Transit operations opportunity register

This document includes the transit operations opportunity register and an overview of the system projects framework. Sound Transit and King County Metro operations and maintenance staff identified opportunities for savings through efficiencies in current practices or larger changes warranting further study. Opportunities are organized across four categories: asset management, resiliency, core capacity, and governance, revenue, and policy. Each carries a qualitative ranking for investment level and implementation complexity. As with other opportunity registers, some items interrelate with or repeat policies found in the Capital Delivery and Policy Opportunity registers.

Options	Description	Benefit to Financial Plan	Investment Level	Implementation
Asset Management				
Energy management solutions	Reduce power with multiple strategies including escalator soft starters, LED retrofits, traction power energy management, and others	$		
Fleet reliability improvements	Focus on reliability to reduce spare ratio and capital cost of LRVs	$		
Evaluate passenger restroom investment level	Evaluate lifetime costs of passenger restrooms and adjust to plan	$		
Optimize LRV maintenance	Minimize train movements and evaluate maintenance and cleaning intervals	$		
Optimize deployment of Maintenance of Way (MoW) resources	Assess spacing of MoW facilities to enable quick response	$		
Invest in Conditions Based Maintenance	Invest in technologies to improve maintenance efficiency ands reduce long-term O&M costs	$$ - $$$		
In-house vertical transportation program	Bring O&M of elevators and escalators in house	$		
Sounder maintenance base	Build dedicated Sounder maintenance base to allow competitive bidding on maintenance	$		
Technology improvements to support safety and efficiency	Investments into technologies that reduce operational and maintenance risks, improve workforce readiness, and strengthen the reliability of day-to-day system performance.	$		
Resiliency				
Add special track work	Add special track work (crossovers, pocket tracks, etc) to reduce staffing needs during disruptions and improve resiliency	$		
Systemwide spare parts strategy	Examine project funded spare parts requirements considering systemwide inventories	$		
Review operating business model	Review operating model to increase control of service and reduce duplication	$		
Core Capacity				
Purchase longer LRVs	Longer LRVs increase capacity and decrease long term maintenance costs	$$		
Accelerate Communications Based Train Control (CBTC) implementation	Accelerate the implementation of CBTC to realize efficiency benefits and cost savings sooner	$$		
Optimize service levels with demand	Review and modify headways and train lengths based on demand to balance fleet and maintenance needs with high quality service	$		
Reduce deadhead hours	Review all deadhead miles and create a goal to reduce non-revenue service - consider short-turn service during beginning and end of service day	$		
Governance, revenue, and policy				
Implement paid parking	Launch system-wide, revenue-maximizing parking policy	$		
Implement special event and surge pricing	Consider demand-based variable fares to increase ridership and reduce crowding pressure	$		
Increase fares	Increase baseline fare rates more aggressively than planned	$		
More ways to pay fares	Increase revenue by expanding payment options and partnering with special events	$		
Install faregates	Install faregates at select stations to increase fare revenue	$		
Digital advertising signage	Increase advertising revenue using digital signage	$		
Station naming rights	Sell naming rights to stations to third-party sponsors to generate ongoing revenue for the financial plan	$		
Market based investments in surplus property	Seek proposals from private industry to deliver innovative solutions for TOD affordable housing and parking on ST surplus property	$		
Review leased facilities	Review all facilities leased for storage of O&M equipment to identify savings	$		
Consolidated bulk purchases for rail and station equipment with spare parts supply agreements with suppliers for long-lead parts	Evaluate if purchasing equipment and materials in bulk saves costs for items such as welded rail, escalator parts and electrical equipment. Would increase the number of ST owner supplied items to projects but could save maintenance with uniform equipment across replacement and expansion projects	$		

Legend		
Benefit to Financial Plan	**Investment Level**	**Implementation**
$ Less than $500M	Significant	Requires voter or state legislature approval
$$ $500M-$1B	Modest	Requires Board approval or coordination with other jurisdictions
$$$ $1B - $3B	Small	Can be changed or implemented by ST staff
$$$$ Above $3B		

