

BART Maintenance and Service Options Study

September 14, 2017



BART Maintenance and Service Options Study Overview

Why?

BART Board Resolution #5291

Purpose:

1. Why is so much maintenance required and why is it so disruptive to service?
2. Feasibility of 24/7 service and existing service
3. How to conduct system renewal: increased safety regulations & service
4. Modern technologies and changes to service delivery

Tasks

1. The Current State of BART
2. How Does BART Reach a State of Good Repair (SGR)
3. Peer Agency Review
4. BART's Options for the Future

Overview

- BART's Current State Threatens Future Success
- Proper Maintenance will Require Shutdowns
- Organizational Reforms Must Be Enacted to Support Needed Maintenance
- Continued Maintenance Reforms are Essential
- Predictable Reliability is the Key to Customer Trust
- New Service Models and Communicating Expectations to the Public is Critical



BART's Current State :

Asset Condition

- Large percentage of BART's assets are operating past "Extended Useful Life"
 - Assets no longer function as designed
 - Technology is antiquated/obsolete
 - Increased maintenance costs
- Historic and current challenge to keep up with preventive and growing corrective maintenance

48%

of BART's assets
are in Poor
Condition

>25%:

Percent overage
M&E experienced on
non-labor budget for
FY16 and FY17

BART's Current State: Physical Constraints

- BART's Physical Reality
 - Largely 2-track system
 - 28 Maintenance of Way Access Locations
 - Freeway Median Operations
 - Aerial Structures
 - Tunnels
 - Neighborhoods & Pre-Existing Development
 - 77% ROW does not allow efficient single-tracking

Physical Constraints Affecting SGR & Maintenance

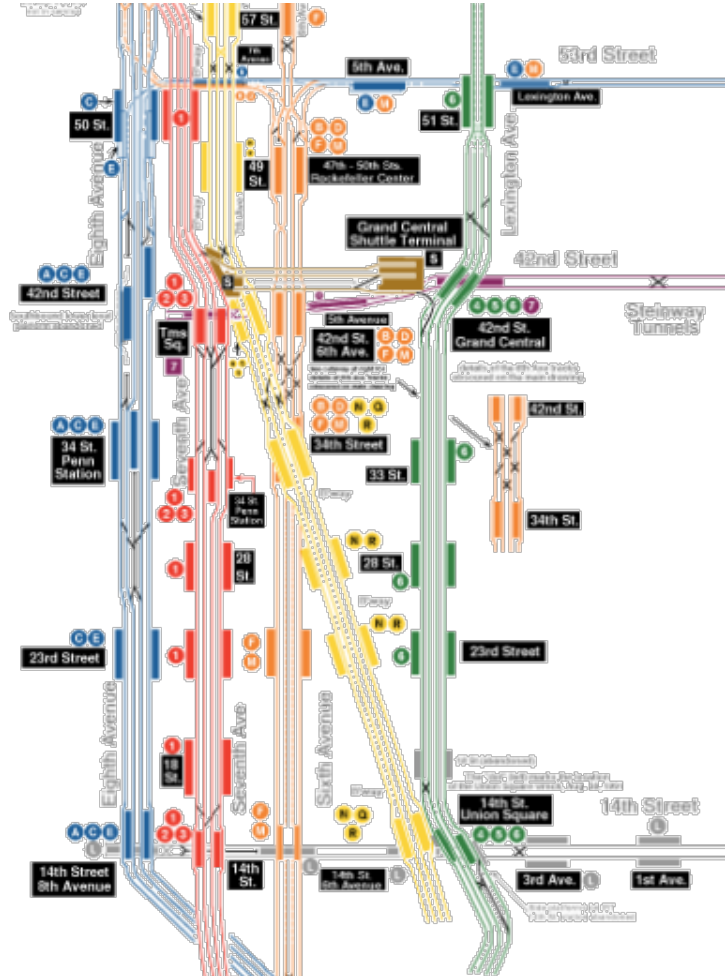
<4%

of BART has more than 2 tracks.

4-Track Systems are More Flexible

- Diversions on Other Routes
- Skip-Stop Service
- Single-Tracking

Manhattan Subway Service



Approx. 60%

of NYCT has more than 2 tracks.

Why is NYC Transit More Flexible?

