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**EAST  
WEST BRT**  
a feasibility study

MILWAUKEE COUNTY EAST-WEST BUS RAPID TRANSIT

Evaluation and  
Screening  
Framework

REVISION #1

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**Prepared for:**

Milwaukee County  
10320 W. Watertown Plank Rd.  
Wauwatosa, WI 53226

**Prepared by:**

AECOM

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## REVISIONS

REVISION NO.	DATE	PREPARED BY
0	April 22, 2016	AECOM – Suprock
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# CONTENTS

- 1. REPORT OVERVIEW .....1-1
- 2. OVERVIEW OF THE EVALUATION PROCESS .....2-2
- 3. TIER 1 EVALUATION .....3-5
- 4. TIER 2 EVALUATION .....4-5
- 5. TIER 3 REFINEMENT .....5-10

## FIGURES

Figure 3-1: East-West Corridor Segments for Tier 1 Evaluation..... 3-3  
 Figure 4-1: Example Spreadsheet Tool ..... 4-9

## TABLES

Table 2-1: Draft Evaluation Criteria ..... 2-3  
 Table 3-1: Tier 1 Mode Evaluation Criteria ..... 3-5  
 Table 3-2: Tier 1 Evaluation Alignments ..... 3-3  
 Table 3-3: Tier 1 Alignment Evaluation Criteria ..... 3-4  
 Table 4-1: Tier 2 Evaluation Criteria: Tech Memo #1: Station Area..... 4-6  
 Table 4-2: Tier 2 Evaluation Criteria: Tech Memo #2: Transportation ..... 4-7  
 Table 4-3: Tier 2 Evaluation Criteria: Tech Memo #3: Environmental Impacts ..... 4-7  
 Table 4-4: Tier 2 Evaluation Criteria: Tech Memo #4: Capital Costs ..... 4-8  
 Table 4-5: Tier 2 Evaluation Criteria: Tech Memo #5: O&M Costs ..... 4-8  
 Table 4-6: Tier 2 Evaluation Criteria: Tech Memo #6: Ridership ..... 4-8

# 1. REPORT OVERVIEW

This report provides an overview of the evaluation criteria that will be used during the Tier 1, Tier 2 and Tier 3 evaluation of alternatives that will be conducted as part of the East-West Corridor BRT Feasibility Study. As described in Section 2 of this report, the evaluation criteria listed in Sections 3 through 5 of the report have been preliminarily identified and defined; they may be modified as the project moves forward through successive tiers of alternative definition and evaluation.

## 2. OVERVIEW OF THE EVALUATION PROCESS

In order to evaluate the initial group of transit modes and alignment options and identify the appropriate mode-alignment pairings that will comprise the detailed alternatives, the East-West Corridor Study will follow a three-step method.

- The first step (“Tier 1 Evaluation”) will entail the assessment of each mode and alignment relative to overall implementation viability.
- The second step (“Tier 2 Evaluation”) will assess the mode/alignment pairings that passed the Tier 1 Evaluation and compare the benefits and impacts of each.
- The alternative(s) that fare(s) best against the detailed criteria in this second step will be identified as Preferred Alternative(s) and further refined in the third step (“Tier 3”). The Locally Preferred Alternative will be identified at the conclusion of the third step.

The evaluation criteria associated with each step are a combination of quantitative and qualitative performance measures.

- The Tier 1 Evaluation will apply fewer and broader measures, including information from previous corridor/area studies. The analysis will largely rely on order-of-magnitude estimates and the outcomes of similar transit projects from around the country.
- The Tier 2 Evaluation will apply more detailed and alternative-specific evaluation results.
- The Tier 3 Evaluation will evaluate the Preferred Alternative(s) against federal criteria to identify and refine the Locally Preferred Alternative.

This three-step process will result in the identification of an LPA that not only meets locally-identified project purpose and needs, but is also competitive for federal funding.

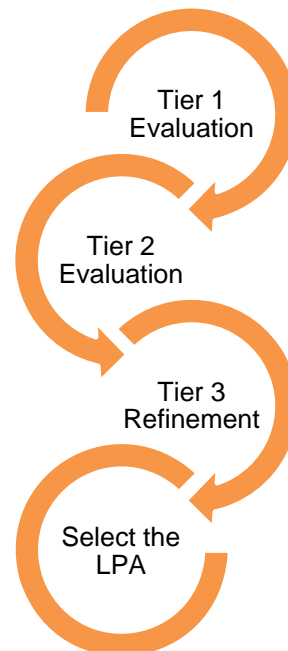


Table 2-1 presents the evaluation criteria that are likely to be used during the three steps of alternative evaluation. Note that each successive step builds upon the criteria from the previous step, ensuring a consistent rating throughout. These criteria are described in more detail in Sections 3 through 5 of this report.

