

Milwaukee County North-South Transit Enhancement Study

TIER 2 EVALUATION

Chapter 6

ENVIRONMENTAL IMPACTS

6.1 OVERVIEW

In this chapter, BRT route alternatives are evaluated based on the expected environmental impacts of changes to vehicle miles traveled (VMT) using the Federal Transit Administration's (FTA) methodology for Small Starts projects, and the potential impacts to historic and cultural resources. As previously shown in the Tier 1 Evaluation, the BRT route alternatives that remain under consideration would not directly impact nearby parks, waterways, or natural areas.

6.2 AIR QUALITY, GREENHOUSE GASES, ENERGY USAGE, AND SAFETY

The following section evaluates the BRT route alternatives based on expected impacts to air quality, greenhouse gases, energy usage, and safety using the FTA methodology for Small Starts projects, which uses changes to VMT to estimate these impacts. Small Starts guidance includes safety as an environmental benefit.

The proposed BRT service is expected to result in a reduction of automobile VMT due to increased ridership, a reduction in VMT for diesel buses due to the elimination of the PurpleLine and changes to other routes, and an increase in VMT for electric buses that will be used on the service. These combined changes would result in a net decrease in VMT for each route alternative with greater decreases expected for route alternatives that include North Option 1, which are expected to result in more new riders (see Chapter 5) and are generally longer, and smaller decreases are expected for route alternatives that include North Option 2.

Table 6.1 shows a range of estimated changes in annual VMT for autos and a static VMT value in 2025 and 2045 for diesel and electric buses by route alternative. Automobile VMT and, subsequently, net changes to annual VMT are a function of ridership estimates and are provided as a range using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future, as described in Chapter 5. Bus VMT is not shown as a range because it is not expected to change within the estimated range of ridership. See Chapter 5 for more detailed information regarding ridership forecasts.

**Table 6.1
Estimated Changes to Annual Vehicle Miles Traveled (VMT) by Vehicle Type and Route Alternative: 2025 and 2045**

Vehicle Type and Year	Route Alternative					
	North Option 1 to South Option A	North Option 1 to South Option B	North Option 1 to South Option C	North Option 2 to South Option A	North Option 2 to South Option B	North Option 2 to South Option C
Automobile	2025 -4,913,000 to -2,331,000	-5,347,200 to -2,604,700	-6,710,000 to -4,202,300	-3,165,000 to -1,501,800	-4,336,700 to -2,180,700	-4,076,400 to -2,793,400
	2045 -4,990,500 to -2,361,700	-5,428,200 to -2,631,400	-6,900,400 to -4,339,200	-3,235,500 to -1,524,600	-4,416,500 to -2,202,300	-4,253,700 to -2,913,600
Bus – Diesel	2025 -771,800	-771,800	-771,800	-692,200	-692,200	-692,200
	2045 -771,800	-771,800	-771,800	-692,200	-692,200	-692,200
Bus – Electric	2025 770,700	883,100	944,700	599,800	703,700	773,800
	2045 770,700	883,100	944,700	599,800	703,700	773,800
Net Changes to Annual VMT	2025 -4,914,100 to -2,332,100	-5,235,900 to -2,493,400	-6,537,100 to -4,029,400	-3,257,400 to -1,594,200	-4,325,200 to -2,169,200	-3,994,800 to -2,711,800
	2045 -4,991,600 to -2,362,800	-5,316,900 to -2,520,100	-6,727,500 to -4,166,300	-3,327,900 to -1,617,000	-4,405,000 to -2,190,800	-4,172,100 to -2,832,000

Note: Automobile VMT and, subsequently, net changes to annual VMT are a function of ridership estimates and are provided as a range, using the 2021 ridership data as a base for the forecasts on the low end of the range and the 2019 ridership data as a base for the high end of the range. This is done to adjust for lower base ridership in 2021 due to the COVID-19 pandemic and uncertainty related to how transit ridership will recover in the near- and long-term future. Bus VMT is not shown as a range because it is not expected to change within the estimated range of ridership.

