

# BROAD STREET CORRIDOR RAPID TRANSIT STUDY

## BRT FARE COLLECTION STRATEGIES

As requested by the Federal Transit Administration on December 7, 2010, the study team for the Broad Street Rapid Transit Corridor has considered the benefits and potential impacts of including off-board fare collection as part of the study's Build Alternative. Table 1 summarizes the pros and cons of both on-board and off-board fare collection.

**TABLE 1: COMPARISON OF BRT FARE COLLECTION STRATEGIES**

Factor/Issue	Pay On-Board Driver Assisted	Pay Off-Board Self-Service Fare Collection
Equipment needed	Fareboxes, ticket processing units	TVMs, validators, hand-held readers
Station or platform characteristics	NA	Space, shelters and utilities required for equipment
Handling large passenger volumes	Slows boarding	Reduces platform boarding and station dwell times.
Fare evasion	Caused by using invalid pass. Also caused by crowding at boarding point.	Depends on inspection pattern, fine structure, level of crowding
How customers use automated fare collection system	Uses on-board units/card readers to validate pass.	Use to buy pass, or validate pass—or have pass inspected (inspectors needs hand- held readers)
Security and customer service	Driver responsible for security and customer assistance on bus.	Inspectors provide additional presence on vehicles and platforms. Added security needed during TVM servicing.
Customer convenience	Requires exact change or prepayment (pass or multi- ride option); may be queues at boarding.	Provides validation of multi-ride passes; eliminates queues to buy or validate passes at boarding. Potential for Credit/Debit card acceptance.
Station dwell time	Involvement of the BRT vehicle driver in on-boarding fare collection transactions can increase dwell time. May require the purchase of more vehicles to maintain the 10 minute headway. Use of passes can reduce transaction time.	Allows multiple door boardings which can significantly reduce BRT vehicle dwell time at station. Increases the ability to maintain headways (i.e., better service without adding vehicles)
Capital costs	Lowest costs: fareboxes, but no TVMs	Higher costs. Requires additional station equipment. .
Operating costs	Lowest labor cost	Higher labor cost

Overall, it is estimated that off-board fare collection could result in a travel time savings of 1.5 seconds per Bus Rapid Transit (BRT) boarding while adding \$2.7 million to the capital costs of the Build Alternative and \$626,000 to GRTC's annual operations and maintenance costs. As decreased boarding times on BRT services could have a positive effect on reducing dwell times for all services using the dedicated lanes proposed along Broad Street, it is anticipated that the benefits of off-board fare collection may outweigh the additional costs of implementing such improvements. The following sections discuss

the recommended approach to off-board fare collection and its implications for BRT operations under the Build Alternative.

## **OVERVIEW OF OFF-BOARD FARE COLLECTION**

On-board and off-board fare collection strategies present different advantages and disadvantages to the BRT operation. As noted in Table 1, paying off-board has two major advantages: reduced station dwell times and the elimination of the vehicle operator from fare collection tasks. These advantages may reduce travel times and improve the schedule reliability of services that allow off-board fare collection. However, these advantages come with increased capital and operating costs, including: fare inspectors, station provisions for TVM installation, and the purchase of TVMs.

## **ASSESSMENT OF BRT FARE COLLECTION BENEFITS**

To consider the benefits and impacts of off-board fare collection, the study team assumed that off-board fare collection would allow an average boarding time of 2.5 seconds per passenger boarding a BRT vehicle under the Build Alternative, while boarding times on local buses under all scenarios would remain at 4.0 seconds per passenger. The boarding times for local buses is consistent with observed boarding times on existing GRTC services; the assumed boarding times for off-board fare collection are consistent with the ranges documented in the *Transit Capacity and Quality of Service Manual*. These boarding times were coded into VISSIM models of the No Build and Build Alternatives.