- Multiple Trunk Lines
- 4 Tracks in Core Areas
- Nearby Routes

BART's Current State – Safety Regulation

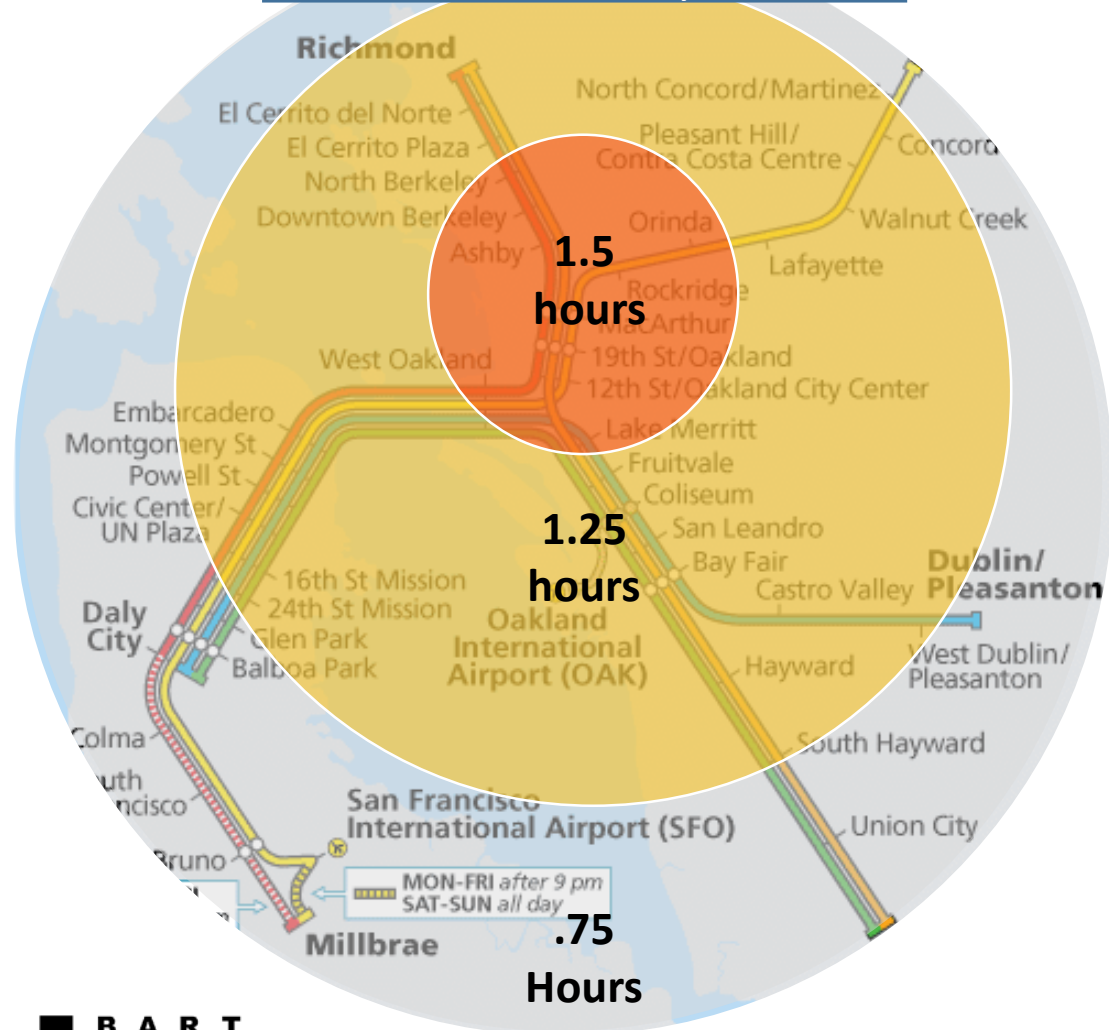
- Increased Federal (FTA) and State (CPUC) Safety Regulation
 - More stringent requirements – GO175
 - More resources required to inspect and maintain
 - Further limits on worker track access
 - New regulations for an older system
- 49 CFR Part 625 – Transit Asset Management (TAM)
- Need to grow out of old practices & accept these costs

BART's Current State – Increased Ridership

- Increased Ridership Effects
 - New extensions = more service = narrower overnight work window
 - More trains & longer trains = more wear on aged system
- Accommodation of Service Increases
 - Plant must be adapted to support anticipated service
 - Renewal efforts to achieve a State of Good Repair
 - Added Capacity
 - Traction Power
 - Crossovers and Turnouts

