

# BROAD STREET RAPID TRANSIT STUDY: INITIAL SCREENING OF ALTERNATIVES

This Initial Screening of Alternatives summarizes the first round analysis performed on the initial set of alternatives identified to meet the purpose and need of the Broad Street Rapid Transit Study. The initial screening utilizes the measures of effectiveness identified in the January 6, 2010 *Evaluation Methodology* in combination with feedback provided by stakeholders (Technical Advisory Committee, Policy Advisory Committee, general public) to make an determination as to which subset of alternatives would be most likely to meet the goals and objectives of the study. This technical memorandum also documents the rationale for removing alternatives from further consideration as part of this study.

## 1.0 INITIAL ALTERNATIVES

The initial alternatives for this study are summarized in Table 1-1, and are described in greater detail in the January 21, 2010 *Initial Definition of Alternatives*. Each of the alternatives was developed to (a) meet the goals and objectives established for the study; and, (b) ensure that they would meet the minimum requirements of a project under the Federal Transit Administration (FTA) Small Starts program.

**TABLE 1-1: SUMMARY OF INITIAL ALTERNATIVES**

	No-Build	Baseline	Build Alternatives	
			Build 1	Build 2
Route Length (mi.)	Existing Route 6	7.6		
Miles of Dedicated Bus Lanes	0.75	0.75	3.4	6.7
Number of Stations	Existing local stops	16 stations		
Peak/Off Peak Frequency (min.)	n/a	10/15		
Hours of Operation	Weekdays: 5:30 AM-11:30 PM Weekends: 6:00 AM-11:30 PM			
Network Changes and Feeder Service	None*	Comprehensive Operations Analysis Phase I and Phase II recommendations*		
Fare Collection	On-board (cash, Go Cards)		Off-board Proof of purchase (BRT tickets)	
Vehicles	Existing GRTC vehicles		Dedicated Bus Rapid Transit (BRT) vehicles	
Intelligent Transportation Systems	Existing traffic control systems	Signal priority at intersections along bus lanes		
Branding?	No	Stations only	Stations, vehicles, guideway, signage, marketing efforts	

\*Since the initial alternatives were defined, new information from on-board surveys has been made available to the study team. GRTC has indicated that the survey information may warrant the implementation of some COA improvements before the opening year. Refinements in the implementation of the COA will be noted in the No Build and Baseline as part of the Detailed Definition of Alternatives.

## 2.0 INITIAL SCREENING METHODOLOGY

The intention of the initial screening is to generate sufficient information about the conceptual alternatives to screen out those alternatives least likely to meet the established Purpose and Need. At this stage in the analysis, the emphasis is on developing qualitative, order-of-magnitude estimates of the costs, benefits and impacts of each alternative, such that major differences between alternatives are readily apparent. The measures of effectiveness for the initial screening have been developed to reflect the qualitative approach to the initial screening, and are listed in Table 2-1.

**TABLE 2-1: INITIAL SCREENING CRITERIA**

Goal	Objectives	Measures of Effectiveness
Improve local and regional mobility	<ul style="list-style-type: none"> <li>• Increase transit ridership</li> <li>• Decrease travel times in the study area</li> <li>• Minimize negative impact on roadway congestion</li> </ul>	<ul style="list-style-type: none"> <li>• Impact on transit ridership</li> <li>• Impact on general traffic</li> <li>• Impact on on-street parking</li> <li>• Impact on vehicle and pedestrian safety within the corridor</li> </ul>
Support economic development along the corridor	<ul style="list-style-type: none"> <li>• Improve transit access to existing and future developments</li> <li>• Create connections between transit and centers of employment, education, residence, shopping, culture and entertainment</li> </ul>	<ul style="list-style-type: none"> <li>• Impact on residential access to transit</li> <li>• Impact on transit access to activity centers</li> <li>• Impact on transit access to redevelopment sites</li> </ul>
Promote livable, transit-oriented development	<ul style="list-style-type: none"> <li>• Provide high-capacity transit facilities at locations where existing and future land uses make them mutually supportive</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to support higher density land uses</li> </ul>
Create a multi-modal transportation system with attractive travel choices	<ul style="list-style-type: none"> <li>• Create a premium transit route with service characteristics that make it competitive with the private automobile</li> <li>• Integrate premium transit service with local bus, bicycle, pedestrian, private automobile and intercity travel modes</li> <li>• Create opportunities for future upgrades or additional premium transit services</li> </ul>	<ul style="list-style-type: none"> <li>• Average operating speed</li> <li>• Number of intermodal connections</li> <li>• Level of investment that can support future upgrades</li> <li>• Frequency, schedule, and travel times of transit services in the corridor</li> </ul>
Optimize return on public investment	<ul style="list-style-type: none"> <li>• Develop cost-effective transit solutions</li> </ul>	<ul style="list-style-type: none"> <li>• Order-of-magnitude capital cost</li> <li>• Order-of-magnitude operating cost</li> </ul>
Enhance environmental quality	<ul style="list-style-type: none"> <li>• Minimize and mitigate negative impacts to the human and natural environment</li> </ul>	<ul style="list-style-type: none"> <li>• Impact on natural resources (parklands, wetland, water, habitat)</li> <li>• Impact on historic and cultural resources</li> </ul>

