Federal Transit Administration

AECOM CONSULT

FTA State of Good Repair Summit

Working Session Presentations

August 2008

Agenda

Working Sessions

- Day 1
  - Current Conditions
  - Standards for Preventive Maintenance
  - Measuring State of Good Repair
  - Transit Asset Management
- Day 2
  - Core Capacity
  - Research Needs
  - Non-Federal Funding
  - Summary and Wrap-Up

Current Conditions

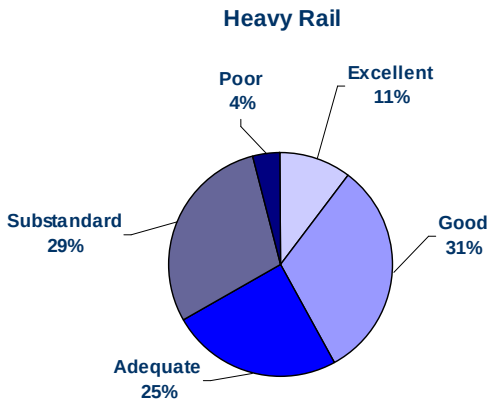
Overview: Current Conditions

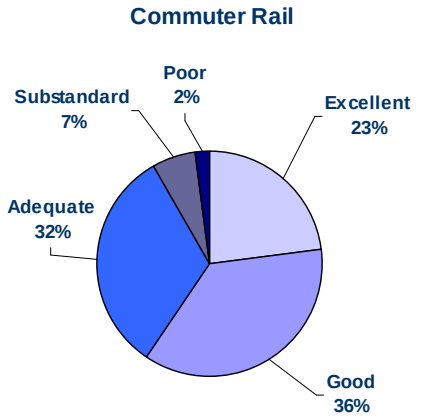
- Objective: To consider the current condition and reinvestment needs of transit infrastructure at the local and national levels:
  - What is the current physical and service condition of the nation's transit assets?
  - How do these conditions compare to an "ideal state of good repair"?
  - What is the current investment backlog and what level of investment would be required to attain a state of good repair?
  - How are unmet reinvestment needs impacting service quality and maintenance needs?

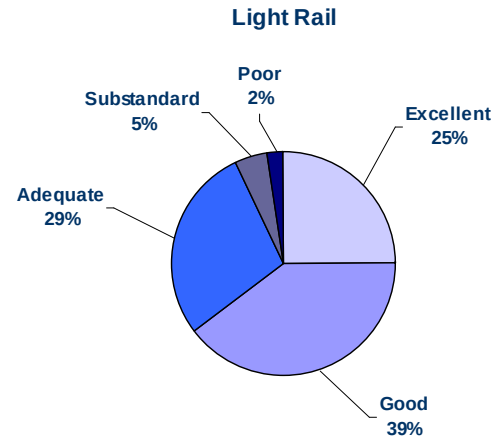
Current Physical Conditions

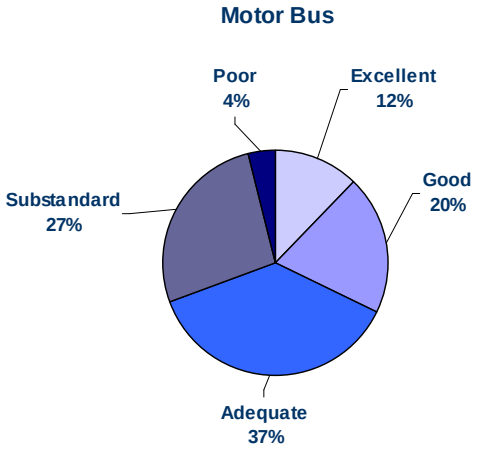
- How would you assess the overall condition of transit assets at your agency?
  - What proportion of assets are in a “state of good repair”?
  - Are conditions better for some asset types than others?
  - Do conditions vary by mode?

