Wake County Transit Plan MIS

BRT Evaluation Framework

BRT EVALUATION FRAMEWORK

OVERVIEW

As part of the Wake County Transit Plan Major Investment Study (MIS), the 20 miles of BRT infrastructure defined by the Wake Transit Plan will be further refined into specific concept alignments. In order to select a preferred routing for each general corridor and to prioritize the implementation of BRT infrastructure, the evaluation framework will be applied to understand the relative performance of potential corridor alignments and configurations, and their ability to meet the community's goals.

The evaluation metrics shown in Figure 1 are meant to allow potential BRT corridors to be compared to one another in order to identify which alignment alternatives have the potential to be most successful. Comparisons will be made over two tiers of evaluation, described below. Please note that both tiers of the evaluation will take place within Phase 1 of the MIS planning process:

- Tier 1: All potential concept alignments within each of the four corridors will be evaluated in order to understand strengths and weaknesses of each of the variants within the north, south, east, and west corridors. Because corridors with multiple variants may have shared segments that are common to two or more variants, all concept alignments within a corridor will be broken into unique segments. This will ensure that the evaluation produces clear comparisons to aid decisions about which segments to piece together to create a preferred alignment within each corridor. The results of this tier will also provide a baseline understanding of how the four corridors compare to each other.
- Tier 2: Using the results of the Tier 1 evaluation, the travel demand analysis, and feedback from the public engagement process, potential BRT projects will be defined. Projects may include different configurations of the selected north, south, east, and west corridor alignments from Tier 1. The evaluation framework will be applied to potential BRT projects in order to understand how they compare to one another.

While most metrics will be used in both evaluation tiers, those that incorporate ridership projections will only be applied during Tier 2. This is because the ridership modeling effort will be conducted once BRT "projects" are defined, which will take place after the Tier 1 evaluation and likely include combinations of the north, south, east, and west corridors.

Some of the metrics are based on data points that factored into the FTA Capital Investment Grant (CIG) funding criteria. This ensures that projects that are prioritized as part of the MIS process have characteristics that are required for federal funding. However, not all measures described below are a part of the FTA funding process, and instead are intended to ensure that the proposed projects integrate into the existing transit system in Wake County.

Metrics are also based on feedback collected during the first round of public engagement regarding the prioritization of large projects. When asked how the Wake Transit Plan should prioritize large projects, respondents favored projects that would attract the most ridership, improve access to underserved neighborhoods, have high level of community support in the project corridor, and increase economic growth in the corridor. This evaluation framework includes metrics based on ridership, equity, and economic development, which reflect both community feedback and FTA CIG criteria. A robust public engagement process will continue to inform the outcomes of the MIS so that it represents a balance of community support and technical merit. The goal of the evaluation process is to prioritize projects that address the community's goals and desires and to identify which projects are well positioned to be realized through the FTA funding process.

Data sources for the evaluation metrics are a combination of publicly available data sets and projections that will be developed as part of the MIS process. The future bus network as defined by the Wake Transit Plan will be used to evaluate potential integration of BRT infrastructure and other bus routes. The Census American Community Survey (ACS) and Longitudinal Employer Household Dynamics (LEHD) dataset will be used to evaluate demographic and employment characteristics of the areas surrounding each BRT corridor. The MIS will produce conceptual designs, speed predictions, cost estimates, and ridership estimates, which will be used to compare predicted performance of potential BRT alignments.

It is important to note that the evaluation framework developed for the MIS is designed to serve as a decision-making aid in selecting and prioritizing concept corridor alignments. This evaluation framework is not designed to provide guidance on detailed turn-by-turn movements for each corridor nor will it necessarily produce a definitive recommendation for corridor alignments and prioritization. The mix of quantitative and qualitative metrics in the framework will allow potential alignments to be compared to each other using consistent data sets as a way to communicate the relative merit of each potential alignment across a range of characteristics. However, this evaluation must be integrated with community and stakeholder input to ultimately identify a set of preferred alignments and implementation plans.

