

APPENDIX 1

COST ESTIMATING AND UNIT COSTS ASSUMPTIONS

Cost Data used for developing the estimates include:

Paving \$135 SY – This assumes 12” of HMA on 12” (two six inch lifts) of GAB using the SHA Cost Estimating guide prices of \$120 ton for HMA and \$25 a SY for 6” GAB

Class I Excavation – For an average roadway widening of 4’ use 60 CY per 100’ of widening (one side). For addition of new sidewalk use 30 CY per 100’ of new sidewalk. Use the SHA 2010 Cost Estimating Guide price of \$37 CY for Class I. This assumes a minor amount of grading and does not include significant cuts, fills or retaining walls.

SWM – Use 2010 cost estimating guide for quantities and R/W required.

ADA Ramps – Retrofit existing ramps \$3,000 EA. This assumes approximately 105 SF of sidewalk, 20 LF of C&G and detectable warning surface using the 2010 Cost Estimating Guide for sidewalk and curb & gutter. For new construction the items for sidewalk and C&G can be used.

Category Percent Contingencies

Category 1 – 35% of major quantities

Category 3 -35% of major quantities

Category 7 – 5% of major quantities

Utilities – 6% of major quantities

Overall, add 40% to the estimate (use for all station estimates)

UNIT COSTS

Sidewalks

- Unit Cost for Sidewalks - \$15/SF.

Curb and Gutter

Unit Cost for Curb and Gutter - \$50/LF.

Pedestrian Signal (Signalized Intersection Mod.)

\$7500/Each Pedestrian Signal Pole – From 2010 Highway Construction Cost Estimating Manual.

Lighting

Roadway light pole: \$9800/Each Light Pole - From 2010 Highway Construction Cost Estimating. Manual.

Bus Stop lighting: \$4900/Each for Bus Stop Lighting – Assumed half of the cost for roadway light pole.

Luminaire: \$800/Lighting Arm + \$300/Luminaire = \$1100 Total for installing Luminaire on Utility poles – From SHA Price Index (January 2011). We assumed \$500/Luminaire for installing luminaire on pedestrian bridge.

Pavement Markings

Removal of Preformed Letters, Symbols, Arrows and Numbers - \$25/SF

White Preformed Thermoplastic Pavement Marking Legends and Symbols - \$15.00/SF

Removal of Existing Pavement Line Markings, Any Width - \$1.25/LF

5 Inch White Permanent Preformed Patterned Reflective Pavement Markings - \$3.50/LF

\$10/LF, Average between 12 inch White Lead Free Reflective Thermoplastic Pavement Markings and 24 inch White Lead Free Reflective Thermoplastic Pavement Markings – From SHA Price Index (January 2010).

Signing

Pedestrian Signing Unit Cost for Sheet Aluminum Signs - \$30/SF – From SHA Price Index (January 2011)

Bicycle Signing Unit Cost for Sheet Aluminum Signs - \$30/SF (posts are incidental)

Directional Signing Unit Cost for Sheet Aluminum Signs - \$30/SF – From SHA Price Index (January 2011)

Utility Poles

Assumed \$10,000/Pole Relocation.

Drainage

- Bicycle Safe Grates - \$300/EA (<http://www.co.lancaster.pa.us/purchasing/lib/purchasing/roadpipesgrates.pdf>, Page 31)

Highways

Repaving 1-1/2” Depth - \$150,000/LM (Includes milling)

Widening (4-ft) - \$952,176/CPM

Paving - \$316,800/CPM \$135.00/SY

ROW - \$150,000/CPM \$250,000/Acre

Earthwork - \$117,216/CPM \$37.00/CY (Class I)

Hydraulics - \$67,200/CPM \$42,000/Acre

Curb & Gutter - \$264,000/CPM \$50.00/LF

Pavement Markings - \$ 36,960/CPM \$3.50/LF

Cost per mile (CPM) is computed from established unit costs for roadway widening (4-feet).

Costs do not include right-of-way costs needed for any SWM needs or widening that could fall outside estimated existing right-of-way limits. Existing right-of-way was visually assumed to be set along utility pole locations, back edge of sidewalks, fence lines, or other similar boundary delineations.