**Table 2-1: Draft Evaluation Criteria**

Project Goals	Evaluation Phases		
	Tier 1 (qualitative analysis)	Tier 2 (qualitative and quantitative)	Tier 3 (quantitative and qualitative)
Increase the efficiency, attractiveness and utilization of transit for all users	Typical ridership capacity Typical service characteristics	Ridership Transit travel times	Mobility improvements*
Efficiently manage the forecasted increase in corridor travel demand	Engineering / operational feasibility	Traffic impacts Parking impacts Potential right-of-way impacts Bicycle and pedestrian impacts	Mobility improvements* Congestion relief*
Contribute to a socially-, economically-, and environmentally-sustainable transportation network	Environmental impacts (visual, natural) Demonstrated ability to catalyze economic development Consistency with existing and planned corridor character Compatibility with local and regional plans	Station area population and employment Equitable access Station area development potential Natural environment impacts Cultural / historic impacts	Economic development* Land use* Environmental benefits*

Evaluation Phases			
Project Goals	Tier 1 (qualitative analysis)	Tier 2 (qualitative and quantitative)	Tier 3 (quantitative and qualitative)
Develop and select an implementable and community-supported project	Typical per-mile capital cost	Capital and operating and maintenance costs Cost effectiveness	Financial capacity analysis* Cost effectiveness*

\*consistent with FTA New Starts/Small Starts criteria



### 3. TIER 1 EVALUATION

The purpose of the Tier 1 evaluation is to identify the modes and alignments that are not feasible for implementation within the East-West Corridor. As discussed in Section 2 of this report, the Tier 1 evaluation will apply broad, qualitative measures, including information from previous corridor/area studies, that is designed to identify whether a mode or alignment is feasible for implementation – rather than if it is the comparatively best alternative. The assessment of benefits will occur during the Tier 2 evaluation. The Tier 1 evaluation will largely rely on order-of-magnitude estimates and the outcomes of similar transit projects from around the country.

Modes and alignments will be measured against each criteria on a pass / fail basis; if the mode or alignment receives one or more “fail” rankings, it will be removed from further consideration as part of the East-West Corridor Feasibility Study.

The modes under consideration in the Tier 1 Analysis will include:

- Bus Rapid Transit
- Light Rail
- Streetcar
- Commuter Rail

The criteria, data sources, and pass/fail benchmarks for the evaluation of modes are shown in Table 3-1.

**Table 3-1: Tier 1 Mode Evaluation Criteria**

Evaluation Criteria	Evaluation Outcome	Data Sources	Fail Threshold
Typical ridership capacity	Ability of the mode to meet rider demand without providing excess capacity	Industry standard ranges of ridership by mode, as demonstrated by operational peer systems	Mode typically carries less than 10,000 riders/per day or more than 20,000/day
Typical service characteristics	Ability of the mode to provide frequent, all-day service	Typical operating characteristics of modes, as demonstrated by peer systems	Mode typically provides only peak-hour /commuter-oriented service