Each alternative was evaluated against these measures of effectiveness using the five-grade ranking system shown in Table 2-2. A more detailed explanation of the rank assigned to each alternative is provided in Section 3.0.

**TABLE 2-2: RANKING SYSTEM FOR INITIAL SCREENING CRITERIA**

<b>Rank</b>	<b>General Assessment</b>
A	The alternative may provide major benefits and/or significantly minimize negative impacts
B	The alternative may provide some benefits and/or minimize some negative impacts
C	The alternative will have negligible benefits or impacts
D	The alternative may have some negative impacts
F	The alternative may have major negative impacts

In addition to these corridor-wide criteria, the proposed station areas for each alternative were evaluated using a separate station area identification methodology. This methodology will determine which of the initial stations under consideration should be carried forward into the detailed definition of alternatives. The methodology used to evaluate station locations is described in greater detail in the *Station Area Assessment Methodology*. As each of the alternatives utilizes the same route, it will be possible to feed the results of the station area screening into the results of this initial screening to develop a detailed definition of each of the alternatives that survives this screening.

### **3.0 INITIAL SCREENING RESULTS**

Table 3-1 summarizes the findings of the initial screening. The Baseline and Build Alternatives are anticipated to offer a measurable level of improvement in transit access and mobility over the No Build Alternative, as each of these alternatives will offer a new, limited stop service that will improve transit travel times in the study corridor. In general, the major difference between alternatives is related to the degree to which they use dedicated lanes. While new bus lanes are anticipated to improve transit travel times and reliability of service, these benefits come at the expense of additional capital costs, parking impacts, traffic impacts, and right-of-way requirements.

The following paragraphs provide a more detailed description as to how the alternatives fared against each of the initial screening measures of effectiveness.

**TABLE 3-1: SUMMARY OF INITIAL SCREENING RESULTS**

Measures of Effectiveness	No Build	Baseline	Build I	Build 2
<b>Improve local and regional mobility</b>				
▪ Impact on transit ridership	C	B	B	B
▪ Impact on general traffic	C	C	D	F
▪ Impact on on-street parking	C	C	D	F
▪ Impact on vehicle and pedestrian safety	F	F	B	B
<b>Support economic development along the corridor</b>				
▪ Impact on residential access to transit	C	B	B	B
▪ Impact on transit access to activity centers	C	B	A	A
▪ Impact on transit access to redevelopment sites	C	B	A	A
<b>Promote livable, transit-oriented development</b>				
▪ Ability to support higher density land uses	C	C	B	B
<b>Create a multi-modal transportation system with attractive travel choices</b>				
▪ Average operating speed	C	B	B	A
▪ Number of intermodal connections	C	C	B	B
▪ Level of investment that can support future upgrades	C	B	B	B
▪ Frequency, schedule, and travel times of transit services in the corridor	C	B	A	A
<b>Optimize return on public investment</b>				
▪ Order-of-magnitude capital cost	C	C	D	F
▪ Order-of-magnitude operating cost	C	C	D	D
<b>Enhance environmental quality</b>				
▪ Impact on natural resources (parklands, wetland, water, habitat)	C	C	B	B
▪ Impact on historic and cultural resources	C	C	C	C

Notes:

A = The alternative may provide major benefits and/or significantly minimize negative impacts

B = The alternative may provide some benefits and/or minimize some negative impacts

C = The alternative will have negligible benefits or impacts

D = The alternative may have some negative impacts

F = The alternative may have major negative impacts

### 3.1 Local and Regional Mobility

#### Impact on Transit Ridership

The Baseline and Build Alternatives were anticipated to provide some benefit to transit ridership. In all cases, the implementation of a new, limited stop transit service was anticipated to encourage new ridership. Under all three alternatives, the local transit network would be optimized to work in

conjunction with the new service, which is also anticipated to provide benefits to existing riders and encourage new ridership.

