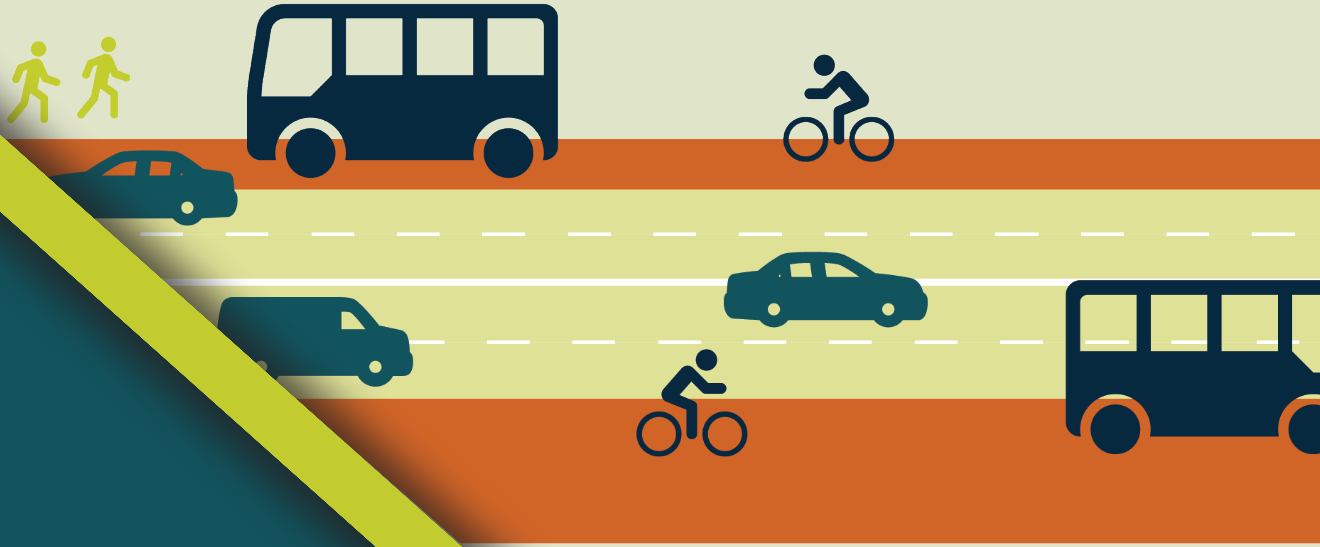

Appendix A

Technical Analysis Methodology

FAST

Freeway And Street-based Transit network

TECH MEMO

Memorandum

To: Joe Milazzo, RTA

Date: May 1, 2020

VHB Project #: 39165.00

From: VHB FAST Team

Re: RTA FAST Network Study
Phase 1 (Visualize) Technical Approach

The scope of work for the FAST Study incorporates two phases:

- **Phase 1: Visualize** identifies routes with potential transit ridership benefits resulting from operational or infrastructure improvements, based on a combination of travel demand, traffic and transit performance, and corridor context. Analyses will proceed from existing conditions through interim years to the ultimate 2045 plan year.
- **Phase 2: Believe** recommends appropriate types of improvements for the opportunities identified in Phase 1 and develops a prioritized plan for implementation. This implementation plan will evolve through a process of iterating among existing, interim year, and 2045 conditions. This process must coordinate FAST recommendations with other transportation infrastructure and land development plans, considering project lives, timing, and integration opportunities.

This memorandum summarizes the technical approach For Phase 1, focusing on developing the FAST network (service, standards, and corridors). The review and incorporation of available studies, plans, and data is a given at the outset of Phase 1. Interim results of the analyses described below will be shared with the Steering Committee for feedback and validation; a status meeting mid-May may be scheduled for this purpose. To maintain schedule, ongoing communications with staff of transit agencies will address specific questions as they arise.

