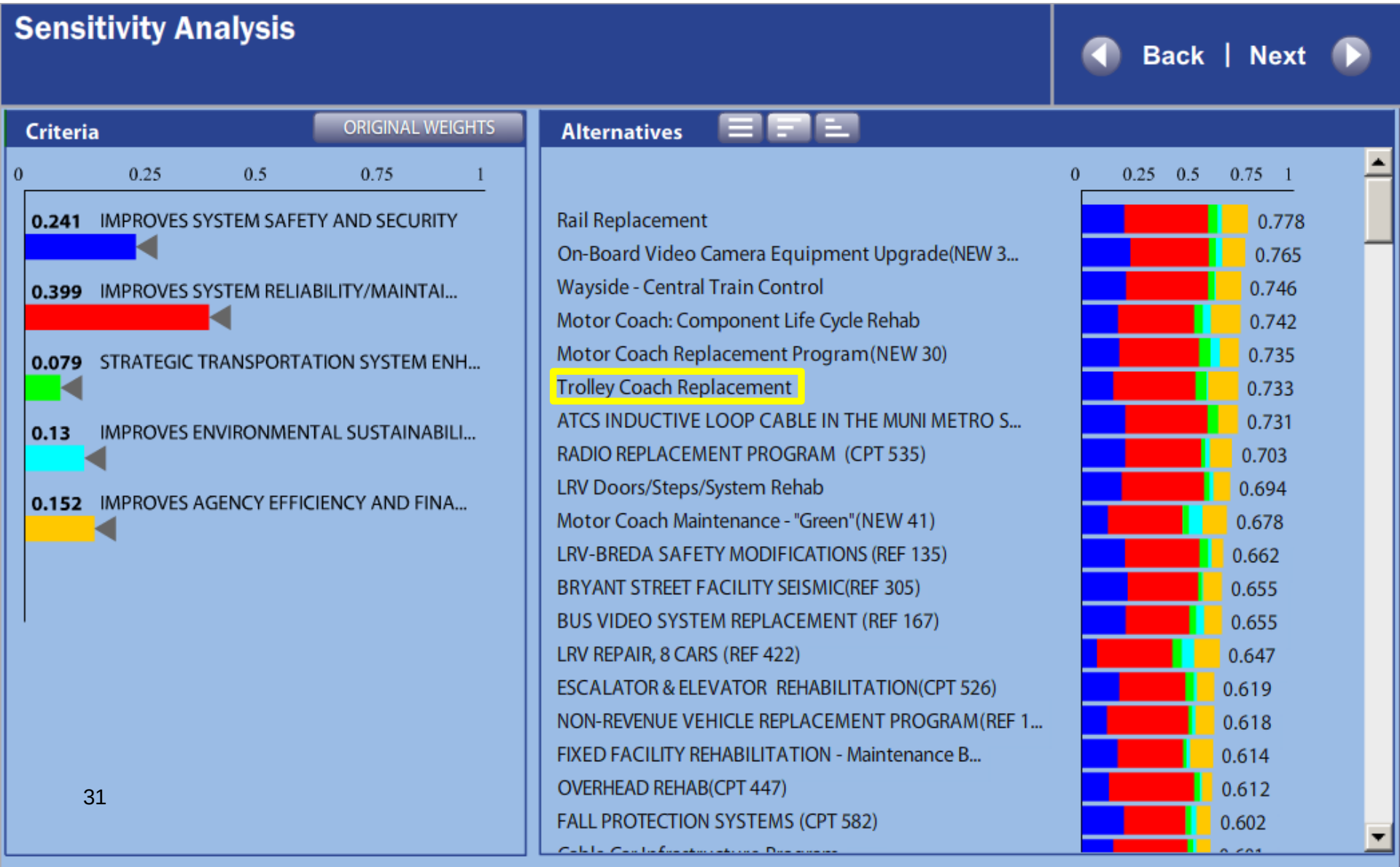
DECISION LENS-DERIVED CRITERIA	Weight	
Transit System Preservation	**28.0%**	
Maintain Administrative Support		3.2%
Maintain Facilities Infrastructure		5.8%
Maintain Service System		19.0%
Transit System Improvements	**12.7%**	
Improves Administrative Support		1.9%
Improves Facilities Infrastructure		1.4%
Improves Service System		5.9%
mproves Customer Experience		3.5%
creases Ridership	**20.2%**	
nhances Safety and Security	**7.1%**	
Safety		2.0%
Security		5.1%
Environmental Sustainability	**5.3%**	
Encourage Use of Alternative Modes		2.3%
Resource Conservation		3.0%
Cost Impact	**26.7%**	
Financial Sustainability		17.4%
Improves Cost Efficiency/Effectiveness		9.3%

Rating Scales Defined for Each Evaluation Criterion (Sample Transit Agency Example)

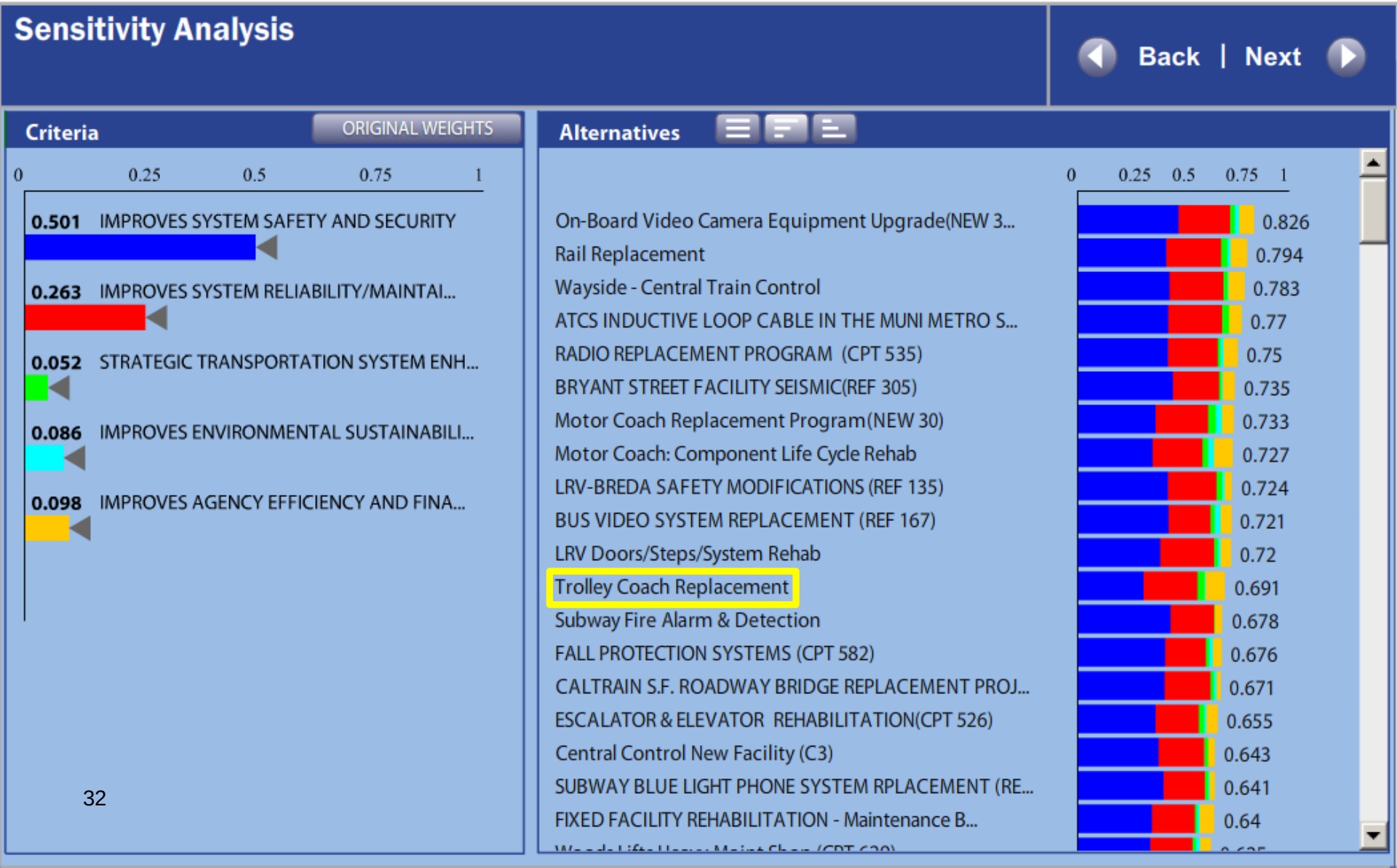
SUB-CRITERION VALUE 1B. REDUCES AGENCY SAFETY INCIDENTS AND INJURIES

Rating	Definition	Rating Weight
Major *Critical*	The project directly improves and mitigates a documented safety exposure to employees or the public; the project improves or restores a service/ “safety-critical” asset.	100%
Medium *Important*	The project is expected to reduce incidents and injuries; without the project, current physical plant or system conditions related to safety of employees or the public may worsen.	50%
Moderate *Useful*	The project maintains current safety conditions	25%
Minor *Negative, or Unknown*	The project is not expected to improve current conditions and its impacts on the Agency’s safety goals are not generally measurable.	0%

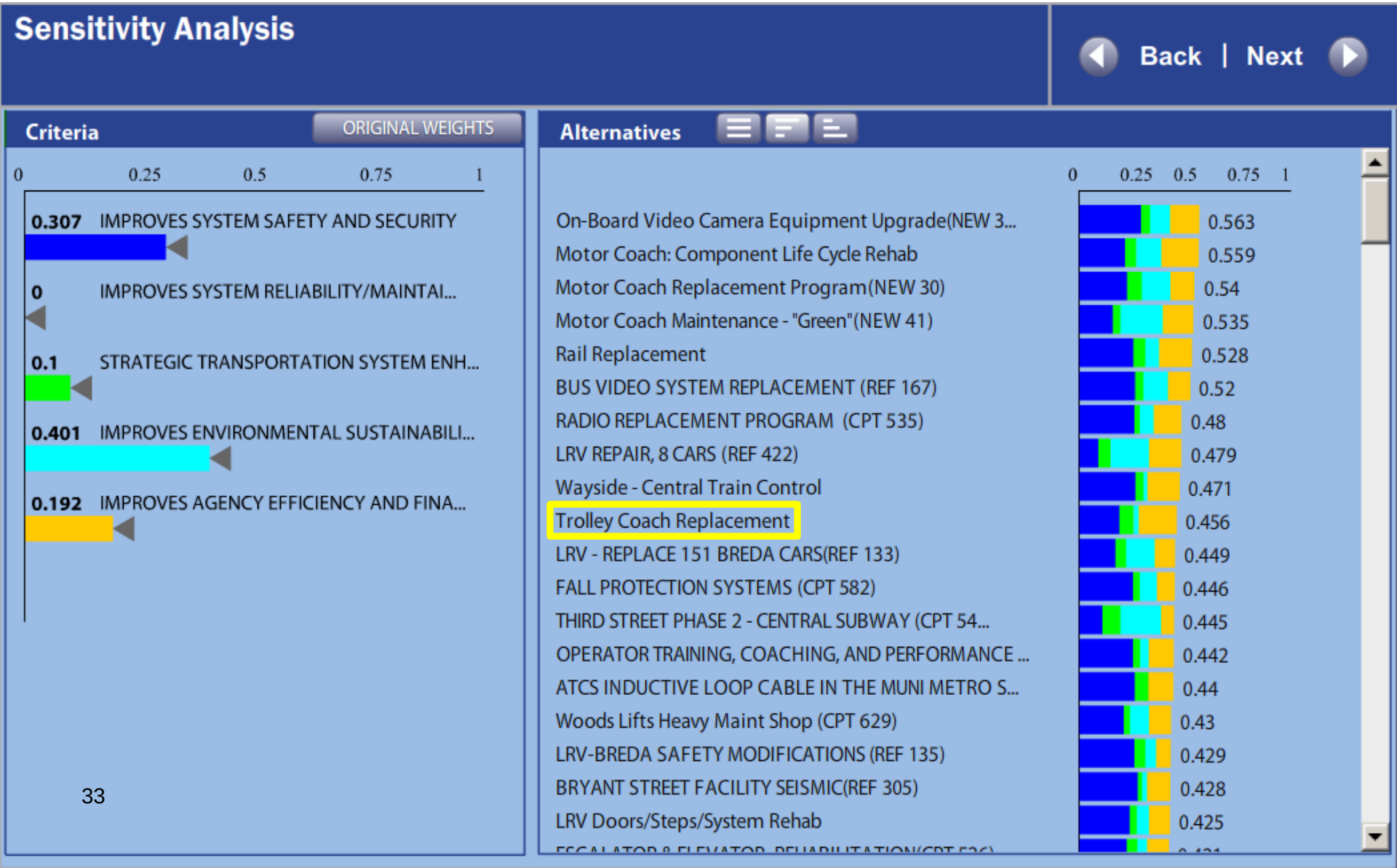
Project Priorities Based on Original Criteria Weights (Sample Transit Agency Example)