Distribution of National Asset Conditions by Mode





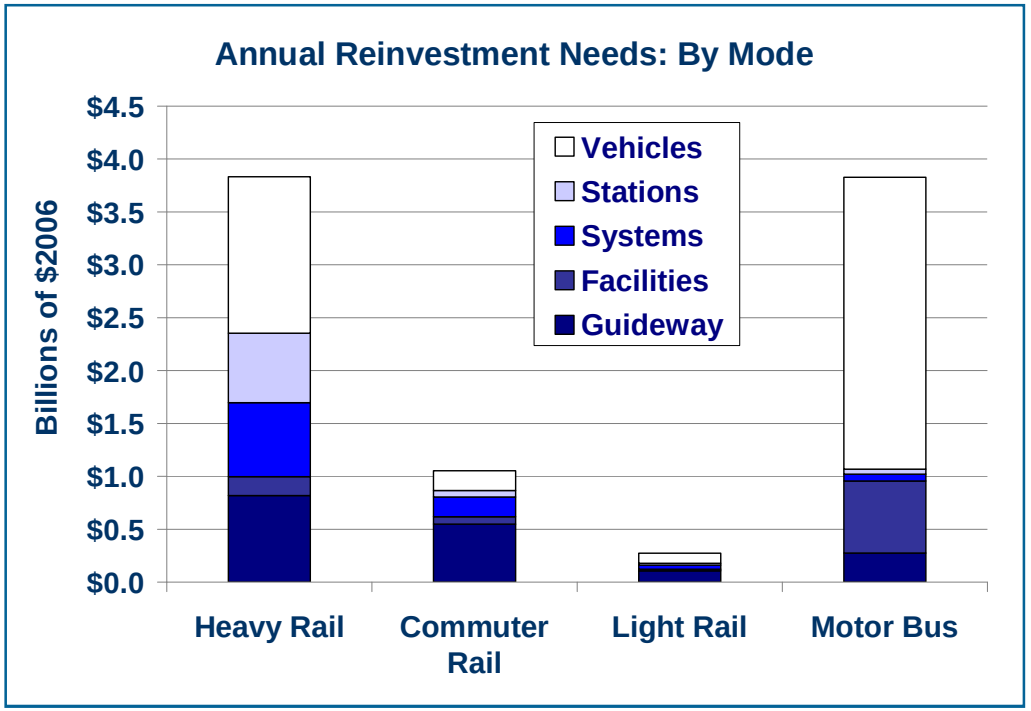




Current Reinvestment Needs

- Where are your largest deferred investment needs in terms of investment $"s (i.e., by mode or asset type)?
- Where are the most significant sources of potential risk if needs are not addressed?
  - E.g., in terms of safety, potential for extended service disruptions, or other risks).
  - Is there a specific asset type most associated with risk?

TERM Estimates of National Reinvestment Needs: By Mode and Asset Type



Capital Reinvestment Priorities

- What asset types tend to have the highest capital reinvestment priorities?
  - Vehicles?
  - Trackwork?
  - "Customer facing" assets?
- What asset types tend to have the lowest reinvestment priorities?
  - Maintenance facilities?
  - "Unseen" assets?
- How will assets with low investment priorities be met?
  - Can these needs be met?

Estimated Percent of Assets Not Currently in a State of Good Repair

Asset Type	TERM Estimates
Guideway Elements	
Structures	5%
Trackwork	5%-10%
Facilities	
Bus	20%
Rail (Yards & Shops)	15%
Systems	
Signals	30%
Power	5%
Communications	20%
Elevators / Escalators	15%
Stations	20%
Revenue Vehicles	25%

Funding Gap

- How significant is the gap between capital reinvestment needs and available funding?
- What are the consequences of not addressing that gap?
  - Service reliability issues?
  - Reduced expansion plans?

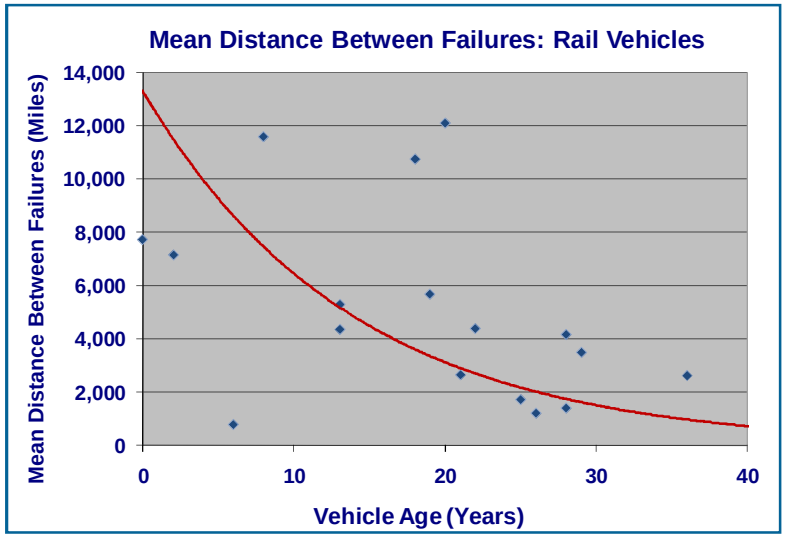
TERM Estimates of Unconstrained Reinvestment Needs vs. Expected Funding* ($Millions)

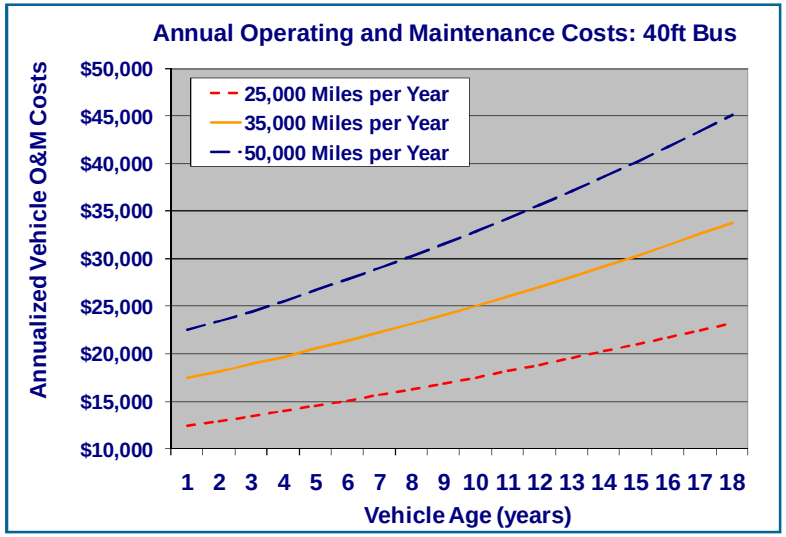
Asset Category	Average Annual Needs	Actual Expenditures (2006)	Difference
Guideway	$ 2,319.7	$ 1,963.7	$ 356.0
Facilities	$ 591.3	$ 657.1	$ (65.8)
Systems	$ 1,153.2	$ 651.6	$ 501.7
Stations	$ 973.2	$ 1,029.8	$ (56.6)
Vehicles	$ 2,081.0	$ 1,406.8	$ 674.2
Total	$ 7,118.5	$ 5,709.0	$1,409.5

*** Replace at condition 2.75; Excludes benefit-cost analysis**

Current Conditions: Impact on Performance

- How would attaining full SGR impact your agency's performance in terms of:
  - Throughput
  - Reliability
  - Operating speed
  - Maintenance costs
  - Overall quality of service?