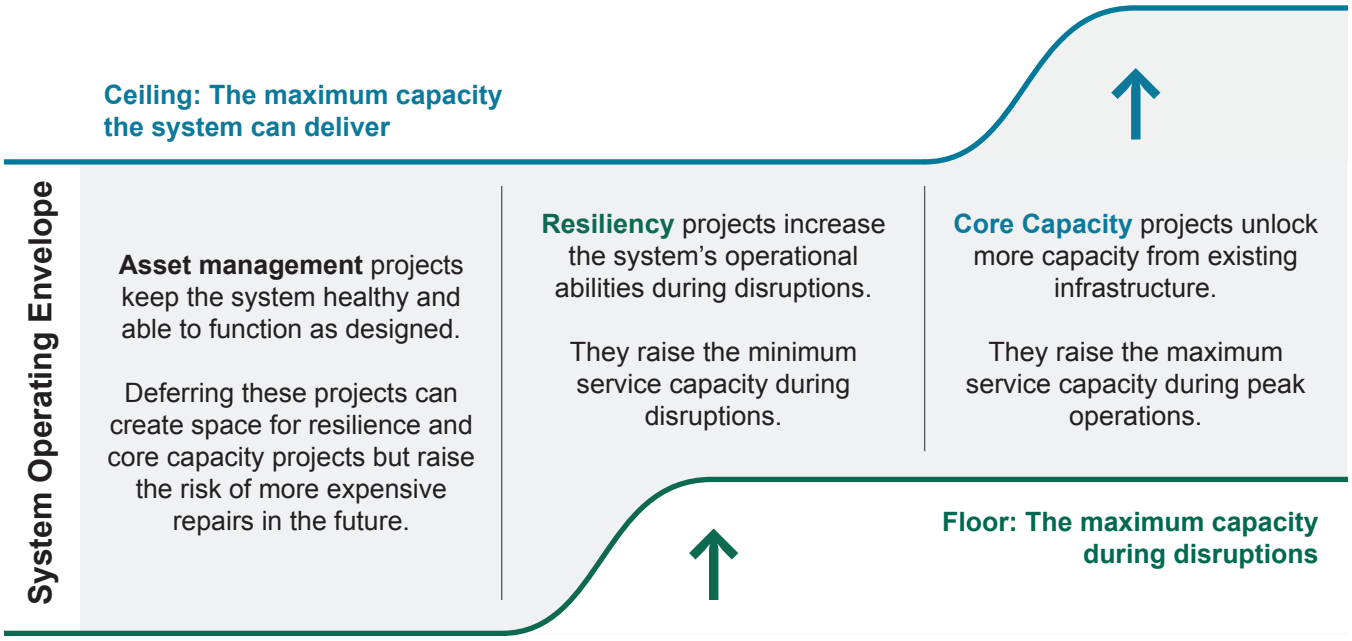
System projects overview

Sound Transit's rail system requires investments to support ongoing operations and to maintain assets in a state of good repair. These type of investments are System Projects that can be classified as Asset Management, Resiliency, or Core Capacity projects depending on the outcomes that they are meant to drive.

