

Evaluation Matrix

(Part 1 of 4)

ENGINEERING

	Criterion	Measure	Alt 1 (2 Tracks)	Alt 2 (2 Tracks)	Alt 3A (4 Tracks)	Alt 3B (4 Tracks)	Alt 3C (4 Tracks)	Alt 11A (4 Tracks)	Alt 11B (4 Tracks)
Operations	1. Travel Time Between Penn Station and Gwynns Falls Bridge (SB/NB)	Minutes: Seconds	<u>Amtrak Acela</u> 5:43/6:10 <u>Amtrak Regional</u> 5:50/6:19 <u>MARC</u> 5:50/6:14	<u>Amtrak Acela</u> 5:43/6:10 <u>Amtrak Regional</u> 5:50/6:19 <u>MARC</u> 5:50/6:14	<u>Amtrak Acela</u> 3:59/4:02 <u>Amtrak Regional</u> 4:19/4:19 <u>MARC</u> 4:56/4:17	<u>Amtrak Acela</u> 3:24/3:25 <u>Amtrak Regional</u> 3:43/3:34 <u>MARC</u> 4:22/3:56	<u>Amtrak Acela</u> 3:27/3:27 <u>Amtrak Regional</u> 3:46/3:37 <u>MARC</u> 4:33/4:04	<u>Amtrak Acela</u> 3:16/3:11 <u>Amtrak Regional</u> 3:31/3:25 <u>MARC</u> 4:09/3:25	<u>Amtrak Acela</u> 3:20/3:16 <u>Amtrak Regional</u> 3:34/3:29 <u>MARC</u> 4:16/3:28
	2. Travel Time Savings over Alternative 1 (SB/NB)	Minutes: Seconds	Not Applicable	<u>Amtrak Acela</u> 0:00 <u>Amtrak Regional</u> 0:00 <u>MARC</u> 0:00	<u>Amtrak Acela</u> 1:56 <u>Amtrak Regional</u> 1:46 <u>MARC</u> 1:26	<u>Amtrak Acela</u> 2:32 <u>Amtrak Regional</u> 2:26 <u>MARC</u> 1:53	<u>Amtrak Acela</u> 2:30 <u>Amtrak Regional</u> 2:23 <u>MARC</u> 1:44	<u>Amtrak Acela</u> 2:43 <u>Amtrak Regional</u> 2:37 <u>MARC</u> 2:15	<u>Amtrak Acela</u> 2:39 <u>Amtrak Regional</u> 2:33 <u>MARC</u> 2:10
	3. Value of Time Savings for All Passengers ¹	Dollars per year	Not Applicable	\$0 per Year	\$32.5 Million per Year	\$43.4 Million per Year	\$42.3 Million per Year	\$46.8 Million per Year	\$45.5 Million per Year
	4. Lowest Design Speed within the Alignment	MPH	30 mph	30 mph	50 mph	50 mph	50 mph	50 mph	50 mph
	5. Maximum Design Speed along the Alignment	MPH	75 mph	75 mph	100 mph	100 mph	100 mph	110 mph	110 mph
	6. Average Operating Speed (SB/NB)	MPH	<u>Amtrak Acela</u> 35/34 mph <u>Amtrak Regional</u> 34/34 mph <u>MARC</u> 34/34 mph	<u>Amtrak Acela</u> 35/34 mph <u>Amtrak Regional</u> 34/34 mph <u>MARC</u> 34/34 mph	<u>Amtrak Acela</u> 54/56 mph <u>Amtrak Regional</u> 50/52 mph <u>MARC</u> 44/52 mph	<u>Amtrak Acela</u> 63/66 mph <u>Amtrak Regional</u> 57/63 mph <u>MARC</u> 49/57 mph	<u>Amtrak Acela</u> 65/68 mph <u>Amtrak Regional</u> 59/65 mph <u>MARC</u> 49/57 mph	<u>Amtrak Acela</u> 60/65 mph <u>Amtrak Regional</u> 56/60 mph <u>MARC</u> 47/60 mph	<u>Amtrak Acela</u> 59/64 mph <u>Amtrak Regional</u> 55/60 mph <u>MARC</u> 46/60 mph
	7. Operational Flexibility and Reliability	High Medium Low	Low – only two tracks in common bore	Low – only two tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	High – four tracks in individual bores and the ability to platform at West Baltimore from two different tunnel tracks	Medium – four tracks in individual bores; can only platform at West Baltimore from one tunnel track
	8. Meets Projected Year 2040 Level of Service for Amtrak/ MARC/ Freight	Yes/No	No – two tracks does not accommodate projected level of service; does not accommodate double-stack freight	No – two tracks does not accommodate projected level of service	Yes	Yes	Yes	Yes	Yes
	9. Length of Alignment between Penn Station and Gwynns Falls Bridge	Miles	3.5 Miles	3.5 Miles	3.66 Miles	3.66 Miles	3.83 Miles	3.31 Miles	3.35 Miles
	10. Length of Tunnel	Miles	1.42 Miles	1.42 Miles	1.91 Miles	2.03 Miles	2.23 Miles	1.90 Miles	2.26 Miles
	11. Steepest Vertical Grade	% Grade	1.3%	1.3%	2.0%	2.0%	2.0%	2.0%	2.0%
	12. Ability to Meet Current Project Design Criteria: Passenger (P) and Freight (F)	High Medium Low	Low (P) Low (F) Two tracks in a single bore, does not accommodate double-stack freight	Low (P) High (F) Two tracks in separate bores, accommodates double-stack freight	High (P) Medium (F) Four tracks in individual bores, accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores, accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores, accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores, accommodates double-stack freight, steep grades for freight	High (P) Medium (F) Four tracks in individual bores, accommodates double-stack freight, steep grades for freight
	13. Depth of Tunnel	Average Depth in Feet	15 foot average depth	10 foot average depth	130 foot average depth	130 foot average depth	140 foot average depth	95 foot average depth	105 foot average depth
	14. Extent of Major Utility Relocations	Minor Moderate Major Severe	None	Major – Relocations along entire existing tunnel alignment	Major – Relocations in the general vicinity of tunnel portals	Severe – Relocations extend significant distances outside of tunnel portal areas	Major - Relocations in the general vicinity of tunnel portals	Severe – Relocations extend significant distances outside of tunnel portal areas	Severe – Relocations extend significant distances outside of tunnel portal areas