Real-Time Maintenance Availability is Insufficient

Weekday Maintenance Wrench Time, by zone



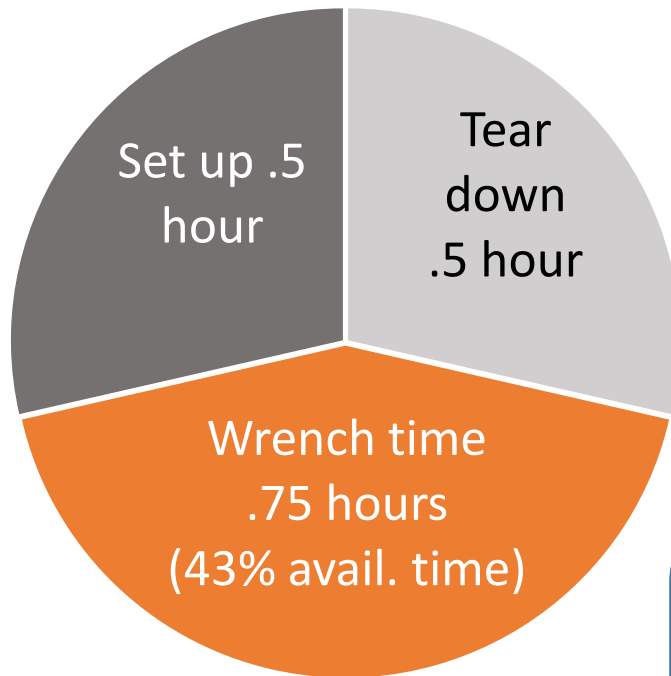
Zone	Sun-Thurs hours*	Weekly hours*	Yearly hours (Current Conditions)	Yearly Hours with Extra Hour per night	% Mtc. Time Added with Extra Hour per night
Richmond	1.5	16.5	858	1,223	43% more
Oakland	1.25	14.75	767	1132	48% more
Millbrae	.75	11.2	585	950	62% more



*Maximum potential “wrench time” does not include half hour for set up and half hour for tear down

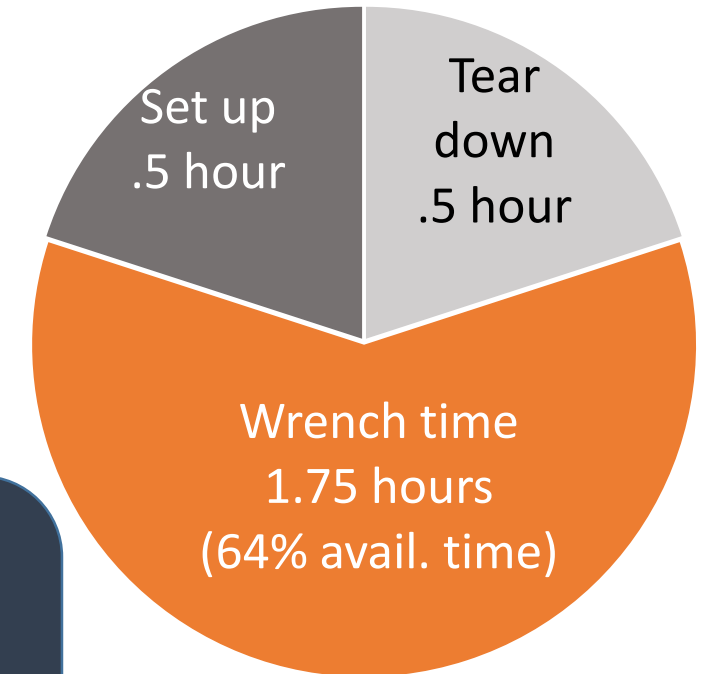
“When an Hour Is More Than Just an Hour”

Current Available Track Time (1.75 hours)



