ECONOMIC ANALYSIS UPDATE

Updates to Regional Transportation Resilience Economic Analysis

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Regional Transportation Resilience Subcommittee Meeting
May 30, 2025

National Capital Region
Transportation Planning Board

Agenda Item 2B

Regional Transportation Resilience Economic Analysis

- Conducting analysis to demonstrate the cost of inaction and provide support for the benefits of proactive resilience investment
- Up to five case studies quantifying the costs and benefits of resilience and adaptation
- Transportation assets (e.g., rail stops, bus stops, road segments, rail segments, bridges)
- Climate hazards (flooding and extreme heat)
- Develop a framework for risk-based economic impact analysis, and guidance for the evaluation of further assets and projects

Current Case Studies

Bus Stop: Army Navy Drive & S. Joyce St stop in Arlington

Extreme Heat

Rail Stop: Greenbelt MARC Station

Extreme Heat & Flood Risk

Asset Selection Research: Bus Stops

	Location	Existing Sha	Description	Equity Emphasis Area	Amenities	Route(s) Served	Ridership*
2	Pennsy Drive & #3133	N/N	Overgrown siding on one side; limited sp	Y (8041.01)	None	WMATA F12	454
3	S Pickett St & Shilling	Y/N	Trees on one side	Y (2004.08)	Benches on one side; designed green space	WMATA 7A, 32; DAS	8,555
4	Columbia Park Rd at Cabin Branch Dr	N/N	Overgrown siding on one side; limited sp	Y (8032)	None	WMATA F12	454
5	Mt Vernon Ave & Russell Rd	Y/Y	Trees on both sides; limited space for she	Y (2012.06)	Designed green space	WMATA 10A, 10B	3,231
6	Army Navy Dr Eb & S Joyce St Fs	Y/N	Minimal trees/shade from building on or	Just outside (1035.05)	Bench near, but not right at, stop on one side	WMATA 16A, 16C, 1	9,189
7	N Glebe Rd Eb & N Piedmont St Fs	Y/Y	Shelters in both direction; trees on one si	Y (1020.03)	Shelters with bench on each side	WMATA 10B, 23B, 2	4,774
8	Amherst Ave and Springfield Boulevard	Y	Bus stop only on one side of the street? T	Y (4306)	None	FFX Connector 310	354.2
9	Annandale and Pine	Y/N	Minimal tree shade on one side. No shad	Y (4507.02)	None	FFX Connector 803	N/A
10	Backlick Rd and Spring Garden Dr	Y	Bus shelter, minimal tree coverage.	Y (4316.02)	Shelter + bench	FFX Connector 310	354.2
11	Commerce St and Amherst Ave	Y/N	Tree coverage near one stop. No shade n	Y (4306)	Bench at one stop - the one without trees	WMATA 18J, FFX Cor	363
12	Commerce St and Brandon Ave	Y/Y	Shelters with benches at both stops	Y (4306)	Shelters and benches at both	FFX Connector 321, 3	1,159
13	Fordson Rd and Huntley Meadows Plz	Y/N	Minimal tree coverage on one side, no sh	Y (4215)	None	FFX Connector 162	349.6
14	Fordson Rd and Richmond Hwy	N	Small stretch of sidewalk, on street corne	Y (4215)	None	FFX Connector 161, 1	745.2
15	John Marr Dr and Little River Tpke	N	Tree(s) on private property near stop, bu	Y (4521.01)	None	WMATA 26A, FFX Co	1,191
16	Little River and Annandale	Y	Shelter with bench, tree	Y (4507.02)	Shelter, bench	WMATA 16A, 29G, 29	5,893
17	Frederick Shopping Center North	Y	Stop located outside of business plaza; o	Y (7507.02)	Bench available at adjacent business	Frederick County Co	N/A
18	Frederick Shopping Center South (Giant Eagle)	Y	Stop located outside of business plaza; o	Y (7507.02)	Bench available at adjacent business	Frederick County Cor	N/A
19	Opossumtown Pike @ Thomas Johnson Drive		Busy intersection, minimal shade (unsure e	Y (7507.02)	None	Frederick County Cor	N/A
20	26th St NE & Bladensburg Rd NE	Y	Tree next to stop; stop next to maybe a fe	Y (89.03)	None	WMATA B2	8,413
21							*WMATA Ridership is Av
22							
23							
24							
25	Maryland						
26	Virginia						
27	DC						

Bus Stop: Army Navy Drive & S. Joyce St stop in Arlington: Methods

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Transit: Bus Stop

Case Study

Overview: The National Capital Region Transportation Planning Board (TPB) is conducting five benefit-cost analysis (BCA) case studies of transportation assets within the National Capital Region to demonstrate the cost of inaction, compare low-cost and high-cost solutions, and provide support for the benefits of proactive resilience investment.

