

BROAD STREET RAPID TRANSIT STUDY

CAPITAL COST ESTIMATES

The GRTC Transit System and Virginia Department of Rail and Public Transportation (GRTC/DRPT) are conducting a study consistent with the requirements of the Federal Transit Administration’s (FTA) Small Starts program to evaluate transit improvements along the Broad Street corridor. This memo provides a summary of the capital costs estimated for the Build Alternative as defined in the November 17, 2010 *Detailed Definition of Alternatives*. As shown in Table 1, the total capital cost for the Build Alternative is estimated at \$51.7 million in 2013 dollars (\$53.8 million in 2015 dollars). These numbers reflect the operating plans and travel times modeled by VHB and AECOM and discussed with GRTC and DRPT. They also reflect adjustments made based on discussions with stakeholders and the Federal Transit Administration (FTA), including:

- Reduction of BRT headways from 5 minutes peak to 10 minutes peak (thereby reducing BRT rolling stock requirements from 16 vehicles to nine);
- Increase in professional services from 30 to 35%, consistent with the guidelines of the Virginia Department of Transportation (VDOT);
- Removal of Park and Ride lot at Rocketts Landing;
- Allowance for right-of-way (if necessary) to accommodate an eastbound bus lane at Belvidere and Broad Street; and,
- Addition of off-board fare collection to the Build Alternative.

These estimates are well within the capital cost limits of the Small Starts program.

TABLE 1: SUMMARY OF CAPITAL COSTS

Category/Element	Capital Cost (x1,000)	
	2013 \$	2015 \$
10 GUIDEWAY & TRACK ELEMENTS	\$3,955.4	\$4,115.2
20 STATIONS, STOPS, TERMINALS, INTERMODAL	\$3,859.7	\$4,015.6
30 SUPPORT FACILITIES	n/a	n/a
40 SITEWORK & SPECIAL CONDITIONS	\$11,009.3	\$11,454.0
50 SYSTEMS	\$9,393.7	\$9,773.2
60 ROW, LAND, EXISTING IMPROVEMENTS	\$1,776.00	\$1,847.8
70 VEHICLES	\$9,450.00	\$9,831.8
80 PROFESSIONAL SERVICES	\$9,761.6	\$10,156.0
90 UNALLOCATED CONTINGENCY	\$2,459.0	\$2,558.3
Total Project Cost (10-90)	\$51,664.7	\$53,751.8

I.0 OVERVIEW OF METHODOLOGY AND ASSUMPTIONS

As described in the January 5, 2010 *Capital Cost Methodology Report*, these cost estimates were developed in a manner consistent with FTA guidance published in two documents:

- Part II (Conduct of the Analysis), Chapter 3 (Estimation of Capital Costs) of *Procedures and Technical Methods for Transit Project Planning*; and,
- *Final Guidance on New Starts/Small Starts Policies and Procedures*.

All costs were based on the description of the Build Alternative provided in the November 17, 2010 *Detailed Definition of Alternatives* technical memorandum. The Build Alternative assumes that the dedicated service would operate at a peak headway of 10 minutes and off-peak headway of 15 minutes using a dedicated fleet of compressed natural gas (CNG) vehicles.

Capital costs were developed based on unit costs from three, primary sources:

- Transport, a Virginia Department of Transportation (VDOT) tool for establishing unit costs. These costs were rounded up to the next whole dollar to reflect the conceptual nature of the estimate.
- Transit vehicle, system, and facility costs provided by GRTC in a September 27, 2010 e-mail from Larry Hagin.
- Federal Transit Administration. *Reporting Instructions for the Section 5309 Small Starts Criteria*. July 2010. p. 14, Table 1: Small Starts Baseline Prototypical Costs for Specific Elements.

All costs were organized according to FTA cost categories, with unit costs being multiplied versus quantities estimated for each category. Allocated contingencies were then applied to each category based on the degree of uncertainty anticipated for each type of cost. An unallocated contingency of 5% was applied to the subtotal of all unit costs; this is consistent with current FTA practice for projects in the Alternatives Analysis stage of the Small Starts program. Appendix A provides detailed explanations of the unit costs and quantities used to develop the capital costs for the Build Alternative.

Current FTA guidance requires that all capital costs for Small Starts be presented in current year dollars. Year of expenditure (YOE) have also been listed to provide a better representation of likely capital costs associated with the Build Alternative. To provide a conservative estimate of total capital costs, it was assumed that the opening year of 2015 was the year of expenditure for all cost categories. Actual years of expenditure will be refined during Project Development as a design and construction schedule is established for the project.

Table 2 compares the capital costs of the Build Alternative to prototypical costs established by the FTA in 2010, as well as the costs submitted for other Small Starts projects that have been approved by FTA to continue into Project Development. On a cost per-mile basis, the guideway costs of the Build Alternative fall well within the range of costs seen on other, competitive Small Starts projects. Costs per station for the Build Alternative average approximately \$275,000 per station—almost ten times greater than the



\$25,000 shelters currently used by GRTC, but relatively less expensive than the stations being designed for the other Small Starts in this table.

Table 3 provides a detailed breakdown of the costs associated with the Build Alternative. The quantities and unit costs used to develop these estimates are provided in Appendix A.