Current Conditions

Conclusions?

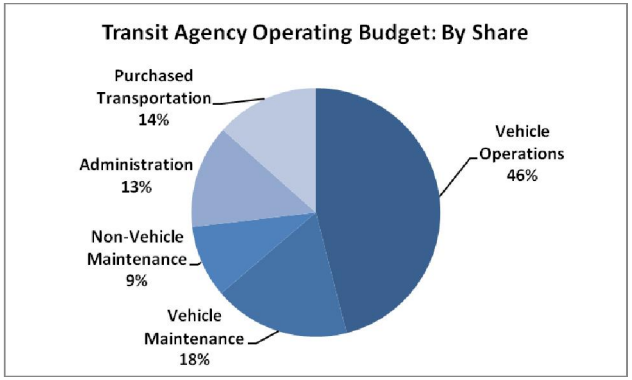
Preventive Maintenance

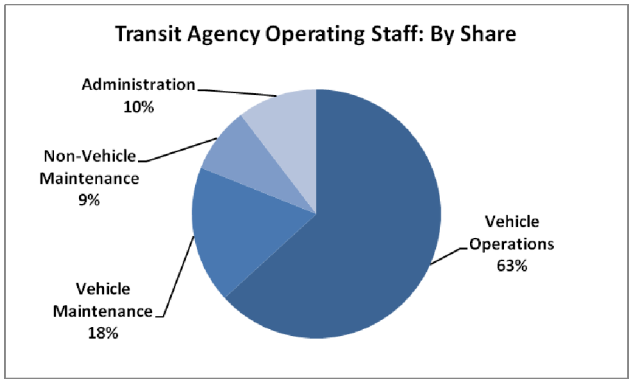
Overview: Preventive Maintenance

- Objective: To review maintenance and preventive maintenance practices from the following perspectives:
  - What proportion of agency resources are devoted to maintenance activities?
  - What options do agencies have to make more productive use of these resources?
  - How can better preventive maintenance practices reduce other maintenance needs and other agency costs?
  - Should the industry adopt standardized requirements for preventive maintenance?
  - How do PM practices impact asset conditions and state of good repair needs?

Enhancing Preventive Maintenance

- It has been observed that enhanced preventive maintenance programs can yield:
  - Increased service reliability and reduced un-scheduled maintenance
  - Improved physical conditions and longer asset life
- Is it realistic to expect transit agencies to significantly increase planned maintenance activities and reduce unplanned maintenance?
  - How can it be accomplished?
  - What are some of the potential obstacles?





Other Preventive Maintenance Options

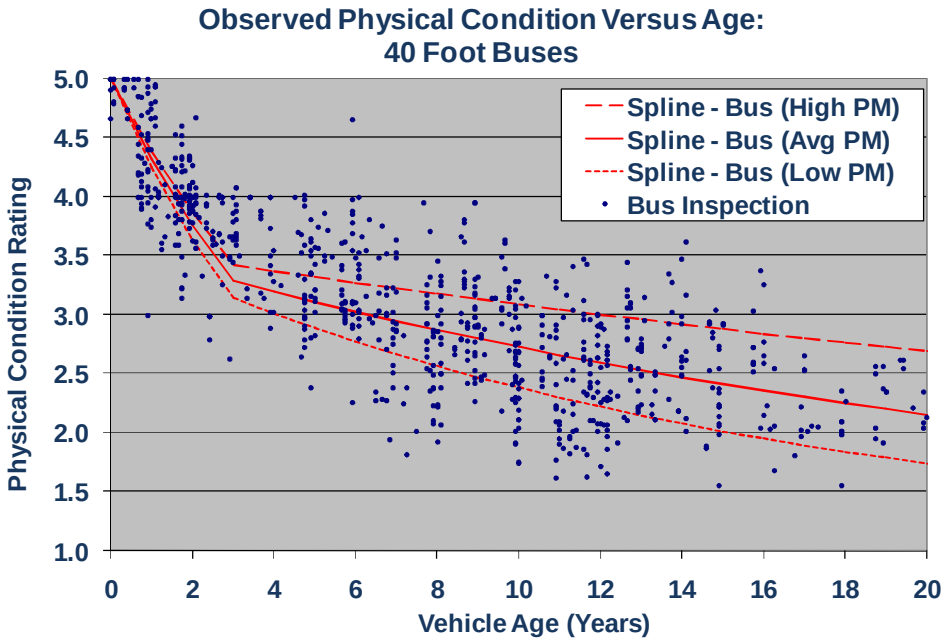
- What else can be done to improve maintenance performance and reduce costs?
  - Improved use of maintenance management systems?
  - Improved design of maintenance management systems?
  - Research on the relationships between PM practices and:
    - Unscheduled maintenance needs
    - Asset physical conditions
    - Asset life expectancy?
- How can FTA help the transit operators improve maintenance and reduce costs?