Asset Management Keeps the system in a state of good repair so it can operate as designed.	**Resiliency** Increases system capacity and improves system recovery during and after service disruptions.	**Core Capacity** Increases system capacity by enabling more frequent train service from the existing tracks.
What is it? State of good repair (SOGR) and condition-based maintenance programs that keep assets within their designed operating parameters over their lifecycle. **What is success?** • No slow zones, no emergency shutdowns. • System elements replaced on schedule, not after failure. • A predictable, stable system baseline. **Example projects:** • Rebuild tracks • Station upgrades for legacy DSTT facilities • Vehicle replacement purchases (all modes) • Condition-based maintenance	**What is it?** Dedicated infrastructure that enables greater network flexibility during disruptions to contain and recover from disruptions. **What is success?** • A single failure contained to one segment with faster gap fills. • Coordinated system-wide response. • Minimizing overall system delays. **Example projects:** • Fiber network update • Add pocket tracks and crossovers to the DSTT • Upgrade the traction power system • Improve at-grade crossings in the Rainier Valley • Unified control center • PIMS (Passenger Information System)	**What is it?** Capital investments in the current system that increase the operational efficiency and overall system capacity. **What is success?** • More trains per hour and consistent headways. • A system capable of meeting long-term ridership growth without building paralleling infrastructure. **Example projects:** • Communications-Based Train Control (CBTC) • DSTT ventilation upgrades • OMF Central expansion • End of Line storage tracks
Cost of underinvestment • Deferred costs compound. • Gradual degradation can cause unexpected and major service disruptions. • Recovery costs far exceed the original maintenance investment.	**Cost of underinvestment** • Higher disruption impact with every incident. • A system without resilience infrastructure has no buffer when something goes wrong.	**Cost of underinvestment** • Capacity of the system stays fixed unless new parallel infrastructure is built. • Interlining of different services depends on tight coordination between operations. • Existing signaling system is expected to become obsolete within 15 years, and delaying action risks a more expensive, disruptive upgrade later.

How system projects benefit operational capacity

Sound Transit's three categories of system projects—asset management, resiliency, and core capacity—each compete for the same limited funding pool. How that money is allocated across the three determines the overall health, reliability, and capacity of the system.



System projects funding approaches

Each category contains projects at different stages of readiness, with some already underway. Because all three draw from the same capital pool, investment choices in one area create real pressure on the others. As the agency cannot fully fund all three simultaneously, three approaches were developed to illustrate the trade-offs.

	Approach 1: Business-as-Usual	Approach 2: Phased CBTC (2047)	Approach 3: Accelerated CBTC (2036)
Asset Management	Fix assets when they break with no investment in smarter maintenance tools or processes.	**Adds** investments for predictive maintenance tools to catch problems before they cause failures. Potential for 10% savings over 20 years.	No change from approach 2
Resiliency	Crossovers and storage tracks are deferred. Maintains existing ability to contain and recover from disruptions.	**Adds** infrastructure to improve ability to contain disruptions. Prioritizes key DSTT improvements.	No change from approach 2
Core Capacity	No core capacity improvements to existing system as modern train control systems are deferred. Current signaling system approaching end of useful life in 15 years.	Modern train control phased in with ST3 build out, with full system **implementation by 2047.**	Modern train control upgraded across the full system **by 2036 on an accelerated timeline.**
Tradeoffs	Lowest near-term cost, but deferred maintenance compounds over time. When ST3 opens, the existing signalling system could be obsolete and migration to a new system could take 10 years.	Near-term cost nearly identical to approach 1 while capturing long-run maintenance savings; but almost a decade without CBTC benefits.	Maximum long-run system performance and fastest implementation of benefits but requires ~$4.5B in near-term capital; directly competes with ST3 spine completion for funding.
Estimated SOGR investments	~$14B over 20-years (YOE$)	~$13B over 20-years (YOE$)	~$18B over 20-years (YOE$)

Asset management projects

Condition-based maintenance program

State of Good Repair (SOGR)

What is it: SOGR is the concept that infrastructure has a lifecycle and investments must be made to keep the system in a "good state of repair". It is a policy commitment to keeping assets highly reliable throughout their lifecycle rather than running them to premature failure.