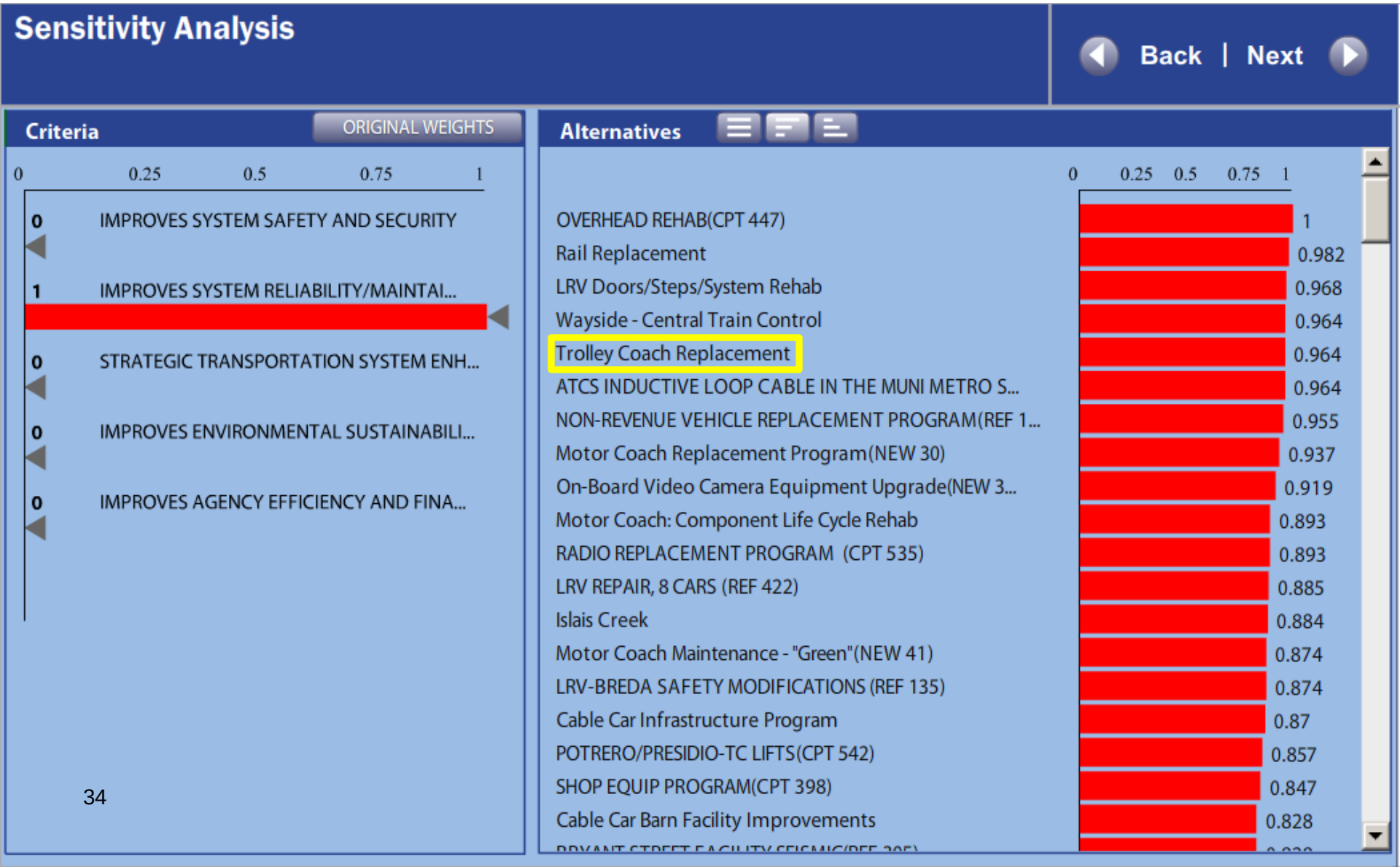
Project Priorities with Increased Priority on Safety and Security



Project Priorities with Increased Priority on Environmental Sustainability / Remove System Reliability

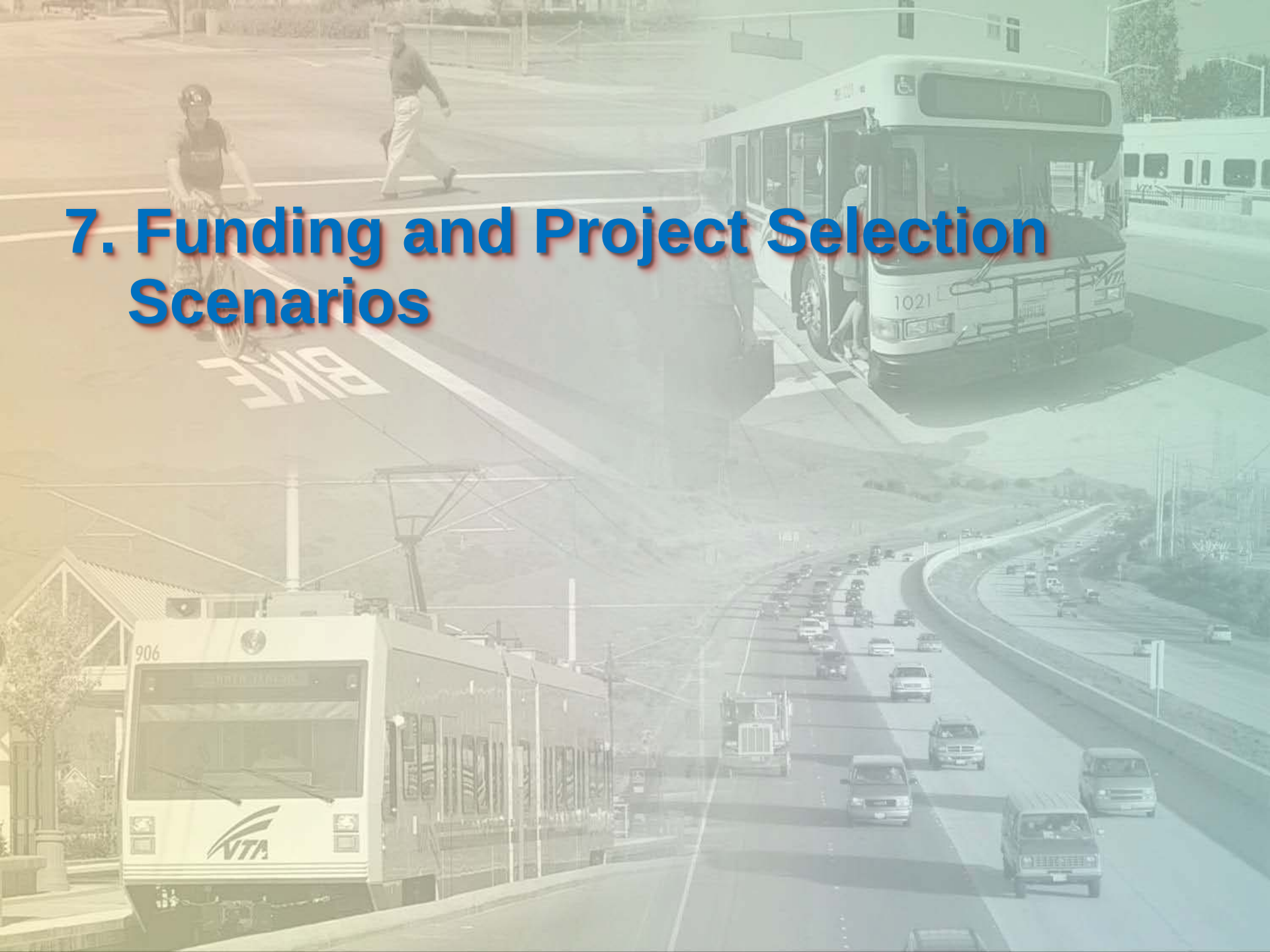


Project Priorities only Considering System Reliability/Maintains a State of Good Repair



Decision Lens Ranking

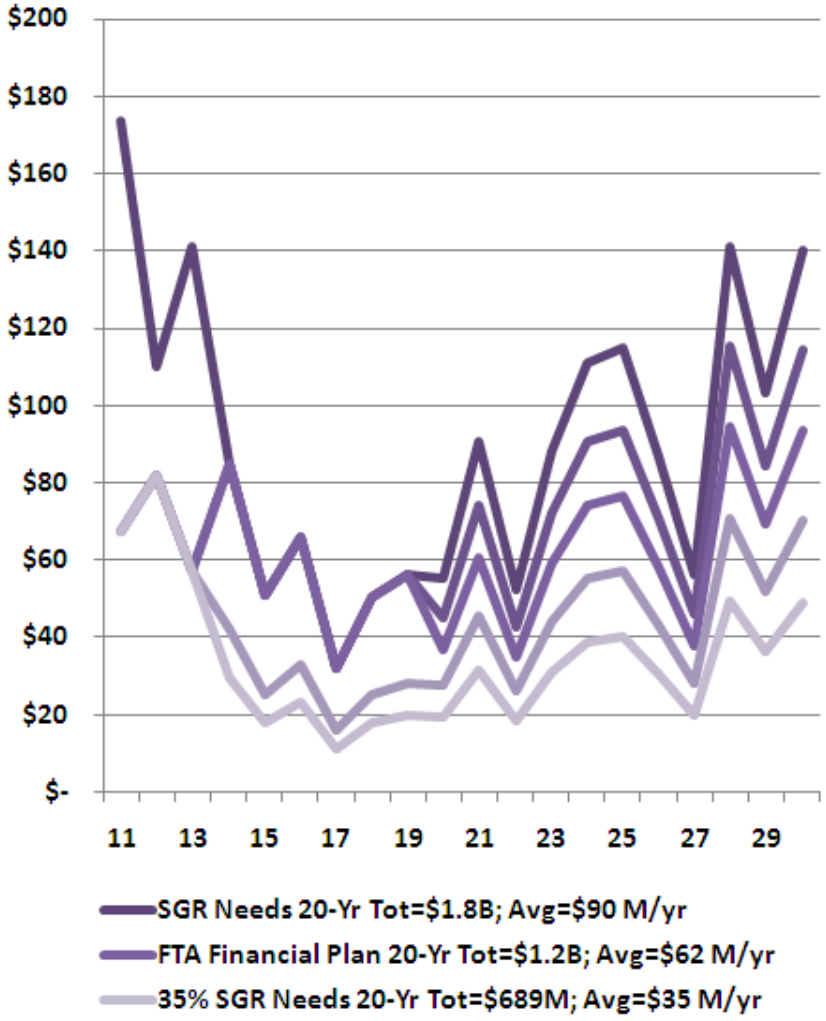
Project Description	Score	Current Rank
Express Bus Vehicle Purchase	0.4238	1
Purchase 60' Articulated Buses	0.4099	2
Rail Rehabilitation and Replacement	0.4046	3
Procure 40' replacement buses	0.3906	4
North First Street Corridor Speed Improvements	0.3750	5
Purchase Community Buses	0.3603	6
Overhead Catenary System (OCS) Rehabilitation	0.3574	7
Replace 35' - Heavy-Duty Diesel Buses	0.3494	8
LRT Crossovers and Switches	0.3378	9
Replace Kinkisharyo SCVTA900 Light Rail Vehicles	0.3348	10
Replace elevators at light rail transit stations	0.3295	11
Guadalupe Corridor 12 TPSS Replacement Program	0.3266	12