Preventive Maintenance Standards?

- Should preventive maintenance practices be standardized across agencies?
  - Do asset preventive maintenance needs (e.g., per hours, miles or years of service) relatively common across operators, or do they differ significantly between operators?
  - If so, what are the factors that drive these differences and are the resulting differences in PM needs significant across operators?
    - Ridership levels
    - Annual hours and miles of service (e.g., per vehicle)
    - Headways and duty cycles
    - Climate / environment (e.g., presence of salt)
    - Make and Model

Preventive Maintenance and State of Good Repair

- Does the term “state of good repair” imply that an asset’s (or system’s) preventive maintenance needs are met ?
  - Is effective PM a “necessary but not sufficient condition” to SGR?
- How significant is the relationship between the PM program and:
  - Asset conditions and asset life expectancy
  - State of good repair?



Preventive Maintenance

Conclusions?

Measuring State of Good Repair

Overview: Measuring State of Good Repair

- Objective: To consider working definitions of "state of good repair" (SGR) and how SGR can best be measured:
  - How should the transit industry define SGR?
  - How can SGR (or movement towards or away from SGR) best be measured? Based on:
    - Asset age or physical condition?
    - Reliability and performance?
    - Maintenance requirements?
  - Should SGR be measured based entirely on asset physical condition or should issues of technological obsolescence or service performance also be considered?

How Should the Transit Industry Define SGR?

- Before *measuring* SGR it is first necessary to *define* what it means
- The table below presents definitions of "state of good repair" as applied by a sample of US transit operators

Sample Agency Definitions of State of Good Repair (SGR)

Agency	*Definition*
Chicago CTA	CTA defines SGR primarily in terms of standards: • Rail lines should be free of slow zones and have reliable signals • Buses should be rehabbed at 6 years and replaced at 12 years • Rail cars should be rehabbed at quarter- and half-life intervals and replaced at 25 years • Maintenance facilities should be replaced at 40 years (70 years if rehabbed)
Cleveland RTA	State good repair projects are those needed to bring the system to a consistent, high quality condition systemwide
Boston MBTA	A state of good repair standard [is where] all capital assets are functioning at their ideal capacity within their design life
New Jersey NJT	"State of good repair" is achieved when infrastructure components are replaced on a schedule consistent with their life expectancy
New York, NYCT	Investments that address deteriorated conditions and make up for past disinvestment
Philadelphia, SEPTA	An asset or system is in a state of good repair when no backlog of needs exists and no component is beyond its useful life. [State of good repair projects] correct past deferred maintenance, or replace capital assets that have exceeded their useful life.

How Should the Transit Industry Define SGR (cont)?

- An *operational* definition of SGR based on the sample of agency definitions above might read as follows:

> *"An asset or system is in a state of good repair when no backlog of capital needs exists – hence all asset life cycle investment needs (e.g., preventive maintenance, rehab, replacement) have been addressed and no capital asset exceeds its useful life."*

- What are the strengths and weaknesses of this definition?
  - Potential Strengths: Operational / measureable
  - Potential Weaknesses: Makes SGR an idealized state (not actually attainable)
- Does your agency have an established definition of SGR?
  - If yes, is attaining / maintaining SGR a stated agency objective?

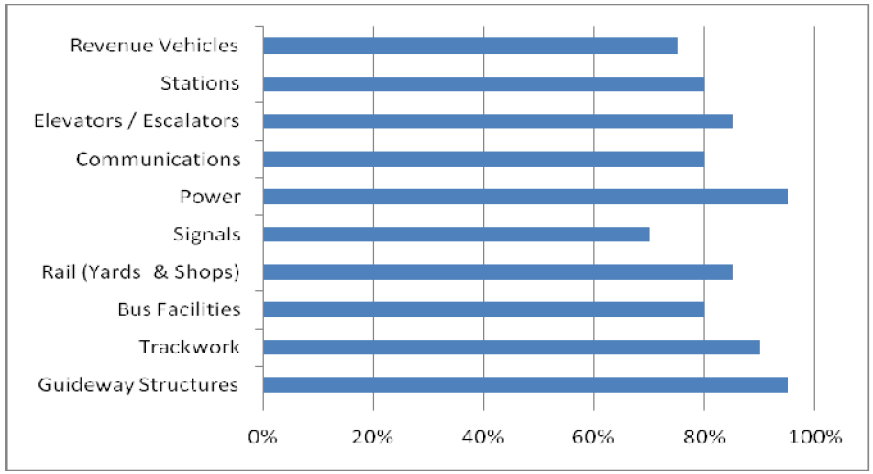
How Should the Transit Industry Define SGR (cont)?

- Should the definition include / highlight other factors?
  - Performance (e.g., service quality or passenger throughput)?
  - Service or Asset Reliability?
  - Operating costs?
  - Customer complaints?