PHASE 1: VISUALIZE

Our approach to the Vision Phase of the FAST study applies multifactor screening to identify corridors and corridor segments with the greatest potential to benefit from FAST enhancement strategies in term of shorter travel times, greater reliability, improved comfort and convenience, broader accessibility. Ultimately, the goal is to define an integrated, implementable set of cost-effective improvements that will increase ridership across a diverse market.

In addition to being compatible with established budget and schedule, a successful approach for this project must be scalable and transferable, rely on readily available and forecastable data, and yield visualizable results that are technically sound yet easily communicated. Outcomes will focus on opportunities with impact potential, projects that "move the needle" in the near term, while building a foundation for future progress. This boils down to determining the size of the travel market affected multiplied by the magnitude of the transit service improvement realized. These benefits will be further analyzed to assess the equity of the distribution of benefits (and costs) by market type, especially underserved communities or disadvantaged populations.

The proposed metrics for determining the suitability of a range of possible transit improvements are organized into two tiers, each of which consider both existing and future conditions. Each metric will be weighted to reflect importance, uncertainty, and associated contingencies. The first set of metrics is applied to screen corridors to establish potential transit mobility benefits, identify candidate improvement types, and provide a preliminary estimate of the type and magnitude of benefits.

The second screening tier is applied to candidate projects that have demonstrated potential for improving mobility in the Tier 1 analyses. Tier 2 consists primarily of quantifying accessibility benefits and identifying the socio-economic profiles associated with the user communities who benefit (or who are harmed). This second analysis tier also considers the impacts of planned projects and identifies "missing links" in the transit network. **Figure 1** depicts the basic elements and relationships of the two tiers in Phase 1.

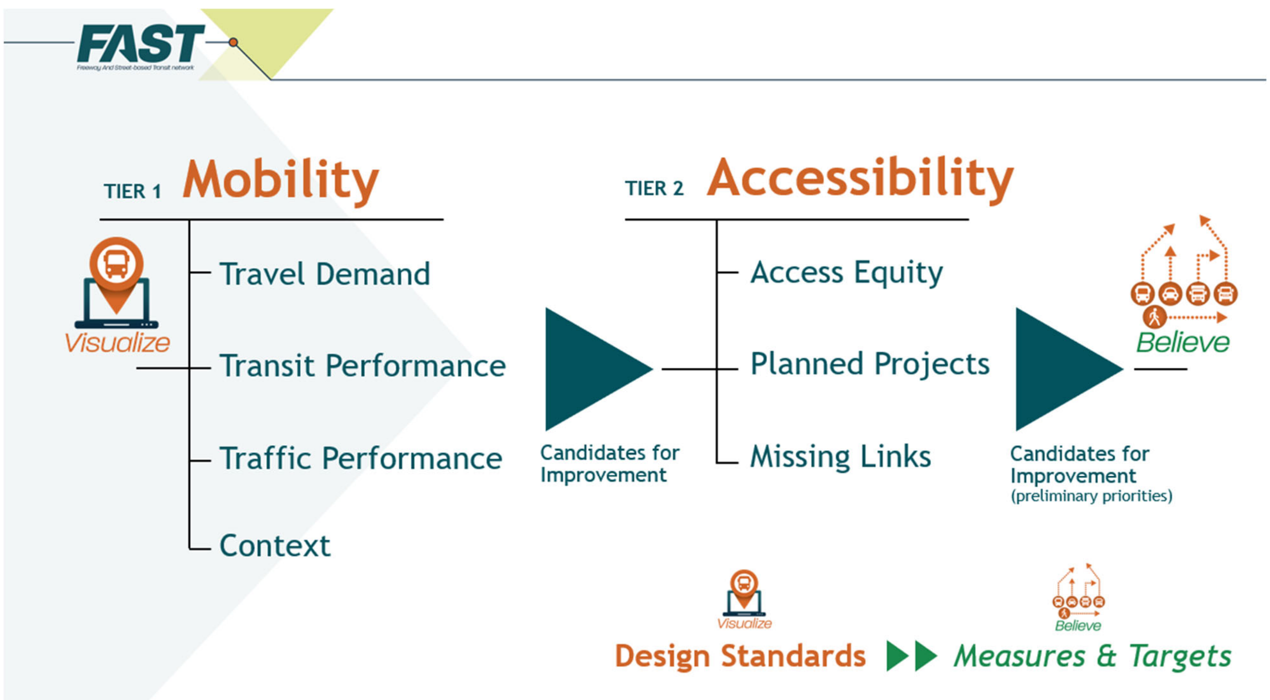

Figure 1: Tiered Phase 1 Process

<u>Tier 1 – Mobility</u>

The mobility tier includes four sets of metrics:

- Travel Demand
- Transit Performance
- Traffic Performance
- Context

Each potential metric is summarized below. The single most suitable metric in each category (in terms of explanatory power, availability, simplicity, ease of forecasting, and reliability), is listed first and tagged with an asterisk. Within each category, multiple metrics would be assigned a weight. Although there is value in maintaining these subtotal scores, relative weights could also be applied to each category total to generate composite score. The final form of the metrics and the relative weighting decisions will depend on testing of initial results.

These metrics lend themselves to GIS analysis and display. Overlaying the results of each metric category will help both in quantitative analysis and in communicating findings. **Figure 2** is an example from a commuter study of the Metrolina Region, depicting AM commuter travel demand along with current transit routes categorized by service frequency. **Figure 3** represents the levels of road congestion relative to transit service. Analyzing and combining results from these and similar maps (depicting land use, accessibility, facility type, and other attributes) provides a basis for identifying and quantifying opportunities for improvement.

Although both existing and future conditions will be evaluated, it is anticipated that existing conditions will weigh more heavily due to this project's emphasis on Super FAST implementation, and the uncertainty associated with future forecasts. Additional consideration of future conditions will take place in the Tier 2 analysis.

Travel Demand (whether in terms of traffic or transit ridership) must be great enough to yield enough benefits to warrant improvements. There must be a sizeable market for potential ridership growth, and travel demand should be increasing over time.

- *Traffic volumes** (AADT) are readily available from count programs and travel demand models and provide the best single indicator of travel demand in a corridor.
- *Transit ridership* provides a baseline of current transit demand, but in itself does not indicate potential for increases, outside of model results.

Transit Performance reflects critical characteristics of transit operations or service that can significantly affect its attractiveness as a travel option.

- *Frequency** (or alternately, effective headway) is the simplest representation of the level of transit service provided in a corridor, especially when headways are short enough that they do not affect scheduling decisions for potential riders. It can also be a surrogate for demand, since higher frequency typically correlates with higher demand. This is an easily obtained metric that can be evaluated under a range of future policy scenarios.
- *Reliability* (or schedule adherence) is an important factor both for providing a functional service and in attracting additional riders. Typically thought of in terms of lateness, an even more disruptive problem for users is uncertainty about early arrivals. Transfers place an even greater premium on reliability. GPS tracking adds a more objective, quantifiable measure to user/operator feedback. Accurately forecasting reliability is a challenge, however.