Increase overnight by one hour

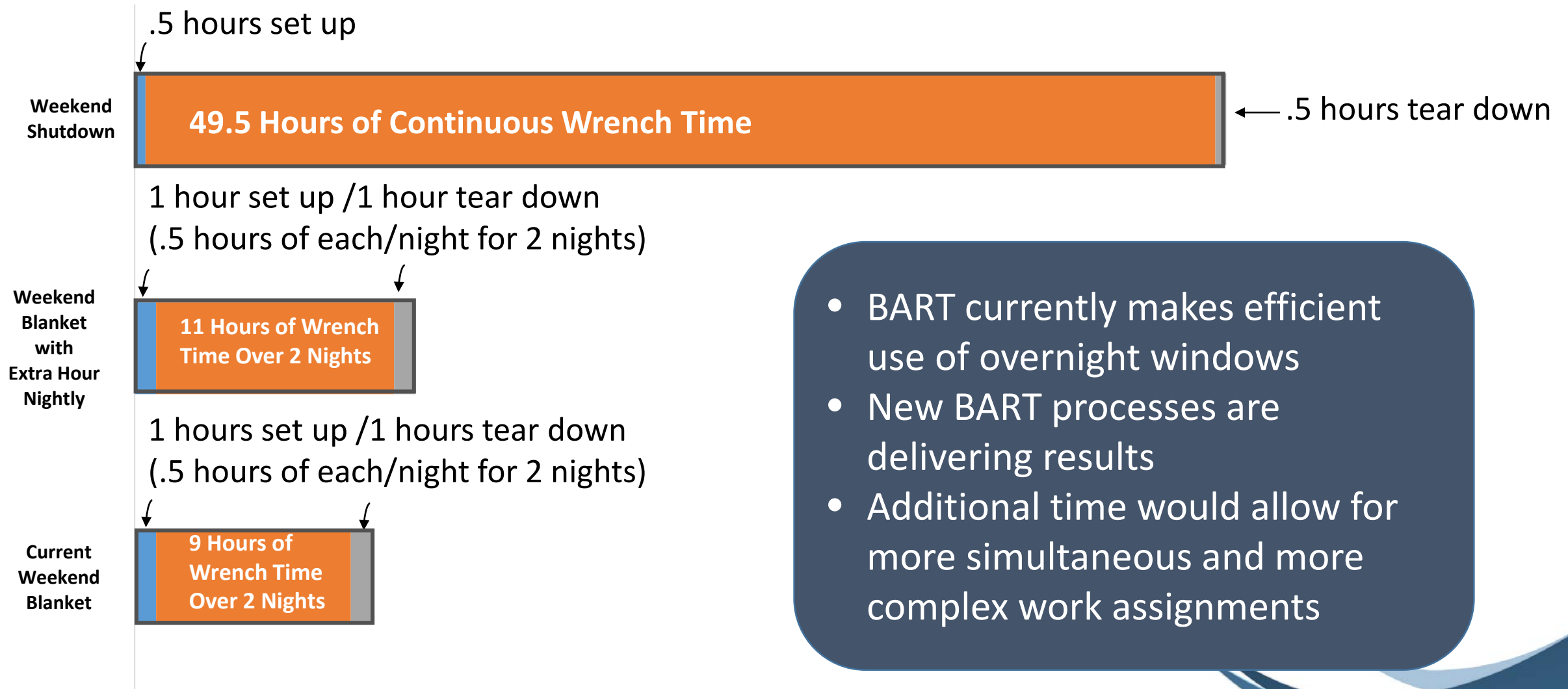
One Additional Hour to Current Track Time



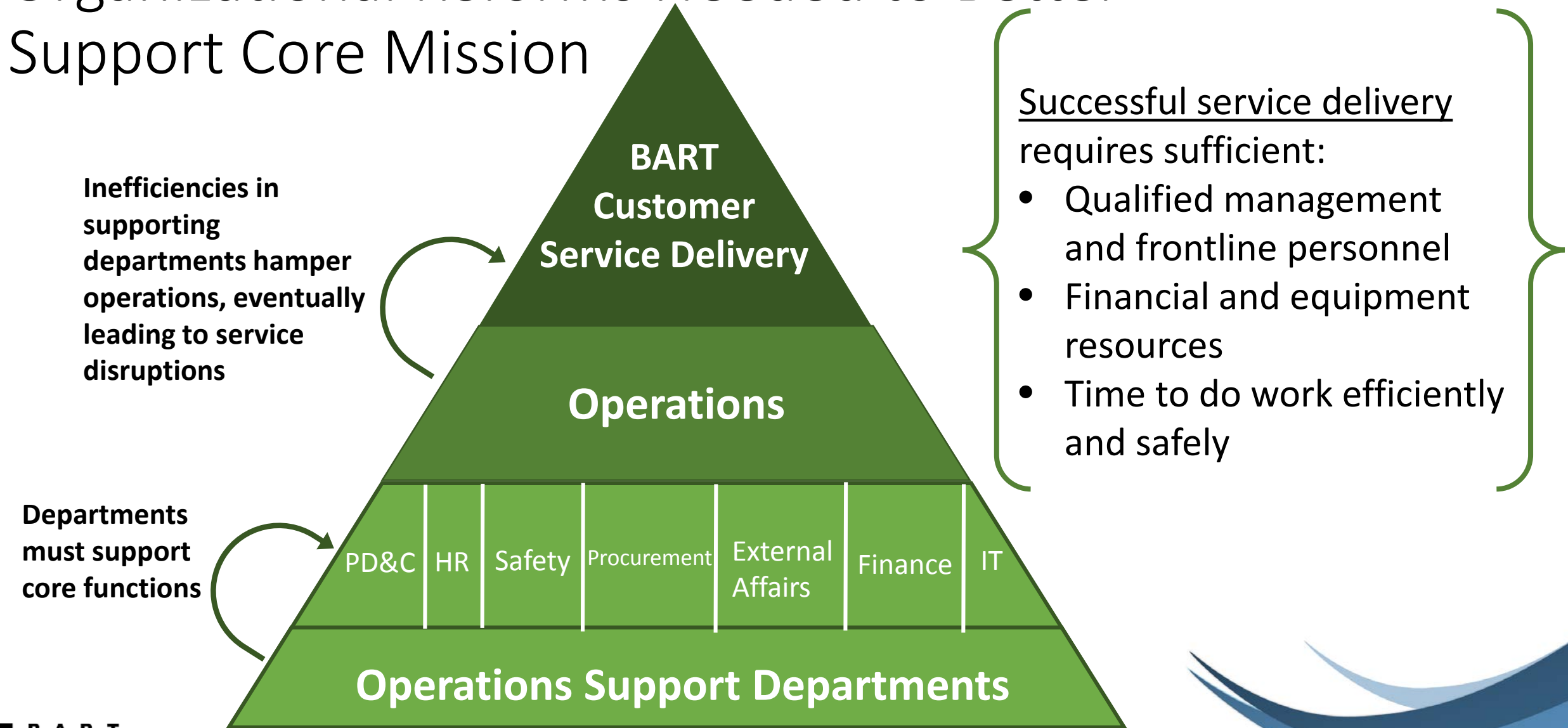
Longer Work Windows Mean More:

- Work Completed
- Complex Projects Completed
- Efficient Use of Staff Time
- Reliability

Weekend Shutdowns Provide More Wrench Time



Organizational Reforms Needed to Better Support Core Mission



BART's Current State: Evolution is Underway

- **Transforming into mature agency**
 - Capital improvement projects now the norm
 - Measure RR provides critical funding
- **Innovating maintenance practices**
 - Improved maintenance work scheduling
 - New inspection technologies
 - Weekend shutdowns & work scheduled during revenue service
 - Restructuring of work assignments
- **Hiring people with the right skills**
 - Engineering pilot program
 - Partnership with community based organizations
 - Apprentice programs

Organizational Reform Solutions

- Right-size the M&E Department to address current needs
 - Balancing Corrective Maintenance (CM) & Preventive Maintenance (PM) work
 - Achieve PM compliance goals
 - Renewal project pressures
- Hiring and HR coordination
 - Address large backlog of vacant Operating Positions (81 operating + 49 SVBX – 7/2017)
 - Hire to support aggressive capital project schedules (324 capital positions – 7/2017)
- Improve equipment and asset procurement
 - Fitting current needs and timelines
 - Establishing clear responsibilities
 - Simplify process with clear instructions and training
- Right-size budget to address operating and renewal needs

**There is no “Quick Fix” solution for reaching
a State of Good Repair and keeping BART
safe and reliable...
but there are streamlining tactics to benefit
BART.**

***Continued Maintenance Reforms are
Essential***

Current BART Efforts for System Renewal

- Strategic System Asset Management Plan
- New practices supporting efficient asset renewal
 - Track allocation
 - Longer Term (10-year) planning and coordination
 - Planned alternate service to maintenance outages
- Formalized maintenance goals, schedules, KPIs, and job plans
- Prioritized rebuilding and renewal effort
 - Job plans
 - Work schedules
 - Project prioritization
- Many new efforts enacted in past two years

Maintenance Reform Improvements

- Personnel
 - Right-sized based on needs
 - Continuous evaluation of skills
 - Team composition and scheduling
 - Work assignments
 - Separate Capital and Operating workforce
- Contracting
 - One-time force multipliers on big projects
 - Potential employee source

New Approaches for ROW Maintenance

- Innovative technologies
 - Autonomous track inspection technology
 - Needs more industry analytics
 - Drone inspections for infrastructure (Pilot program with UC Berkeley)
 - Laser tunnel inspections
 - Track geometry vehicle
- Leveraging traditional approaches
 - Rail-bound track inspection & maintenance equipment
 - Conversion of old trains to work trains

Predictable Reliability Key Customer Expectation

- **Reliable Service** = #1 concern in Biannual Customer Satisfaction Survey
- BART best serves its customers when it delivers safe, reliable train service
 - Contingent on assets in State of Good Repair
 - Functioning as designed
 - Not failing in-service
 - Inspected, repaired, and replaced on a set schedule
 - Customer service programs only succeed if underlying product is reliable
- Avoiding State of Good Repair results in declining system reliability