2.0 NEXT STEPS

The travel demand forecasts for the study are being finalized, pending final input from FTA. Once these forecasts have been finalized, they will be used in conjunction with the annualized costs for the project to estimate the Cost-Effectiveness Index (CEI) for the project. The capital costs will also be utilized by the cost model for the project so that an appropriate financial plan for the project may be developed.

TABLE 2: COMPARISON OF BUILD ALTERNATIVE COSTS TO OTHER SMALL START PROJECTS

Category/Element			Unit	Broad Street Build I Unit Costs (2013\$ x 1,000)	FTA Prototypical Unit Costs* (2010\$ x 1,000)	Unit Costs of BRT Projects in Project Development (2010\$)			
						E Street (San Bernardino, CA)	East Bay (AC Transit)	El Camino (San Jose, CA)	Division Avenue (Grand Rapids, MI)
10 GUIDEWAY & TRACK ELEMENTS									
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	per route mile	\$1,273	\$1,200	\$1,746	\$643	\$2,427	\$171	
20 STATIONS, STOPS, TERMINALS, INTERMODAL									
20.01	At-grade station, stop, shelter, mall, terminal, platform	per station	\$276	\$225	\$713	\$615	\$3,061	\$404	
40 SITEWORK & SPECIAL CONDITIONS									
40.07	Automobile, bus, van accessways including roads, parking lots	per on-grade space	\$6.2	\$5.6					
50 SYSTEMS									
50.02	Traffic signals and crossing protection	per intersection	\$104	\$28					
50.05	Communications	per vehicle	\$64	\$20					
50.06	Fare collection system and equipment	per vehicle	\$181	\$11					
50.07	Central Control	per vehicle	\$0	\$17-28					
60 ROW, LAND, EXISTING IMPROVEMENTS									
60.01	Purchase or lease of real estate	lump sum	\$1,776						
70 VEHICLES									
70.04	Bus (Standard GRTC)	per vehicle	\$390	\$500					
70.04	Bus (BRT)	per vehicle	\$1,050	\$1,000	\$1,117	\$0	\$1,100	\$654	
80 PROFESSIONAL SERVICES		25 - 35% of Construction Subtotal (10-50)	35%	25-35%	40%	46%	40%	24%	
90 UNALLOCATED CONTINGENCY		5% of Subtotal (10-80)	5%	5%	7%	4%	2%	9%	
Allocated Contingency as % of Base Yr. Dollars			10%		10%	56%	18%	12%	
TOTAL PROJECT COST (YOE)			\$53,751.83		\$191,706	\$216,121	\$239,584	\$36,688	
YOE Total Project Cost per Mile w/o Vehicles			\$5,779		\$11,193	\$15,029	\$19,926	\$3,000	
Total Length			7.6		14.38	15.7	11.16	9.87	
Semi-exclusive ROW			3.1		14.38	5.4	11.16	9.87	

TABLE 3: BUILD ALTERNATIVE CAPITAL COST BY STANDARD COST CATEGORY CODE (SCC)

Category/Element		Unit	Quantity	Base Cost 2013\$ (x\$1,000)	Contingency	Total Cost 2013\$ (x\$1,000)	Base Year Unit Cost 2013\$ (\$1,000)	YOE 2015 (x\$1,000)
10 GUIDEWAY & TRACK ELEMENTS						\$3,955.42		\$4,115.22
10.02	Guideway: At-grade semi-exclusive (allows cross-traffic)	route mile	3.1	\$3,588.82	10%	\$3,947.70	\$1,273.5	
10.03	Guideway: At-grade in mixed traffic	route mile	4.5	\$7.02	10%	\$7.72	\$1.7	
20 STATIONS, STOPS, TERMINALS, INTERMODAL								
20.01	At-grade station, stop, shelter, mall, terminal, platform	station	14	\$3,356.24	15%	\$3,859.67	\$275.7	\$4,015.60
40 SITEWORK & SPECIAL CONDITIONS						\$11,009.26		\$11,454.03
40.01	Demolition, clearing, Earthwork	route mile	7.6	\$157.68	10%	\$173.44	\$22.8	
40.02	Site utilities, Utility Relocation	route mile	7.6	\$369.97	10%	\$406.96	\$53.5	
40.06	Pedestrian/Bike Access and Accommodation	route mile	7.6	\$193.98	10%	\$213.38	\$28.1	
40.07	Automobile, bus, van accessways including roads, parking lots	on-grade space	95	\$532.00	10%	\$585.20	\$6.2	
40.08	Temporary Facilities and other indirect cost during construction	route mile	7.6	\$8,754.79	10%	\$9,630.27	\$1,267.1	
50 SYSTEMS						\$9,393.66		\$9,773.16
50.02	Traffic signals and crossing protection	intersection	55	\$5,195.00	10%	\$5,714.50	\$103.9	
50.05	Communications	vehicle	9	\$840.00	15%	\$966.00	\$107.3	
50.06	Fare collection system and equipment	vehicle	9	\$2,359.27	15%	\$2,713.16	\$301.5	
50.07	Central Control	vehicle	9	\$0.00	10%			
60 ROW, LAND, EXISTING IMPROVEMENTS								
60.01	Purchase or lease of real estate	lump sum	1	\$1,480.00	20%	\$1,776.00	\$1,776.0	\$1,847.75
60.02	Relocation of existing households and businesses			\$0.00	20%			
70 VEHICLES								
70.04	Bus	vehicle	9	\$9,000.00	5%	\$9,450.00	\$1,050.0	\$9,831.78
80 PROFESSIONAL SERVICES		25 - 35% of Construction Subtotal (10-50)		\$8,874.16	10%	\$9,761.58	35%	\$10,155.95
90 UNALLOCATED CONTINGENCY		5% of Subtotal (10-80)		\$2,235.45	10%	\$2,458.99	5%	\$2,558.33
TOTAL				\$46,944.36		\$51,664.58		\$53,751.83