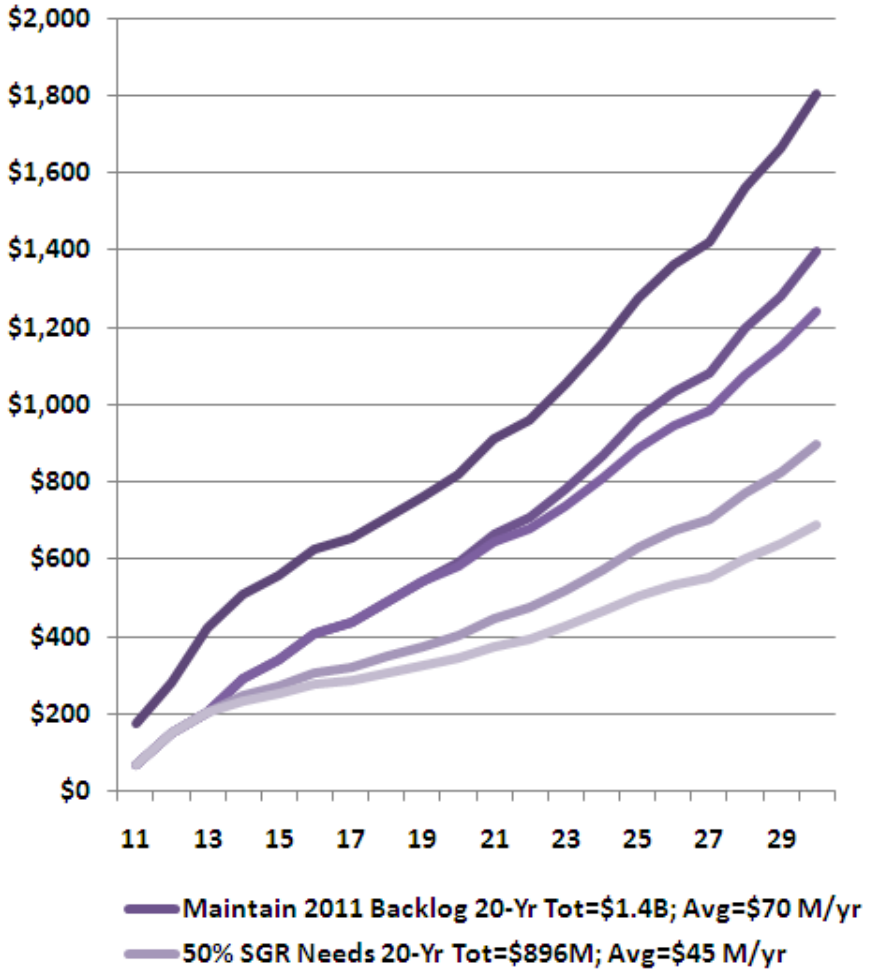
7. Funding and Project Selection Scenarios

SGR Funding Scenarios (2011$ Millions)

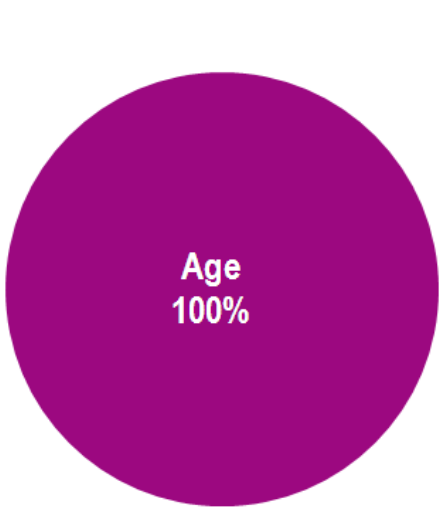
Annual

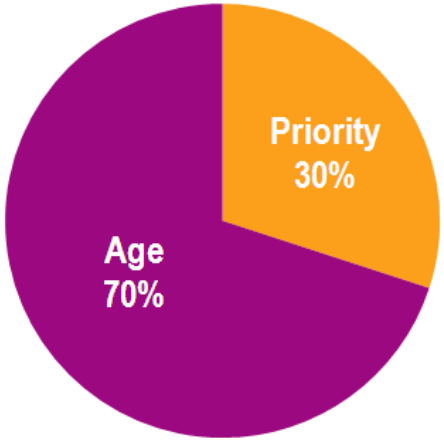


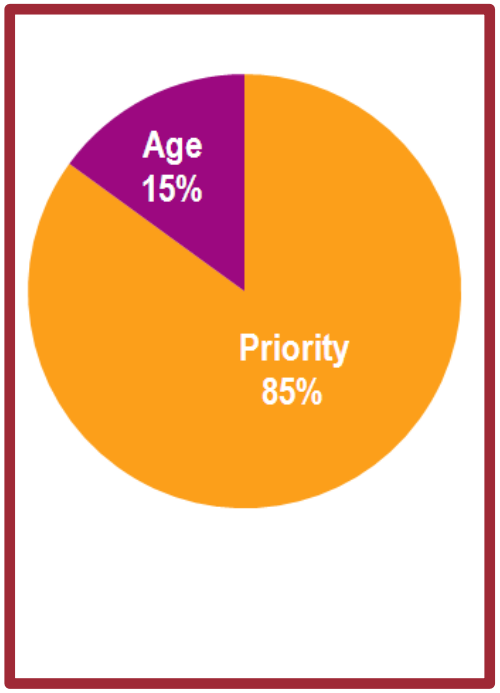
Cumulative



Project Selection Scenarios Applied in SGR Analysis



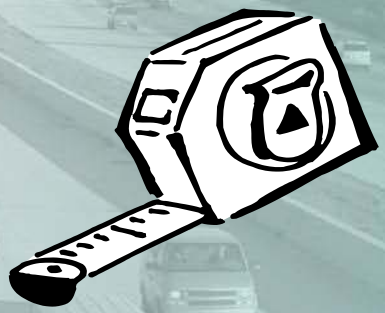




Applied in Analysis

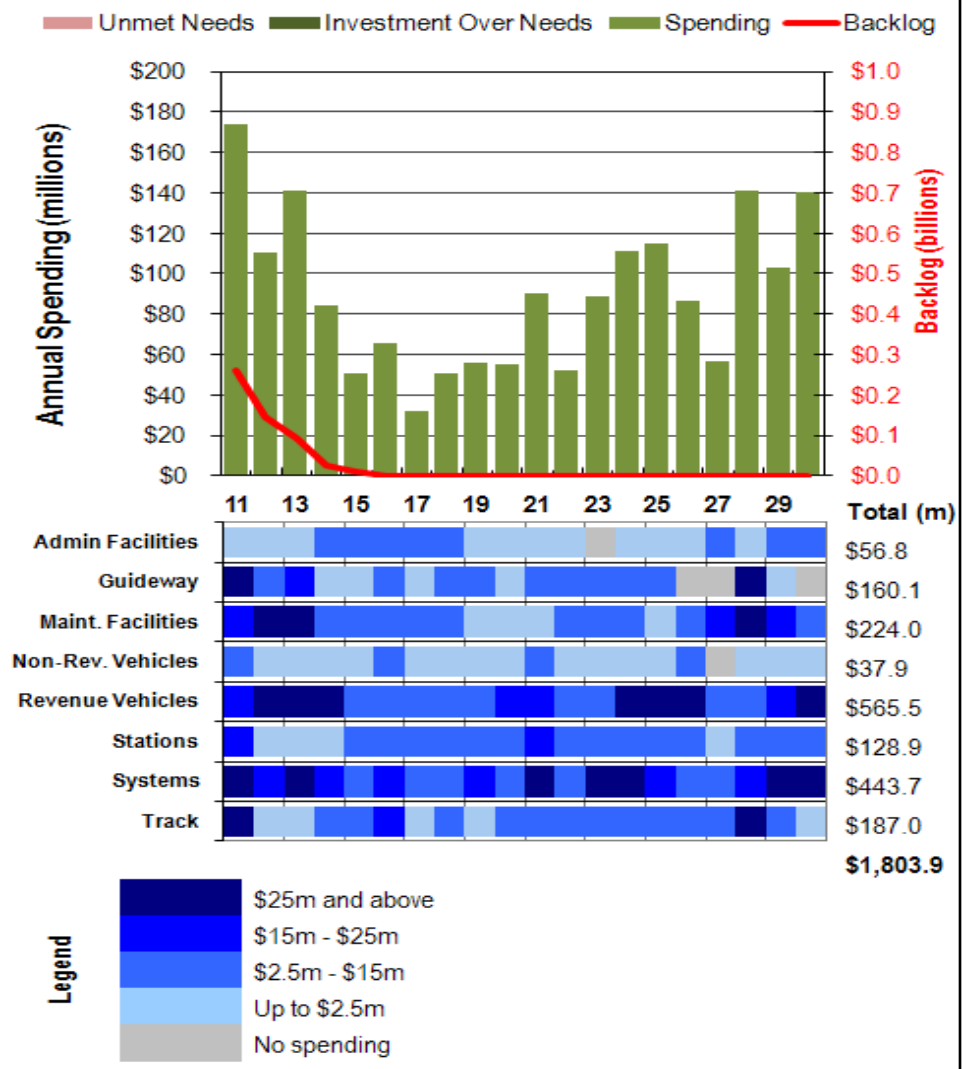
SGR Analysis Performance Measures and Results