When Agencies Accept the Status Quo

- Failure to appropriately invest in maintenance and align the support departments leads to serious problems.
 - WMATA (Currently)
 - CTA (2000s-2010s)
 - NYCT (1970s-1980s, Currently)
 - SEPTA (1980s-1990s)
- Peer agency experiences have included:
 - Derailments, collisions, fires, fatalities, injuries, unplanned shutdowns
 - Damaged relationships with the public and customers

NYCT Case Study – The Past

- NYCT delayed renewal efforts in the 1970s-1980s
 - Numerous incidents occurred on the system throughout the 1970s and 1980s
 - After 10 derailments in first six months of 1983, NYCT report found:
 - Need for a “more aggressive maintenance program”
 - “Emphasis had been on cars and keeping them in good repair rather than on track.”
 - Need for increased nighttime and weekend closures for repairs

NYCT Case Study – The Present

- NYCT is experiencing similar infrastructure failures today
- Governor Cuomo declared a “state of emergency” for NYCT subways
- Customers demanding return to reliability
- NYCT is accelerating its current maintenance and renewal efforts
 - FASTRACK program
 - 18-month shutdown of its L-Line
 - NYC Subway Action Plan



CTA Case Study - NTSB Investigation

Derailment of Chicago Transit Authority Train Number 220 Between Clark/Lake and Grand/Milwaukee Stations

Probable Cause

The National Transportation Safety Board determines that the probable cause of the July 11, 2006, derailment of Chicago Transit Authority train number 220 in the subway in Chicago, Illinois, was the Chicago Transit Authority's ineffective management and oversight of its track inspection and maintenance program and its system safety program, which resulted in unsafe track conditions. Contributing to the accident were the Regional Transportation Authority's failure to require that action be taken by the Chicago Transit Authority to correct unsafe track conditions and the Federal Transit Administration's ineffective oversight of the Regional Transportation Authority. Contributing to the seriousness of the accident was smoke in the tunnel and the delay in removing that smoke.

Source: <https://www.nts.gov/investigations/AccidentReports/Reports/RAR0702.pdf>

WMATA Case Study

- Outcomes of delaying renewal efforts
 - Increasing service disruptions, accidents, and incidents.
 - Hazards for public and employees
- Management, Board, and Public focused on pressure to expand service instead of a State of Good Repair

The Infuriating History of How Metro Got So Bad

By Luke Mullins and Michael J. Gaynor on December 9, 2015



Source: <https://www.washingtonian.com/2015/12/09/why-does-metro-suck-dangerous-accidents-escalator-outages/>

NTSB: Metro should have fixed tracks before derailment



By Max Smith | @amaxsmith
August 3, 2016 3:31 pm



Source: <http://wtop.com/tracking-metro-24-7/2016/08/ntsb-metro-didnt-inspect-rails-enough-before-derailment/>

A look inside the smoke and fire defects that paralyzed D.C. Metro

Metro's March 16 daylong shutdown was precipitated by a predawn fire two days before in a tunnel near the McPherson Square station. General Manager Paul J. Wiedefeld called the fire "disturbingly similar" to the deadly smoke incident in which a woman died near L'Enfant Plaza in 2015, and he said he doesn't want to risk another such tragedy. Metro was plagued by a surge in fires and smoke incidents last year.



Take a look at the damaged cables that shut down Metro

NTSB criticizes Washington Metro over 2009 crash

By **Mike M. Ahlers**, CNN
 July 27, 2010 8:47 p.m. EDT



The National Transportation Safety Board says the June 22, 2009, accident was preventable.

Washington (CNN) -- A year after a Washington, D.C., subway crash killed nine people and injured dozens, federal accident investigators on Tuesday blamed faulty track circuits for the wreck, but also criticized the numerous local and federal entities entrusted with keeping passengers safe.

The National Transportation Safety Board said the June 22, 2009, accident was preventable.

STORY HIGHLIGHTS

- A federal report criticizes the safety record of Washington's subway system
- The NTSB report blames a 2009 crash that killed nine people on faulty track circuits
- Washington Metro officials failed to conduct a test that would have discovered the problem

Its report said the Washington Metropolitan Area Transit Authority (WMATA) failed to ensure that a verification test developed after an earlier incident was used system-wide. The test would have identified the faulty track circuit before the accident, the NTSB said.




The accident near the Fort Totten Station on the system's Red Line occurred when one train struck the rear car of a stopped train. Automated systems should have prevented the two trains from occupying the same stretch of track at the same time.

