Milwaukee County North-South Transit Enhancement Study

TIER 2 EVALUATION

Chapter 7

CAPITAL COSTS

7.1 OVERVIEW

In this chapter, the costs required to build the proposed BRT service are detailed and analyzed for the each of the BRT route alternatives. The details of each of the route alternatives are described in Chapter 2, Detailed Definition of Alternatives. The features of the BRT service, information, limitations, and methodology used to determine the route alternative capital cost estimates are described in the sections below. For the purpose of estimating costs for this project, no additional capital costs are attributed to the no-build alternative.

7.2 CAPITAL COSTS

Capital costs are those construction and purchasing costs associated with each of the proposed BRT service route alternatives under consideration. The cost estimates, required to apply for the FTA's capital investment grant program, provided in this chapter also include professional services costs for the environmental documentation, transit roadway design, and station design. In addition, a thirty percent contingency has been added to the cost estimates, which is appropriate at this early stage. The capital cost estimates for this feasibility study are not intended be a detailed, final cost estimate, but rather they provide a high-level, magnitude of cost comparison for the route alternatives appropriate for the level of planning undertaken in this study. Where noted, higher line-item costs were used to ensure the cost estimate would cover the project options. During the next phases of the project, a more accurate line item-based cost estimate can be developed when more detailed environmental and engineering information is available.

Methodology

FTA has developed a breakdown of costs for capital projects pursuing FTA funds called standard cost categories (SCC) and a workbook that uses the cost categories to develop transit project capital cost estimates. Table 7.1 lists the main cost categories, the typical items for each cost category, a description of the category and sub-category costs, some specific cost items for this project, and the method used to calculate each cost item.

Table 7.1
FTA's Standard Cost Categories

Category Number	Cost Items	Description of Costs Covered
10	Guideway and Track Elements	Roadway configuration (using existing curb-to-curb roadway) where the transit vehicles operate, calculated by length
20	Stations, Stops, Terminals, Intermodal Facilities	Stations, platforms, passenger amenities, including one restroom, calculated by number of items
30	Support Facilities: Yards, Shops, Administration Buildings	Transit maintenance and storage facilities. There are no costs attributed to additions or upgrades to maintenance facilities for this project
40	Sitework and Special Conditions	Construction, demolition, and earthwork that is not included in stations and support facilities, such as curb and bollard transit lane delineation included along high pedestrian crash segments, utility costs, roadway construction beyond what is covered in guideway and track elements, and street scaping/landscaping, calculated by length
50	Systems	Traffic signal infrastructure, communications, central systems control, calculated by length, and next bus automated signage, ticket vending, and ticket validators, calculated by number of units
60	Right-of-Way, Land, Existing Improvements	Includes expected land purchase or easements required for the roadway, stations, or parking areas, calculated by length
70	Vehicles	Buses and spare parts for electric, dual door, forty-foot buses and two on-route fast bus chargers, calculated by number of items
80	Professional Services (applies to categories 10 – 50)	Environmental analysis and documentation, design of roadway configuration, supporting infrastructure and stations, construction administration and management, legal document costs, pre-construction surveys, inspection and testing, and construction startup costs (calculated as a percentage of infrastructure costs)
90	Unallocated Contingency (applies to categories 10 – 80)	Percentage added for unanticipated future costs and escalation. This cost estimate includes a contingency of thirty percent
100	Finance Charges	Costs related to financing the project. A financial plan for the project has not been developed at this time, but will be determined in later phases of the project, therefore, no finance charges have been included in the cost estimates

Source: FTA and SEWRPC

The FTA SCC workbook provides a calculation for each cost item to determine cost estimates for each of the route alternatives. The value for each cost item was derived from estimated and actual costs from the Milwaukee East-West BRT project, under construction as of the writing of this report, and the Wisconsin Department of Transportation's (WisDOT) construction average unit price list[1] and are calculated using the more expensive options for curb-protected lanes (center-running) and buses with opening doors on both

[1] *wisconsindot.gov/hccidocs/contracting-info/average-unit-price.pdf.*

sides that are required for the center-running recommended segments. The cost estimates were also compared to construction costs for other BRT projects in Pittsburgh, Cleveland, and Boston by checking each project's cost categories using FTA's Capital Cost Database.[2]

In addition, each cost item was inflated using published inflation rates based on the Engineering News-Record (ENR) magazine's construction cost index (CCI). The ENR CCI was then used to calculate an inflation factor of seven percent to estimate 2021 costs based on the 2019 East-West BRT cost items. An average annual inflation rate of approximately four percent was used to estimate costs for the years 2022 through 2026. The anticipated year that each item would be purchased or constructed was estimated, and the costs were then inflated to reflect the year of expenditure.

Estimating Capital Costs for BRT Alternatives

As mentioned above, FTA's SCC workbook was used for the route alternative cost estimates using cost categories, and each cost category is calculated based on segment length or item quantity, and unit cost. Table 7.2 shows the variable length and number of units for each of the route alternatives.