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**APPENDIX A:
BUILD ALTERNATIVE
CAPITAL COST ASSUMPTIONS**

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BUILD ALTERNATIVE: COST ESTIMATE SUMMARY BY SECTION (2013\$, without contingency)

COST CATEGORY	UNIT	UNIT COST	SYSTEMWIDE ELEMENTS		MEDIAN RUNNING SEGMENTS		CURB RUNNING SEGMENTS		MIXED TRAFFIC SEGMENTS		TOTAL
			QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	
10 GUIDEWAY AND TRACK ELEMENTS											
10.02 Guideway: At-grade semi-exclusive(allows cross traffic)											
Aggregate Base Material Type I, Size 21B	TON	\$20.00			2,929	\$58,580	1,811	\$36,220			
Asphalt Concrete Base CR TY BM-25.0A	TON	\$59.00			2,424	\$143,016	1,499	\$88,441			
Asphalt Concrete Ty SM-9.5A	TON	\$84.00			12,266	\$1,030,344	4,944	\$415,296			
Asphalt Concrete Ty SM-19.0	TON	\$65.00			741	\$48,165	458	\$29,770			
Flexible Pavement Planing	SY	\$3.00			194,332	\$582,996	76,151	\$228,453			
Median (MS-1)	SY	\$75.00			8,096	\$607,200		\$0			
Sign Panels	SF	\$26.00			740	\$19,240	70	\$1,820			
Sign Post Steel 4"	LF	\$61.00			144	\$8,784	72	\$4,392			
Ty. B C I I Pavement Line Marking 4"	LF	\$1.00			57,684	\$57,684	19,272	\$19,272			
Ty. B C I I Pavement Line Marking 6"	LF	\$1.00			46,656	\$46,656	19,008	\$19,008			
Ty. B C I I Pavement Line Marking 12"	LF	\$3.00			12,144	\$36,432	7,392	\$22,176			
Ty. B C I I Pavement Line Marking 24"	LF	\$5.00			2,382	\$11,910		\$0			
Rumble Strip, Asphalt (RS-5)	LF	\$2.00			23,328	\$46,656	9,504	\$19,008			
Liquid Asphalt Coating (Rumble Strips)	SY	\$2.00			2,592	\$5,184	1,056	\$2,112			
SUB-TOTAL						\$2,702,847		\$885,968			\$3,588,815
10.03 Guideway: At-grade in mixed traffic											
Sign Panels	SF	\$26.00							101	\$2,626.00	
Sign Post Steel 4"	LF	\$61.00							72	\$4,392.00	
SUB-TOTAL										\$7,018.00	\$7,018
SUB-TOTAL						\$2,702,847		\$885,968		\$7,018.00	\$3,595,833
20 STATIONS, STOPS, TERMINALS,INTERMODAL											
20.01 At-grade station, stop, shelter, mall,terminal,platform.											
Concrete Bus Pad	CY	\$744.00			98	\$72,912	293	\$217,992	147	\$109,368.00	
Concrete Platform	SY	\$75.00			480	\$36,000	1,760	\$132,000	880	\$66,000.00	
Station Furniture(Lighting, Benches and Bike Racks)	LS				1	\$87,200	1	\$261,600	1	\$130,800.00	
Sign Panels	SF	\$26.00			60	\$1,560	60	\$1,560	53	\$1,365.00	
Sign Post Steel 4"	LF	\$61.00			216	\$13,176	216	\$13,176	189	\$11,529.00	
Enhanced Shelters	Per Platform	\$50,000.00			8	\$400,000	24	\$1,200,000	12	\$600,000.00	
SUB-TOTAL						\$610,848		\$1,826,328		\$919,062.00	\$3,356,238
40 SITEWORK & SPECIAL CONDITIONS											
40.01 Demolition, Clearing, Earthwork											
Removal of existing trees	LS				1	\$0	1	\$10,000			
Removal of Median	SY	\$8.00			6,733	\$53,864	4,164	\$33,312		\$0.00	
Removal of Sidewalk	SY	\$8.00			533	\$4,264	1,280	\$10,240	687	\$5,496.00	
Removal of curb and gutter	LF	\$5.00			960	\$4,800	1,440	\$7,200	720	\$3,600.00	
Demolition of Pavement(Flexible)	SY	\$4.00			480	\$1,920	1,760	\$7,040	880	\$3,520.00	
Remove Ty I Signs	EA	\$230.00			20	\$4,600	8	\$1,840	26	\$5,980.00	
SUB-TOTAL						\$69,448		\$69,632		\$18,596.00	\$157,676
40.02 Site Utilities, Utility Relocation											
Drainage (20% of the pavement cost)	LS					\$256,021		\$113,945		\$0.00	
SUB-TOTAL						\$256,021		\$113,945		\$0.00	\$369,966
40.06 Pedestrian/Bike access and Accommodation											
Hydr. Cement Concrete Sidewalk 4"	SY	\$36.00			533	\$19,188	800	\$28,800	400	\$14,400.00	