APPENDIX 2: PEDESTRIAN AND BICYCLE CRASH DATA SUMMARY

Station Name	Jurisdiction	Crash Location										Total Ped Crashes	Total Bike Crashes
		AA County		Baltimore County		Baltimore City		Harford County		Howard County			
		Ped Crash (0.6 Miles)	Bike Crash (3 Miles)	Ped Crash (0.6 Miles)	Bike Crash (3 Miles)	Ped Crash (0.6 Miles)	Bike Crash (3 Miles)	Ped Crash (0.6 Miles)	Bike Crash (3 Miles)	Ped Crash (0.6 Miles)	Bike Crash (3 Miles)		
Owings Mills	Balto. Co.	0	0	2	17	0	0	0	0	0	0	2	17
Old Court	Balto. Co.	0	0	1	16	0	0	0	0	0	0	1	16
Milford Mill	Balto. Co.	0	0	10	4	2	0	0	0	0	0	12	4
Reisterstown Plaza	Balto. City	0	0	0	1	11	2	0	0	0	0	11	3
Rogers Avenue	Balto. City	0	0	0	1	21	11	0	0	0	0	21	12
West Cold Spring	Balto. City	0	0	0	0	38	10	0	0	0	0	38	10
Mondawmin	Balto. City	0	0	0	0	22	3	0	0	0	0	22	3
Penn North	Balto. City	0	0	0	0	59	5	0	0	0	0	59	5
Upton/Ave Market	Balto. City	0	0	0	0	44	8	0	0	0	0	44	8
State Center/Cultural Center	Balto. City	0	0	0	0	14	1	0	0	0	0	14	1
Lexington Market (Metro)	Balto. City	0	0	0	0	37	6	0	0	0	0	37	6
Charles Center	Balto. City	0	0	0	0	65	9	0	0	0	0	65	9
Shot Tower/Market Place	Balto. City	0	0	0	0	68	13	0	0	0	0	68	13
Johns Hopkins Hospital	Balto. City	0	0	0	0	56	68	0	0	0	0	56	68
Hunt Valley	Balto. Co.	0	0	3	0	0	0	0	0	0	0	3	0
Pepper Road	Balto. Co.	0	0	1	0	0	0	0	0	0	0	1	0
McCormick Road	Balto. Co.	0	0	0	1	0	0	0	0	0	0	0	1
Gilroy Road	Balto. Co.	0	0	0	0	0	0	0	0	0	0	0	0
Warren Road	Balto. Co.	0	0	0	2	0	0	0	0	0	0	0	2
Timonium Fairgrounds	Balto. Co.	0	0	0	4	0	0	0	0	0	0	0	4
Timonium Business Park	Balto. Co.	0	0	4	3	0	0	0	0	0	0	4	3
Lutherville	Balto. Co.	0	0	6	7	0	0	0	0	0	0	6	7
Falls Road	Balto. Co.	0	0	1	10	0	2	0	0	0	0	1	12
Mount Washington	Balto. City	0	0	0	1	4	4	0	0	0	0	4	5
Cold Spring Lane	Balto. City	0	0	0	0	1	15	0	0	0	0	1	15
Woodberry	Balto. City	0	0	0	0	4	4	0	0	0	0	4	4
North Avenue	Balto. City	0	0	0	0	23	14	0	0	0	0	23	14
Penn Station	Balto. City	0	0	0	0	34	19	0	0	0	0	34	19
University of Baltimore/Mount Royal	Balto. City	0	0	0	0	2	0	0	0	0	0	2	0
Cultural Center	Balto. City	0	0	0	0	13	3	0	0	0	0	13	3
Centre Street	Balto. City	0	0	0	0	27	8	0	0	0	0	27	8
Lexington Market (LRT)	Balto. City	0	0	0	0	6	1	0	0	0	0	6	1