Annual Spending, SGR Backlog, State of Repair

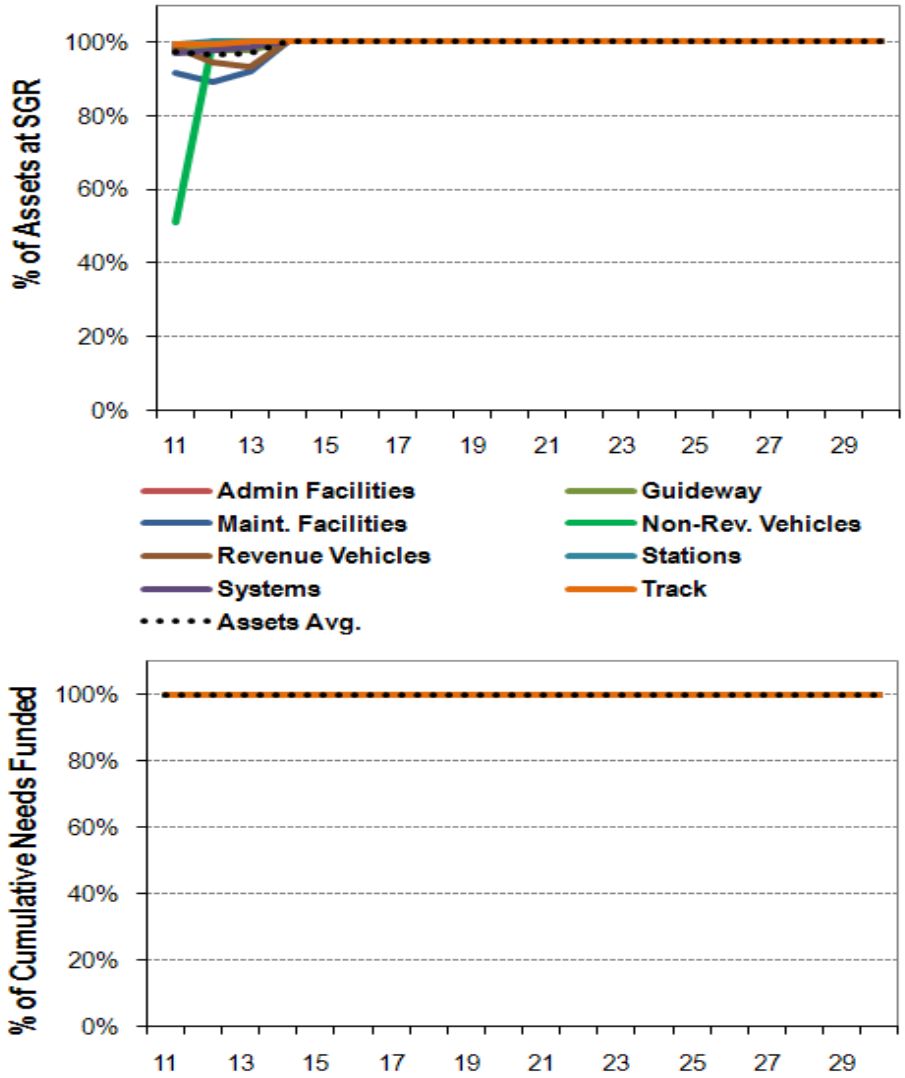


Unconstrained Funding/100% of SGR Needs Funded

ANNUAL SPENDING



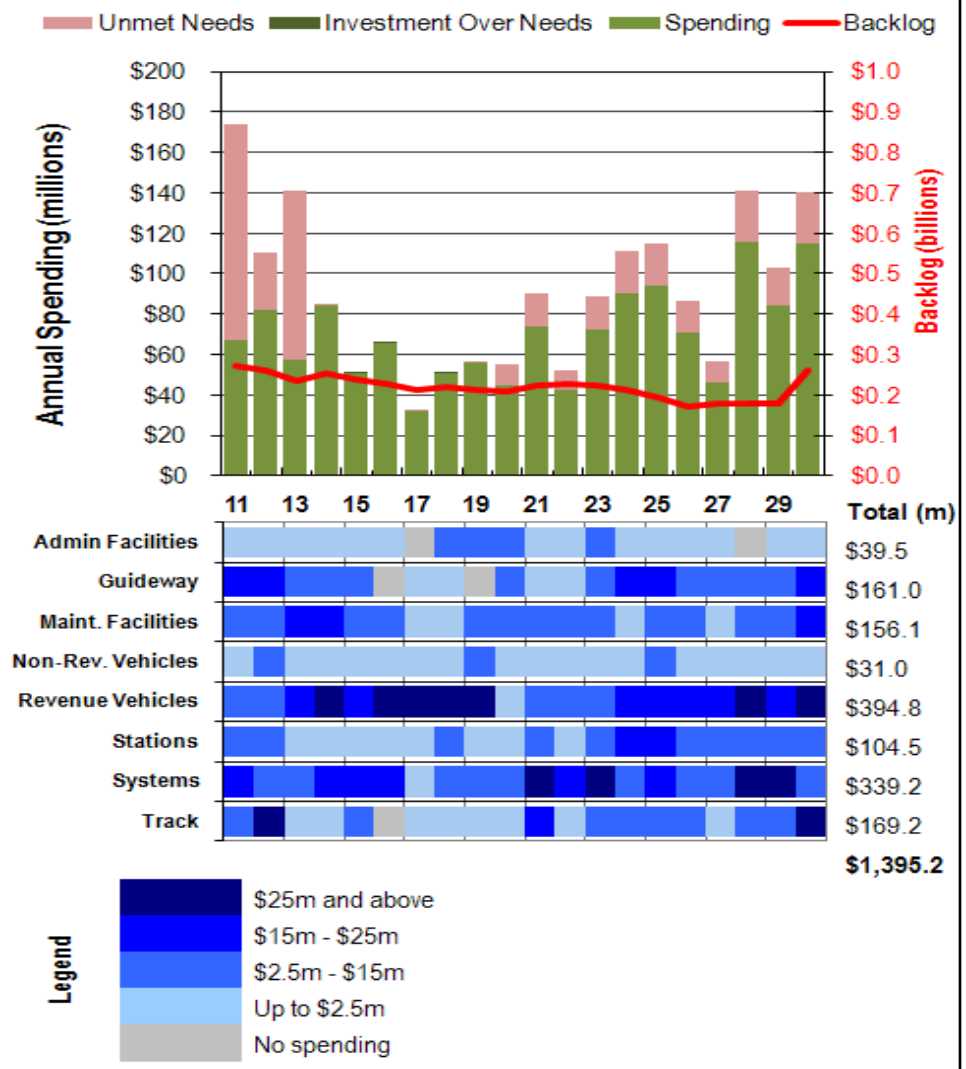
STATE OF REPAIR



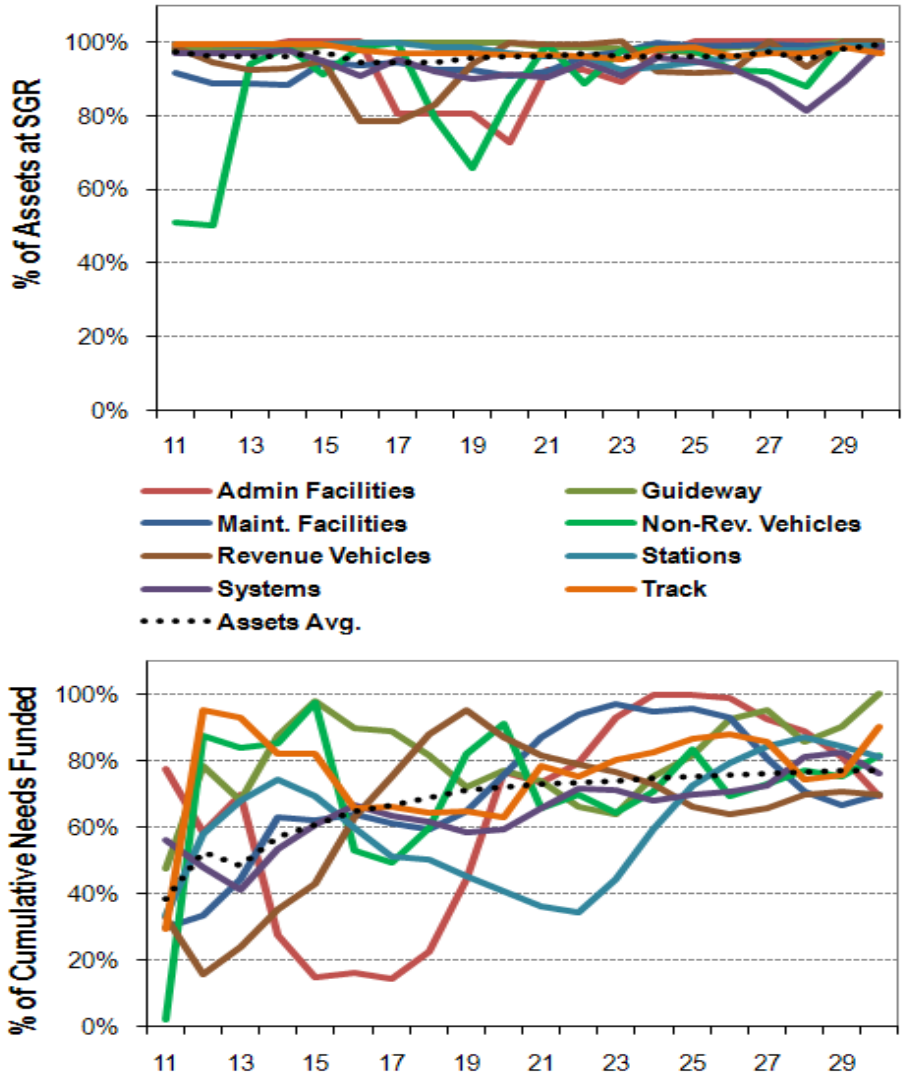
Maintain 2011 SGR Backlog/77% SGR Needs Funded