BUILD ALTERNATIVE: COST ESTIMATE SUMMARY BY SECTION (2013\$, without contingency)

COST CATEGORY	UNIT	UNIT COST	SYSTEMWIDE ELEMENTS		MEDIAN RUNNING SEGMENTS		CURB RUNNING SEGMENTS		MIXED TRAFFIC SEGMENTS		TOTAL
			QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	QUANTITY	COST	
St'd Combination Curb and Gutter CG-6	LF	\$20.00			960	\$19,200	1,440	\$28,800	720	\$14,400.00	
CG-12 Curb Ramp	SY	\$186.00			288	\$53,568	48	\$8,928	36	\$6,696.00	
SUB-TOTAL						\$91,956		\$66,528		\$35,496.00	\$193,980
40.07 Automobile, bus, van, accessways including roads,parking lots											
Parking spaces	per space	\$5,600.00	95.00	\$532,000							
SUB-TOTAL	LS			\$532,000		\$0		\$0		\$0.00	\$532,000
40.08 Temporary Facilities and other indirect costs during construction											
Landscaping (1% of 10-50)	LS			\$30,713		\$75,911		\$41,024		\$18,351.72	
Maintenance of Traffic (10% of 10-50)	LS			\$256,998		\$766,703		\$414,343		\$185,352	
Construction Survey (1% of 10-50)	LS			\$33,897		\$85,096		\$45,988		\$20,572.28	
Mobilization (5%(10-50)	LS			\$169,644		\$425,942		\$230,188		\$102,972	
Contingency (30% of 10-50)	LS			\$1,068,756		\$2,683,432		\$1,450,183		\$648,726.24	
SUB-TOTAL				\$1,560,008		\$4,037,084		\$2,181,725		\$975,975.03	\$8,754,792
SUB-TOTAL			1	\$2,092,008		\$4,454,509		\$2,431,831		\$1,030,067.03	\$10,008,415
50 SYSTEMS											
50.02 Traffic signals and crossing protection	LS				1	\$3,740,000	1	\$780,000	1	\$675,000.00	\$5,195,000
50.05 Communications											\$840,000
Variable Message Signs	LS					\$120,000		\$360,000		\$180,000.00	
Vehicle Communication	per vehicle	\$20,000.00	9	\$180,000							
50.06 Fare Collection	LS	\$2,359,269.00	1	\$2,359,269							\$2,359,269
SUB-TOTAL				\$2,539,269		\$3,860,000		\$1,140,000		\$855,000.00	\$8,394,269
60 ROW, LAND, EXISTING IMPROVEMENTS											
60.01 Purchase or lease of real estate	LS					\$1,480,000					\$1,480,000
60.02 Relocation of existing households and bussinesses											
SUB-TOTAL				\$0		\$1,480,000		\$0		\$0.00	\$1,480,000
70 VEHICLES											
70.04 Bus	BRT Vehicle	\$1,000,000.00	9	\$9,000,000							\$9,000,000
	GRTC Vehicle	\$390,000.00									
80 PROFESSIONAL SERVICES											
35% of Construction (10-50)				\$1,620,947		\$4,069,871		\$2,199,444		\$983,901.46	\$8,874,164
90 UNALLOCATED CONTINGENCY											
5% of Sub-total (10-80)				\$762,611		\$858,904		\$424,179		\$189,752.42	\$2,235,446
TOTAL COST				\$16,014,835		\$18,036,979		\$8,907,750		\$3,984,800.91	\$46,944,365

Median Running - 2.2 mi from Thompson St. to Adams St.

10 GUIDEWAY AND TRACK ELEMENTS

10.02 Guideway: At-grade semi-exclusive (allows cross traffic)

Aggregate Base Material Type I, Size 21B		60,596 SF
Assumes 8" thickness		40,397 CF
@ 145 LBS/CF		5,857,613 LBS
		2,929 TONS
Asphalt Concrete Base CR TY BM-25.0A		60,596 SF
@ 120 LBS/SY/IN		6,733 SY
Assumes 6" thickness		807,947 LBS/IN
		4,847,680 LBS
		2,424 TONS
Ashpalt Concrete Ty. SM-9.5A		60,596 SF
@ 120 LBS/SY/IN		6,733 SY
Assumes 1.5" thickness		807,947 LBS/IN
		1,211,920 LBS
		606 TONS
Ashpalt Concrete Ty. SM-9.5A (Overlay)	2.3 mi	12,144 SF
@ 120 LBS/SY/IN	77	97,166 SY
Assumes 2.0" thickness		11,659,893 LBS/IN
		23,319,787 LBS
		11,660 TONS
	Sub-total	12,266 TONS
Asphalt Concrete Ty. SM-19.0		60,596 SF
@ 110 LBS/SY/IN		6,733 SY
Assumes 2" thickness		740,618 LBS/IN
		1,481,235 LBS
		741 TONS
Flexible Pavement Planing	2.3 MI	12,144 LF
<i>Assume milling the entire cross section (77ft)</i>	77 FT Cross Section	
	12144*77-60596	194,332 SY
Median Strip MS-1		
Between Bus Lane and Travel Lanes	2.3*5280*3*2	72,864 SF
W=3' Assume 2.3 mi on both direction		8,096 SY
Sign Panels		
<i>Assumes 1 sign per 0.25 mile</i>		
<i>Preferential Only Lane Operation for 2.3 mi - overhead</i>	72 IN X 60 IN	600 SF
<i>Additional Sign near Station (4 Each station)</i>	30 IN X 42 IN	140 SF
	Sub-total	740 SF
Sign Post Steel 4"	9*4*4	144 LF
<i>Additional Sign near Station (4 Each station)</i>		
Rumble Strip, Asphalt		
<i>Assumes application between Bus Lane and Car Travel Lane</i>	2.3*5280 minus platforms	11,664 LF
<i>RS-5 12" Rumble Strips in east and west direction</i>		23,328 LF