Figure 1| Evaluation Framework

Category	Prioritization Metric	Evaluation Methodology	Data Source
Speed & Reliability	Speed improvement	Calculate the change in average speed in the corridor by comparing existing bus speeds to anticipated BRT speed. Example output: 1.3 mph improvement	Existing bus speeds operating in mixed traffic and projected BRT speeds to be developed as part of the MIS based on stop spacing, intersections, dedicated running way, etc. Assumptions for each speed improvement will be documented.
	Reliability*	Calculate percent of corridor length in each direction that has transit-only ROW. Example output: 53% dedicated ROW	Conceptual design
Supporting Bus Network Connections	Potential corridor connections	Determine the number of planned bus routes that could use a portion of the infrastructure (qualitative assessment). Example output: 4 bus routes	Wake Transit Plan route network in Tier 1. If schedule permits, 2027 network from MYBSIP will be used in Tier 2.
	Potential corridor utilization	Determine the number of planned peak buses per hour that could use a portion of the infrastructure, based on set of routes identified in the measure above. Example output: 9 buses per hour	Wake Transit Plan route frequencies in Tier 1. If schedule permits, 2027 frequencies from MYBSIP will be used in Tier 2.

* These metrics are based on inputs to the FTA CIG evaluation process.

Category	Prioritization Metric	Evaluation Methodology	Data Source
Connectivity	Connections to frequent transit	Determine the number of planned routes that will operate at least every 15 minutes that provide a transfer opportunity with the corridor. Example output: 5 intersecting 15-minute routes	Wake Transit Plan network shapefile in Tier 1. If schedule permits, 2027 network from MYBSIP will be used in Tier 2.
	Connections to commuter rail	Determine the number of planned commuter rail stations that intersect the corridor. Example output: zero connecting stations	Wake Transit Plan.
	Ease of access*	Calculate the intersection density within ½ mile† of the corridor, excluding interstates and ramps. Example output: 115 intersections per sq. mile	Road network shapefile
Equity	Affordable housing access*	Calculate the ratio of legally binding affordability restricted housing units to all housing units within ½ mile† of corridor.	National Housing Preservation Database and supplemental data from TJCOG (http://www.preservationdatabase.org/) Recent 5-year ACS (block group)

* These metrics are based on inputs to the FTA CIG evaluation process.

† All calculations of ½-mile buffers will be completed using the road network to measure distance rather than straight-line distance. This will more accurately capture what is within a ½ mile of the corridor, an acceptable walking distance to premium transit.

Category	Prioritization Metric	Evaluation Methodology	Data Source
		Example output: 21% affordable units	
	Minority access	Calculate the ratio of minority residents to all residents living within ½ mile† of corridor. Definition of minority will be consistent with TRM definition. Example output: 36% minority residents	Recent 5-year ACS data (block group)
	Transit dependent access*	Calculate the ratio of zero vehicle households to all households located within ½ mile† of corridor Example output: 15% zero vehicle households	Recent 5-year ACS data (block group)
Ridership & Cost Effectiveness	New transit trips*‡	Calculate the change in corridor ridership by comparing the projected ridership to ridership on segments of existing routes in the corridor. Example output: 3,200 new weekday riders	TRM v6 ridership model output

* These metrics are based on inputs to the FTA CIG evaluation process.

† All calculations of ½-mile buffers will be completed using the road network to measure distance rather than straight-line distance. This will more accurately capture what is within a ½ mile of the corridor, an acceptable walking distance to premium transit.

‡ This metric will only be used in Tier 2 of the evaluation.

Category	Prioritization Metric	Evaluation Methodology	Data Source
	Operating cost per passenger trip*‡	Divide the predicted daily operating cost by the predicted daily ridership (2045) of BRT service and non-branded corridor service. Example output: $3.92 per passenger trip	Operating cost estimates (2018 dollars) and TRM v6 ridership model output
	Capital cost per passenger trip*‡	Divide the predicted total capital cost by the predicted daily ridership (2045) of BRT service and non-branded corridor service. Example output: $43,100 per passenger trip	Capital cost estimates (2018 dollars) and TRM v6 ridership model output
Transit Supportive Land Use	Total People + Jobs served*	Calculate the total number of residents and jobs within ½ mile† of corridor. Example output: 110,800 people+jobs	2045 projections from TRM v6
	Concentration of People + Jobs*	Calculate the number of residents and jobs within ½† mile of corridor divided by the ½ mile network buffer around the corridor.	2045 projections from TRM v6

* These metrics are based on inputs to the FTA CIG evaluation process.

‡ This metric will only be used in Tier 2 of the evaluation.

† All calculations of ½-mile buffers will be completed using the road network to measure distance rather than straight-line distance. This will more accurately capture what is within a ½ mile of the corridor, an acceptable walking distance to premium transit.