85% Priority Scores/15% Age Decision Weights

ANNUAL SPENDING



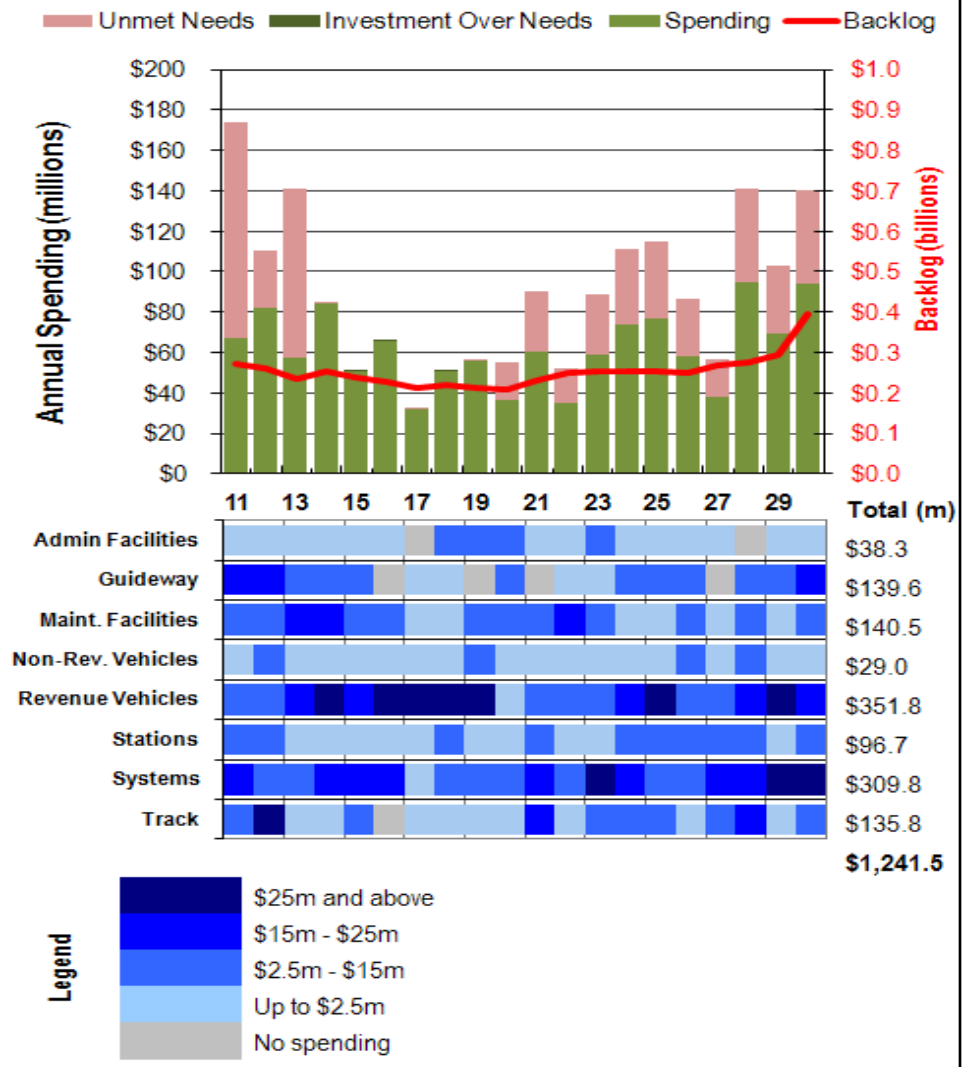
STATE OF REPAIR



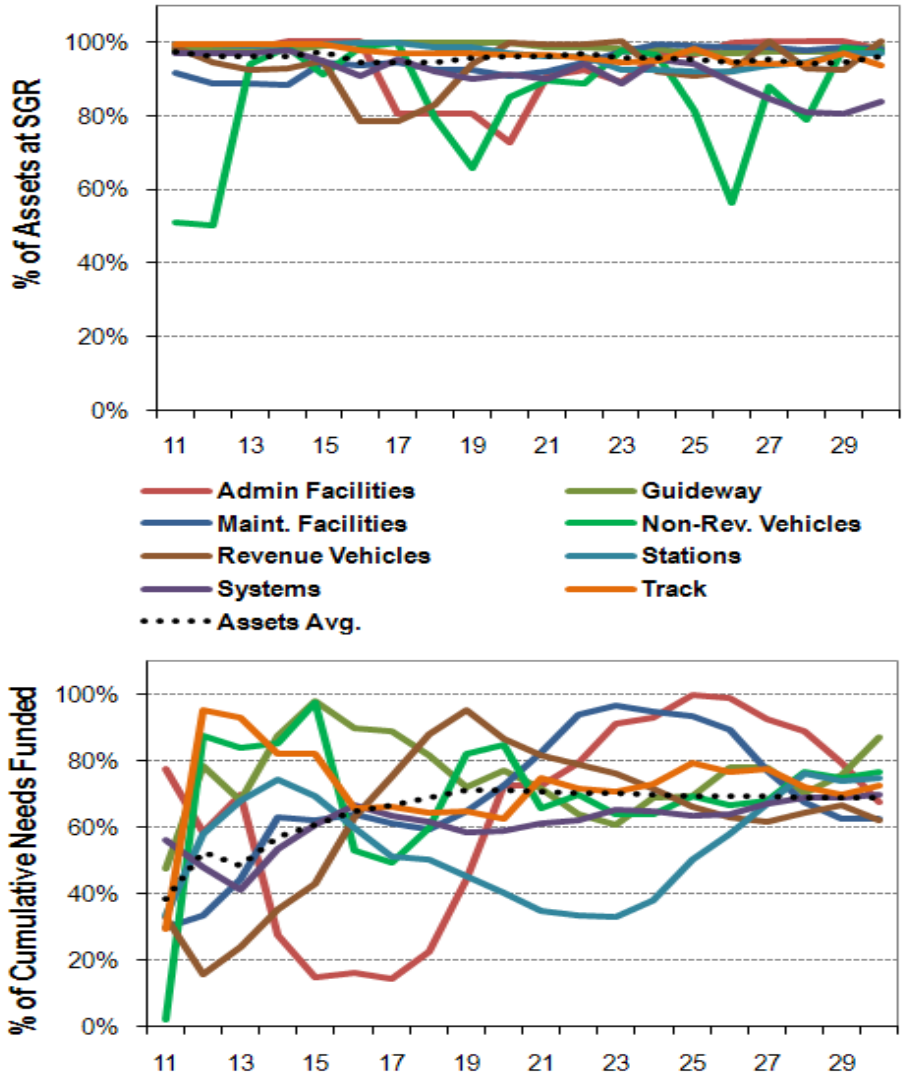
2011 Financial Plan CIP/69% SGR Needs Funded

85% Priority Scores/15% Age Decision Weights

ANNUAL SPENDING



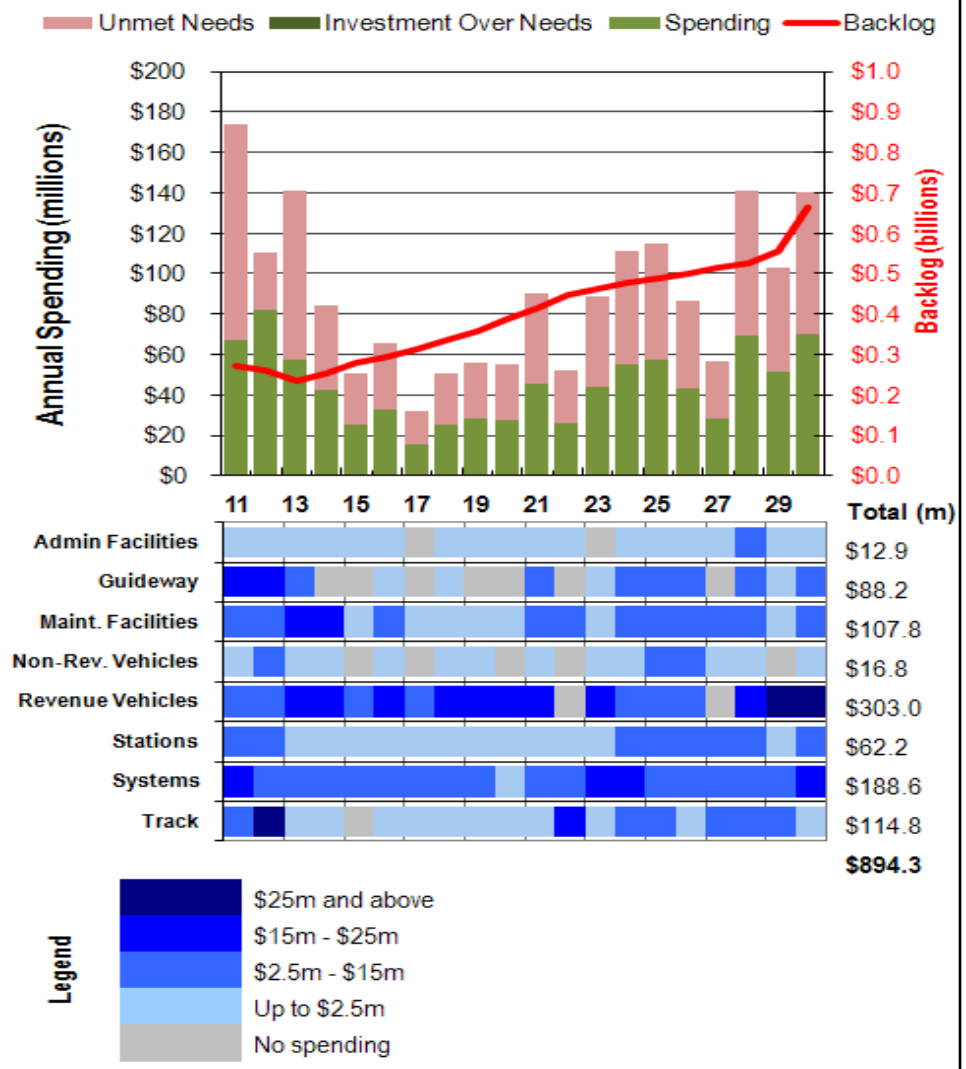
STATE OF REPAIR



50% of SGR Needs Funded

85% Priority Scores/15% Age Decision Weights

ANNUAL SPENDING



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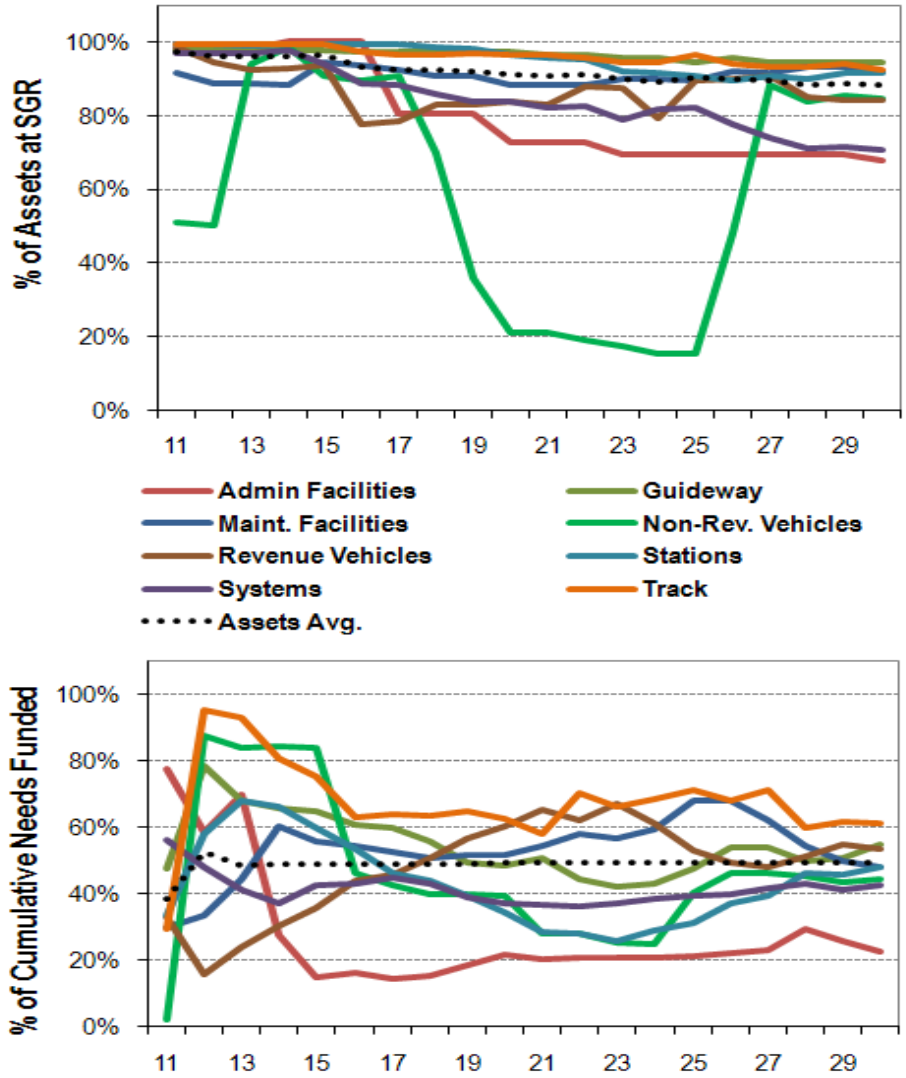
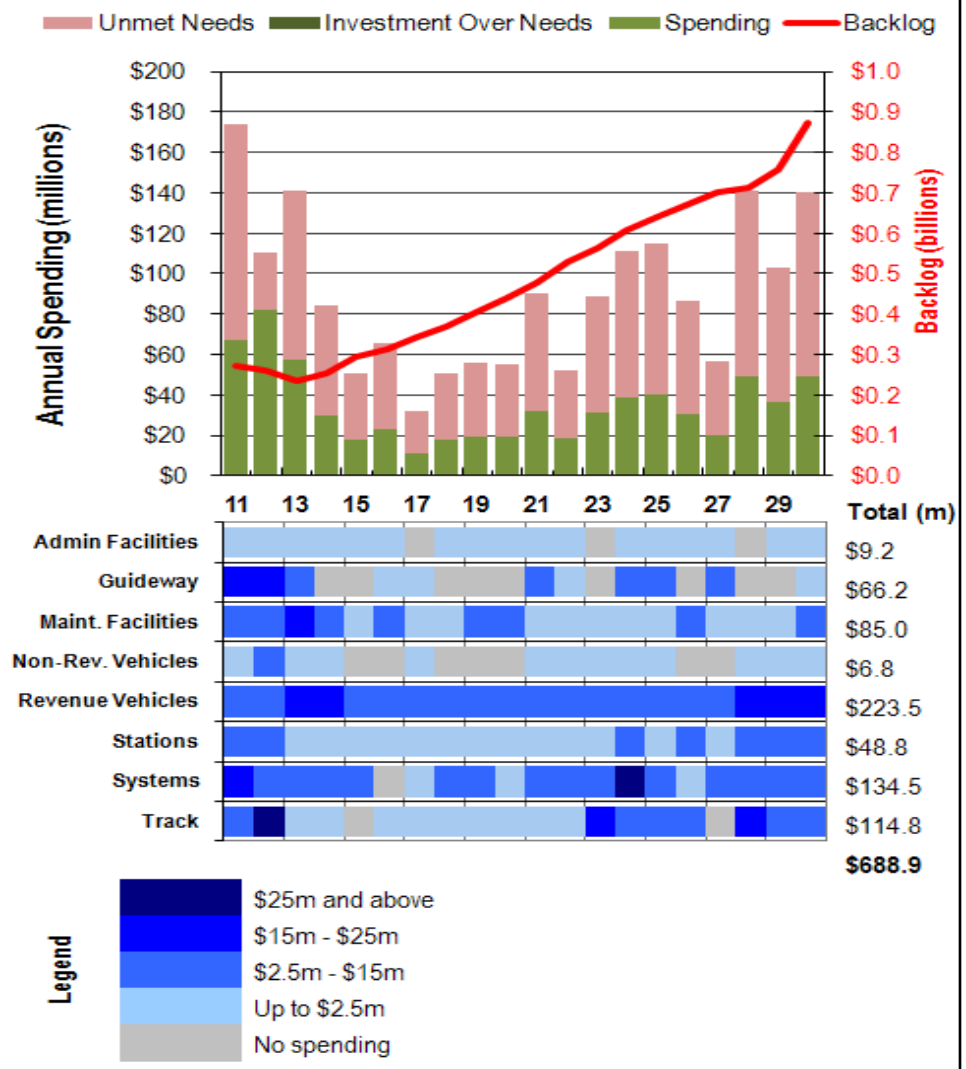