Median Running - 2.2 mi from Thompson St. to Adams St.

Liquid Asphalt Coating	2.3*5280 minus platforms	11,664 LF
RS-5 12" Rumble Strips		11,664 SF
In east and west direction		23,328 SF
		2,592 SY
Ty. B Cl I Pavement Line Marking 4"	2.3 *5280/40*10*3	9,108 LF
Assumes 3 Broken and 4 Solid markings. See Typical	2.3*5280*4	48,576 LF
		57,684 LF
Ty. B Cl I Pavement Line Marking 6"	2.3*5280 minus platforms	11,664 LF
Assumes striping on each side of rumble strip		23,328 LF
In east and west direction along Broad Street		46,656 LF
Ty. B Cl I Pavement Line Marking 12"	2.3*5280	12,144 LF
Ty. B Cl I Pavement Line Marking 24"	13*15*10	1,950 LF
Assumes 13 locations w/crosswalk		
Assumes 1 solid and 15 stop bars	33*8+24*7	432
		2,382
	Sub-total	

20 STATIONS, STOPS, TERMINALS, INTERMODAL

Concrete Bus Pad		
at Station Location L=60' W=11' T=6"	4*2*60*11*6/12	98 CY

Concrete Platform Slabs	Area of Platform (9' X 60') =	540 SF
2 platform per station, 4 Stations	540*2*4	4320 SF
		480 SY

Station Furnitures

Lighting at Station		
2 platform per station, 4 Stations	\$7,500/pole *2*4	\$60,000.00 LS

Bench		
2 platform per station, 4 Stations	\$1,500/bench*2*2*4	\$24,000.00 LS
2 per platform		

Bicycle Rack		
2 platform per station, 4 Stations	\$400/rack*2*4	\$3,200.00 LS

Station Furnitures Sub-Total **\$87,200 LS**

Enhanced Shelters		
2 platform per station, 4 Stations	\$50,000/platform *2*4	8 Platforms

Sign Panel at station location		
No Parking (with transit logo)	12 IN X 30 IN	2.5 SF
Assumed 6 signs per station (1 for bus stop, 2 for no parking on each side of the street)		60 SF

Sign Post Steel 4"		
At station location	9*3*2*4	216 LF
pole length of 9 FT		

Median Running - 2.2 mi from Thompson St. to Adams St.

40 SITEWORK & SPECIAL CONDITIONS

40.01 Demolition , Clearing, Earthwork

Removal of Median <i>Measured from GIS layer</i>		60,596 SF 6,733 SY
Removal of sidewalk 2 platform per station, 4 Stations L=60', W=5' replace both sides of the platform	2*4*2*60*5	4,800 SF 533 SY
Removal of Curb and gutter 2 platform per station, 4 Stations L=60', replace both sides of the platform	2*4*2*60	960 LF
Demolition of Pavement at Station Location 4 Station	9*60*8	480 SY
Remove Ty. I Signs <i>Assumes 1 sign per 0.25 mile</i>	2.3 MI / 0.25 MI	20 EA

40.06 Pedestrian/Bike Access Accomodation

Hydr. Cement Concrete Sidewalk 4" 2 platform per station, 4 Stations L=60', W=5' replace both sides of the platform	2*4*2*60*5	4,800 SF 533 SY
St'd Combination Curb and Gutter CG-6 2 platform per station, 4 Stations L=60', replace both sides of the platform	2*4*2*60	960 LF
<i>CG-12 Curb Ramp</i> 12 curb ramp per station, 4 station, 54 sf per ramp	12*4*54	288 SY

50 SYSTEMS

50.02 Traffic signal and crossing Protection

There are 28 signals between Thompson and Adams	Pre-emption (\$5,000 per signal)	\$140,000 LS
Where structures are located in the median and must be relocated, costs will be assumed for entire intersection; includes costs for moving loops and pavement markings 15 signals will be impacted	\$120,000 per T-Intersection \$220,000 per 4-Leg Intersection	\$1,320,000 LS \$880,000 LS
		\$2,340,000 LS
There are 28 signalized intersection between Thompson and Adams	\$50,000 per box per intersection	\$1,400,000 LS
	Sub-Total	\$3,740,000

50.05 Communications

Variable Message Signs 2 platform per station, 4 Stations	\$15,000/platform	\$120,000 LS
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Median Running - 2.2 mi from Thompson St. to Adams St.