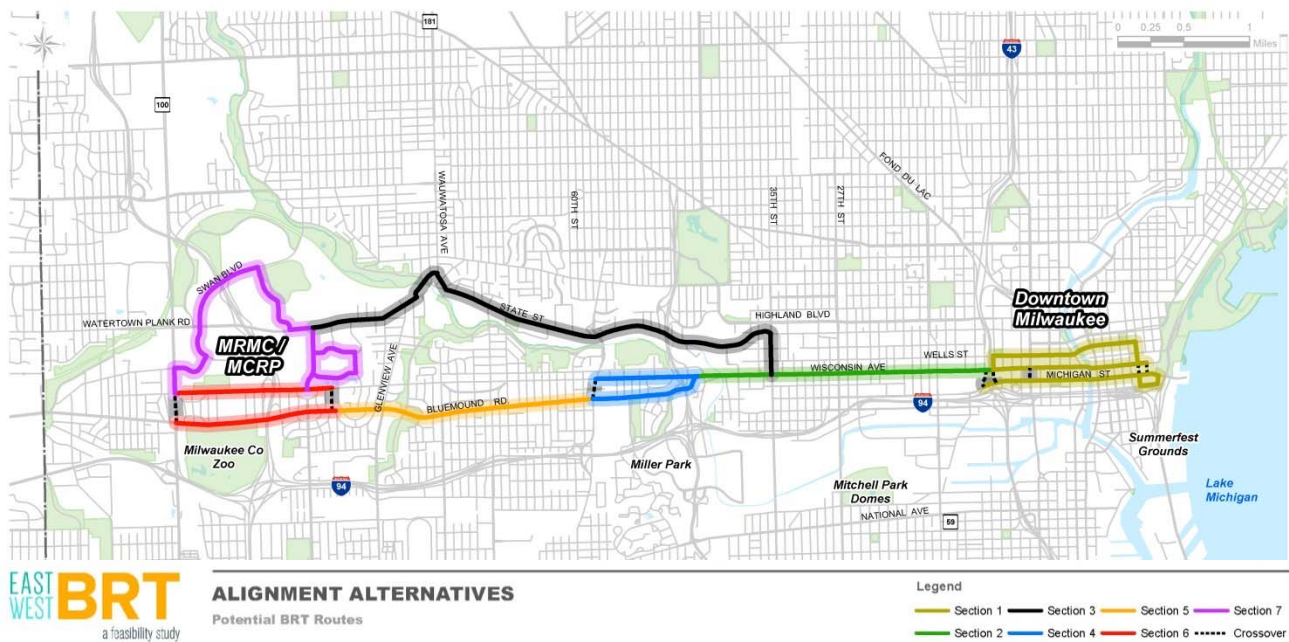
Evaluation Criteria	Evaluation Outcome	Data Sources	Fail Threshold
Environmental impacts	Degree to which a mode introduces a significant new visual element into the corridor and/or generates significant noise and vibration impacts	Review of each mode’s typical physical and operational characteristics	Mode introduces intrusive visual elements and/or generates significant noise and vibration
Demonstrated ability to catalyze economic development	Demonstrated ability of each mode to catalyze station area economic development	Review of peer agencies and systems from around the country	Mode does not tend to catalyze station area economic development
Consistency with existing and planned corridor character	Degree to which each mode is consistent with the existing and planned corridor character	Review of each mode’s typical physical and operational characteristics within the context of the corridor’s development pattern and character	Mode would be disruptive to/in conflict with existing and planned corridor character
Compatibility with local and regional plans	Degree to which each mode is consistent with local and regional plans	Review of existing local and regional plans (as documented in the Existing Conditions and Purpose and Need Reports)	Mode is not recommended for implementation in one or more local/regional plans
Typical per-mile capital costs	Typical per-mile capital cost by mode	Average per-mile capital cost of projects in the FTA Project Development pipeline	Mode typically cost more than \$XXM/mile (threshold to be determined by MCTS)

The alignments under consideration during the Tier 1 Evaluation are shown in Figure 3-1 and described in Table 3-2.

**Table 3-2: Tier 1 Evaluation Alignments**

Color	Segment Boundaries	Potential Alignments
Yellow	Downtown	Wisconsin Avenue Michigan Street Wells Street
Green	10th Street to 45th Street	Wisconsin Avenue
Black	State Street	--
Blue	45th Street to Hawley Road	Wisconsin Avenue Bluemound Road
Orange	Hawley Road to 89th Street	Bluemound Road
Red	89th Street to Highway 100 / Mayfair Road	Wisconsin Avenue Bluemound Road
Pink	MRMC / MCRP / Swan Boulevard / Mayfair Rd	--

**Figure 3-1: East-West Corridor Segments for Tier 1 Evaluation**



The criteria, data sources, and pass/fail benchmarks for the evaluation of alignments are shown in Table 3-3.

**Table 3-3: Tier 1 Alignment Evaluation Criteria**

Evaluation Criteria	Evaluation Outcome	Data Sources	Fail Threshold
Engineering / operational feasibility	Qualitative assessment of potential engineering and/or operational constraints that would affect implementation viability	Review of the roadway conditions contained in the Existing Conditions Report in combination with typical transit right-of-way requirements	An alignment is judged not to be viable for implementation because of engineering and/or operational constraints
Environmental impacts	Degree to which transit service along the alignment would introduce a significant new visual element into the corridor and/or potentially generate significant adverse impacts to the natural environment	Review of each alignment’s visual profile and presence of natural resources (based on SEWRPC GIS information)	Transit service along the alignment would introduce intrusive visual elements and/or potentially generate significant adverse impacts to the natural environment
Consistency with existing and planned corridor character	Degree to which transit investment along each alignment is consistent with the existing and planned corridor character	Review of transit service compatibility with the existing and planned development pattern and character of the corridor	Transit service would be disruptive to/in conflict with existing and planned corridor character

## 4. TIER 2 EVALUATION

The Tier 2 Detailed Evaluation of Alternatives will evaluate the mode and alignment pairings that advance through the Tier 1 evaluation by analyzing more detailed, alternative-specific aspects of the alternatives. At the beginning of Tier 2, station locations will be identified along each alignment and service plans for the mode and alignment combinations will be created. A No Build alternative, which will include existing and programmed corridor transit service, will serve as the baseline against which the Build alternatives will be compared.