Source: <http://www.cnn.com/2010/US/07/27/dc.metro.crash.report/>

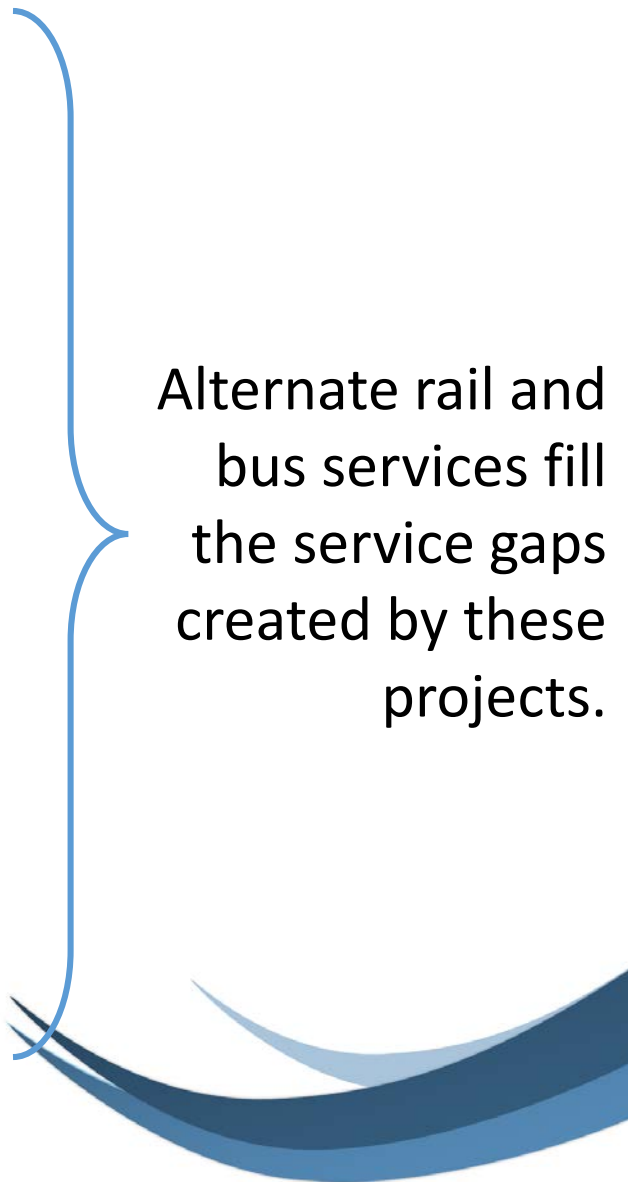
BART Must Embrace Service Adjustments

- All agencies must conduct occasional shutdowns for maintenance projects
 - Heavy maintenance required, regardless of level of service
 - 24/7 agencies use same approaches
- BART must plan service adjustments to increase maintenance time
 - Later Opening - 5:00 AM opening
 - Earlier Closing
- BART must schedule maintenance shutdowns and provide viable service alternatives

System Renewal Programs

Agency	Program
<p>New York City Transit (NYCT)</p> 	<p>####FASTRACK</p> <p>Ongoing, multi-year maintenance program of extended nighttime and weekend shutdowns.</p>
<p>Washington Metropolitan Area Transit Authority (WMATA)</p> 	<p>SafeTrack</p> <p>Accelerated work plan to rehabilitate the system, mostly on nights and weekends, to improve safety and reliability.</p>
<p>Chicago Transit Authority (CTA)</p> 	<p>rs Red Line South Reconstruction Project</p> <p>Complete shut down and rebuilding of a 10.2-mile stretch of Red Line over 6-month.</p>

Alternate rail and bus services fill the service gaps created by these projects.



System Renewal Projects: Impacts

System	Length of time	Purpose	Service Disruptions for Renewal	Redundancies
NYCT	18 months	Rebuild L Line	<ul style="list-style-type: none"> • <u>Full 18-month shutdown</u> 	Bus Bridges, Other Rail Routes
PATH	5 months	Rebuilding between Hoboken and Manhattan	<ul style="list-style-type: none"> • <u>Full weekend shutdowns</u> 	Bus Bridges, Other Rail Lines
CTA	6 months and overtime in 2000s	<ul style="list-style-type: none"> • Rebuild Red Line (2013) • Rebuild: Red, Blue, and Brown Lines (2000s) 	<ul style="list-style-type: none"> • <u>6-month shutdown</u> • <u>Track closures, station closures, slow zones, and bus bridges</u> 	Extensive New Bus Services
PATCO	2 years	Total reconstruction of tracks on bridge	<ul style="list-style-type: none"> • <u>Continuous single-tracking for 2 years with significant service reductions</u> 	No Alternative Service