60 ROW, LAND, EXISTING IMPROVEMENTS

60.01 Purchase or Lease of Real Estate

Belvidere and Broad Street: assume total value of parcel and improvements of parking lot in SE corner of the intersection (ROW needed to fit bus lane in without losing a dedicated turn lane)

\$1,480,000 LS

Curb Running - 0.9 mi Adams St. to 14th St.

10 GUIDEWAY AND TRACK ELEMENTS

10.02 Guideway: At-grade semi-exclusive (allows cross traffic)

Aggregate Base Material Type I, Size 21B		37,479 SF
Assumes 8" thickness		24,986 CF
@ 145 LBS/CF		3,622,970 LBS
		1,811 TONS

Asphalt Concrete Base CR TY BM-25.0A		37,479 SF
		4,164 SY
@ 120 LBS/SY/IN		499,720 LBS/IN
Assumes 6" thickness		2,998,320 LBS
		1,499 TONS

Ashpalt Concrete Ty. SM-9.5A		37,479 SF
		4,164 SY
@ 120 LBS/SY/IN		499,720 LBS/IN
Assumes 1.5" thickness		749,580 LBS
		375 TONS

Ashpalt Concrete Ty. SM-9.5A(Overlay)	0.9 mi	342,681 SF
	80	38,076 SY
@ 120 LBS/SY/IN		4,569,080 LBS/IN
Assumes 2" thickness		9,138,160 LBS
		4,569 TONS
		4,944 TONS

Sub-total

Asphalt Concrete Ty. SM-19.0		37,479 SF
		4,164 SY
@ 110 LBS/SY/IN		458,077 LBS/IN
Assumes 2" thickness		916,153 LBS
		458 TONS

Flexible Pavement Planing		
Assume milling the entire cross section	0.9 MI	4,752 SF
	80 FT Cross Section	342,681 SF
		76,151 SY

Sign Panels		
Assumes 1 sign per 0.25 mile	30 IN X 42 IN	70 SF
Preferential Only Lane Operation for 0.9 mi - ground		

Sign Post Steel 4"	9*8	72 LF
Assumes 1 sign per 0.25 mile for 0.9mi		
pole length of 9 FT		

Rumble Strip, Asphalt		
Assumes application between Bus Lane and Car Travel Lane	0.9*5280	4,752 LF
RS-5 12" Rumble Strips in east and west direction		9,504 LF

Curb Running - 0.9 mi Adams St. to 14th St.

Liquid Asphalt Coating	0.9*5280	4,752 LF
RS-5 12" Rumble Strips		4,752 SF
In east and west direction		9,504 SF
		1,056 SY
Ty. B Cl I Pavement Line Marking 4"	0.2*5280*5+02*5280/40*10*4	6,336 LF
	0.7*5280*3+.7*5280/40*10*2	12,936 LF
		19,272 LF
Ty. B Cl I Pavement Line Marking 6"	0.9*5280	4,752 LF
Assumes striping on each side of rumble strip		9,504 LF
In east and west direction along Broad Street		19,008 LF
Ty. B Cl I Pavement Line Marking 12"	0.7*5280*2	7,392 LF

20 STATIONS, STOPS, TERMINALS, INTERMODAL

Concrete Bus Pad	6*4*60*11*6/12	293 CY
at Station Location L=60' W=11' T=6"		
Concrete Platform	Area of Platform (11' X 60') =	660 SF
6 platforms per station, 4 Stations	660*6*4	15,840 SF
		1,760 SY
Station Furnitures		
Lighting at Station	\$7,500/pole *6*4	\$180,000 LS
6 platforms per station, 4 Stations		
Bench	\$1,500/bench*6*2*4	\$72,000 LS
6 platforms per station, 4 Stations		
2 benches per platform		
Bicycle Rack	\$400/rack*6*4	\$9,600 LS
6 platforms per station, 4 Stations		
Station Furniture Sub-Total		\$261,600 LS
Enhanced Shelters	\$50,000/platform *6*4	24 Platforms
6 platforms per station, 4 Stations		
Sign Panels at station location	12 IN X 30 IN	
No Parking (with transit logo)		60 SF
Assumed 6 signs per station (1 for bus stop, 2 for no parking on each side of the street)		
	9*3*2*4	216 LF
Sign Post Steel 4" at station Location		
pole length of 9 FT		

40 SITEWORK & SPECIAL CONDITIONS

40.01 Demolition , Clearing, Earthwork

Removal of Existing trees along median	\$10,000 LS
Removal of Median	37,479 SF

Curb Running - 0.9 mi Adams St. to 14th St.