The Tier 2 Evaluation will apply the following criteria; the methodologies, data sources, and results of each evaluation criterion will be organized into the following six technical memoranda. The six tech memos will be included as appendices to a summary Tier 2 Evaluation report:

- Tech Memo #1: Station Area
  - Station area population and employment
  - Equitable access to the transit investment
  - Development potential
- Tech Memo #2: Transportation
  - Right-of-way impacts
  - Parking impacts
  - Traffic impacts
  - Safety impacts
  - Bicycle and pedestrian mobility and accessibility impacts
  - Transit travel time

- Tech Memo #3: Environmental Impacts
  - Natural environment
  - Cultural, social, and historical impacts
- Tech Memo #4: Capital costs (including cost effectiveness)
- Tech Memo #5: O&M costs
- Tech Memo #6: Ridership forecasts

The Tier 2 evaluation criteria were initially identified in the project Purpose and Need Report, and were chosen because they will help to determine which of the alternatives best meet the project’s stated purpose and need.

The criteria, evaluation outcomes, and data sources for the evaluation of Tier 2 alternatives are summarized by tech memo in Tables 4-1 through 4-6.

**Table 4-1: Tier 2 Evaluation Criteria: Tech Memo #1: Station Area**

Evaluation Criteria	Evaluation Outcome	Data Sources
Station area population and employment	Existing and forecast population and employment counts and density in the half-mile around each station location	SEWRPC regional model and US Census American Community Survey 2010-2014 Five-Year Estimates
Equitable access to the transit investment	Number and percent of households living below the poverty line, zero-car households, and people of color living with a half-mile of each station location	US Census American Community Survey 2010-2014 Five-Year Estimates
Development potential	Qualitative assessment of each station area’s development potential based on land uses and presence of transit-supportive zoning	Current zoning regulations as provided by the Wauwatosa and Milwaukee along each alternative and at each station location, SEWRPC data, and desktop research/aerial imagery

**Table 4-2: Tier 2 Evaluation Criteria: Tech Memo #2: Transportation**

Evaluation Criteria	Evaluation Outcome	Data Sources
Right-of-way impacts	Qualitative assessment of ROW needs along each alignment by reviewing existing ROW and parcel data, and GIS aerials	Recent GIS aerial imagery from SEWRPC will form the basis for the analysis
Parking impacts	Number of on-street parking spaces that may be impacted by each alternative	Field work of signed and marked on-street spaces; in the event that on-street spaces are not marked on the pavement, a parking space length of 20 feet will be assumed
Traffic impacts	Potential traffic impacts of the alternatives from a level of service and time delay (at select critical intersections) perspective	Average annual daily traffic counts and intersection turn movement counts; previous traffic studies, as appropriate and relevant
Safety impacts	Forecast reduction in roadway fatalities	Vehicle miles travelled by alternative, compared to the No Build; FTA-approved methodology, including formula
Bike and pedestrian mobility and accessibility impacts	Qualitative assessment of the degree to which each alternative will positively impact existing bike and pedestrian facilities, and the degree to which the alternative is compliant with bike and pedestrian plans	Regional and local bike and pedestrian policies and plans
Transit travel time	Travel time by alternative	Project service plans

**Table 4-3: Tier 2 Evaluation Criteria: Tech Memo #3: Environmental Impacts**

Evaluation Criteria	Evaluation Outcome	Data Sources
Natural environment	Each alternative will be evaluated for the impact that it would have on regional air quality pollutants, energy use, and greenhouse gas emissions; this methodology incorporates the change in distance traveled by automobiles and transit vehicles	FTA-approved methodology, including formula

Evaluation Criteria	Evaluation Outcome	Data Sources
Cultural, social and historical impacts	Number of cultural and historic sites that may be impacted by alternative. Cultural and social resources include: concert venues, museums, zoos, city halls, parks, churches, schools, and outdoor market/farmer’s market, and National Register of Historic Places (NRHP) sites and districts	Desktop review