Memorandum

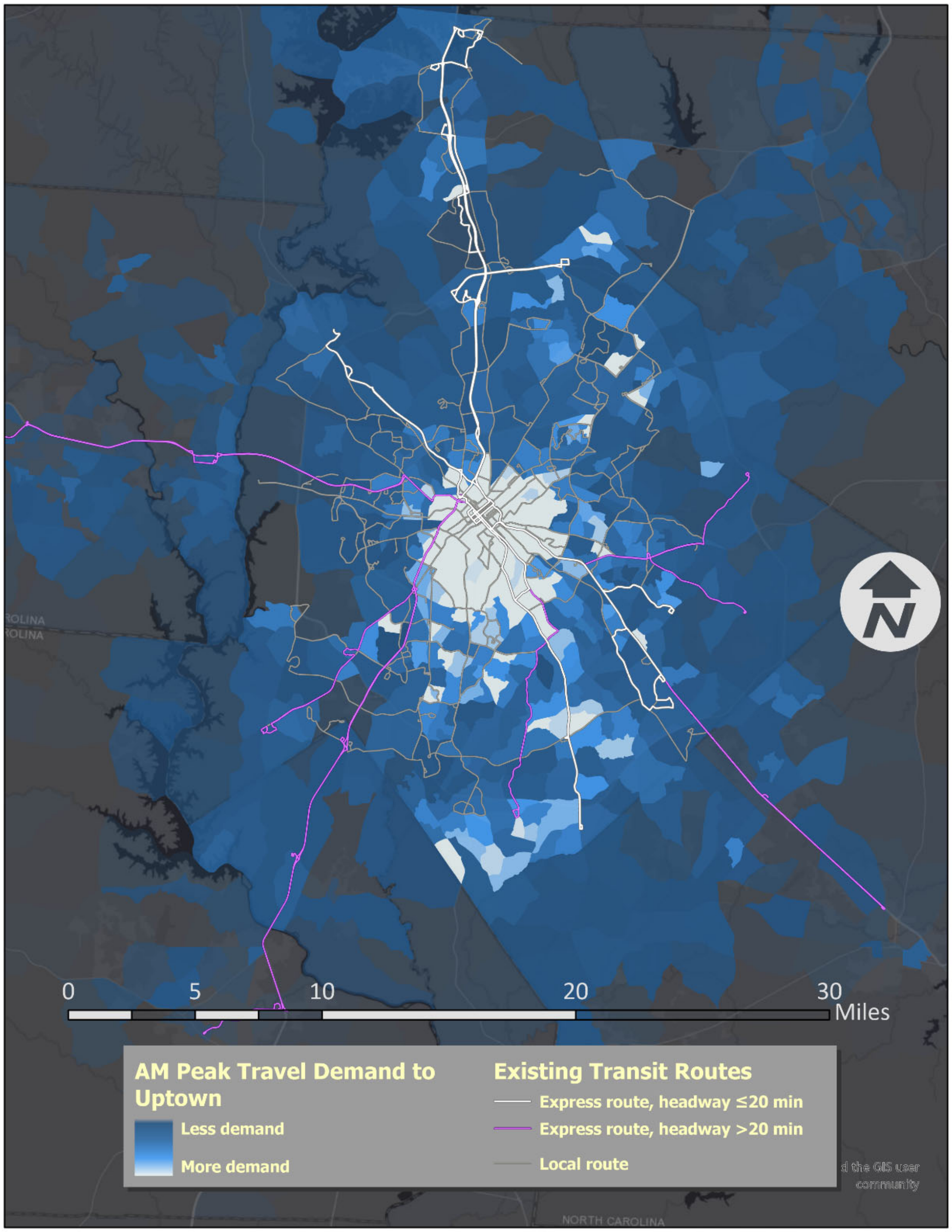

Figure 2: Travel Demand with Transit Service (Metrolina)