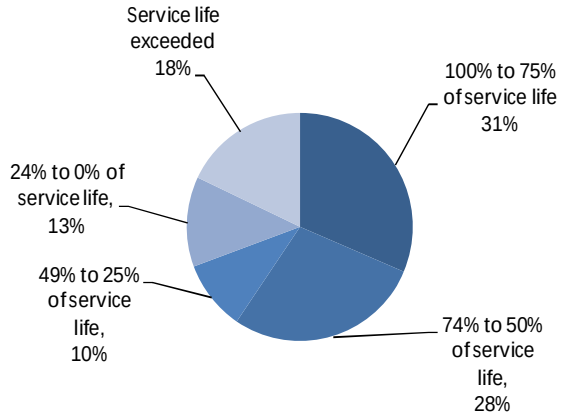
How Should State of Good Repair be Measured (cont)?

- Percent of Assets in SGR?: The percent of assets (by count or value) that:
  a) Do not exceed their expected useful life
  b) Are in "good working order" (based on engineering assessment)
- Percent of Service life Remaining?: Segment assets into cohorts based on the percent of service life remaining/ consumed:
  - Also measure percent exceeding expected service life

Percent of Transit Assets in SGR (Estimate)



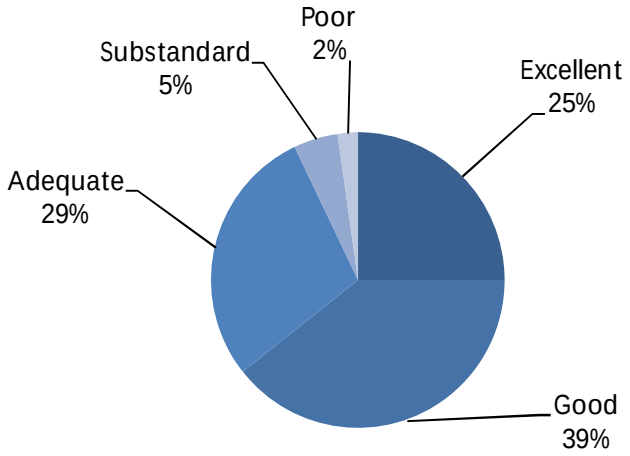
Percent Service Life Remaining by Quartile



How Should State of Good Repair be Measured (cont)?

- Asset Condition Rating?: Rate assets on an integer scale based on their overall physical condition. For example, FTA's TERM model uses:
  1. Excellent
  2. Good
  3. Adequate
  4. Substandard
  5. Poor

Condition Distribution of Light Rail Assets (TERM)



- Asset Specific Measures?: measures unique to each asset type such as:
  - Trackwork: Geometry car readings
  - Vehicles: Mean distance between failures
  - Electronics: Mean time between failures

Measuring State of Good Repair

Conclusions?

Transit Asset Management

Overview: Transit Asset Management

- Objective: To help define “asset management” and consider how it is being practiced by transit agencies and by other transportation modes
  - What is asset management?
  - How is asset management being defined and practiced in other transportation modes (highways), other industries and internationally?
  - How is asset management being applied in the transit industry?
  - How can asset management help address state of good repair needs?

Transit Asset Management: Definition

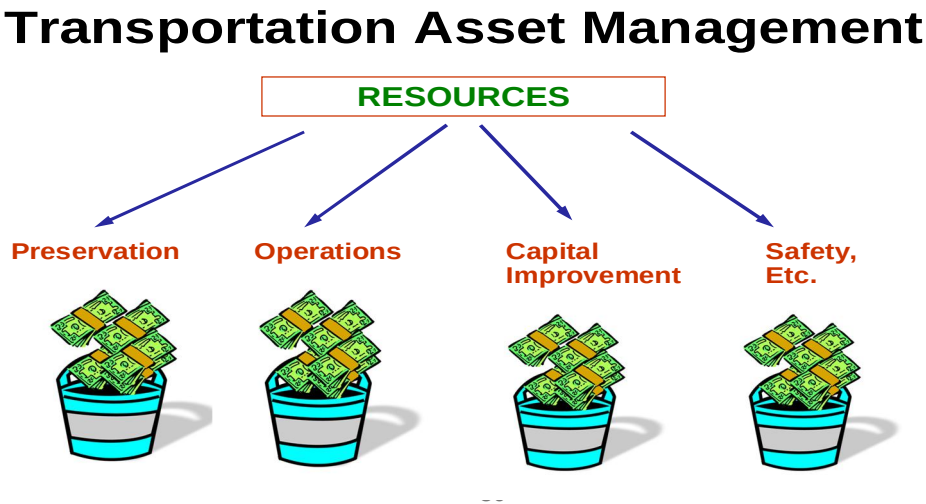
- "Asset management" has different meanings to different users
  - For many in the US transit community asset management is synonymous with maintenance management
- US highway and transportation agencies in the UK, Canada, Australia, and New Zealand are pursuing a much broader definition:

> *"Transportation Asset Management is a strategic and systematic process of operating, maintaining, improving and expanding physical assets effectively throughout their lifecycle. It focuses on business and engineering practices for resource allocation and utilization, with the objective of better decision making based upon quality information and well defined objectives."*

- The US transit industry lags highways and the international community in pursuing this broader definition

Transit Asset Management: Definition (cont)

- Based on this broader definition, asset management is:
  - *Strategic* and not *tactical* (i.e., has a long-term focus)
  - Seeks to *balance the competing needs* of operations, maintenance, reinvestment and system expansion
  - An *organization wide endeavor*: It seeks to integrate planning, engineering, funding, and IT perspectives
  - Seeks to make *informed* and *prioritized* decisions regarding the use of *scare resources* based on *reliable data*