Source: SEWRPC

Methodology

The FTA Small Starts reporting tool¹ uses a conversion factor to estimate changes in regional air quality pollutants, greenhouse gas emissions, energy usage, and injuries and fatalities based on changes in VMT. These estimates are also provided as a range to account for the range of net changes in VMT used in this analysis. Regional air quality pollutants include carbon monoxide (CO), mono-nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulate matter (PM_{2.5}). Table 6.2 lists each of the conversion factors by vehicle type. Changes in VMT are estimated using ridership forecasts developed using FTA’s STOPS model (described in Chapter 5), and SEWRPC’s regional travel demand model. The current vehicle occupancy average of 1.2 people per vehicle is used for this analysis.

Table 6.2
FTA Factors Applied to Air Pollutants, Greenhouse Gas Emissions,
Energy Usage, and Safety Changes by Vehicle Type: 2025 and 2045

FTA Factors Applied		Year	Vehicle Type		
			Automobile	Bus – Diesel	Bus - Electric
Air Pollutants (grams/VMT)	CO	2025	16.77	5.83	6.45
		2045	10.26	2.89	5.04
	NO _x	2025	0.91	8.67	5.83
		2045	0.20	1.14	3.98
	VOCs	2025	0.60	0.73	0.12
		2045	0.21	0.16	0.10
	PM _{2.5}	2025	0.01	0.48	0.39
		2045	0.01	0.03	0.03
Greenhouse Gases (CO _{2e} /VMT)		2025	532	3,319	2,934
		2045	397	2,721	2,303
Energy Use (Btu/VMT)		2025	7,559	41,436	-- ^a
		2045	5,633	33,978	-- ^a
Safety (per million VMT)	Fatal Crashes	2025	0.013	0.004	0.004
		2045	0.013	0.004	0.004
	Injuries	2025	0.195	1.824	1.458
		2045	0.195	1.824	1.458

^a The FTA Small Starts Reporting Template does not provide an energy use conversion for electric buses.

Source: FTA Small Starts Reporting Templates, 5/14/2021

Air Quality and Energy Usage

Expected net changes in CO, NO_x, VOCs, and PM_{2.5} are shown in Table 6.3 and net changes in greenhouse gases (CO_{2e}), and energy usage are shown in Table 6.4 for each BRT route alternative when compared to the no-build. For all the BRT route alternatives, reductions in CO, VOCs, CO_{2e}, and energy usage are expected in both 2025 and 2045 with larger reductions expected in 2025.

¹ www.transit.dot.gov/funding/grant-programs/capital-investments/small-starts-reporting-instructions.

Table 6.3
Net Changes in Air Pollutants: 2025 and 2045

Route Alternatives	Air Pollutants (kg)							
	CO		NO _x		VOCs		PM _{2.5}	
	2025	2045	2025	2045	2025	2045	2025	2045
North Option 1 to South Option A	-81,920 to -38,620	-49,550 to -22,580	-6,670 to -4,320	1,190 to 1,720	-3,420 to -1,870	-1,090 to -540	-130 to -100	160 to 180
North Option 1 to South Option B	-88,480 to -42,480	-53,470 to -24,780	-6,410 to -3,910	1,550 to 2,110	-3,670 to -2,020	1,180 to -590	-90 to -60	190 to 210
North Option 1 to South Option C	-110,930 to -68,880	-68,270 to -41,990	-7,290 to -5,010	1,500 to 2,010	-4,480 to -2,970	-1,480 to -940	-80 to -60	190 to 220
North Option 2 to South Option A	-53,240 to -25,350	-32,170 to -14,620	-5,380 to -3,870	950 to 1,290	-2,330 to -1,330	-730 to -370	-140 to -120	130 to 140
North Option 2 to South Option B	-72,220 to -36,070	-43,770 to -21,050	-5,850 to -3,880	1,130 to 1,570	-3,020 to -1,730	-970 to -500	-110 to -90	150 to 170
North Option 2 to South Option C	-67,410 to -45,890	-41,740 to -27,990	-5,200 to -4,030	1,440 to 1,710	-2,860 to -2,090	-930 to -650	-80 to -70	170 to 180