¹ 2040 Projected ridership, 2015 dollars

Note: All surface area impacts based on estimated limit of disturbance for conceptual design. Includes portal area only and does not include vent/egress shafts.

Preliminary - Subject to Change

Evaluation Matrix

(Part 2 of 4)

ENGINEERING (continued)

	Criterion	Measure	Alt 1 (2 Tracks)	Alt 2 (2 Tracks)	Alt 3A (4 Tracks)	Alt 3B (4 Tracks)	Alt 3C (4 Tracks)	Alt 11A (4 Tracks)	Alt 11B (4 Tracks)
Transportation	15. Estimated Number of On-Street Parking Spaces Lost	# Spaces	0	310	0	150	40	120	10
	16. Requires Reconstruction of West Baltimore MARC Station	Yes/No	No	No	No	Yes	Yes	Yes	Yes
	17. West Baltimore MARC Station in proximity to Existing MARC Parking	Yes/No	Yes	Yes	Yes	Yes	Yes	No – Shifts West Baltimore MARC Station south	Yes
	18. Allows for High-Level Platforms for West Baltimore MARC Station between Franklin and Mulberry Streets	Yes/No	No	No	No	Yes	Yes	No	Yes
Cost	19. Capital Cost Estimate	YOE \$	\$0	\$700 Million	\$ 3.7 Billion	\$ 4.0 Billion	\$ 4.2 Billion	\$ 3.7 Billion	\$ 4.2 Billion
Construction	20. Impacts to Existing Amtrak Operations during Construction/ Rehabilitation	Minor Moderate Major Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Severe – There are no detours for Amtrak service; no service between Washington and Baltimore; limited regional service between Baltimore and Philadelphia; and no Acela service between New York and Washington for duration of construction.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Major – Most work would be performed without affecting NEC operations once temporary runaround tracks are in place; however, low speed of runaround would cause major impacts.
	21. Impacts to Existing MARC Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off-peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Severe – There are no detours for MARC service; MARC would be shut down between West Baltimore and Baltimore Pennsylvania Station.	Minor – Most work would be performed without affecting NEC operations; only final cutover would cause minor impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most work would be performed without affecting NEC operations; numerous track shifts and temporary cutovers would cause moderate impacts.	Moderate – Most Work would be performed without affecting NEC operations once temporary runaround tracks are in place; low speed of runaround would moderately impact MARC.
	22. Impacts to Existing LRT Operations During Construction/ Rehabilitation	Minor Moderate Severe	None – Construction would be contained within existing tunnel.	Severe – Construction requires open cut through North Avenue and LRT track bed.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Minor – Adequate ground cover between proposed tunnel and LRT track for minimally disruptive tunneling.	Moderate – Minimal ground cover between proposed tunnel and LRT track requiring off-peak shutdown of LRT.	Moderate – Minimal ground cover between proposed tunnel and LRT track requiring off-peak shut down of LRT.
	23. Impacts to Existing NEC Freight Rail Operations During Construction/ Rehabilitation	Minor Moderate Severe	Minor – Scheduled maintenance would continue during off peak; emergency repairs could cause significant delays. Frequency and magnitude of repairs expected to increase with time.	Severe – There are no convenient detours for freight service; local freight trains could not traverse B&P Tunnel to serve customers' sidings.	Minor – Most work would be performed without affecting freight operations; only final cutover would cause minor impacts.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	Minor – Most work would be performed without affecting freight operations; freight trains could be scheduled around the numerous track shifts and temporary cutovers.	Minor – Most work would be performed without affecting freight operations once temporary runaround tracks are in place.
	24. Temporary Community Impacts During Construction	High Medium Low	None	High – Extensive cut-and-cover construction would result in street closures and major impacts to communities.	Low – The portal construction area is mostly located in either existing Amtrak ROW or industrial property.	Medium – Portal construction would impact residential and industrial areas east of the existing NEC.	Medium – Portal construction would impact residential and industrial areas west of the existing NEC.	High – Portal construction would require extensive excavation in residential areas.	High – Portal construction would primarily impact industrial areas and existing Amtrak ROW, with some impacts to residences. Requires reconstruction of Franklin and Mulberry Streets over NEC.

