## CONCLUSIONS

A great deal of progress has been made on bicycle and pedestrian accommodations since the Access 2000 report was published in 1997. Considerably more information is available on existing conditions and planned improvements throughout the region. The level of scrutiny of the conditions is also more rigorous due to higher levels of federal, State and local interest in improving multi-modal accessibility. This project has revealed that there are fairly simple and obvious improvements that can be made to improve pedestrian and bicycle accommodations. These improvements include: more wayfinding signage; elimination of sidewalk gaps; increased lighting; provision of pedestrian crossing improvements; replacing drainage grates; adding signage for shared use lanes and shoulder bike accommodations and restriping to provide bicycle lanes. Most of the recommended improvements would serve the broader community as well as rail transit customers.

But addressing overall bicycle and pedestrian safety is neither simple nor obvious. The recommendations made in this report are based on the standards and guidelines developed for safe pedestrian and bicyclist mobility. However, without more information and analysis of the crashes it is difficult to draw conclusions about the bicycle and pedestrian crash data that was obtained and mapped. There are station areas with notably higher numbers of crashes. However, stations that are situated in urbanized areas with higher levels of activity and more traffic would typically experience more crashes.

Determining whether pedestrians or bicyclists destined to or from stations are impacted disproportionately seems unnecessary. Bicycle and pedestrian crashes are undesirable and there are State and local pedestrian safety programs in place that could be directed to the areas of concern without determining whether they are rail station related crashes. The more significant question is whether rail station areas are priorities for directing the resources.

Optimizing conditions and safety for bicyclists and pedestrians in station areas may involve strategies such as traffic calming. The BRTB and local jurisdictions should consider whether traffic calming or other such strategies should be pursued in station areas for which optimal bicycle and pedestrian accommodations are to be achieved.

The planning level costs that were developed for this report provide an indication of the level of funding commitment that may be needed to address the identified deficiencies. The list of improvements is not intended to be incorporated directly into the capital improvement program of any jurisdiction or the State. If deemed consistent with the region's long range plan goals for mobility and accessibility, the BRTB could establish funding for a regional program or consider developing a systematic approach to monitor the progress made by state and local jurisdictions in addressing the deficiencies.

There could be an incremental funding program implemented over time or a focused program that prioritizes stations or jurisdictions based on regional priorities. An approach for regional prioritization could link funding link of improvements to existing or anticipated future rail station ridership growth.

It makes sense from a funding perspective for some of the listed improvements to be made as part of the normal cycle of rehabilitation/reconstruction undertaken by local jurisdictions and the State. Some deficiencies such as bicycle route signage for example may be small in scale but large in quantity. Other improvements can possibly be incorporated with the development or redevelopment of adjacent properties.

The more substantial recommendations should be given specific consideration as potential project planning and funding priorities for local jurisdiction and state programs. These projects should be evaluated against the goals for mobility and accessibility in the region's long range transportation plan.

## **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

<u>Pedestrian Signing</u> Unit Cost for Sheet Aluminum Signs - \$30/SF – From SHA Price Index (January 2011) <u>Bicycle Signing</u> Unit Cost for Sheet Aluminum Signs - \$30/SF (posts are incidental) <u>Directional Signing</u> 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 (<u>http://www.co.lancast</u> Page 31)

### Highways

\$135
\$250
\$37.
\$42,
\$50.
\$3.5

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-ofway 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.

• Bicycle Safe Grates - \$300/EA (http://www.co.lancaster.pa.us/purchasing/lib/purchasing/roadpipesgrates.pdf,

25.00/SY 50,000/Acre 7.00/CY (Class I) 2,000/Acre 0.00/LF 50/LF

## **APPENDIX 2: PEDESTRIAN AND BICYCLE CRASH DATA SUMMARY**

		AA County		Baltimore Co		Baltimore C	Location City	Harford Cou	inty	Howard Cou		Total Ped Crashes	Total Bike Crashes
Station Name	Jurisdiction	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 Re	<b>ya</b> ] 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

						Crash	Location						
		AA County		Baltimore C	ounty	Baltimore (	City	Harford Cou	unty	Howard Co	unty	Total Ped	Total Bike
Station Name	Jurisdiction	Ped Crash (0.6 Miles)	Bike Crash (3 Miles)	Crashes	Crashes								
University Center/Balto Street	Balto. City	0	0	0	0	22	1	0	0	0	0	22	1
<b>Convention Center/Pratt St.</b>	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
<b>BWI Business District</b>	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