Source: SEWRPC

Table 6.4
Net Changes in Greenhouse Gases and Energy Usage: 2025 and 2045

Route Alternatives	Greenhouse Gases (metric tons)		Energy Usage (Million Btu)	
	2025	2045	2025	2045
North Option 1 to South Option A	-2,910 to -1,540	-2,310 to -1,260	-69,100 to -49,600	-54,300 to -39,500
North Option 1 to South Option B	-2,820 to -1,360	-1,110 to -2,220	-72,400 to -51,700	-56,800 to -41,000
North Option 1 to South Option C	-3,360 to -2,030	-1,650 to -2,660	-82,700 to -63,700	-65,100 to -50,700
North Option 2 to South Option A	-2,220 to -1,340	-1,110 to -1,790	-52,600 to -40,000	-41,700 to -32,100
North Option 2 to South Option B	-2,540 to -1,390	-1,140 to -2,020	-61,500 to -45,200	-48,400 to -35,900
North Option 2 to South Option C	-2,220 to -1,510	-1,260 to -1,790	-59,500 to -49,800	-47,500 to -39,900

Source: SEWRPC

Nitrogen oxides and PM_{2.5} are expected to be reduced in 2025 but increase in 2045 for all BRT route alternatives when compared to the no-build. This is because emissions generated by automobiles are expected to see more significant reductions over the next two decades as the vehicle fleet turns over and newer cleaner vehicles replace older vehicles. Electric vehicles already produce significantly lower emissions, and some of the emissions are tied to power generation, which is expected to experience emissions reductions at a slower rate of decline than fossil-fueled vehicles. This results in a net increase in these two emissions.

Traffic Safety

Shown in Table 6.5, small reductions in injuries and fatalities are expected as a result of the net reduction in VMT. As noted above, ridership and VMT have been forecast using a range because of the recent variations in transit ridership due to the COVID-19 pandemic, and therefore, the net changes to injuries and fatalities are also shown as a range. It is expected that additional reductions in injuries and fatalities—not quantified

in Table 6.5—may occur due to reduced excessive automobile travel speeds in the portions of the corridor proposed for physically-separated bus lanes. These reductions could be expected to be similar across all alternatives.

Table 6.5
Net Changes in Injuries and Fatalities: 2025 and 2045

Route Alternatives	Injuries		Fatalities	
	2025	2045	2025	2045
North Option 1 to South Option A	-1.24 to -0.03	-1.26 to -0.03	-0.06 to -0.03	-0.06 to -0.03
North Option 1 to South Option B	-1.16 to -0.03	-1.18 to -0.03	-0.07 to -0.03	-0.07 to -0.03
North Option 1 to South Option C	-1.34 to -0.05	-1.38 to -0.06	-0.09 to -0.05	-0.09 to -0.06
North Option 2 to South Option A	-1.01 to -0.02	-1.02 to -0.02	-0.04 to -0.02	-0.04 to -0.02
North Option 2 to South Option B	-1.08 to -0.03	-1.10 to -0.03	-0.06 to -0.03	-0.06 to -0.03
North Option 2 to South Option C	-0.93 to -0.04	-0.96 to -0.04	-0.05 to -0.04	-0.05 to -0.04

Source: SEWRPC

Summary of Results

Table 6.6 provides the results of the regional air quality pollutant, greenhouse gases, energy usage, and safety evaluations, which are a function of expected changes to VMT. Route alternatives rated as green, which are estimated to result in greater net reductions in VMT, are expected to result in greater net benefits as it relates to these metrics and those rated as yellow are expected to provide smaller net benefits when compared to the no-build alternative.

Table 6.6
Route Alternative Evaluation Results: Air Pollutants, Greenhouse Gas, Energy Usage and Safety

Route Alternative	Air Pollutants	Greenhouse Gases	Energy Usage	Safety	Summary
North Option 1 to South Option A	●	●	●	●	●
North Option 1 to South Option B	●	●	●	●	●
North Option 1 to South Option C	●	●	●	●	●
North Option 2 to South Option A	●	●	●	●	●
North Option 2 to South Option B	●	●	●	●	●
North Option 2 to South Option C	●	●	●	●	●

Source: SEWRPC

6.3 HISTORIC AND CULTURAL RESOURCES

Historic and cultural resources are structures, historic districts, artifacts, and burial sites that represent the heritage of the United States. A description and the number of inventoried historical and cultural resources located within the service area of the BRT route alternatives are provided in the following sections.