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University Center/Balto Street	Balto. City	0	0	0	0	22	1	0	0	0	0	22	1
Convention Center/Pratt St.	Balto. City	0	0	0	0	7	0	0	0	0	0	7	0
Camden Yards	Balto. City	0	0	0	0	3	1	0	0	0	0	3	1
Hamburg Street	Balto. City	0	0	0	0	15	7	0	0	0	0	15	7
Westport	Balto. City	0	0	0	0	3	5	0	0	0	0	3	5
Cherry Hill	Balto. City	0	0	0	1	6	1	0	0	0	0	6	2
Patapsco	Balto. Co.	0	1	0	0	3	13	0	0	0	0	3	14
Baltimore Highlands	Balto. Co.	0	8	3	0	0	1	0	0	0	0	3	9
Nursery Road	AA Co.	3	4	0	0	0	0	0	0	0	0	3	4
North Linthicum	AA Co.	3	1	0	0	0	0	0	0	0	0	3	1
Linthicum	AA Co.	0	3	0	0	0	0	0	0	0	0	0	3
Ferndale	AA Co.	6	3	0	0	0	0	0	0	0	0	6	3
Cromwell /Glen Burnie	AA Co.	8	33	0	0	0	0	0	0	0	0	8	33
BWI Business District	AA Co.	0	0	0	0	0	0	0	0	0	0	0	0
BWI Marshall Airport	AA Co.	6	1	0	0	0	0	0	0	0	0	6	1
Aberdeen	Harford Co.	0	0	0	0	0	0	13	4	0	0	13	4
Edgewood	Harford Co.	0	0	0	0	0	0	2	9	0	0	2	9
Martin Airport	Balto. Co.	0	0	0	29	0	0	0	0	0	0	0	29
West Baltimore	Balto. City	0	0	0	0	40	32	0	0	0	0	40	32
Halethorpe	Balto. Co.	0	0	0	12	0	1	0	0	0	0	0	13
BWI	AA Co.	1	0	0	0	0	0	0	0	0	0	1	0
Odenton	AA Co.	3	15	0	0	0	0	0	0	0	0	3	15
Camden	Balto. City	0	0	0	0	9	3	0	0	0	0	9	3
St. Denis	Balto. Co.	0	0	2	0	0	0	0	0	0	3	2	3
Dorsey	How./AA Co.	0	0	0	0	0	0	0	0	0	6	0	6
Jessup	AA Co./How.	0	1	0	0	0	0	0	0	1	3	1	4
Savage	How./AA Co.	0	0	0	0	0	0	0	0	0	2	0	2
Laurel Park	How./AA Co.	3	2	0	0	0	0	0	0	0	4	3	6
	TOTALS	33	72	33	109	659	271	15	13	1	18	741	483

APPENDIX 3: LIST OF REFERENCES

ENGINEERING

AASHTO, A Policy on Geometric Design of Highways and Streets, 2001	Howard County Design Manual, Volume III - Roads and Bridges, October 2006	City of Aberdeen Comprehensive Plan 2011
AASHTO, Guide for the Development of Bicycle Facilities, 1999	Howard County, Volume IV Design Manual, Standard Specifications and Details for Construction, 2007	City of Baltimore Comprehensive Master Plan 2007-2012
AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 1st Edition, 2004	Maryland State Highway Administration, Maryland Manual on Uniform Traffic Control Devices, 2006 Edition (Rev. 1, July 2009)	City of Baltimore Bicycle Master Plan, May 2006
Anne Arundel County Design Manual, January 2001	Maryland State Highway Administration, Highway Location Reference, Anne Arundel County, Baltimore, Harford and Howard Counties, 2009	City of Baltimore Bicycle Facility Design Toolkit, April 2006
Anne Arundel County Standard Details, January 2001	Maryland State Highway Administration, Book of Standards for Highway and Incidental Structures, Latest Revision	Eastern Baltimore County Pedestrian and Bicycle Access Plan, November 6, 2006
Anne Arundel County Pedestrian and Bicycle Master Plan, March 2003	Maryland State Highway Administration, Highway Construction Cost Estimating Manual, 2010, 2011 Price Index	Harford County Transportation Element Plan, 2010
Anne Arundel County Functional Classification Map, 2009	Maryland Standard Sign Book, Standard Signs – 2008 Revision	Harford County Master Plan and Land Use Element Plan 2004
Baltimore County Department of Public Works Design Manual, August 2, 2010	Maryland State Highway Administration Bicycle and Pedestrian Design Guidelines	Harford County Transportation Element Plan 2010
Baltimore County Standard Specifications and Details, 2007	Access 2000 Bicycle and Pedestrian Access to Maryland's Rail Transit Stations, June, 1997, RKK Consulting Engineers	Howard County General Plan 2000
Baltimore County Office of Planning, Federal Highway Functional Classification Map, 2009	Anne Arundel County General Development Plan April 2009	Howard County Pedestrian Master Plan, August 2007
City of Baltimore Book of Standards, August 2010	Baltimore County Master Plan 2020 November 15, 2010	MDOT 20 Year Bicycle and Pedestrian Access Master Plan Technical Appendix (2002)
Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2003 Edition	Baltimore Metropolitan Council Desktop Tool – Bicycle and Pedestrian Level of Service Calculator, 2007	Route 1 Manual Howard County July 2009
Harford County Road Code, Book II, Roadway and Stormdrain Design Standards, December 2, 2008		Western Baltimore County Pedestrian and Bicycle Access Plan (Preliminary Draft for Public Review), July 30, 2010
Harford County Book of Standard Details, December 2, 2008		www.MDOT-realestate.org
		www.westportwaterfront.com

PLANNING

APPENDIX 4: REFERENCES FOR TYPICAL IMPROVEMENTS

BICYCLE ACCOMMODATIONS – BICYCLE LANES, MARKINGS AND SHARED USE WIDE OUTSIDE LANES

AASHTO Guide for the Development of Bicycle Facilities, 1999
Bicycle and Pedestrian Design Guidelines (Maryland State Highway Administration), <http://www.roads.maryland.gov/Index>.