<i>Measured from GIS layer</i>		4,164 SY
Removal of Median/Sidewalk <i>at Station location, sidewalk width from aerial</i>	4*6*60*8	11,520 SF 1,280 SY
Removal of Curb and gutter 6 per station, 4 Stations L=60'	6*4*60	1,440 LF
Demolition of Pavement at Station Location 4 Station	60*11*6*4	1,760 SY
Remove Ty. I Signs <i>Assumes 1 sign per 0.25 mile</i>	0.9 MI / 0.25 MI	8 EA

40.06 Pedestrian/Bike Access Accomodation

Hydr. Cement Concrete Sidewalk 4" 6 per station, 4 Stations L=60', W=5'	6*4*60*5	7,200 SF 800 SY
St'd Combination Curb and Gutter CG-6 6 per station, 4 Stations L=60'	6*4*60	1,440 LF
CG-12 Curb Ramp 2 curb ramp per station, 4 station, 54 sf per ramp	2*4*54	48 SY

50 SYSTEMS

50.02 Traffic Signal and Crossing Protection

There are 12 signals between N. 3rd St and N. 14th St	Pre-emption (\$5,000 per signal)	\$60,000 LS
Where structures are located in the median and must be relocated, costs will be assumed for entire intersection; includes costs for moving loops and pavement markings 1 signal will be impacted	\$120,000 per T-Intersection	\$120,000 LS
	\$220,000 per 4-Leg Intersection	\$0 LS
	Sub-total	\$180,000 LS
<i>There are 12 signalized intersections between N. 3rd St and N. 14th St</i>	\$50,000 per box per intersection	\$600,000 LS
	Sub-Total	\$780,000 LS

50.05 Communications

Variable Message Signs 6 platform per station, 4 Stations	\$15,000/sign*6*4	\$360,000 LS
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Mixed Traffic Operations - 4.5 miles

10 GUIDEWAY AND TRACK ELEMENTS

10.03 Guideway: At-grade in mixed traffic

Sign Panels		
<i>Assumes 1 sign per 0.25 mile</i>	66 IN X 36 IN	66 SF
<i>Preferential Only Lane Ahead for 1 mi approaching Thompson St</i>	30 IN X 42 IN	35 SF
<i>Preferential Only Lane Ahead for 1 mi approaching 12th St - ground</i>		101 SF
Sign Post Steel 4"	8*9	72 LF
<i>Assumes 1 sign per 0.25 mile and pole length of 9 FT</i>		

20 STATIONS, STOPS, TERMINALS, INTERMODAL

Concrete Bus Pad	12*60*11*6/12	147 CY
12 platform, 6 stations		
<i>L=60' W=11' T=6"</i>		
Concrete Platform)	Area of Platform (11' X 60') =	660 SF
12 platform, 6 stations	660*12	7,920 SF
		880 SY

Station Furnitures

Lighting at Station	\$7,500/pole *6*2	\$90,000 LS
2 platforms per station, 6 stations		
Bench	\$1,500/bench*6*2*2	\$36,000 LS
2 platforms per station, 6 stations		
2 per platform		
Bicycle Rack	400/rack*6*2	\$4,800 LS
2 platforms per station, 6 stations		
		\$130,800 LS

Station Furnitures Sub-Total

Enhanced Shelters	\$50,000/platform *6*2	12 Platforms
2 platforms per station, 6 stations		
Sign Panels	12 IN X 30 IN	53 SF
<i>No Parking (with transit logo)</i>		
<i>Assumed 6 signs per station (1 for bus stop, 2 for no parking on each side of the street)</i>		
Sign Post Steel 4"		189 LF
<i>pole length of 9 FT</i>		

Mixed Traffic Operations - 4.5 miles

40 SITEWORK & SPECIAL CONDITIONS

40.01 Demolition , Clearing, Earthwork

Removal of Sidewalk <i>at Station location, sidewalk width from aerial</i>	3*5*60+12*4*60+5*8*60	6,180 SF 687 SY
Removal of curb and gutter 12 platform, 6 Stations L=60'	12*60	720 LF
Demolition of Pavement at Station Location 12 platform, 6 stations	11*60*12	880 SY
Remove Ty. I Signs <i>Assumes 1 sign per 0.25 mile</i>	1.42 MI / 0.25 MI 1.75 MI / 0.25 MI	12 EA 14 EA 26 EA

40.06 Pedestrian/Bike Access Accomodation

Hydr. Cement Concrete Sidewalk 4" 12 platform, 6 Stations L=60', W=5' replace the sidewalk on the other side of the platform	12*60*5	3,600 SF 400 SY
St'd Combination Curb and Gutter CG-6 12 platform, 6 Stations L=60'	12*60	720 LF
<i>CG-12 Curb Ramp</i> 6 station, 54 sf per ramp	6*54	36 SY

50 SYSTEMS

50.02 Traffic signal and crossing Protection

There are 15 signals	Pre-emption (\$5,000 per signal)	\$75,000 LS
<i>There are 6 signalized intersection between Willow Lawn and N. Hamilton and 9 between Bank St. and Orleans St.</i>	\$50,000 per box per intersection	\$600,000 LS
	Sub-Total	\$675,000

50.05 Communications

Variable Message Signs 12 platform, 6 stations	15000/sign*12	\$180,000 LS
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Systemwide Elements

40 SITEWORK & SPECIAL CONDITIONS

40.07 Automobile, bus, van, accessways including roads, parking lots

Parking spaces	Assume 95 spaces at \$5,600/space	300 parking spaces
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50 SYSTEMS

50.05 Communications

Vehicle Communications		
Costs are assumed per vehicle	\$20,000 per vehicle	\$300,000 LS
<i>The Build Alternative will require 15 vehicles (12 peak, 3 spare)</i>		

50.06 Fare Collection

<i>Includes TVMs, stand-alone validators, cash room modifications, and control systems. See table "Broad Street BRT Fare Collection System" for details</i>		\$2,359,269 LS
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60 ROW, LAND, EXISTING IMPROVEMENTS