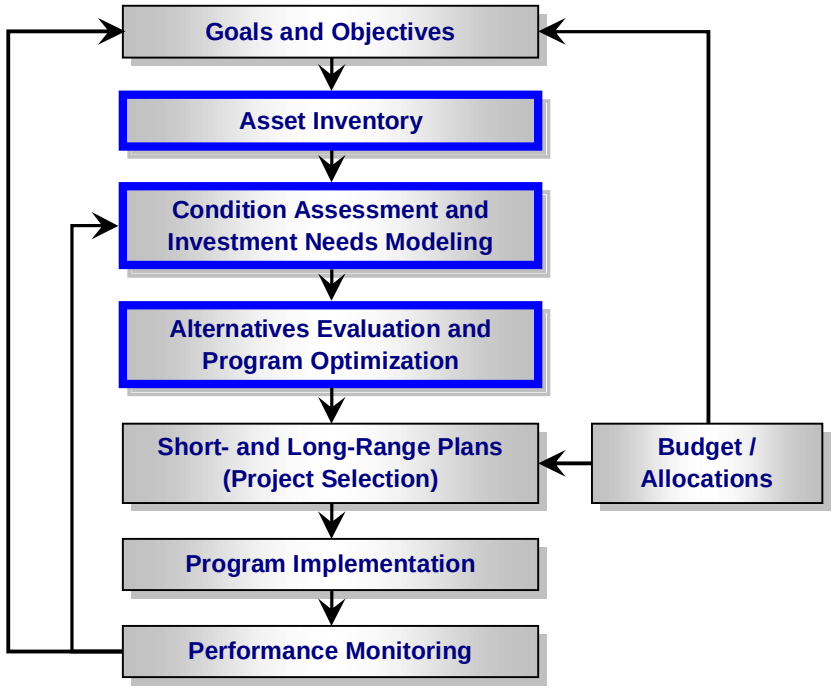


Components of Transit Asset Management

Comprehensive asset management includes:

- Goals and Objectives: For example, attainment of a state of good repair
- Asset Inventory: Listing of all fixed assets, including type, condition, remaining life and value
- Condition Assessment Process: Process to assess the condition of all inventory assets
- Decision Support Tools (models): Tools to analyze and prioritize long-term investment needs
- Options and Tradeoff Analysis: Process to evaluate the investment tradeoffs and investment returns of alternate investment options
- Decision Making processes: Decision making process to allocate resources between competing uses
- Monitoring: Performance measures and performance targets based on agency goals and objectives

Transportation Asset Management (TAM) Process

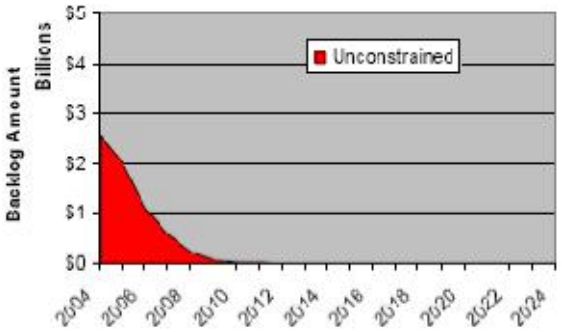


TAM process as promoted by AASHTO and FHWA

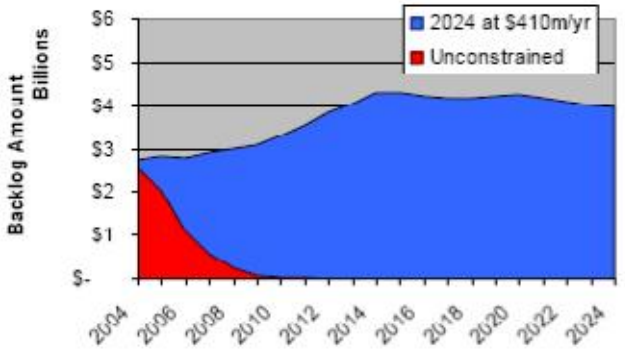
What We Can Learn from Asset Management

- Asset management provides decision makers with reliable information on:
  - Current asset conditions
  - Investment levels required to attain specific objectives
  - Funding scenario analysis

Years to Address Current Backlog if Funding is Unconstrained

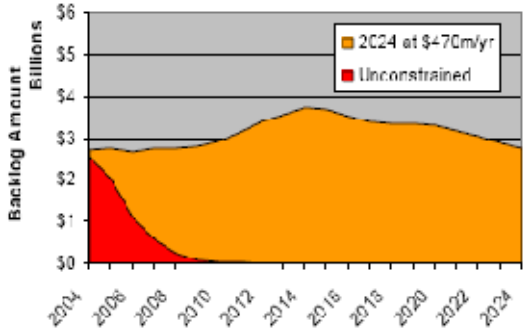


Backlog if Current Funding Levels Remain Unchanged ($410m/yr)