PEDESTRIAN ACCOMMODATIONS-SIDEWALKS, CURB RAMPS, CROSSWALKS

AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 1st Edition, 2004
Bicycle and Pedestrian Design Guidelines (Maryland State Highway Administration), <http://www.roads.maryland.gov/Index>.
The Design Manuals for applicable jurisdiction should be referenced for specifics.

APPENDIX 5: LIST OF ACRONYMS

AADT	Average Annual Daily Traffic	TOD	Transit Oriented Development
AASHTO	American Association of State Highway and Transportation Officials	SF	Square Feet
ADA	Americans with Disabilities Act	SHA	Maryland State Highway Administration
APG	Aberdeen Proving Ground	SHA HSO	Maryland State Highway Administration Highway Safety Office
B&A	Baltimore & Annapolis Hiker Biker Trail	SWM	Stormwater Management
BLOC	Bicycle Level of Comfort	SY	Square Yard
BLOS	Bicycle Level of Service	WB&A	Washington, Baltimore & Annapolis Railway Trail Park
BMC	Baltimore Metropolitan Council		
BRTB	Baltimore Region Transportation Board		
CPM	Cost per mile		
CY	Cubic Yard		
GIS	Geographic Information System		
GPS	Global Positioning System		
LRT	Light Rail Transit		
LF	Linear Feet		
LM	Linear Mile		
MARC	Maryland Area Commuter Train Service		
MDOT	Maryland Department of Transportation		
MTA	Maryland Transit Administration		
OHS	SHA Office of Highway Safety		
TIP	Transportation Improvement Program		

APPENDIX 6: WEBSITES FOR REGIONAL TRAILS WITHIN VICINITY OF BALTIMORE REGION RAIL STATIONS

Baltimore and Annapolis Trail/Park - from BWI Airport Trail to Annapolis

www.railstotrails.us/md_baltimore_annapolis_trail.html

BWI Trail - 12.5 loop encircling the BWI Airport

www.dnr.state.md.us/greenways/bwi_trail.html

Gwynns Falls Trail - from I-70 Park & Ride to Inner Harbor

www.gwynnsfallstrail.org

Jones Falls Trail - from Druid Hill Park to Penn Station

www.trailink.com/trail/jones-falls-trail

Northern Central Railroad Trail - from Ashland Road in Hunt Valley to the MD/PA state line

www.dnr.state.md.us/greenways/ncrt_trail.html

APPENDIX 7: PRELIMINARY RECOMMENDATIONS NOT RETAINED

Certain of the options for improvements developed during preliminary analysis were dropped from further consideration. Cost estimates were not prepared for these options. Those recommendations and the reasons for not carrying them forward to through cost estimating are noted here.

Station Area	Initial Recommendation	Basis for Removal
Owings Mills Metro	Improve the pedestrian path (desire line) through the station parking lot	transit oriented development project expected to occur on the station parking lots in the near future
Shot Tower Metro	Bicycle improvements along Central Ave between Aliceanna and East Baltimore St	2011-2014 TIP includes project for major reconstruction of Central between Monument and Lancaster
Cold Spring Lane LRT	Pedestrian bridge over I-83 from Medfield Heights Community	was not considered financially reasonable to recommend such a costly capital improvement when pedestrians have an alternative route
Odenton MARC	Pedestrian improvements along MD 175 (Annapolis Road) @ Town Center Blvd.	2011-2014 TIP includes project for improvement to bicycle and pedestrian accommodations on MD 175 from 295 - MD 170
Dorsey MARC	Widening of a segment of Coca Cola Drive between Dorsey Road and County Line for improved bicycle accommodations	would involve costly bridge widening; intent was to conduct BLOC analysis to determine whether warranted by bicycle level of service improvement. Since Coca Cola Dr. characteristics were not included in BMC base model for BLOC analysis, we were unable to complete LOS analysis and did not confirm recommendation.
Laurel Park MARC	US 1 bicycle and pedestrian improvements	FY'11-16 CTP includes a Project Planning Study for US 1 from PG County to Baltimore County. Plan is to be consistent with County's vision for safety and mobility