60.01 Purchase or Lease of Real Estate

<i>2103 Staples Mill Rd: assume agreement in place with Anthem to use a portion of their lot. Costs to restripe or dedicate this section to Park and Ride included under 40.07</i>		LS
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70 VEHICLES

70.04 Bus

BRT Vehicles	7 peak vehicles, 2 spares	
Costs are assumed per vehicle	\$1,000,000 per vehicle	9 vehicles

Exhibit 2
Broad Street BRT Fare Collection System

Mode	Note	Equipment/Modification Type	Quantity	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
BRT Stations		TVMs (2 per station)	28	40,000	1,120,000					1,120,000
		Stand Alone Validators, SAVs (2 each at 4 CBD Stations)	8	8,000	64,000					
		Hand Held Devices (2 per Inspector)	4	5,000	20,000					20,000
		Network Equipment at Stations (1 set per station)	14	5,000	70,000					70,000
		subtotal (equipment)			1,274,000	0	0	0	0	1,274,000
	A	Engineering (10%)			127,400	0	0	0	0	127,400
	A	Installation and Testing (5%)			63,700	0	0	0	0	63,700
	A	Support, Training and Manuals (5%)			63,700	0	0	0	0	63,700
	A	Non-recurring Parts & Services (13.5%)			171,990	0	0	0	0	171,990
	A	Contingency (15%)			255,119	0	0	0	0	255,119
		subtotal (add-ons)			681,909	0	0	0	0	681,909
		Total Future Cost for Equip./Mod.			1,955,909	0	0	0	0	1,955,909
	B	Maintenance materials (10% of Non-recurring Parts & Services)			17,199	18,059	18,962	19,910	20,905	95,035
		Total future cost of equip./mod. and materials			1,973,108	18,059	18,962	19,910	20,905	2,050,944
Cash Room		Additional Change Hoppers (2 per TVM)	56	500	28,000					28,000
		Additional Coin Vaults (1 per TVM)	28	300	8,400					8,400
		Additional Bill Vaults (1 per TVM)	28	1,000	28,000					28,000
		Revenue Carts	2	50,000	100,000					100,000
		subtotal (equipment)			164,400	0	0	0	0	164,400
	A	Engineering (10%)			16,440	0	0	0	0	16,440
	A	Support (5%)			8,220	0	0	0	0	8,220
	A	Non-recurring Parts & Services (13.5%)			22,194	0	0	0	0	22,194
	A	Contingency (15%)			31,688	0	0	0	0	31,688
		subtotal (add-ons)			78,542	0	0	0	0	78,542
		Total Future Cost for Equip./Mod.			242,942	0	0	0	0	242,942
	B	Maintenance materials (10% of Non-recurring Parts & Services)			2,219	2,330	2,447	2,569	2,698	12,264
		Total future cost of equip./mod. and materials			245,162	2,330	2,447	2,569	2,698	255,206

Exhibit 2
Broad Street BRT Fare Collection System

Mode	Note	Equipment/Modification Type	Quantity	Unit Cost	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Central and System Support		Central Computer System	1	325,000	325,000					325,000
		Workstations	2	5,000	10,000					10,000
		subtotal (equipment)			335,000	0	0	0	0	335,000
	A	Engineering (10%)			33,500	0	0	0	0	33,500
	A	Installation (5%)			16,750	0	0	0	0	16,750
	A	Support (5%)			16,750	0	0	0	0	16,750
	A	Non-recurring Parts & Services (13.5%)			45,225	0	0	0	0	45,225
	A	Contingency (15%)			67,084	0	0	0	0	67,084
		subtotal (add-ons)			179,309	0	0	0	0	179,309
		Total Future Cost for Equip./Mod.			514,309	0	0	0	0	514,309
	B	Maintenance materials (10% of Non-recurring Parts & Services)			4,523	4,749	4,986	5,235	5,497	24,990
		Total future cost of equip./mod. and materials			518,831	4,749	4,986	5,235	5,497	539,298
Grand Total Future Cost					2,737,100	25,138	26,395	27,715	29,100	2,845,448

Notes:

- A. Percentage of equipment subtotal
- B. Escalation rate of 5% for years 2 to 10

Estimate of ROW Costs at Belvidere and Broad Street

ParcelID	Property_1	LandUse	ACREAGE	SqFt	OwnerName	Assessment	LandValue	DwellingVa	TotalValue
9169	B Drug Stores/Pharmacy	Commercial	0.69	30,205	Rite-va1 Administrator Inc C/o Rite Aid Corporation	1/1/2009	\$698,000.00	\$873,600.00	\$1,571,600.00
38183	B Vehicle Srv Station w/pumps	Commercial	0.60	26,330	Hess Realty Corp	1/1/2009	\$515,000.00	\$119,000.00	\$634,000.00
51968	B College/University Facility	Institutional	2.24	97,426	Vcuref	1/1/2009	\$3,066,000.00	\$24,039,000.00	\$27,105,000.00
80531	B Paved Surface Parking	Commercial	0.71	30,981	Universal Ford Acquisition Corp	1/1/2009	\$1,396,000.00	\$84,000.00	\$1,480,000.00
80533	B Commercial Vacant Land	Vacant	0.01	608	City Of Richmond Public Works	1/1/2009	\$45,000.00	\$0.00	\$45,000.00