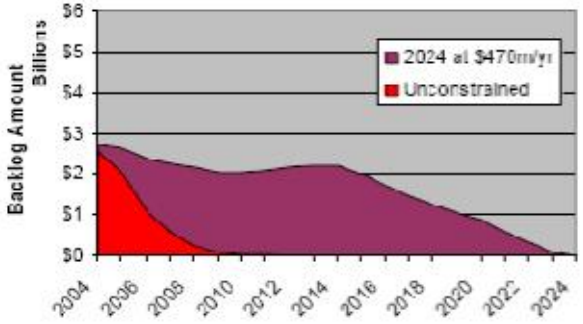


Output from MBTA's SGR Model

Funding to Maintain Current Backlog ($470m/yr)



Investment Required to Eliminate Backlog in Twenty Years ($620m/yr)



Transit Asset Management: Current Transit Practices

- Has your agency implemented an asset management program?
- If so, what does it consist of?
  - Regular or periodic condition assessments?
  - Do you actively maintain an asset inventory in support of asset management practices (i.e., distinct from your fixed asset ledger)?
  - Have you developed / utilized any decision support tools?

Example Transit Decision Support Tools

Transit Asset Management: Current Transit Practices

- How does your agency prioritize investment dollars between competing uses (e.g., expansion vs. rehab-replace)?
- Similarly, how does your agency determine how capital reinvestment funds will be allocated between various asset types / uses? Who participates in making these decisions and what processes do you use?
- Has your agency identified any specific capital investment objectives (e.g., to attain a state of good repair by 2015)?

Transit Asset Management

Conclusions?

Core Capacity

Overview: Core Capacity

- Objective: Explore the relationships between core capacity and state of good repair including:
  - How are core capacity and state of good repair related?
  - How do agencies prioritize these differing needs?
  - Should these needs be funded independently?

Core Capacity Plans

- Does your agency have planed core capacity investments?
- If so, are these plans:
  - Conceptual?
  - Programmed?
  - Underway?
- If not, what are the primary constraints to addressing core capacity needs?
  - Capital funding
  - Operating funding
  - SGR and other needs
  - Physical barriers

Relationship Between Core Capacity and SGR

- How are core capacity and state of good repair related?
  - Can these needs be distinguished as follows?
    1. State of Good Repair Investments ⇒ Investments to ensure assets are in good physical condition and reliable
    2. Core Capacity Investments ⇒ Investments to ensure the ability to comfortably, reliably and efficiently serve travel demand in the urban core
    3. State of Good Performance Investments ⇒ Investments that address SGR or core capacity needs
  - Do unmet core capacity needs (suggesting system crowding) significantly impact asset maintenance and replacement needs?
  - Do SGR investments typically include elements of core capacity improvements (e.g., replacing existing train control with higher capacity systems)?

Prioritizing Core Capacity and SGR Investments

- How does your agency prioritize between these differing needs?
  - At what level in the organization is this prioritization addressed?
  - Are these needs determined independently of one another?
  - Do you use any trade-off methods or analyses?
  - Do state of good repair needs constrain your ability to address core capacity needs or visa versa?

Funding Core Capacity and SGR Investments

- To what extent are investments in either or core capacity or SGR improvements driven by the color of money:
  - For example, the segmentation and relative availability of Federal New Starts vs. Fixed Guideway Modernization funds?
- Should these needs be funded using independent sources (as with the current New Starts and Fixed Guideway Mod funds)?
  - Or should capital funding be entirely “fungible”
- Which do you consider to have the greater (unmet) funding need?
  - Core capacity
  - State of good repair / modernization

Core Capacity

Conclusions?