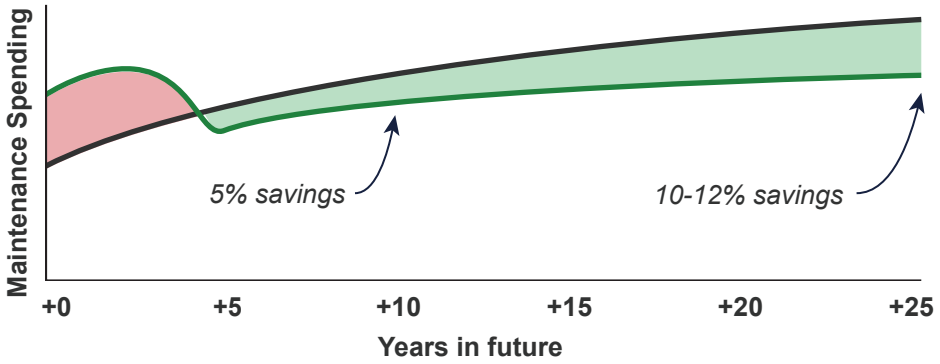
Why is it important: Many systems defer SOGR projects to preserve resources. This can result in paying more in the long run and cause major service disruptions. SOGR projects can also be done too soon, before assets have reached the end of the useful life, because maintenance is based on fixed schedules rather than the actual state of the system. This leads to spending on unnecessary maintenance and reduces the availability of the asset for revenue service.

Condition-Based Maintenance (CBM)

What is it: CBM is a methodology (others include time-based or run-to-failure) that uses asset condition data and good-governance practices to prioritize and proactively complete maintenance activities. It is a more targeted approach to SOGR, which contrasts with the current time-based preventative maintenance strategy. While effective and conservative, time-based maintenance is inefficient and expensive.

Why is it important: When agencies are limited on budgets and need to make more intelligent decisions around where capital funding goes. CBM will allow for proactive predictive maintenance of assets, improving the reliability, availability, and useful life of assets.

What's in the way: CBM requires upfront investment in monitoring and data gathering equipment, a learning curve of 3-5 years, and good governance structures that allow data-driven decisions to prioritize maintenance and equipment replacement dollars.



Investing in the technology needed for CBM in the short term could result in savings of up to 5% yearly in the medium term and 10-12% savings in the long term.

Other investments to improve safety and operational efficiency

Targeted technology investments would improve how the agency maintains, operates, and protects its physical assets. These include:

- Better training tools and simulators would build a more skilled and prepared workforce across maintenance and operations.
- Improved field safety systems would reduce risk for workers on and around active infrastructure.
- Broader system safety technology would reduce accident risk and improve overall network performance, while administrative tools would bring scheduling and payroll efficiencies to day-to-day operations.
- Analysis and exploration of a range of operating business models provides insight into how they enable opportunities for improved operational efficiency and cost savings.

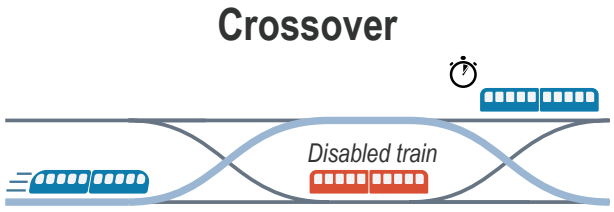
Resiliency projects

Crossovers and storage tracks

Resiliency projects raise the "floor" of service quality and capacity during times of disruption

Crossovers

What they are: Crossovers are connections between parallel tracks that allow trains to reverse or reroute around a blockage.



Why they are important: During single-tracking operating frequencies are limited by the time it takes each train to pass the affected segment, the more crossovers the shorter this time is. Crossovers also allow trains to switch directions if needed. Crossovers are critical for operational resiliency on Lines 1 & 2 through Downtown, and are recommended in the 2025 Link Light Rail Resiliency Report.

What's in the way? Crossovers can be expensive, especially when they are underground or retrofitted into an existing system. Installing them on an operating line can also cause service disruptions.

Peer Example: *WMATA uses crossovers and storage tracks to short-turn trains at Mount Vernon Square station, providing more service in the core and reducing operating costs on the tails of the system.*