Note: All surface area impacts based on estimated limit of disturbance for conceptual design. Includes portal area only and does not include vent/egress shafts.

Preliminary – Subject to Change

Evaluation Matrix (Part 3 of 4)

ENVIRONMENTAL

	Criterion	Measure	Alt 1 (2 Tracks)	Alt 2 (2 Tracks)	Alt 3A (4 Tracks)	Alt 3B (4 Tracks)	Alt 3C (4 Tracks)	Alt 11A (4 Tracks)	Alt 11B (4 Tracks)
ROW	25. Surface Right-of-Way Acreage Required, by land use type ²	Acres	Residential: 0 Acres Commercial: 0 Acres Industrial: 0 Acres Other: 0 Acres Total: 0 Acres	Residential: 4.8 Acres Commercial: 0.7 Acres Industrial: 0 Acres Other: 3.9 Acres Total: 9.4 Acres	Residential: 0 Acres Commercial: < 0.1 Acres Industrial: 2.5 Acres Other: 4.2 Acres Total: 6.7 Acres	Residential: 1.9 Acres Commercial: 3.1 Acres Industrial: 5.1 Acres Other: 5.9 Acres Total: 16.0 Acres	Residential: 0.9 Acres Commercial: 1.7 Acres Industrial: 6.2 Acres Other: 6.0 Acres Total: 14.8 Acres	Residential: 5.1 Acres Commercial: 0.4 Acres Industrial: 0.1 Acres Other: 6.6 Acres Total: 12.2 Acres	Residential: 1.2 Acres Commercial: 1.7 Acres Industrial: 0.8 Acres Other: 8.6 Acres Total: 12.3 Acres
	26. Surface Acreage of Roadway LOD	Acres	0 Acres	0 Acres	1.4 Acres	4.0 Acres	5.4 Acres	Undetermined	6.5 Acres
	27. Estimated Surface Parcels Impacted	# of Parcels	0	130	10	100	40	160	40
	28. Area of Excavation (including open cut)	Acres	0 Acres	8.23 Acres	8.6 Acres	16.1 Acres	20.0 Acres	8.9 Acres	12.2 Acres
	29. Area of Permanent Open Cut	Acres	0 Acres	Existing openings as they are today; no other permanent open cut	2.8 Acres	9.6 Acres	9.5 Acres	4.1 Acres	4.6 Acres
Community Resources	30. Estimated Residential Building Displacements	# Displaced	0	< 10	0	48	24	139	22
	31. Estimated Business Displacements	# Displaced	0	< 5	< 5	10	10	20	15
	32. Estimated Community Facility Displacements ³	# Displaced	0	1	0	6	1	2	2
	33. Estimated Residential Properties Impacted, but Residence Not Displaced ⁴	# of Parcels	0	100	< 5	15	< 5	10	< 5
	34. Estimated Non-Residential Properties Impacted with No Displacement ³	# of Parcels	0	20	< 5	10	10	15	5
	35. Right-of-Way Impacts within Minority Population Areas	Acres	0 Acres	7.5 Acres	5.8 Acres	15.1 Acres	13.9 Acres	12.2 Acres	11.4 Acres
	36. Right-of-Way Impacts within Low Income Population Areas	Acres	0 Acres	4.1 Acres	0.9 Acres	2.4 Acres	5.0 Acres	5.0 Acres	8.8 Acres
	37. Impacts to Baltimore City's West Baltimore MARC Station Master Plan	Minor Moderate Severe	None – Compatible with West Baltimore MARC Station Master Plan	None – Compatible with West Baltimore MARC Station Master Plan	None – Compatible with West Baltimore MARC Station Master Plan	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.	Moderate – Excavation would impact portions of industrial land proposed for redevelopment. MARC Station could remain between Franklin and Mulberry Streets.	Severe – Requires demolition of American Ice Co. and adjacent buildings proposed as central hub of redevelopment efforts. Relocates W. Baltimore MARC station platforms south.	Severe – Requires demolition of American Ice Co. and adjacent buildings proposed as central hub of redevelopment efforts.
	38. Parks Potentially Impacted	# of Parks	0	4 – Eutaw Pl Median Park, Park Ave Median Park, Mt. Royal Median Park, Fitzgerald Park	0	1 – Lafayette and Payson Park	0	0	1 – Winterling Elementary Recreation Facilities
	39. Estimated Area of Parkland Impacted	Acres	0 Acres	0.1 Acres	0 Acres	< 0.1 Acres	0 Acres	0 Acres	0.3 Acres