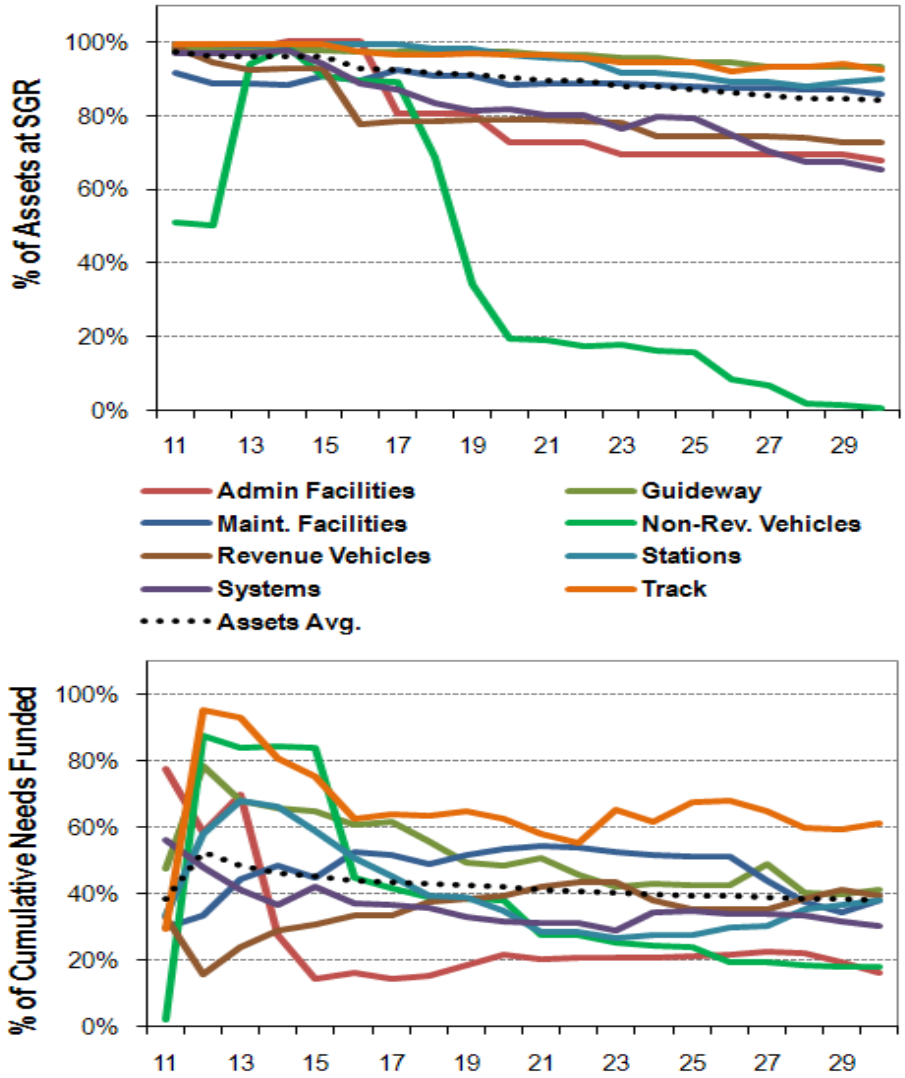
35% of SGR Needs Funded

85% Priority Scores/15% Age Decision Weights

ANNUAL SPENDING

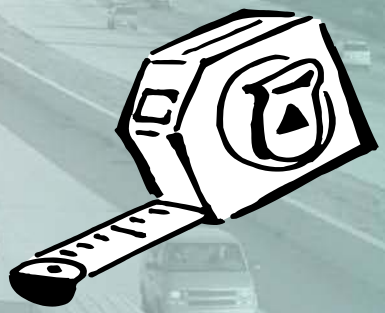


STATE OF REPAIR



SGR Analysis Performance Measures and Results

TERM Condition Score



Asset Condition Measurement Using Scale Applied in FTA Transit Economic Requirements Model (TERM)

ASSET CRITERIA AND SCORING SYSTEM

Asset Rating Score	Asset Age (Percent of Useful Life Remaining)	Asset Condition (Quality, Level of Required Maintenance)	Asset Performance (Reliability, Ambience, Safety, Meets Industry Standards)	Level of Maintenance (Level of Preventative and Corrective Maintenance)
5	Asset new or nearly new 75% - 100%	Asset new or like new; no visible defects	Asset meets or exceeds all performance and reliability metrics, industry standards	No unfunded or deferred maintenance activities
4	Asset nearing or at its midlife point 50% - 75%	Asset showing minimal signs of wear; some slight defects or deterioration	Asset generally meets performance and reliability metrics, industry standards	Some temporary deferments of PM and CM; but no activities skipped completely
3	Asset has passed its midlife point 25% - 50%	Some moderately defective or deteriorated components; expected maintenance needs	Occasional performance and reliability issues; may be substandard in some areas	More frequent and extended deferments of PM and CM; some activities skipped altogether
2	Asset nearing or at end of its useful life 0% - 25%	Increasing number of defects; deteriorating components; growing maintenance needs	Performance and reliability problems becoming more serious; sub-standard elements	PM and CM activities frequently delayed or skipped until major problems surface
1	Asset is past its useful life	Asset in need of replacement or restoration; may have critically damaged components	Frequent performance and reliability problems; does not meet industry standards	Significant backlog of PM and CM work due to history of deferred and skipped activities
0	Asset non-operable	Asset non-operable	Asset non-operable	Asset non-operable

CONDITION RATING

Asset Condition Rating	
Rating Description	Scoring Range
Excellent	4.8 to 5.0
Good	4.0 to 4.7
Adequate	3.0 to 3.9
Marginal	2.0 to 2.9
Poor	1.0 to 1.9
Non-Operable	0

In SGR >2.5

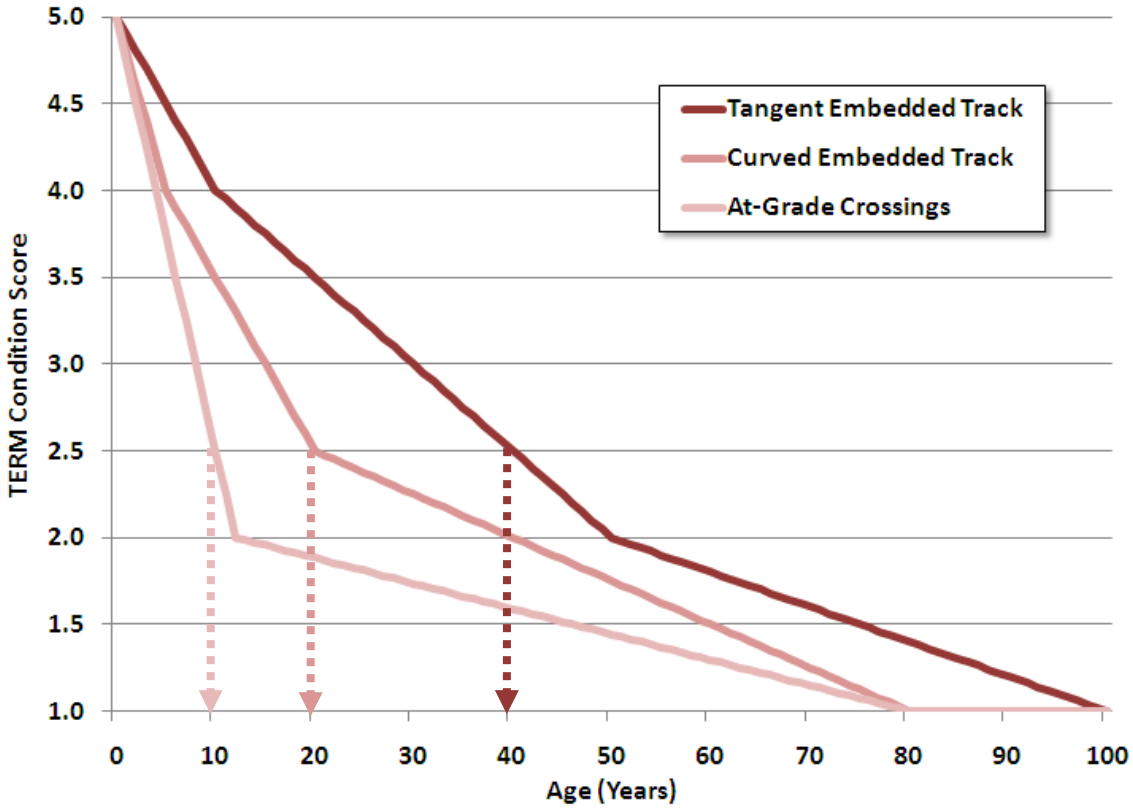
SGR 2.50

Not SGR <2.5

SAMPLE SCORING BASED ON PREDETERMINED WEIGHTINGS (ILLUSTRATION ONLY)