**Table 4-4: Tier 2 Evaluation Criteria: Tech Memo #4: Capital Costs**

Evaluation Criteria	Evaluation Outcome	Data Sources
Capital cost by alternative	Capital cost of each alternative in \$2016 in FTA’s Standard Cost Category workbook format	WisDOT unit prices; MCTS unit prices; industry standard unit prices
Cost effectiveness of each alternative	FTA-compliant rating of cost-effectiveness	FTA-approved cost-effectiveness methodology, including formulas

**Table 4-5: Tier 2 Evaluation Criteria: Tech Memo #5: O&M Costs**

Evaluation Criteria	Evaluation Outcome	Data Sources
Annual O&M costs	Annual O&M costs for the Build alternatives and the background bus network	MCTS unit costs; project service plans

**Table 4-6: Tier 2 Evaluation Criteria: Tech Memo #6: Ridership**

Evaluation Criteria	Evaluation Outcome	Data Sources
Daily ridership by alternative and station location	Daily ridership by station by alternative, including the number of transit-dependent riders and impacts to system ridership	SEWRPC regional travel demand model; project service plans and travel times

After the Tier 2 evaluation results are generated, an Excel-based spreadsheet tool will be created to help decision-makers to understand – in real-time - the trade-offs of design decisions across some of the key Tier 2 evaluation criteria: capital costs, traffic impacts, and



transit travel time. Ridership and O&M costs can then also be estimated based on the design decisions made.

The alignment associated with each service place will be segmented to facilitate the mixing-and-matching of different runningway configurations (BRT in mixed traffic, BRT in a dedicated center lane, and BRT in a dedicated side lane) along the length of the corridor. This segmentation will likely be consistent with the segments used in the Tier 1 evaluation.

The tool, which will be structured similarly to the example shown in Figure 4-1, will include drop-down menus that allow the user to select a segment’s runningway configuration, and then – based on that decision – will immediately auto-populate the outcome of that decision across capital costs, transit travel time, and traffic delays columns.

The tool enables the user to geographically isolate areas of negative cost, travel time, or traffic impacts, and to modify design decisions to mitigate those impacts.

**Figure 4-1: Example Spreadsheet Tool**

Segment	Service Plan	Runningway	Capital Cost	Travel Time	Travel Time Savings	Additional Traffic Delay at Intersections	
						AM Peak	PM Peak
A	Service Plan 2	Dedicated curb - construct	\$ 20,100,000	04:38	00:17	--:00:20	--:00:05
B	Service Plan 2	Dedicated curb - construct	\$ 15,100,000	05:15	00:36	--:00:02	--:00:01
C	Service Plan 2	Dedicated curb - convert	\$ 9,500,000	05:22	01:01	:01:28	:01:26
D (N of Manning)	Service Plan 2	Dedicated curb - convert	\$ 8,900,000	04:04	00:56	:00:39	:01:30
D (S of Manning)	Service Plan 2	Mixed traffic - TSP	\$ 3,800,000	08:19	00:39	:00:00	:00:00
E	Service Plan 2	Dedicated curb - construct	\$ 17,600,000	05:32	00:22	:00:04	--:00:04
Fleet and systemwide expenses	Service Plan 2	Dedicated curb - construct	\$ 21,800,000				
<b>Total</b>			<b>\$ 96,800,000</b>	<b>33:10</b>	<b>03:51</b>	<b>01:49</b>	<b>02:46</b>
Maximum Small Starts Share (5309)			\$ 77,440,000				
Necessary Non-Small Starts Match			\$ 19,360,000				

## 5. TIER 3 REFINEMENT

The alternative(s) that advance through the Tier 2 detailed evaluation [called the Preferred Alternative(s)] will be subject to additional refinement and tweaking during Tier 3.

The criteria that may be used to refine the Preferred Alternative(s) are consistent with the criteria that are used by the FTA when it evaluates projects for potential funding through the Small Starts program, including:

- Mobility improvements
- Congestion relief
- Economic development effects
- Land use
- Environmental benefits
- Cost effectiveness
- Financial capacity

The purpose of his final level of refinement is to ensure that the recommended investment's competitiveness for federal funding is maximized, while ensuring that it stills meets the project purpose and need.

At the conclusion of the Tier 3 refinement, the Preferred Alternative(s) become the Locally Preferred Alternative, which is then carried forward for consideration by local and regional policymakers, including the Cities of Wauwatosa and Milwaukee, the Milwaukee County Board of Supervisors, and SEWRPC.