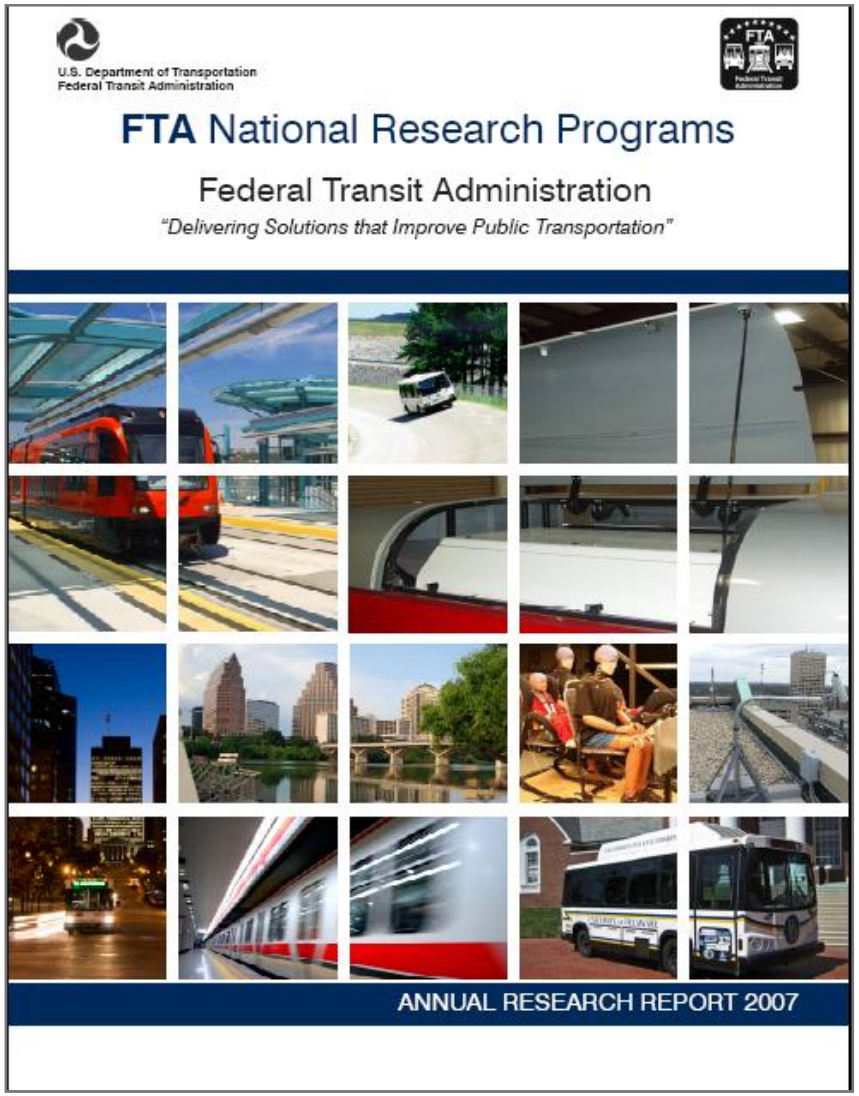
Research Needs

Overview: Research Needs

- Objective: Identify research needs and gaps regarding the State of Good Repair (SGR) for the nation's bus and rail transit infrastructure
  - What have we learned from previous research on maintaining the transit infrastructure?
  - What are some specific research topics that may most help the industry achieve SGR?
  - What are some of the technology advancements that might help better maintain the nation's transit infrastructure?
  - What are some of the SGR research gaps that should be addressed by transit research?
  - Should FTA provide technical assistance to help agencies develop their SGR and asset management programs?

Background: Research Needs

- FTA uses industry input to prioritize and shape our research programs
- Most suggestions come from dialog with the industry.
- The Transit Research Analysis Committee (TRAC) meets twice each year to advise FTA on research strategy
- FTA works closely with grantees to ensure Congressional earmarks address goals and objectives found in the agencies Strategic Research Plan



SGR Research Needs

- What are some specific research topics that would most help the industry achieve SGR?
- Are these topics related to:
  - Engineering?
  - Best Practice Studies?
    - Maintenance and training
    - SGR measurement and monitoring
    - Preventive maintenance practices
    - Investment prioritization
  - Life cycle cost research?

New Technologies

- What are some of the technology advancements that might help better maintain the nation's transit infrastructure?
  - New materials?
  - New generations of condition measurement systems
    - Rail geometry measurement
    - Vehicle and rail systems equipment diagnostics
    - Structural health monitoring technologies
  - IT systems?
    - Maintenance management systems
    - Data integration

Technical Assistance: Asset Management

- FHWA maintains an Office of Asset Management that provides technical assistance to State DOTs for:
  - Dissemination of best practices
  - Asset inventory development and data management support
  - Decision support tool use and development (e.g., HERS-ST)
  - Workshops, conferences and networking
- Should FTA provide similar technical assistance?
  - E.g., agency version of the Transit Economic Requirements Model (TERM)?

Research Needs

Conclusions?

Alternative Approaches to Funding

Overview: Alternative Approaches to Funding

- Objective: Explore alternative approaches to leveraging public funding using resources from private sector investors to meet capital reinvestment needs. Examples include:
  - Public private partnerships (PPPs)
  - Innovative financing methods including:
    - Capital leasing
    - Revenue Bonds
    - Grant anticipation notes
    - Debt service reserves
    - TIFIA

Public vs. Private Motives

- Transit agencies have a responsibility to serve the public interest.
- In contrast, private partners are necessarily motivated primarily by profit.
- How can an agency retain enough control to meet a diverse set of objectives while contracting out large portions of its activities?

Protecting the Public Interest

- One of the London Underground “Infracos” went into receivership and cost the government a reported $4 billion.
- How can PPP contracts be written to protect the public interest?
- Has your agency developed or are you looking to develop such contracts?

PPP Contracts

- PPP contracts are complex and can take a long time to negotiate
- Most transit agencies have little experience with this kind of contracting, whereas private investors often have a great deal
- How can we protect our interests when dealing with a more sophisticated private partner?
- What issues have you faced in developing complex contracts with private sector consortia?

Traditional and Innovative Finance

- Which of the following funding models are best suited to address maintenance and replacement backlogs?
  - Capital Leasing: Grantees may use Federal funds for capital assistance for up to 80 percent the cost of acquiring transit assets by lease
  - Revenue Bonds: Bonds backed by dedicated revenues sources such as sources, such as motor vehicle registrations, sales taxes, and property taxes
  - Grant Anticipation Notes (GANs): Revenue bonds that are backed by anticipated grant receipts (e.g., an FFGA)
  - Debt Service Reserves: SAFETEA-LU authorized transit grantees to be reimbursed for up to 80 percent of the deposits in a debt service reserve established for the purpose of financing transit capital projects from 5307 and 5309 funds
  - TIFIA: The Transportation Infrastructure Finance and Innovation Act (TIFIA) offers eligible applicants the opportunity to compete for secured loans, loan guarantees and standby lines of credit

Federal Financing

- Should the Federal Government act as an investor to provide incentive-based funding that could be paid back as it is in PPPs, or in infrastructure bonds?

Alternative Approaches to Financing

Conclusions?

Wrap up