Future Includes Effective Bus Bridge Service

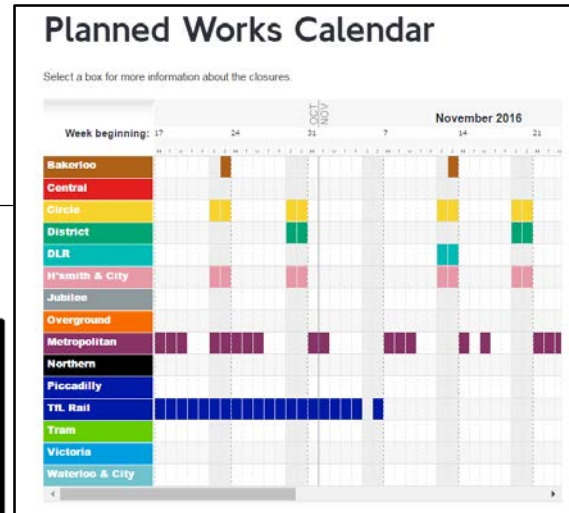
- Other modal support needed during shutdowns & increased service
- Coordination with regional agencies must grow
- BART Bus Model is a preliminary, but innovative idea that should be considered for further analysis, to assess its possible benefit to BART
 - Planned bus bridge service for maintenance activities & shutdowns
 - Emergency bus bridge service
 - Limited overnight service
 - Improved quality control and service predictability for BART

Communications for Shutdowns

- Retaining customers requires excellent plans and exquisite public communication
 - Minimize impact on customer
 - Provide frequent, clear, and encouraging public messages
 - Public website should identify future work and highlight benefit to customer
 - Prepare customers to navigate work zone easily with clear communication, signage, and information from all sources used under normal circumstances

Innovative Tools to Increase BART's Predictability for the Public

- BART's peers use numerous innovative tools to communicate shutdowns with riders



Track renewal

To ensure safe and reliable journeys, our track needs to be maintained and renewed regularly.

Why we need closures to replace track

We are carrying out continuous track renewals and replacements across our network to keep London's transport moving and as safe as possible. Find out why this sometimes takes longer to complete. Browse through our videos on YouTube to find out more. #TubeImprovements

Planned block closures



Track closures six months look ahead

Changes to the closure programme are possible. When this occurs we update this information accordingly. Please 'check before you travel'. For the latest information visit tfl.gov.uk.

Metropolitan line service: Mondays to Wednesdays until late 2018.
 After approximately 22:00, there will be no Metropolitan line service between Aldgate and Wembley Park. Mondays to Wednesdays*. Please use the Jubilee line between Baker Street and Wembley Park and the Circle or Hammersmith & City line between Baker Street and Aldgate.
 *Normal services will run on Bank Holidays and for some Wembley Stadium events.

Track closures look ahead			Correct at date of publication: 14 October 2016
Start	End	Line	Affected
Mon 10 Oct 16	Fri 14 Oct 16	TfL Rail	Brentwood to Shenfield each evening from 23:00 to 00:50
Mon 10 Oct 16	Fri 14 Oct 16	London Overground	Gospel Oak to Barking Monday to Thursday Hackney Downs to Enfield Town each evening from 22:45 Hackney Downs to Cheshunt each evening from 22:45
Sat 15 Oct 16	Sun 16 Oct 16	District	Turnham Green to Ealing Broadway
Sat 15 Oct 16	Sun 16 Oct 16	Piccadilly	Action Town to Uxbridge
Sat 15 Oct 16	Sun 16 Oct 16	London Overground	Gospel Oak to Barking Willesden Junction to Shepherd's Bush Romford to Upminster
Sat 15 Oct 16	Sun 16 Oct 16	TfL Rail	Chadwell Heath to Shenfield Sunday Stratford to Shenfield
Mon 17 Oct 16	Fri 21 Oct 16	London Overground	Gospel Oak to Barking
Mon 17 Oct 16	Fri 21 Oct 16	TfL Rail	Brentwood to Shenfield each evening from 23:00 to 00:50

Report Summary

- Major Themes:
 - BART's Current State Threatens Future Success Without Continued Infrastructure Investment
 - Predictable Reliability is the Key to Holding the Riding Public's Trust
 - Real-Time Maintenance Availability is Insufficient to Conduct Needed Maintenance, Rebuild and Renewal
 - Regular Maintenance Shutdowns Must Become Normal Business
 - Institutional Reforms Must Be Enacted to Modernize Support Functions and Ensure Short- and Long-Term Success
 - BART's Future Includes a Combination of Operations and Maintenance Reforms and Communicating Expectations to the Public Accordingly
- BART is taking many positive steps to address its current issues, but still faces a long road ahead to a State of Good Repair and its future beyond reaching a State of Good Repair