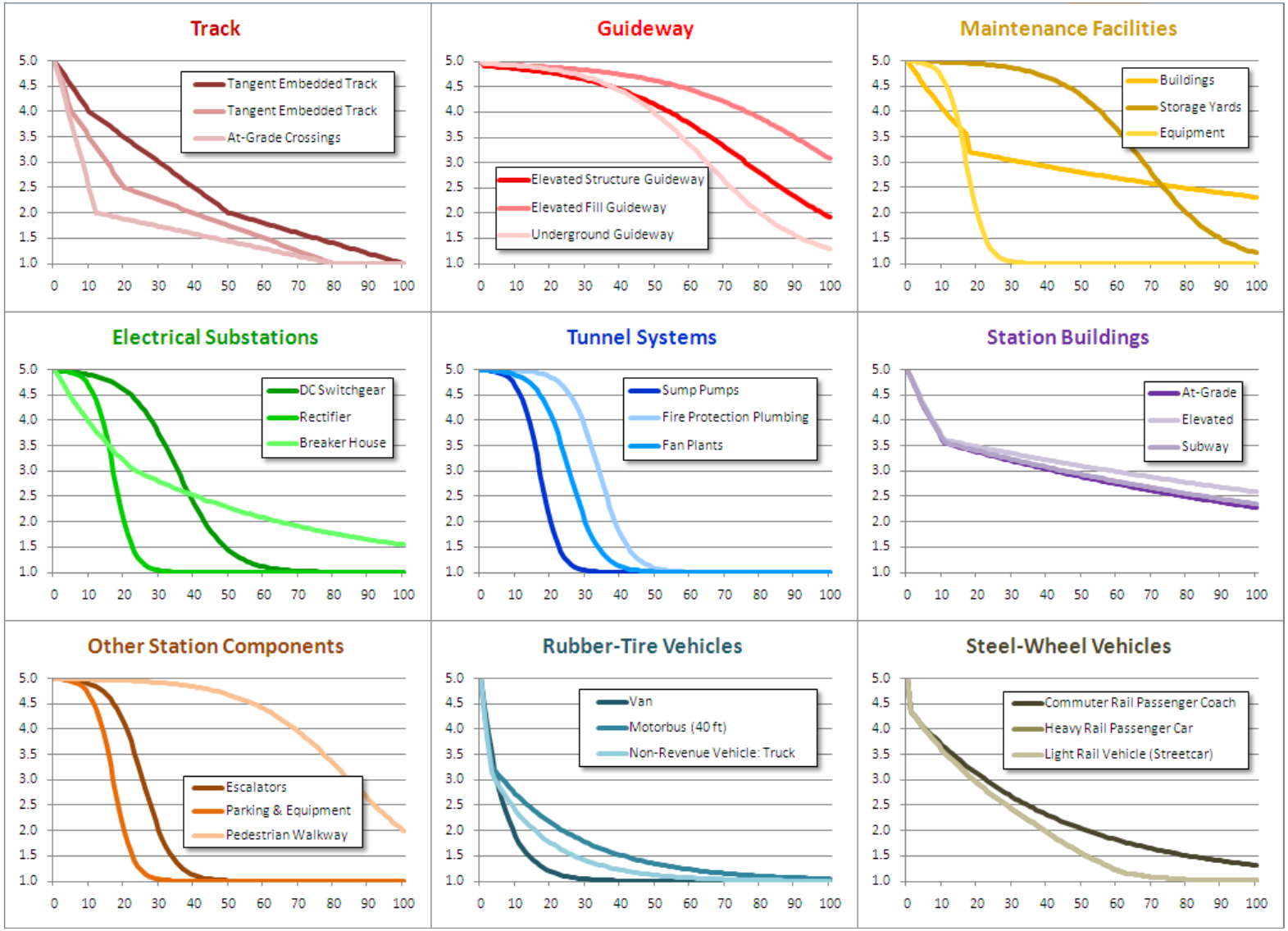
Asset Age	Asset Condition	Asset Performance	Level of Maintenance	Asset Condition Rating
20%	30%	30%	20%	
3	3	2	3	2.70

TERM Condition Decay Curves for Different Types of Embedded Track

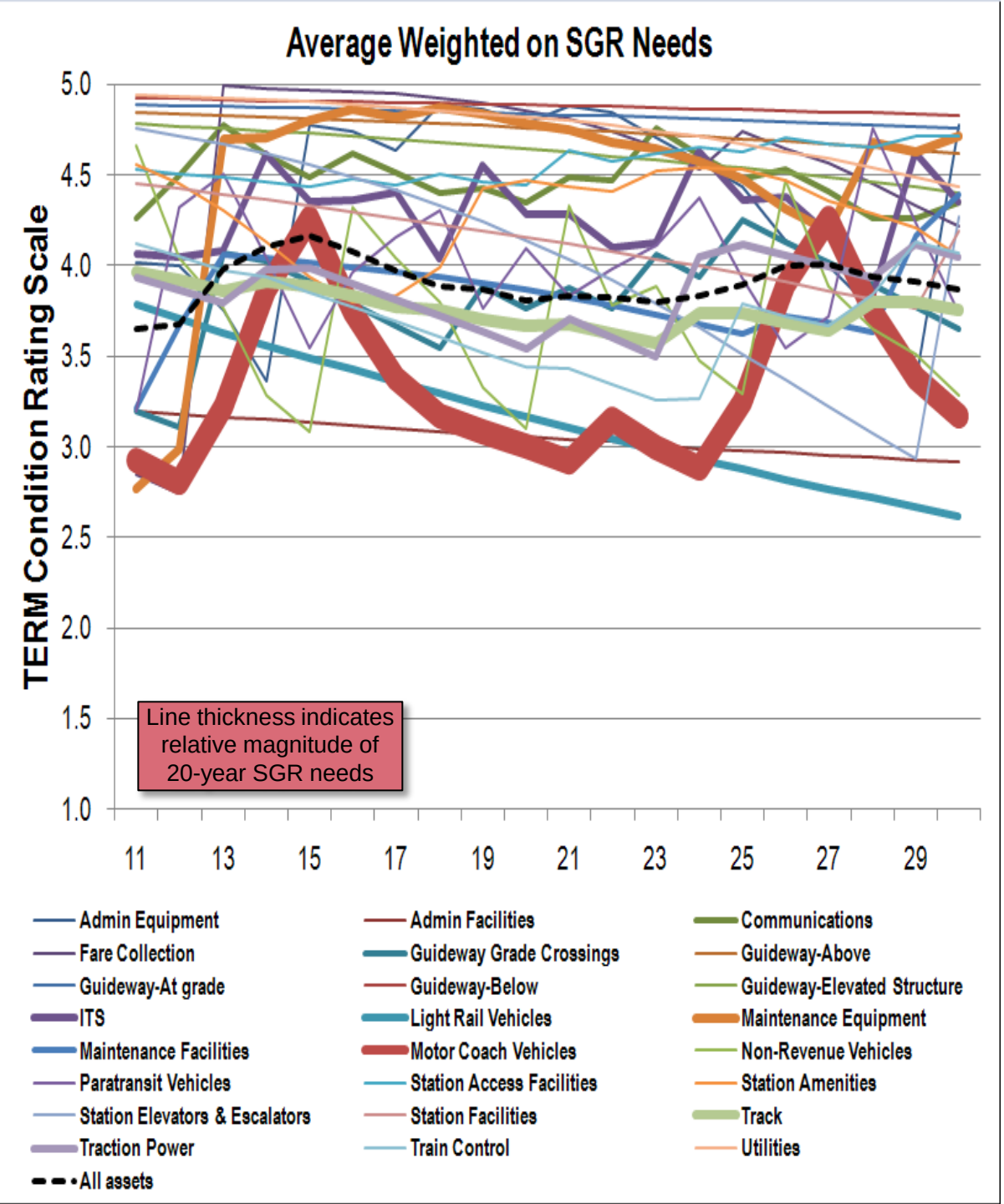


Excellent	4.8 to 5.0	In SGR >2.5
Good	4.0 to 4.7	
Adequate	3.0 to 3.9	
Marginal	2.0 to 2.9	SGR 2.50
Poor	1.0 to 1.9	Not SGR <2.5

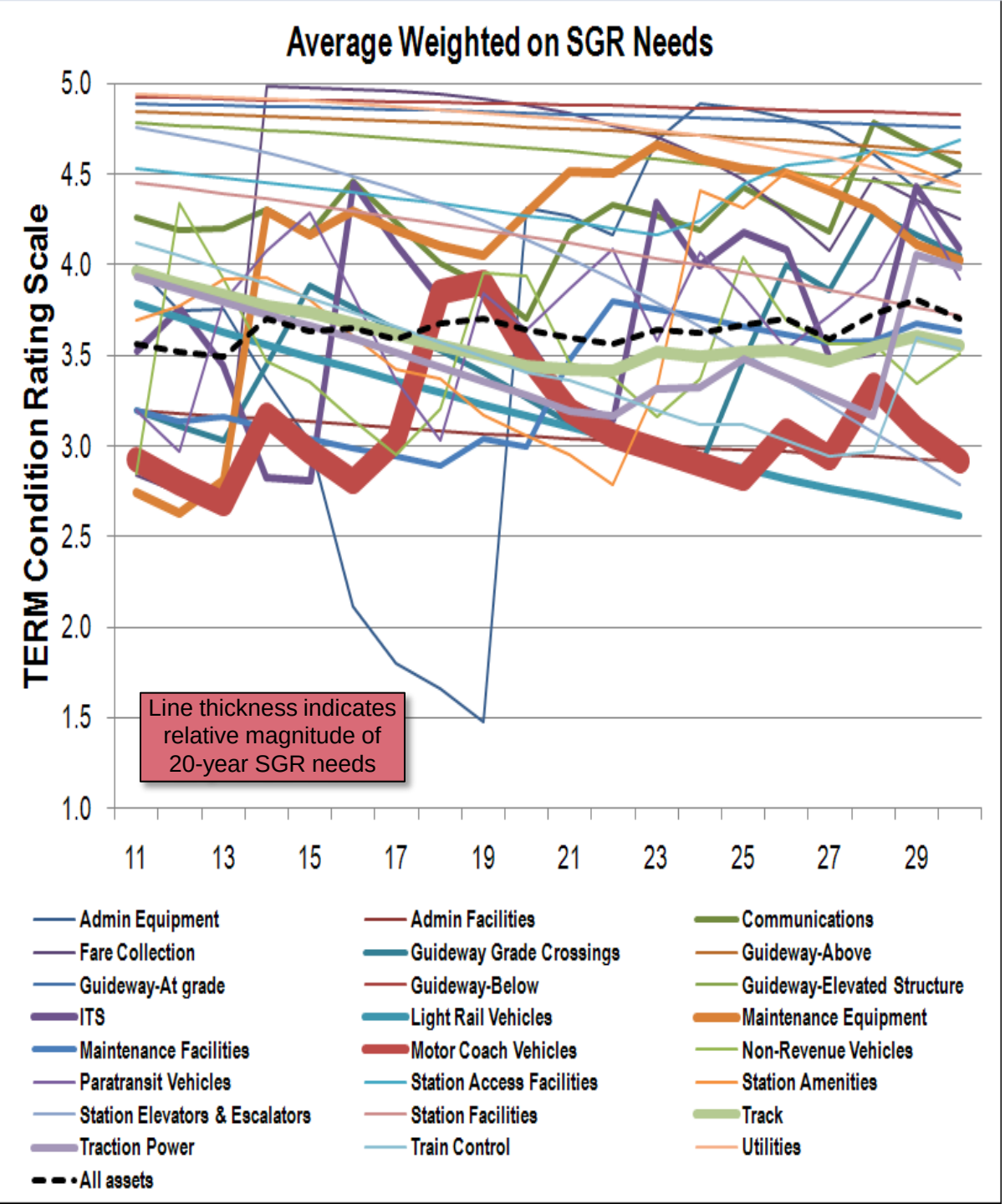
Other Examples of TERM Decay Curves



Source: Federal Transit Administration,
Transit Economic Requirements Model (TERM)