Study Site: The focus of this case study is the Army Navy Drive & South Joyce Street westbound/southbound bus stop in Arlington, VA. This Metrobus and Arlington Transit bus stop serves roughly 70 riders per day and lacks existing shelter or vegetation.

Context: Studies, such as those by the Center for American Progress,[i] show that exposure to extreme heat results in increased emergency department (ED) visits and hospitalizations, and that the number of days with extreme heat is expected to increase. Research published by Arizona's Sun Tran bus service[ii] and Lanza et al. (2025)[iii] shows that shelters and surrounding vegetation can lower ambient and ground temperatures and help mitigate health impacts at bus stops. This case study examines a low-cost solution of erecting a bus shelter and a high-cost solution of supplementing the shelter with additional trees and foliage to lower temperatures around the stop. In addition, the new bus shelter would provide space for advertising, thereby producing advertising revenue.

Key Takeaways

- Shelters and foliage solutions at bus stops can significantly lower ambient temperatures, resulting in decreased health costs.
- Over 20 years, no investment could result in nearly $7,000 in health impacts at a single location.
- Results suggest a 3:1 ROI for proactive investment.
- Similar action could be taken at a regional level to address health concerns in the National Capital Region.

Aerial view, Army Navy Drive/South Joyce Street (Google Maps)

Bus stop with shelter (Killane/Shutterstock)

Results: BCA results suggest that the low-cost and high-cost solutions have discounted (3.1%)[iv] benefit-cost ratios of 3.0 and 2.7, respectively. These results imply that for every $1 invested in solutions, there is a return of nearly $3 in health and advertising revenue benefits. Net benefits are estimated at around $100,000 over 20 years.

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- Estimated the benefits of installing either a bus shelter alone, or a shelter plus surrounding vegetation.
  - Benefits include avoided heat-related illnesses, and advertising revenue from bus shelter signage
- Non-action is estimated to cost nearly $5,000 over 20 years in heat-related illness and hospitalizations at this bus stop alone.
- Every dollar spent in both the low investment (shelter only) and high investment (shelter + vegetation) scenarios returns about $3 in health and advertising benefits
  - Does not include other likely benefits, such as other weather-related illness (e.g., extreme cold) or pollution mitigating effects of vegetation

Bus Stop: Army Navy Drive & S. Joyce St stop in Arlington: Key Takeaways

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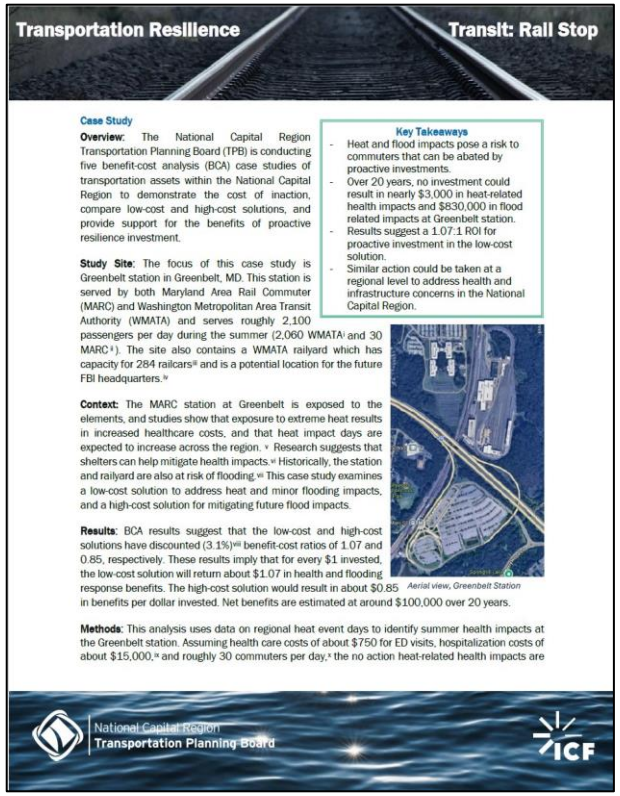
Asset Selection Research: Rail Stops