Methodology

Historic properties are those buildings, structures, and objects that are eligible for and listed on the National Register of Historic Places (NRHP), the Wisconsin Historic Preservation Database, or have local historic preservation designation. Generally, structures are determined to be historic if they are considered significant regarding architecture, archeology, engineering, or culture. Historic districts are those neighborhoods or areas with clusters of historic properties or that signify a historic event within the same geographic area.

Cultural resources are defined as those that depict past human activity, including burial sites, marked and unmarked cemeteries, and cultural sites that may include artifacts, sites, structures, landscapes, and objects.

Historic and cultural information has been determined using data from the National Register of Historic Places (NRHP), the Wisconsin Historical Society and local historic preservation entities. Other historic and cultural resources may be present in the area, but not yet inventoried in the databases.

Evaluation

With the physical disturbance expected to occur only in the curb-to-curb area of the roadway for the construction of the BRT service along all of the route alternatives, the effect on these resources is expected to be minimal. However, during the environmental phase of the project, consultation with the Wisconsin State Historic Preservation Office (SHPO) will take place and an area of potential effect (APE) will be determined based on the locally preferred alternative and any changes that may be determined during the design phase of the project. Historic and cultural sites within the APE will be evaluated for impacts and documented according to Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA).

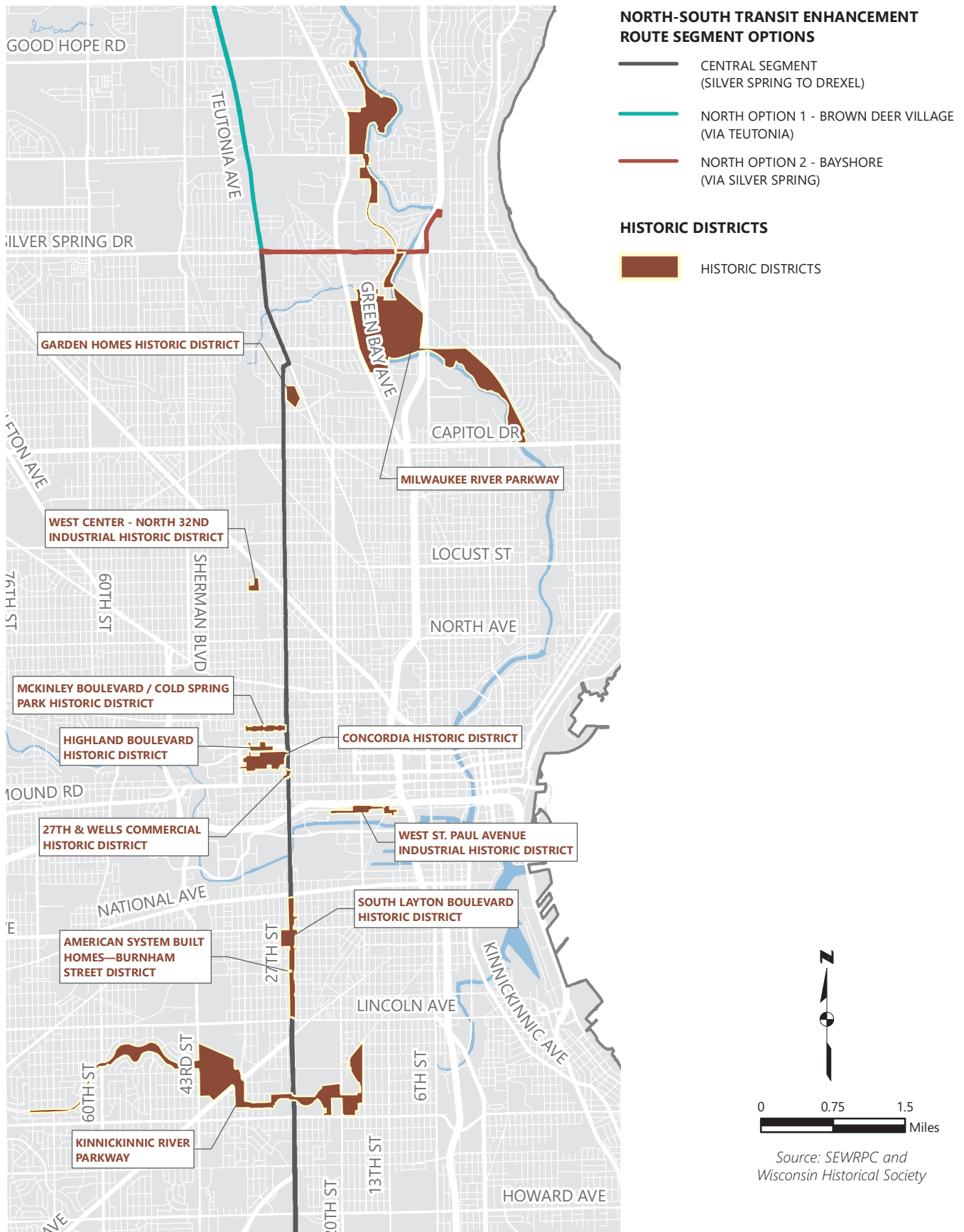
An inventory of historical and cultural resources present within a half mile of each of the remaining alternatives is listed in Table 6.7. Map 6.1 shows the historic districts that are present within a half mile of the route alternatives.