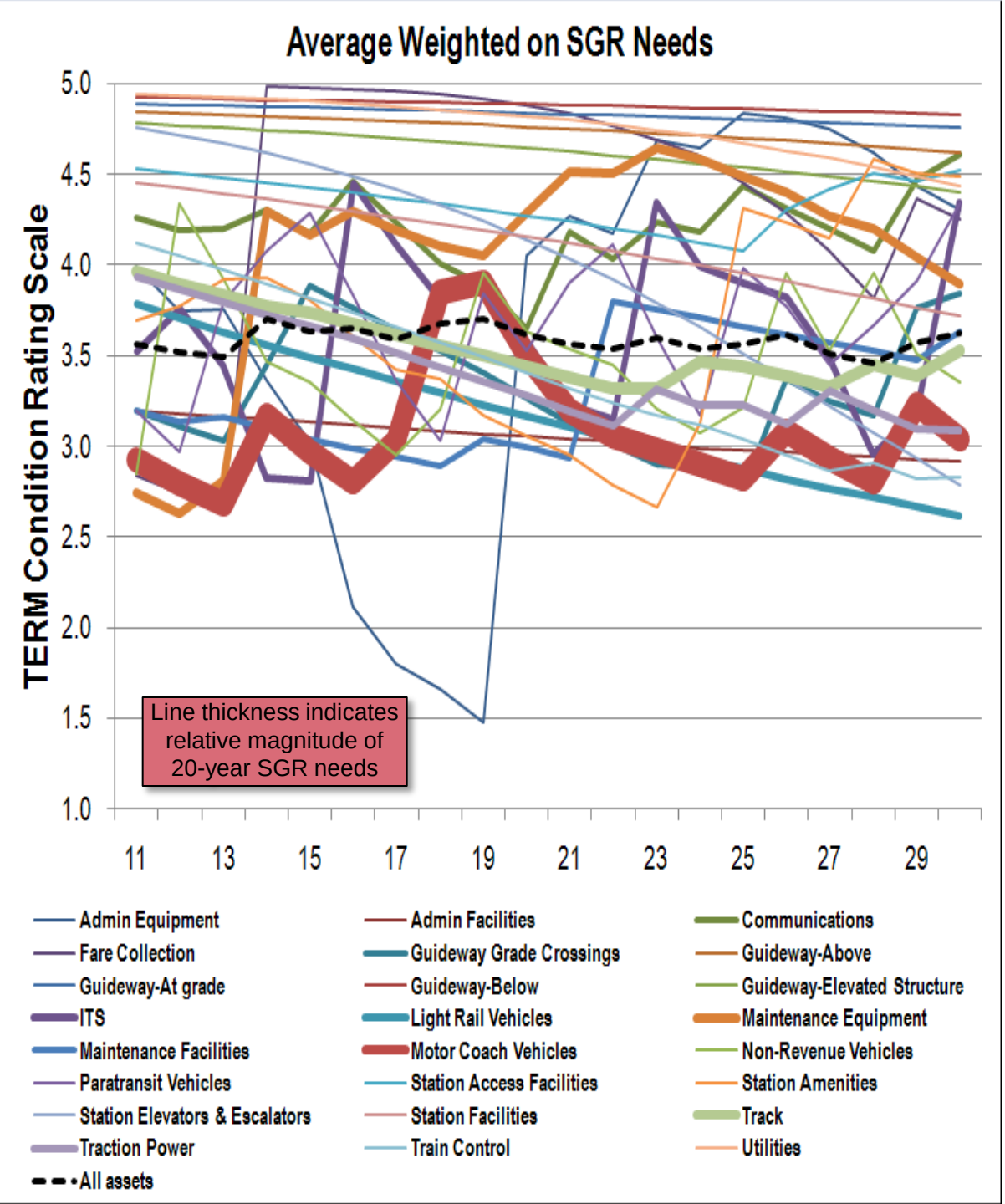


100% of SGR Needs Funded/ Unconstrained Funding



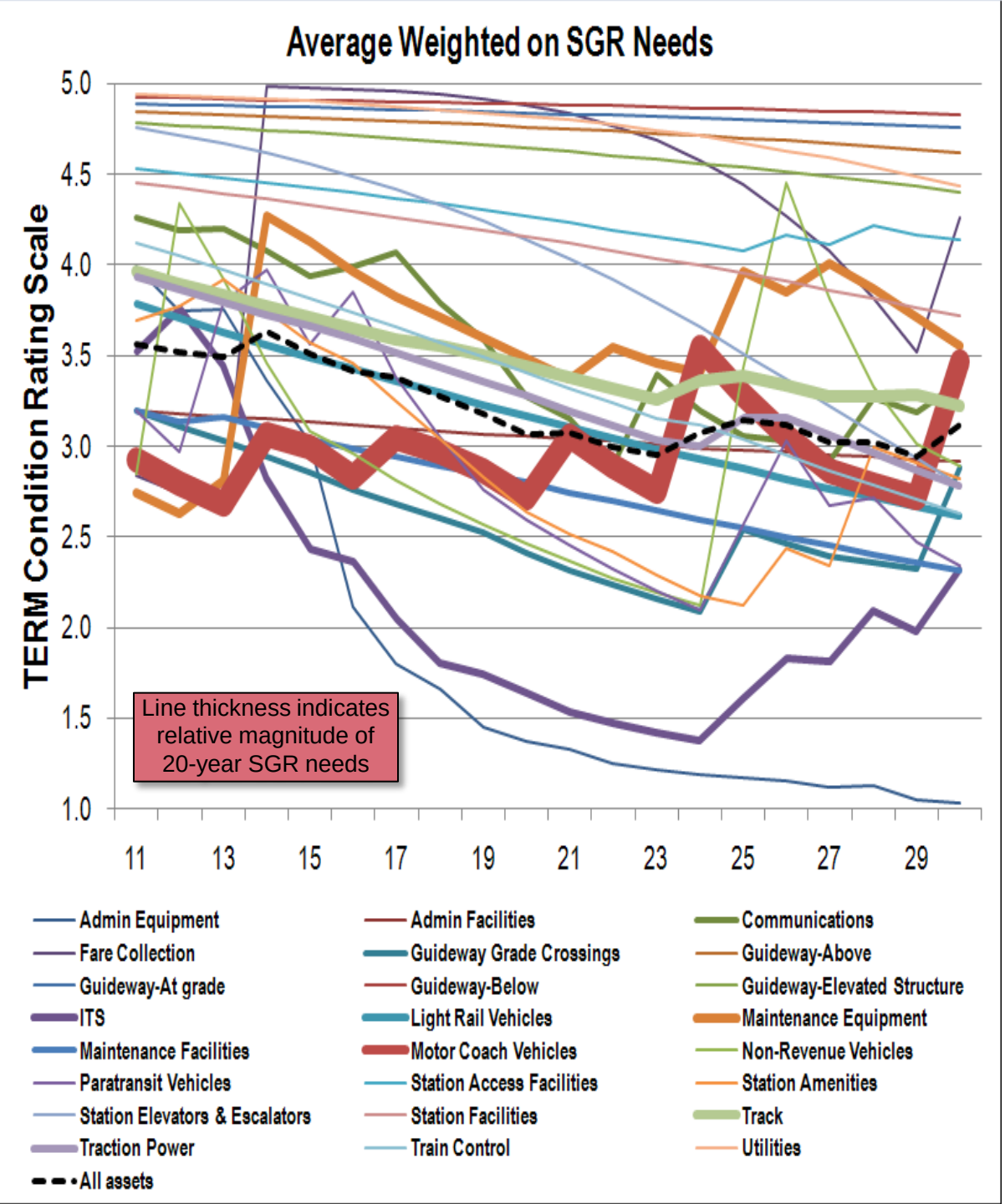
77% of SGR Needs Funded/ Maintain 2011 SGR Backlog

85% Priority Scores/ 15% Age Decision Weights



69% of SGR Needs Funded/ 2011 Financial Plan CIP

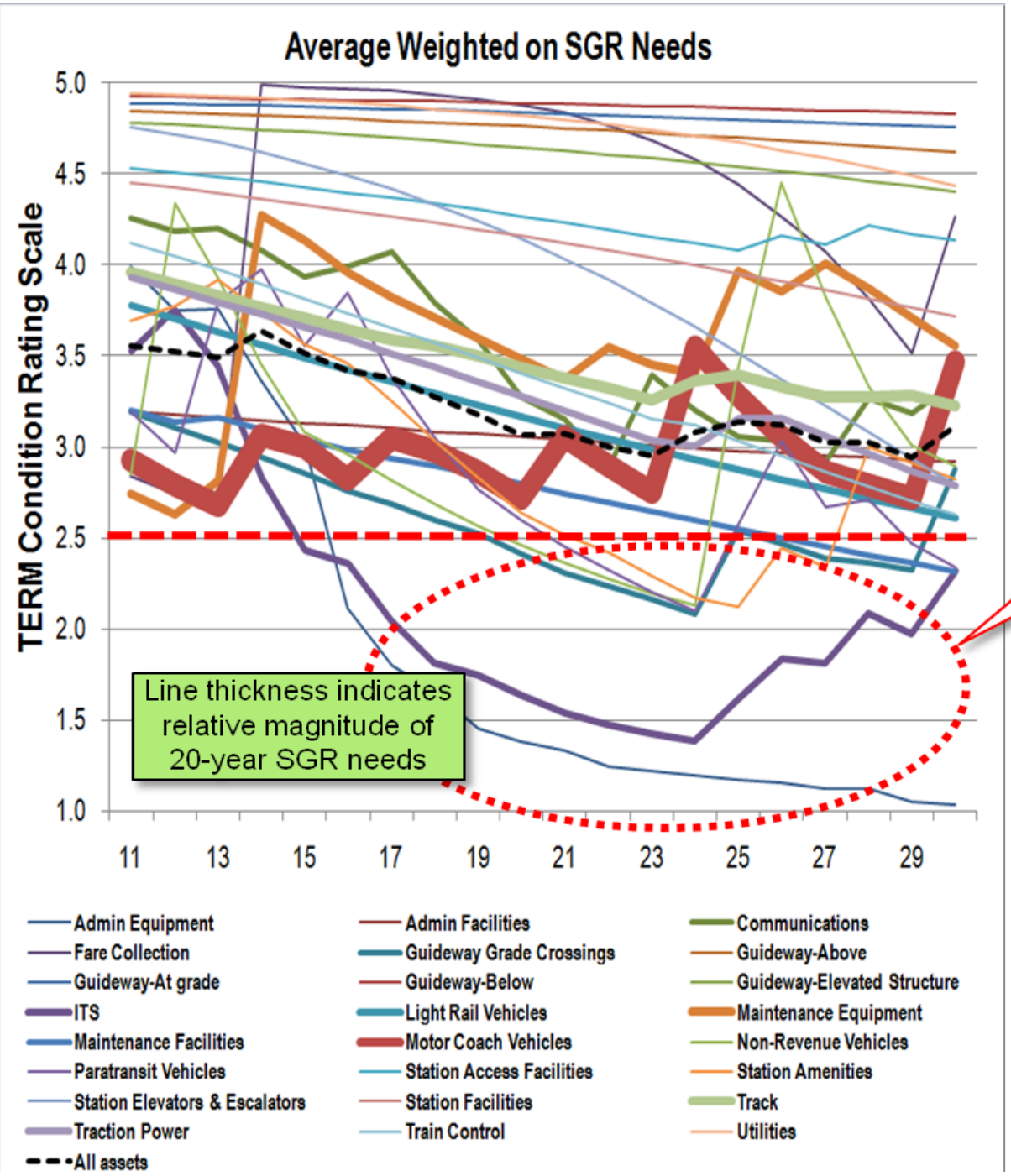
85% Priority Scores/ 15% Age Decision Weights



50% of SGR Needs Funded

85% Priority Scores/
15% Age Decision Weights

50% of SGR Needs Funded



2030 TERM score under 2.5:

- Admin Equipment
- Grade Crossings
- ITS
- Maint Facilities
- Non-Rev Vehicles
- Paratransit Vehicles
- Station Amenities

9. Implications for VTA Financial Plan, Next Steps, Lessons Learned

Implications for VTA Financial Plan

- Satisfied FTA concern that New Starts financial plan demonstrate that VTA:
  - Understood its infrastructure renewal and replacement backlog and future needs
  - Understood the implications of alternative funding levels on future asset condition
  - Could fund both the construction and operation of the proposed project while continuing to operate and renew the infrastructure supporting existing services

Current SGR Projects

- Express Bus Service
- Track replacement
- Substations
- Elevators & escalators
- Eastridge Transit Center
- Bus procurements

SGR - Lessons Learned

- Comprehensive inventory is your friend
- Hire a financial consultant experienced in SGR
- Consider decision-making facilitator / tool
- Spending levels can be reduced and adequate SGR maintained.
- “Head-in-the-sand” approach will lead to monster back-log, loss of customers, loss of revenue

Questions?