# BMC ACCESS TO RAIL PROJECT| FINAL REPORT

## **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 Com
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 Com
AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 1st	Mandard State Histories Administration Mandard Manual on Haifama Traffic	City of Baltimore Bicy
Edition, 2004	Maryland State Highway Administration, Maryland Manual on Uniform Traffic Control Devices, 2006 Edition (Rev. 1, July 2009)	City of Baltimore Bicy
Anne Arundel County Design Manual, January 2001		
Anne Arundel County Standard Details, January 2001	Maryland State Highway Administration, Highway Location Reference, Anne Arundel County, Baltimore, Harford and Howard Counties, 2009	Eastern Baltimore Cou
		Harford County Transp
Anne Arundel County Pedestrian and Bicycle Master Plan, March 2003	Maryland State Highway Administration, Book of Standards for Highway and Incidental Structures, Latest Revision	Harford County Master
Anne Arundel County Functional Classification Map, 2009		
Baltimore County Department of Public Works Design Manual, August 2, 2010	Maryland State Highway Administration, Highway Construction Cost Estimating Manual, 2010, 2011 Price Index	Harford County Transp
Banniore County Department of Fuone works Design Manual, August 2, 2010		Howard County Generation
Baltimore County Standard Specifications and Details, 2007	Maryland Standard Sign Book, Standard Signs – 2008 Revision	·
		Howard County Pedest
Baltimore County Office of Planning, Federal Highway Functional Classification	Maryland State Highway Administration Bicycle and Pedestrian Design Guidelines	
Map, 2009	PLANNING	MDOT 20 Year Bicy
City of Baltimore Book of Standards, August 2010	Access 2000 Bicycle and Pedestrian Access to Maryland's Rail Transit Stations, June,	(2002)
City of Baitimore book of Standards, August 2010	1997, RKK Consulting Engineers	Route 1 Manual Howar
Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2003		
Edition	Anne Arundel County General Development Plan April 2009	Western Baltimore Cou
		Public Review), July 3
Harford County Road Code, Book II, Roadway and Stormdrain Design Standards,	Baltimore County Master Plan 2020 November 15, 2010	
December 2, 2008	Paltimore Matropolitan Council Desitor Tool Pievels and Pedestrian Level of	www.MDOT-realestate
Harford County Book of Standard Details, December 2, 2008	Baltimore Metropolitan Council Desktop Tool – Bicycle and Pedestrian Level of Service Calculator, 2007	www.westportwaterfro

- omprehensive Plan 2011
- omprehensive Master Plan 2007-2012
- icycle Master Plan, May 2006
- Sicycle Facility Design Toolkit, April 2006
- County Pedestrian and Bicycle Access Plan, November 6, 2006
- nsportation Element Plan, 2010
- ster Plan and Land Use Element Plan 2004
- nsportation Element Plan 2010
- neral Plan 2000
- lestrian Master Plan, August 2007
- icycle and Pedestrian Access Master Plan Technical Appendix
- ward County July 2009
- County Pedestrian and Bicycle Access Plan (Preliminary Draft for y 30, 2010
- tate.org
- front.com

## **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.

## BMC ACCESS TO RAIL PROJECT| FINAL REPORT

## **APPENDIX 5: LIST OF ACRONYMS**

AADT	Average Annual Daily Traffic	TOD	Tanait Oriented De la la serie
AASHTO	American Association of State Highway and Transportation Officials	TOD	Transit Oriented Development
ADA	Americans with Disabilities Act	SF	Square Feet
APG	Aberdeen Proving Ground	SHA	Maryland State Highway Administration
B&A	Baltimore & Annapolis Hiker Biker Trail	SHA HSO	Maryland State Highway Administration Highway
BLOC	Bicycle Level of Comfort	SWM	Storrmwater Management
BLOS	Bicycle Level of Service	SY	Square Yard
BMC	Baltimore Metropolitan Council	WB&A	Washington, Baltimore & Annapolis Railway Trai
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		

way Safety Office

rail Park

## 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.traillink.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

## BMC ACCESS TO RAIL PROJECT| FINAL REPORT

# APPENDIX 7: PRELIMINARY RECEOMMENDATIONS 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	2011-12014 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

313 | Appendix 7