While the dedicated lanes, stations, and other service enhancements of the Build Alternatives are expected to increase transit ridership over the Baseline Alternative, the relative size of the Richmond transit market indicates that these improvements may not be an order-of-magnitude greater than those of the Baseline, hence their “B” ranking. Additional travel demand forecasting will be performed during the detailed screening of alternatives to develop a more accurate assessment of the ridership associated with each alternative.

### **Impact on General Traffic**

As the existing road network would remain unchanged under both the No Build and Baseline Alternatives, both of these alternatives were ranked “C.” Build 1 would require the dedication of two lanes for Bus Rapid Transit (BRT) along Broad Street, which could translate to a loss of 25-33% of the roadway capacity between 14<sup>th</sup> Street and Thompson Street. Build 2 would result in the same losses along Broad Street; in addition, Build 2 would require the removal of two lanes of the existing four along Main Street—an unacceptable potential loss of 50% of the capacity of this roadway.

### **Impact on On-Street Parking**

As the existing road network would remain unchanged under both the No Build and Baseline Alternatives, the parking impacts for both of these alternatives were ranked “C.” The impact of Build 1 was ranked as having the same level of impact as under “Impact on General Traffic”, as the dedication of bus lanes on Broad Street could require the elimination of some on-street parking if dedicated lanes could not be created from general travel lanes and/or changes to the cross section of Broad Street. Similarly, the impacts of Build 2 on on-street parking were assumed to be significantly negative, as the current cross-section of Main Street would require the elimination of on-street parking in order to accommodate dedicated bus lanes.

### **Impact on Vehicle and Pedestrian Safety**

As the roadway and pedestrian networks would not be altered under either the No Build or the Baseline Alternative, it is anticipated that their impact on vehicle and pedestrian safety would remain the same as today. As the current configuration and width of bus lanes on Broad Street is a contributing factor to the number of bus-related accidents, both the No Build and Baseline were expected to have a continued negative impact on vehicle and pedestrian safety.

Under either Build Alternative, pedestrian and bicycle improvements would be introduced to station areas, improving pedestrian safety along the corridor. Both Build Alternatives would consider reconfiguring the existing bus lanes to minimize conflicts with automobile traffic and local bus traffic; therefore, they received a “B” ranking to reflect these moderate improvements. Additional analysis of traffic and pedestrian impacts will be conducted as part of the detailed screening of alternatives.

### **3.2 Support for Economic Development**

#### **Impact on Residential Access to Transit**

As the Baseline and Build Alternatives would offer the first fixed-route transit service available to Rocketts Landing, all three of these alternatives were considered to provide greater residential access to transit than the No Build Alternative. The Build Alternatives would also offer the opportunity to improve pedestrian and bicycle connectivity between the transit stations and local residences. While these new connections would be an improvement over the Baseline Alternative, they may not represent an order-of-magnitude difference; therefore, the Baseline and Build Alternatives all received a “B” ranking. A more detailed assessment of residential access to transit will be considered during the detailed screening of alternatives, in conjunction with station area planning efforts.

#### **Impact on Transit Access to Activity Centers**

The Baseline Alternative would provide a more direct service between major activity centers served by the stations, including: downtown Richmond, Rocketts Landing, the Children’s Museum, and Willow Lawn. Therefore, the Baseline Alternative was ranked “B.” The Build Alternatives would offer the opportunity to introduce improved pedestrian and bicycle access to these and other activity centers; therefore, they were ranked higher than the Baseline Alternative.

#### **Impact on Transit Access to Redevelopment Sites**

As noted, the Baseline Alternative would offer a more direct service between redevelopment sites; therefore, it was ranked as having a greater positive impact than the No Build Alternative. The Build Alternatives were ranked as having greater positive impact than the Baseline Alternative, based on their potential to improve pedestrian connectivity. In addition, the stations associated with the Build Alternatives would offer opportunities for joint development with redevelopment sites.

### **3.3 Livable, Transit-Oriented Development**

The Baseline and Build Alternatives would offer a comparative advantage over the No Build in promoting higher density land uses, as each of these alternatives would introduce a new service that is more appealing to choice ridership markets. Both Build Alternatives would have an advantage over the Baseline; since the stations offered under each Build Alternative would offer opportunities for joint development. In addition, the physical improvements associated with the Build Alternatives (stations, guideways) would offer a sense of permanence to the service and help to establish a sense of place, increasing their relative attractiveness to developers and new residents and employers.