Category	Prioritization Metric	Evaluation Methodology	Data Source
		Example output: 17,100 people+jobs per mile	
	Economic development potential*‡	Quantitative assessment based on inputs such as planned developments and community visions for future development, and/or CommunityViz suitability scores Example output: CommunityViz suitability score by segment	Community plans, developer plans, TJCOG CommunityViz Land Suitability Analysis Assumes CommunityViz has been updated by the Cities of Raleigh, Cary, and Garner to reflect multiple BRT corridor options.
Sustainability	VMT reduction*‡	Calculate the reduction in Vehicle Miles Traveled (VMT) that would result from implementation of a BRT corridor. Example output: 9,600 fewer weekday VMT	TRM v6 ridership model output
	Environmental impact	Quantitative assessment of potential negative impacts on existing features due to construction of BRT infrastructure. Example output: The sum of potential impacts created by BRT infrastructure.	GIS layer of EMS stations, fire stations, hospitals, libraries, parks, police departments, schools, cemeteries, places of worship, utility lines, waterways/floodplains, wetlands, biodiversity & wildlife habitat, hazardous waste sites, water resources & water supplies, historic properties, and public open spaces.

*These metrics are based on inputs to the FTA CIG evaluation process.

‡ This metric will only be used in Tier 2 of the evaluation.

Category	Prioritization Metric	Evaluation Methodology	Data Source
Constructability	Constructability	Qualitative assessment of elements that may cause construction to be more difficult, including ease of right-of-way acquisition, need for structures, and intersection/interchange operations. Example output: relative rating on scale of 1-3 where 1 represents ease of construction and 3 represents more difficulty of construction	Conceptual design

EXPLANATION OF METRICS

Speed Improvement

Travel time savings is a primary feature of successful BRT systems in the U.S. By measuring the difference in average operating speed between existing bus service operating in mixed traffic and proposed BRT service, this metric indicates the potential travel time savings that riders would experience. A larger change in travel time savings will be considered a positive characteristic of a potential BRT corridor.

Reliability

The FTA Capital Investment Grant (CIG) requires that projects operate at least 50% of their alignment in dedicated right-of-way during peak times (at a minimum) to be eligible for fixed-guideway funding. Segments of dedicated right-of-way remain congestion free and provide BRT with competitive travel time to driving. The more of a BRT alignment that has all-day dedicated right-of-way, the more likely residents of Wake County will view it as a logical alternative to driving.

Potential Corridor Connections

This metric indicates the potential for BRT infrastructure to provide enhancements to the larger bus network. If existing routes can be modified to have access to dedicated right-of-way, queue jumps, and/or transit signal priority that it implemented as part of the BRT infrastructure, a wider range of Wake County transit services will benefit from the investment.

Potential Corridor Utilization

This metric is similar to the previous metric, but focuses on quantifying the number of buses during peak period (as opposed to the number of routes) that would benefit from access to time-saving infrastructure. BRT infrastructure that could also be utilized by a bus route that provides 15-minute service will be rated more highly than BRT infrastructure that could also be utilized by two different hourly bus routes.

Connections to frequent transit

BRT functions best if the investment will create and strengthen connections and access to other transit routes. In particular, connections to frequent routes (defined as those that operate at least every 15 minutes) are important because riders experience minimal wait times when transferring. This metric will indicate the degree to which a potential BRT corridor will integrate with the planned frequent network.

Connections to commuter rail

Commuter rail carries passengers longer distances and stops less frequently than BRT, and often functions best if riders have access to a range of feeder/distributer services to make first or last mile connections. This metric indicates the potential for BRT corridors to leverage the proposed investment in commuter rail to provide premium connections to a wider range of destinations.

Ease of Access

Most transit riders begin and/or end their trip as pedestrians, walking some distance to or from the bus stop. Ridership on BRT is likely to be higher in places that people can easily and conveniently access the station from the surrounding neighborhood. Intersection density is a common way to measure the density of the road network surrounding the corridor and therefore the number of pedestrian as well as bicycle connections. Areas where the street network is made of small blocks are easier for pedestrians and bicyclists to traverse because destinations can be accessed without out-of-direction travel. Areas with large blocks and circuitous roadways are less accessible because they often do not provide a direct path to a destination.