² Does not include existing Amtrak ROW. Includes temporary and permanent

³ Includes schools, churches, community centers, libraries, hospitals, police and fire stations

⁴ Permanent or temporary impacts to property

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Preliminary – Subject to Change

Evaluation Matrix (Part 4 of 4)

ENVIRONMENTAL (continued)

	Criterion	Measure	Alt 1 (2 Tracks)	Alt 2 (2 Tracks)	Alt 3A (4 Tracks)	Alt 3B (4 Tracks)	Alt 3C (4 Tracks)	Alt 11A (4 Tracks)	Alt 11B (4 Tracks)
Cultural Resources	40. Likely Adverse Effects for Historic Properties	Number of Properties (Number of Contributing Elements)	0	4 (2 contributing historic elements impacted)	5 (4 contributing historic elements impacted)	9 (82 contributing historic elements impacted)	9 (40 contributing historic elements impacted)	6 (144 contributing historic elements impacted)	8 (42 contributing historic elements impacted)
	41. Area of Surface disturbance within Historic District	Acres	0 Acres	8.6 Acres – Bolton Hill, Old West Baltimore, and Baltimore & Potomac Railroad Historic Districts	12.0 Acres – Monroe-Riggs, Baltimore & Potomac Railroad, and Midtown-Edmondson Historic Districts	25.3 Acres – Edmondson Avenue, Baltimore & Potomac Railroad, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic District	20.3 Acres – Baltimore & Potomac Railroad, Edmondson Avenue, Greater Rosemont, Midtown-Edmondson, and Monroe-Riggs Historic Districts	16.0 Acres – Baltimore & Potomac Railroad, Midtown-Edmondson, and Monroe-Riggs Historic Districts	16.4 Acres – Baltimore & Potomac Railroad, Edmondson Avenue, Midtown-Edmondson, and Monroe-Riggs Historic Districts
	42. Known Archaeological Resource Sites Impacted	# of Sites	0	0	0	0	0	0	0
Natural Resources	43. Stream Impacts	Linear Feet	0 Feet	0 Feet	0 Feet	0 Feet	0 Feet	0 Feet	0 Feet
	44. Wetland Impacts	Acres	0 Acres	0 Acres	0 Acres	0 Acres	0 Acres	0 Acres	0 Acres
	45. Estimated Street Trees Impacted	# of Trees	0	80	< 10	< 10	< 10	30	< 10
	46. Forested Land Impacted	Acres	0 Acres	0.1 Acres	1.5 Acres	2.5 Acres	3.7 Acres	1.1 Acres	2.8 Acres
	47. Section 4(f) Properties Impacted	Number of Properties	0	8	4	10	10	5	7
	48. Hazardous Materials Sites Identified	# of Low, Medium, and High Priority Sites (and Total #)	N/A	38 Low, 24 Med, 11 High (73 Total)	60 Low, 28 Med, 8 High (96 Total)	72 Low, 34 Med, 9 High (115 Total)	92 Low, 51 Medium, 12 High (155 Total)	73 Low, 28 Med, 8 High (109 Total)	73 Low, 28 Med, 9 High (110 Total)
	49. Estimated Number of Buildings with Potential Noise Impacts	# of Buildings, Moderate or Severe	0 Severe 0 Moderate	260 Severe 1,300 Moderate	< 10 Severe 250 Moderate	180 Severe 1,080 Moderate	110 Severe 980 Moderate	210 Severe 70 Moderate	30 Severe 240 Moderate
	50. Estimated Number of Sites with Potential Vibration Impacts	# of Sites	24	0	69	138	92	476	320
51. Permanent Negative Visual Impacts	Minor Moderate Severe	None	None – Streets restored to original condition after construction	Moderate – would create visible new railroad trench near proposed south portal, located in primarily industrial area	Severe – would create visible new railroad trench near proposed south portal, located in primarily residential area	Severe – would create visible new railroad trench near proposed south portal, located in primarily residential area	Severe – would create visible new railroad trench near proposed south portal, located in primarily residential area	Severe – would create visible new railroad trench near proposed south portal, located in primarily residential area	

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