### **3.4 Multi-modal Transportation and Travel Choices**

#### **Average Operating Speeds**

The Baseline Alternative would be able to achieve higher speeds than the No Build Alternative by limiting the number of bus stops served. Assuming that each bus averages 20 seconds of “dwell time” (the time necessary for buses to stop, allow passengers to board and alight, and depart) at each station, the Baseline Alternative route would spend approximately 5.3 minutes of dwell time on each trip, in comparison to the 21.3 minutes the Route 6 would spend serving the 64 bus stops along the corridor under the No Build Alternative.

The Build Alternatives would also benefit from the same reduced dwell times as the Baseline Alternative. In addition, signal pre-emption and dedicated lanes should improve travel speeds for BRT vehicles by minimizing the impacts of general traffic congestion in the corridor. For the purposes of this initial screening, it is assumed that Build 2 would offer greater travel time improvements than Build 1, as it provides for a dedicated lane throughout the length of the study corridor. The impacts of signal pre-emption and dedicated lanes on travel times will be modeled in greater detail as part of the next stage of the study.

### **Number of Intermodal Connections**

All of the alternatives serve the same intermodal connections (Main Street Station, local bus stops along Broad Street and Main Street); however, the Build Alternatives would offer the opportunity to introduce new park and ride facilities to the corridor. Therefore, the Build Alternatives were ranked as having a greater positive impact on intermodal connections than the No Build and the Baseline Alternative.

### **Level of Investment to Support Future Upgrades**

The Baseline and Build Alternatives all offer the opportunity to develop a new premium transit market in the study corridor. Introducing a new limited-stop service will encourage choice riders to use transit in the corridor which will, in turn, help develop a market for higher levels of investment in transit (advanced BRT applications, streetcar, and light rail transit). While the stations and dedicated lanes associated with the Build Alternatives may offer an opportunity to dedicate rights of way for future investments, this is not a certainty, since the introduction of a new service on the corridor would require the temporary closure of the existing Build Alternative service; furthermore, depending on the technology selected, future investments may have different requirements for stations and rights-of-way that would not allow GRTC to capitalize fully on the investments made in BRT.

### **Frequency, Schedule, and Travel Times of Transit Services in the Corridor**

The operations plan proposed for the Baseline Alternative and the Build Alternatives would offer a higher frequency of service at those stations served by the limited stop service; however, this would come at a reduction of frequency at local stops along the route. The Build Alternatives would offer improved travel times and reliability of service over the No Build and Baseline Alternatives through the use of dedicated lanes and signal pre-emption. The use of off-board fare collection would also improve travel times on the Build Alternatives by reducing the per passenger dwell time associated with purchasing fares on board the vehicle (and forcing other passengers to wait.)

## **3.5 Return on Public Investment**

### **Order-of-Magnitude Capital Cost**

The Baseline Alternative should offer comparable capital costs to the No Build Alternative, as the new limited stop service and improvements recommended by the Comprehensive Operations Analysis would be operated using vehicles from the existing fleet. On the other hand, Build 1 would require the additional costs of 3.5 miles of guideway, new stations, vehicles, and other improvements. As Build 2 would use an additional 3.5 miles of guideway beyond those associated with Build 1, it is reasonable to assume that it would represent at least double the capital cost of Build 1. A more detailed, quantitative

assessment of the capital costs will be completed as part of the detailed screening of alternatives, using the approach documented in the *Capital Cost Methodology*.

### **Order-of-Magnitude Operating Cost**

The Baseline Alternative would implement the minor route modifications that are designed to optimize route performance. Therefore, the operating costs of the Baseline should be equal to or less than those of the No Build. The Build Alternatives would introduce new operations and maintenance expenses associated with the upkeep of new stations, guideway, and a dedicated fleet of vehicles. A more detailed, quantitative assessment of the operating costs will be completed as part of the detailed screening of alternatives, using the approach documented in the *Operations and Maintenance Cost Methodology*.

## **3.6 Environmental Quality**

### **Impact on Natural Resources**

The Baseline Alternative should offer a comparable level of impact to the environment as the No Build Alternative, promoting transit ridership while having minimal new impacts to natural resources in the corridor. Similarly, because the Build Alternatives would be constructed entirely within the existing streetscape, they would result in minimal impacts to the natural environment. Further because they offer a net benefit to the natural resources of the region by helping to maintain air quality by encouraging new transit ridership.