Table 7.2
Cost Calculation Quantities by Route Alternative

Route Variables	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
Route Length (one-way, miles)	20.40	22.05	22.95	17.95	19.60	20.50
Exclusive transit lanes (one-way, miles)	16.5	16.5	19.95	14.20	14.20	17.60
Length of center-running curb-protected lanes (one way, miles)[a]	6.5	6.5	6.5	7.86	7.86	7.86
Stations (bi-directional)	68	73	71	63	68	66
Number of buses[b]	27	29	27	24	27	26

[a] *Cost for center-running curb-protected lanes was used for cost estimating since it is the most expensive option. Outside-running curb-protected lanes will also be included with recommendations for outside-running BRT segments.*

[b] *The cost for buses with dual doors, left- and right-opening doors, are required for center-running BRT segments and, therefore, are included in the cost estimate since they represent the most expensive option, a cost increase of approximately 10 percent.*

Source: SEWRPC

As described in Table 7.1, the following cost categories were calculated by the one-way route length: (10) Guideway and Track Elements, including costs based on the length of dedicated transit lanes and mixed traffic lanes for each alternative, (40) Sitework and Special Conditions, except a flat fee was used for

[2] *www.transit.dot.gov/capital-cost-database.*

anticipated additional utility costs, (50) Systems, except a line item for the fare collection system and equipment used unit costs since recent purchase data was available from the East-West BRT project, and (60) Right-of-Way, Land and Existing Improvements, although a value of $500,000 in 2021 dollars was used to cover the cost for obtaining easements for each route alternative based on easement costs for the East-West BRT project. The cost categories that are based on unit costs include: (20) Stations, Stops, and Terminals, including one restroom that may be required at the southern end of all route alternatives, and (70) Vehicles. Costs for (80) Professional Services are estimated by multiplying a percentage (19.4 percent) to the construction subtotal (categories 10 – 50).

The (10) Guideway and Track Elements cost estimates were prepared for each of the alternatives based on the recommended lengths of dedicated transit lanes and mixed traffic lanes. However, specific consideration as to whether dedicated outside-running transit lanes or dedicated center-running transit lanes are used is not included in the cost estimate. The costs that would vary based on whether dedicated center- or outside-running transit lanes include the number of stations—dedicated center-running BRT systems may reduce station costs by sharing stations in some areas, but those details will be determined in later phases of the project—and the addition of vertical separation elements, which provide a physical barrier between the transit lane and general-purpose travel lanes.

For this cost estimate, vertical separation elements are defined as a raised concrete curb with 36-inch-high bollards every six feet; however, other treatment options may be considered in future phases of this project. Vertical separation elements are recommended in parts of the study corridor that have been identified as having a prevalence of reckless driving and pedestrian crashes—more details, including specific segments recommended for this treatment, are provided in Chapter 4. The length of vertical separation elements would vary based on whether dedicated center-running transit lanes or dedicated outside-running lanes are present. Dedicated outside-running transit lanes would require more curb openings to accommodate driveways and right turns, whereas vertical separation elements along a dedicated center-running transit lane would be more continuous, with gaps needed only for median openings and intersections that would require cross traffic usage. The cost for the vertical separation elements were calculated for a dedicated center-running transit lane to provide a more conservative cost estimate.

The East-West BRT project's forty-foot electric buses were used as the base vehicle cost. However, vehicles with dual-side doors would be required if a dedicated center-running transit lane with stations in the median is used on portions of the proposed BRT service. To account for this possibility, an extra 10 percent was added to base cost of the East-West BRT vehicles. The estimated number of buses that would be needed

for each route alternative, listed in Table 7.2, was calculated based on anticipated electric charging requirements for the buses, although once in use on the East-West BRT corridor, charging and usage efficiencies may be realized for a reduction in the number of buses required for this corridor.

Capital Cost Estimates

Table 7.3 provides the estimated total cost and cost by category for each route alternative, inflated to the year of expenditure and including the applied contingency of 30 percent (standard cost category 90). These estimated costs were developed using cost data from the East-West BRT project, the WisDOT construction pricing data, and the previous costs items as described in the Methodology section above.

Table 7.3
Cost Estimates by Route Alternative in Year of Expenditure

Standard Cost Categories	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 ($)	North Option 2 to South Option C ($)
10	4,526,900	4,777,400	5,212,900	3,955,600	4,206,200	4,637,300
20	9,093,200	9,720,600	9,469,600	8,465,800	9,093,200	8,842,200
30	0	0	0	0	0	0
40	42,204,000	45,278,500	47,600,200	38,268,500	41,343,000	43,032,800
50	12,809,800	13,858,400	13,851,700	11,869,800	12,924,900	12,924,600
60	584,000	584,000	584,000	584,000	584,000	584,000
70	44,370,600	47,570,800	44,370,600	39,570,300	44,370,600	42,770,500
80	12,364,400	13,273,400	13,731,200	11,248,200	12,158,200	12,505,000
90	37,785,800	40,519,000	40,446,100	34,188,600	37,404,000	37,588,900
100	0	0	0	0	0	0
Total Estimate[a]	163,738,600	175,582,100	175,266,300	148,150,700	162,084,100	162,885,400

[a] *Rounded to nearest $100.*

Source: SEWRPC

Summary of Cost Estimates

Table 7.4 provides a summary with a rating for all route alternative capital cost estimates using green, yellow, and red dots to signify the magnitude of cost. Based on the results of the evaluations outlined in this chapter, North Option 2 to South Option A is rated as green as the least expensive route alternative. North Option 1 to South Option A, North Option 2 to South Option B, and North Option 2 to South Option C have relatively similar capital cost impacts that are all a moderate amount higher than the least expensive alternative and, therefore, are rated as yellow. North Option 1 to South Option B and North Option 1 to South Option C are rated as red as they are the most expensive route alternatives.

Table 7.4
Summary of Capital Cost Estimates for Route Alternatives

Route Alternatives	Capital Costs
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