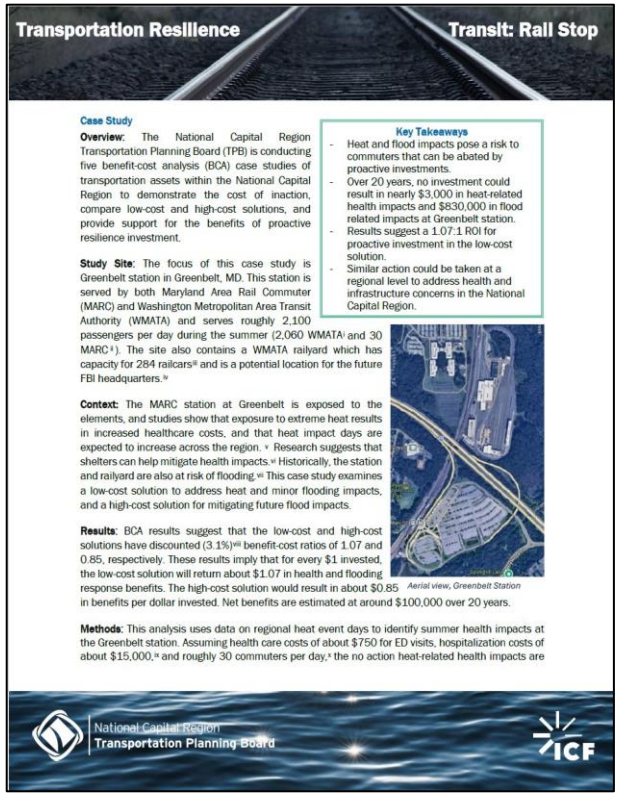
	Location	Existing Shade	Description	Equity Emphasis Area	Amenities	Ridership
2	Brunswick MARC Station	Y	Outdoor station with some overhang shade from station building. Much of platform is expo	Y (7754)	Indoor waiting area with	159
3	Federal Center SW	Y	Underground Metro station	Y (105)	None	2,346
4	Frederick MARC Station	Y	Outdoor station with some overhang shade from station building. Much of platform is expo	Y (7722)	Some overhang, bench, t	50
5	Laurel MARC Station	N	Appears to be predominately open to the sun, no shade	Y (8001.03)	Limited overhang	216
6	Union Station - Amtrak	Y	Indoor station but outdoor platforms	N	Outdoor platform with ov	9,950
7	Union Station - MARC	Y	Indoor station but outdoor platforms	N	Outdoor platform with ov	639
8	Union Station - Metro	Y	Underground Metro station	N	Underground station, sea	13,380
9	Lorton Amtrak	Y	Indoor waiting concourse, boarding platform is Outside. Overhang available for shade	Y (4221.01)	Indoor concourse adjacer	738
10	Quantico Amtrak	Y	Outdoor boarding area, pretty significant overhang for shade	Just outside (9011.01)	Overhang, some benches	44
11	New Carrollton Amtrak	Y	Outdoor station, overhang available along most of boarding area	Y (8036.02)	Outdoor platform with ov	465
12	Manassas Amtrak	Y	Outdoor station with overhang over entire platform	Y (9103.02)	Some overhang, a couple	79
13	Rockville MARC Station	Y	Outdoor station, some overhang available for shade	Y (7009.01)	Benches, some overhang	171
14	Gaithersburg MARC Station	Y	Outdoor station, minimal shade from nearby trees and limited awning from station building	Y (7007.25)	Shelter (bus stop-sized) a	106
15	Riverdale MARC Station	Y	Outdoor station, both sides of track have some tree coverage (likely not a ton of shade)	Y (8065.01)	None	44
16	Greenbelt MARC Station	Y	Aboveground outdoor station with overhang shade	Y (8069)	None	32
17	Seabrook MARC Station	Y	Outdoor station with limited shade from shelter, otherwise open-air	Y (8036.06)	Bus stop-like shelter	120

Rail Stop: Greenbelt MARC Station: Methods



- Explored no-action impacts of extreme heat, nuisance flooding, and 100- and 500-year storm events.
- Low investment scenario. Installation of electronic signage warning of high heat and informing MARC commuters when the train is approaching, allowing them to stay in covered tunnels until then. Slope grading and drainage systems installation to mitigate nuisance flooding.
- High investment scenario. Explored installation of covered shelters along the aboveground MARC platform and hardening embankments as an anti-erosion measure to prevent damages from 100-year and 500-year storm events.

Rail Stop: Greenbelt MARC Station: Key Takeaways



- Heat and flood impacts pose a risk to commuters that can be abated by proactive investments.
- Much of the station, railyard, and track are elevated above the floodplain, resulting in low risk of flood impacts from 100-year and 500-year storm events.
- Preliminary results suggest that low-cost solutions to prevent heat-related health impacts and nuisance flooding are more cost effective than costly flood prevention solutions.
- Preliminary results suggest a 1.07:1 ROI for proactive investment in the low-cost solution.
- Similar action could be taken at a regional level to address health and infrastructure concerns in the National Capital Region.

Next Steps

- Bridge (Beaver Dam Creek at Liverpool Point Road, Charles County, MD)

- Rail segment (WMATA Silver Line, Dulles Station, VA)
- Road segment (Anacostia Freeway, D.C.)

- Develop a framework for risk-based economic impact analysis, and guidance for the evaluation of further assets and projects