Memorandum

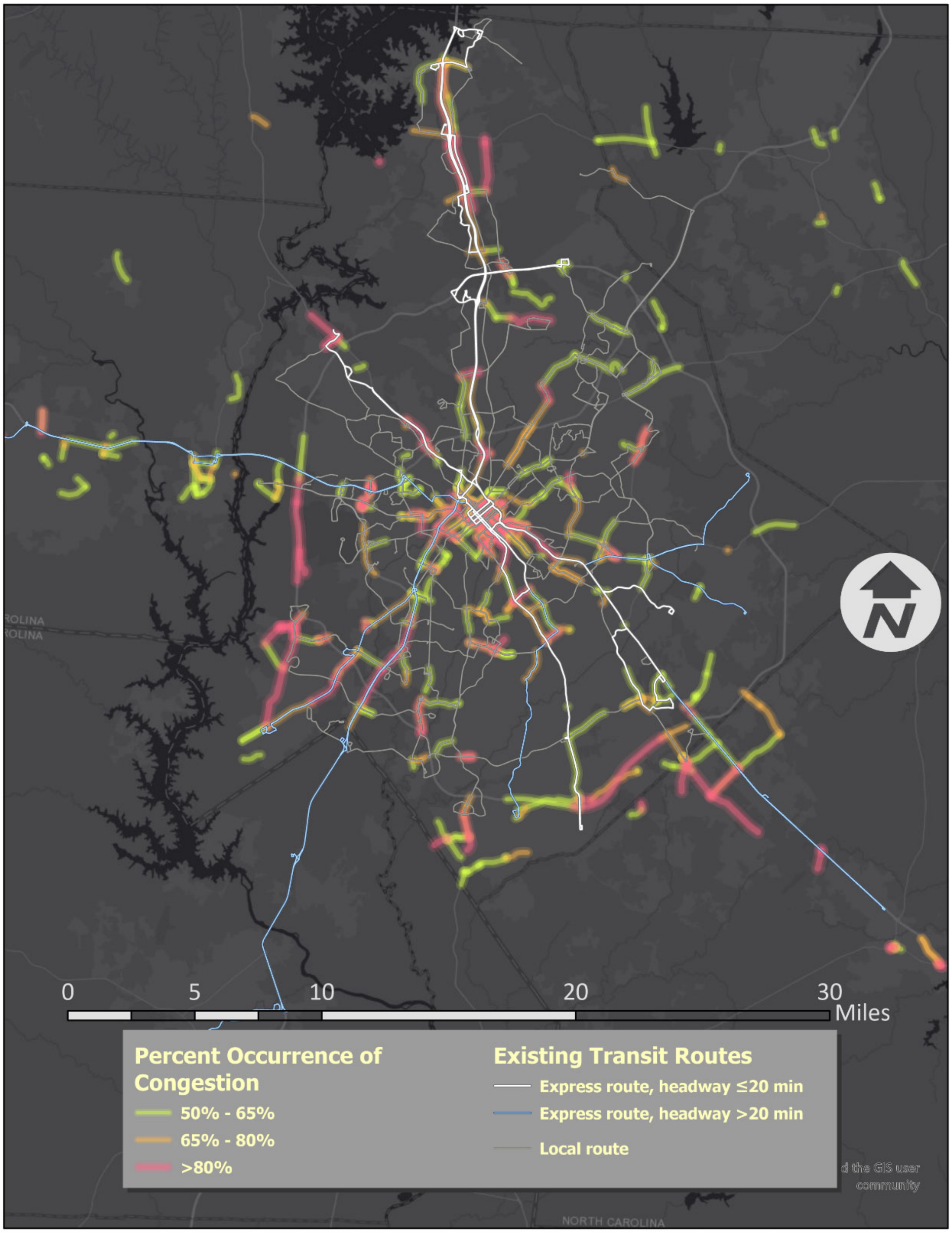

Figure 3: Traffic Congestion with Transit Service (Metrolina)

- *Speed* (or alternately, travel time) is most useful as an indicator of relative performance, rather than as an absolute value. Changes in average transit speed over time, or by time of day, or relative to traffic speeds can be of value in selecting and prioritizing potential solution options. Obtaining and forecasting reliable speed data can be challenging, although GPS tracking systems are useful in establishing baseline conditions.

Traffic Performance measures congestion that can delay buses operating in mixed traffic and impede schedule adherence. High levels of congestion can reduce the relative attractiveness of driving over transit. If congestion is minimal, there may be little opportunity for the types of transit improvements in this study to yield significant benefits.

- *Delay** is a measure of congestion (relative to free-flow or other targeted conditions) that can be obtained from HERE data and estimated from regional travel demand models. It is essential to capture the various dimensions of delay in terms of intensity, extent, timing, duration, and variability/predictability. These attributes greatly influence the type and effectiveness of potential solutions and can determine whether full-time or part-time implementation is most appropriate.
- *Volume/capacity ratios* can be estimated from regional travel demand models; detailed capacity analysis is not practical within the scope of this study. Variations by direction and time of day must be considered. Understanding the unused or reserve capacity available along a roadway segment can help determine the suitable solution options.