Table 6.7
Historic and Cultural Properties

Route Alternative	Historic Properties (Architecture and Historic Inventory)	Cultural Resources (Archaeological Site Inventory)
North Option 1 to South Option A	3,059	40
North Option 1 to South Option B	3,072	44
North Option 1 to South Option C	3,074	49
North Option 2 to South Option A	3,639	33
North Option 2 to South Option B	3,652	37
North Option 2 to South Option C	3,654	42

Source: SEWRPC and Wisconsin Historical Society

Map 6.1 Historic Districts Within the Study Area



Summary of Results

Table 6.8 shows the results of the impacts to historic and cultural resources evaluation. There are historic districts, historic properties, and cultural resources present near the BRT route alternatives, however, since the construction activities will not disturb these resources, all are rated with a green dot. However, a final determination of any visual, noise or other impacts to these resources will be performed during the environmental and design phase of the project in accordance with Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA).

Table 6.8
Route Alternative Evaluation Results: Impacts to Historic and Cultural Resources

Route Alternative	Historic Districts	Historic Properties	Cultural Resources	Summary
North Option 1 to South Option A	●	●	●	●
North Option 1 to South Option B	●	●	●	●
North Option 1 to South Option C	●	●	●	●
North Option 2 to South Option A	●	●	●	●
North Option 2 to South Option B	●	●	●	●
North Option 2 to South Option C	●	●	●	●

Source: SEWRPC

6.4 CONCLUSIONS

Table 6.9 summarizes the conclusions of the environmental impacts evaluation. Because BRT route alternatives that include Route Option 1 are expected to result in a greater net decrease in VMT, and in turn, result in greater improvements to air quality, lower energy usage, and greater reductions in injuries and fatalities, those route alternatives are rated as green. The remaining route alternatives are rated as yellow, as they would still be expected to result in a net benefit to the environment, but to a slightly lesser degree.

Table 6.9
Route Alternative Evaluation Results: Environmental Impacts

Route Alternative	Air Pollutants, Greenhouse Gas, Energy Usage and Safety	Historic & Cultural Resources	Summary
North Option 1 to South Option A	●	●	●
North Option 1 to South Option B	●	●	●
North Option 1 to South Option C	●	●	●
North Option 2 to South Option A	●	●	●
North Option 2 to South Option B	●	●	●
North Option 2 to South Option C	●	●	●

Source: SEWRPC