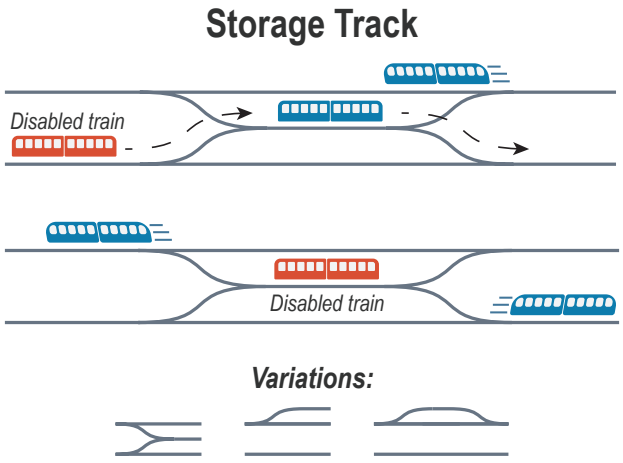
ST Project Example: The addition of crossover tracks at Pioneer Square Station could provide more operational flexibility for 1 Line and 2 Line trains during disruptions.

Storage tracks (pocket tracks)

What they are: Storage tracks provide off-track capacity to hold trains near key service points and remove disabled trains from active tracks.

Why they are important: Having trains on standby means faster recovery from disruptions, more flexible service patterns, and reduced deadhead time. Storage tracks are critical for operational resiliency on Lines 1 & 2 through Downtown, and are recommended in the 2025 Link Light Rail Resiliency Report.

What's in the way? Storage tracks are even more expensive than crossovers because of their larger size and may get only limited use during disruptions or special events.



Peer Example: *TransLink uses a third platform at Stadium Station to position an extra train during events to provide for extra outbound capacity.*

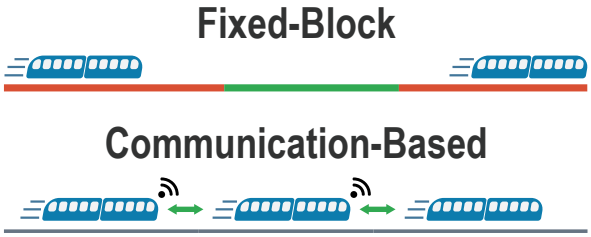
Core capacity projects

Communications-based train control

Core capacity projects raise the "ceiling" of service quality and capacity during normal operations

Communications-based train control (CBTC)

CBTC is an advanced signaling system that helps to maximize operational capacity without providing paralleling capacity. While traditional signaling systems operate on fixed "blocks" which prevent more than one train from entering a segment of track regardless of conditions, CBTC and other "moving-block" systems use a variety of sensors to continuously calculate the safe separation of trains to enable more trains safely to use a segment of track.



These sensors also allow CBTC-equipped trains to manage their speed, acceleration, and braking automatically, creating a smoother ride for passengers and more consistent operations for Sound Transit. On fully grade-separated tracks CBTC even allows for driverless operations.

Link trains equipped with CBTC could have much higher frequencies through constrained areas, like the downtown tunnel, while creating a more comfortable ride and reducing operating costs.

***Peer Example:** The MTA spent around $950M to add CBTC onto the L and 7 lines, resulting in on-time performance reaching above 90% and increasing total capacity by 7%.*

Because of the age and impending obsolescence of the current Link signaling system all ST3 Link extensions will be designed with CBTC. By futureproofing current projects and preparing for full conversion to CBTC Sound Transit will minimize risk and reduce total costs. **The funding to initiate the engineering work and upgrade the current LRV fleet for compatibility was approved in the 2025 Financial Plan.**

Upgrading to CBTC is not an all-or-nothing project, and Sound Transit can phase implementation to best align with other agency priorities and budget constraints. Implementing CBTC on all new extensions and new OMFs will allow technology-assisted train operation in the new yards (OMFS and OMFN) and futureproof the system for technology-assisted train operations on ST3 alignments. Migrating the existing alignment to CBTC can be phased.

Opportunistic implementation
Wait for ST3 projects to be in service for several years to decouple technical risks, then begin implementing CBTC on the existing system in a phased manner, starting with elevated portions of existing lines and all OMFs. Implement in Downtown tunnels after a second tunnel is built and/or when positive financial outlook or grant opportunities are available.

Aggressive implementation
Prioritize upgrades to the entire system to maximize operational and financial benefits of CBTC in the short and long run. This approach would compete for resources with ST3 capital projects.