Affordable housing access

Locating BRT near affordable housing units can have significant long-term benefits for residents, lowering their transportation costs and connecting them to greater regional job accessibility. The FTA Guidelines for Land Use and Economic Development Effects refer to "legally binding affordability restricted housing" as units with a lien, deed of trust, or other legal instrument attached to a property and/or housing structure that restricts the cost of the housing units to be affordable to renters and/or owners with incomes below 60 percent of the area median income for a defined period of time.

Minority access

Wake County is committed to investing in a way that ensures regional equity and access to opportunities. Investment in BRT can help historically disadvantaged populations connect with jobs, educational opportunities, and social services throughout the region.

Transit dependent access

BRT can particularly benefit households that do not have regular access to a vehicle by providing a reliable and fast connection to the region. Zero-vehicle households also often align with households with low income and are more likely to use transit. The FTA uses the ratio of zero vehicle households in a corridor to evaluate eligibility for potential BRT funding.

New transit trips

The change in corridor transit ridership is a predictor of the success of BRT. This measure considers the existing ridership in the corridor and the predicted ridership that would result from the investment in BRT in order to indicate the return on investment of the capital infrastructure and branded service. Existing ridership in the corridor is defined as passenger boardings that occur on the same street as the proposed BRT infrastructure or on a nearby parallel street, and will be based on stop-level ridership data to capture full routes and route segments that serve the proposed BRT corridor. Instead of only measuring total predicted ridership, this provides insight into where already strong ridership corridors may be strengthened through BRT investment as well as where investment in BRT may tap into latent demand for higher quality transit service than exists today. Ridership will be estimated for a representative alignment for each corridor and will not reflect the individual options within each corridor. This metric will only be used in Tier 2 of the evaluation.

Operating cost per passenger trip

This metric provides an even comparison between operating plans and potential BRT alignments of the cost of providing each passenger trip. BRT service has the ability to achieve higher ridership and productivity levels than traditional bus service, which should result in lower operating costs per rider. This metric will only be used in Tier 2 of the evaluation; however, operating costs will be developed as information during the Tier 1 process.

Capital cost per passenger trip

Depending on the level of amenities and the existing constraints of a corridor, BRT can have different capital construction costs. This metric indicates the return on capital investment in terms of predicted ridership. This metric will only be used in Tier 2 of the evaluation; however, capital costs will be developed as information during the Tier 1 process.

Total people + jobs serviced

The number of people living and working along transit corridors can indicate potential ridership levels and likelihood of sustaining the investment over time. Total population and employment indicates the degree to which transit supportive land uses are in place.

Concentration of people + jobs served

By developing land at higher residential densities and a higher percentage of mix of uses, more origins and destinations become located within walking, bicycle and transit proximity. While the total number of people and jobs is important to understand the scale of the impact of a potential BRT corridor, this metric ensures that shorter corridors with dense development are considered positively, even if the total number of people and jobs may not be as high as a longer, less dense corridor.

Economic development potential

High capacity transit has the potential to focus growth and development along key transit corridors, sparking economic development. Peer cities that have seen the largest economic development as a result of BRT investments have focused on capital improvements that cause the BRT to function very similarly to rail, with competitive speed, reliability, and comfort. This metric will include a quantitative assessment of proposed level of capital investment and additional development potential surrounding possible station locations.

VMT reduction

Reduction in Vehicle Miles Traveled (VMT) indicates the degree to which investment in BRT infrastructure can encourage mode shift from driving alone to transit. VMT reduction is also a proxy for reduction in carbon emissions. This metric will only be used in Tier 2 of the evaluation.

Environmental impact

Depending on the constraints of the corridor, BRT infrastructure may require construction of ramps, overpasses, bridges, or lanes. Based on a high-level review of the natural and built entities within a potential corridor, this metric will indicate the degree to which construction of BRT could be impactful in a negative way. It is important to understand the likelihood of an environmental impact because of the effect it may have on ability of a project to move forward, the need for mitigations, or the timeline for construction.

Constructability

It is important that the taxpayers in Wake County experience the benefit of their investment in transit in a timely manner. This metric will evaluate each potential corridor to highlight obstacles that could slow the implementation process. Depending on the constraints of the corridor, BRT infrastructure may require construction of ramps, overpasses, bridges, or lanes. The ease and timeline of construction are dependent upon the level of infrastructure required. For instance, converting on-street parking to a bus lane is easier to implement than constructing an entirely new lane.