Context refers to the type of roadway facility and its surrounding land use. The distinction between freeway and non-freeway facilities is important, due to differences in operational characteristics, land use interactions, and potential solutions alternatives. Number of lanes and right-of-way limits can be important considerations for both freeway and non-freeway facilities, although these attributes will probably more useful in identifying specific projects and prioritizing implementation in Phase 2.

- Freeway segments
- Arterial/non-freeway segments
    - *Intersection density* reflects both the intensity of adjacent land use and the type of transit improvements that might be most effective.
- Land use attributes are most relevant to non-freeway corridors. Key measures are the type, mix, and density of commercial, institutional and residential development along the corridor. Major activity centers and special generators (such as RDU, major universities and medical centers, arenas, regional shopping centers, and CBDs) may require special treatment.

Some processing of results will be needed to develop projects that are practical in terms of scale. Lane-based treatments such as running on shoulder or red lanes have minimum feasible segments; individual intersection interventions such as queue jumps or signal priorities typically provide minimal improvement unless combined in series.

Tier 2 – Accessibility

The set of viable mobility improvement options identified for corridors and segments generated in Tier 1 will be assessed in terms of their impacts on transit accessibility and utility for various populations of interest. Communities of concern (based on socio-economic characteristics) will be emphasized in our analysis. Accessibility can be derived via GIS analysis and from travel demand modeling.

Accessibility to transit refers to a user's ability to reach a destination with relative ease. This study will focus on the relative change in accessibility for certain populations under various improvement scenarios. For example, the number of jobs available within 30 minutes of travel by transit. This metric can be posed from the perspective of either trip end: how many employees or patrons can reach my establishment within a given travel time, or how many jobs or shopping or other opportunities are available to individuals or households. We can further disaggregate our analysis by business type or by socio-economic characteristics of communities served, in order to assess equity impacts, or equitable distribution of opportunities. This analysis also lends itself to quantitative visualizing an analysis by GIS.

As part of Tier 2 screening, two other analyses will be conducted:

Planned projects will be reviewed for impacts, constraints, and opportunities relative to the Tier 1 findings. For example, a near-term widening project might eliminate a red lane recommendation, or it might lead to incorporation of red lanes, depending on the timing and situation. Other roadway improvements might shift transit to another route. Transit improvements such as BRT or commuter rail could change demand patterns and routing as well, either though competition/replacement or as complementary service or connection. Even major developments will need to be considered.

Missing links in the transit network will be identified. Some promising new connections might not be identified through the process described above, since there may be no existing traffic or transit data. This is true for new facilities, and especially for connecting with or complementing pending BRT corridors. Dedicated freeway entry/exit points may also be considered.

Upon completion of the data analysis inputs from the funding partners will be received via the Steering Committee meeting as per the schedule provided in the scope.

Design Standards

Design standards for both infrastructure and service will evolve through an iterative process beginning in Phase 1 and carrying through Phase 2. As potential markets and corridors are identified, the characteristics of the trips, travelers, roadways, and land uses will be used to group candidate projects into categories. Each of these categories will be associated with a set of appropriate potential improvements. Design standards will be proposed and tested for these improvement categories. Typical infrastructure design standards can include maximum stops per mile; minimum percentage of intersections with TSP; presence of level boarding; and availability of off-board fare collection. Service design standards might include maximum headways and minimum span of service. Draft design standards will be developed based on existing conditions and peer comparisons and will be refined along with alternatives in Phase 2, based on the trade-offs of benefits, costs, and risks. As design standards are finalized, specific performance measures will be developed in support of each design standard, along with associated performance targets. These measures and targets will serve not only to guide the design and prioritization of recommendations, but to monitor performance during and after implementation.

PHASE 2: BELIEVE

Upon completing this two-tiered corridor screening, a set of feasible improvement options with basic performance ratings will be available for more detailed analysis and refinement towards implementation as part of **Phase 2**. This will be a focus of Stantec's input, as the VHB transit operations/simulation tool—customized for the FAST study—evaluates multiple routing scenarios, and our spreadsheet model analyzes operations and costs.