### **Impact on Historic and Cultural resources**

No impacts to historic or cultural resources are anticipated as a result of the No Build or Baseline alternatives. The Build Alternatives would add stations and a fixed guideway to the streetscape through downtown Richmond. As a result, historic and cultural resources are being studied to evaluate potential effects to these resources. To date, 54 properties and nine historic districts have been identified near the study corridor that are or potentially are eligible for listing on the historic register. Coordination is ongoing with the Virginia Department of Historic Resources to ensure the identification and protection of these resources. In general, because Build 2 has a longer section of guideway than Build 1, it has more potential for effects to historic and cultural resources.

In addition, it was noted in the public meetings of February 2010 that the proposed routing of the Baseline and Build Alternatives would be considered to have a negative effect on the cobblestone street of 17th Street and the nearby Farmer's Market. Based on this feedback, the study team will consider alternative routing between Broad Street and Main Street.

## **4.0 INPUT RECEIVED AT PUBLIC MEETINGS**

Public meetings were held in February 2010 to introduce this project to the general, describe the alternatives under study, and gather public scoping comments on the alternatives and topics to consider in the environmental assessment. Key comments made at these meetings regarding the Initial Alternatives include questions regarding:

- Study of light rail transit,
- Use of 17<sup>th</sup> Street to access Main Street from Broad Street, and

- Suggestions for station locations.

Previous regional planning efforts and a Technology Assessment conducted as a part of this study have determined that BRT would be the most cost-effective investment for the Broad Street Corridor at the present time. Its technical attributes would allow it to address local transportation needs, support economic development plans and achieve environmental objectives, all within difficult fiscal constraints. Most importantly, the lower capital costs of BRT would make it a more competitive candidate for Small Starts funding, while offering the opportunity to phase in rail alternatives once ridership and land use in the study area warrant further investment.

Given the feedback at the public scoping meetings about the likelihood of impacts of BRT traffic on 17<sup>th</sup> and 18<sup>th</sup> Streets, a study was conducted to evaluate options to access Main Street from Broad Street in the vicinity of the Main Street Station. The following options were compared:

- 7<sup>th</sup>/8<sup>th</sup>/9<sup>th</sup> Grace/Bank/Franklin/15<sup>th</sup> Streets,
- 8<sup>th</sup>/9<sup>th</sup> Streets
- 14<sup>th</sup> Street,
- 17<sup>th</sup> Street,
- 21<sup>th</sup> Street, and
- 25<sup>th</sup> Street.

Based on the analysis documented in the *Broad Street to Main Street Transition Report*, 14<sup>th</sup> Street represents the best north-south connection between Main and Broad since it minimizes impacts to surrounding businesses and allows for important intermodal connections (at Main Street Station) and regional activity centers (MCV) to be served in the most direct manner. The details regarding the outcome of this technical analysis will be formally presented the Technical Advisory Board and the next public meeting (to be held in the fall of 2010).

Comments were also made regarding potential station locations. These will be considered during the process to select station locations and documented in a separate technical memorandum.

## 5.0 CONCLUSIONS

Based on the findings of the initial screening and feedback from the general public, the study team made the following conclusions for each of the alternatives:

- **No Build: Retain.** Required by FTA.
- **Baseline Alternative: Retain.** Based on feedback from public meetings held in February 2010, the route will be moved off of 17<sup>th</sup> Street. Alternative routes will be considered between Broad Street and Main Street as part of the detailed definition of alternatives.
- **Build 1: Retain.** Compared to the Baseline Alternative and the No Build, Build 1 offers advantages in transit travel times, service reliability, and access to activity centers along the study corridor. While Build 1 also has a potentially higher capital cost than the Baseline Alternative, it would be less expense than the anticipated capital costs of Build 2. The exact amount of dedicated lanes necessary to make Build 1 cost-effective will be considered as part of the detailed definition and analysis of alternatives.

- **Build 2: Remove from further study.** Build 2 offers benefits in travel times and service reliability that may exceed those of the other three alternatives; however, the limited right-of-way along Main Street would make it impossible to develop dedicated bus lanes without eliminating on-street parking and/or having major impacts on east-west travel along Main Street. The concerns expressed regarding BRT dedicated lanes near the Farmer's Market, combined with the need to continue studies of Main Street Station, would make it appropriate to postpone the development of a dedicated transitway along Main Street to a later phase of implementation.

## 5.0 NEXT STEPS

Based on the results of this analysis and feedback from the general public, the Technical Advisory Committee, and the Policy Advisory Committee, the study team will review the remaining alternatives and refine them to make it possible to develop more precise, quantitative assessments of the benefits and impacts of each. These detailed alternatives will then be modeled to forecast their traffic impacts, ridership potential, and costs. The results of the detailed screening will be presented to the public for their feedback before a decision is made on the Locally Preferred Alternative (LPA) to be carried forward into design and implementation.