The BRT route under the Build Alternative would experience at least 105 minutes (4,200 boardings x 1.5 seconds savings/60 minutes) in travel time savings in the course of the day. The results of the VISSIM model bears this out: the model indicated that the BRT route under the Build Alternative would have a roundtrip travel time of approximately 64 minutes. While the impact of dedicated bus lanes and consolidated stations are likely to have contributed to the travel time savings under the Build Alternative, it is reasonable to assume that off board fare collection also plays a role and should be considered as part of the strategy for implementing the Build Alternative.

## **OFF-BOARD FARE COLLECTION RECOMMENDATIONS**

To maximize the travel time savings forecast by the VISSIM model, the study team recommends an off-board fare collection system to be implemented as part of the Build Alternative. The recommended approach would allow passengers with validated tickets to board through all doors of BRT vehicles. The off-board/proof-of-payment system would provide ticket vending machines installed at stations for customers needing to purchase Go Cards. The TVMs will also provide ticket validation of Go Cards prior to boarding the BRT buses.

Because of the configuration of the CBD stations, which will have large stations platforms with the inclusion of non-BRT vehicles, it is recommended that Stand Alone Validators (SAV) be installed at these stations to provide additional devices for Go Card validation. These will only be used to validate the Go Cards and two SAVs are recommended for each of the four CBD stations.

Table 2 summarizes the recommended equipment, the estimated capital costs, and first year operating and maintenance costs for the proposed BRT fare collection system. All told, it is anticipated that off-board

fare collection would add \$2.7 million to the capital costs of the Build Alternative and \$626,000 to the operating costs. Key features that would contribute to these costs include:

- Purchase and installation of TVMs and SAVs
- Additional space and systems required to integrate off-board fare collection into current GRTC fare collection practices
- Additional manpower associated with fare inspectors and maintenance staffing

As the total capital cost for the Build Alternative is estimated to be approximately \$54.2 million in 2010 dollars, it is anticipated that the additional costs of off board fare collection may be accommodated without major negative impacts to the cost effectiveness of the Build Alternative.

**TABLE 2: BROAD STREET BRT FARE COLLECTION SYSTEM ESTIMATE**

**Fare Collection System Estimate, Off-Board Equipment**

<u>Note</u>	<b>Capital Cost</b>	<b>Cost (2010 \$)</b>
	1. BRT Stations - Includes 28 TVMs and 8 SAVs installed at 14 stations, 4 hand held devices and network equipment. TVMs costs estimated at \$40k each for commercially available units accepting cash and credit/debit cards,	1,274,000
	2. Cash Room	164,400
	3. Central Computer and System Support	335,00
	<b>Subtotal-Capital Cost by Dept.</b>	<b>1,773,400</b>
<b>A</b>	Percent add-ons	939,800
	<b>SUBTOTAL CAPITAL</b>	<b>2,713,200</b>

<b>Operating Costs (Year I)</b>		<b>Qty</b>	<b>Unit</b>	<b>Total</b>
<b>B</b>	1. Fare Inspectors (1 inspector per 3,000 riders)	2	65,250	130,500
<b>B</b>	2. Revenue, TVM Servicing	2	65,250	130,500
	3. Fare Media, TVM Stock	1	Lot	68,400
	4. Communications Services	1	Lot	30,200
	5. Credit/Debit Services	1	Lot	68,600
	<b>SUBTOTAL OPERATING</b>			<b>428,200</b>

<b>Maintenance Costs (Year I)</b>		<b>Qty</b>	<b>Unit</b>	<b>Total</b>
<b>B</b>	1. Maintenance Staffing	2	87,000	174,000
<b>C</b>	2. Maintenance Materials	1	Lot	23,900
	<b>SUBTOTAL MAINTENANCE</b>			<b>197,900</b>
	<b>SUBTOTAL O&amp;M</b>			<b>626,100</b>

- Notes:**
- A** Add-on includes Engineering (10%), Installation (5%), Support (5%), Non-recurring Parts & Services (13.5%), and Contingency (15%).
  - B** Staffing fringe benefits are estimated at 45%.
  - C** Alternatives based on 10% of Non-recurring Parts & Services cost
  - D** Estimate based on projected daily ridership of 4,685 for year 1.