TECHNICAL MEMORANDUM

To: Jennifer Weeks, MTA

From: Parsons Brinckerhoff

Date: April 10, 2008

Subject: Baltimore-Washington Investment Corridor: Corridor Boundaries and Data Collection

This memorandum provides an overview of the work performed under Tasks 1 and 2 of the Baltimore-Washington Investment Corridor (BWIC) Travel Markets Study. It identifies how the corridor and district boundaries were defined, the travel data collected and adjustments used in the analysis, major population and employment trends in the corridor, as well as major transportation and land use plans in the corridor.

Study Area and Corridor Boundaries

A large study area has been defined to ensure that major trip flows in the area between Baltimore and Washington are included. The Baltimore-Washington Investment Corridor is defined to be the area between the District of Columbia (DC) and Baltimore City, centered around I-95 and the MARC (Camden and Penn) rail lines. To capture potential long-distance trips beyond DC or Baltimore and to provide a comparison for how the Corridor fits within the overall context of trips in the metropolitan areas, the boundaries of data collection extend as far southwest as Arlington and Alexandria (Virginia) and as far northeast as northeastern Baltimore County. The analysis boundaries include the District of Columbia, the southern and eastern portions of Montgomery County, the northern half of Prince George's County, the northern half of Anne Arundel County, Howard County, Carroll County, Baltimore County, and Baltimore City.

The primary focus of the analysis will be on trips that originate or terminate within the Baltimore-Washington Investment Corridor (more specifically the area between the Washington and Baltimore beltways); consideration will also be given to trips that span the full length of the corridor (i.e., from DC to Baltimore City). If it is found that there is a significant market to districts outside the BWIC (e.g., from Odenton to Alexandria), the BWIC area may be expanded in later Tasks.

As shown in Exhibit 1 (exhibits are presented in Appendix A), the analysis area has been subdivided into 30 travel districts. Each travel district has been designed and named to represent "a place" that is easily identifiably to the general public and local jurisdictions, often having relatively homogenous socio-economic, employment, or land use relative to other parts of the corridor.[1] For example, one district represents the general area of Columbia, Maryland; this community would like to know how it fits within the travel patterns of the Corridor, and it is easiest to answer these questions if it is defined to be a distinct district. Another example is the small geographic district surrounding the Baltimore-Washington International (BWI) Airport, which has different land use and trip patterns than districts adjacent to it. Many of the districts in the central part of the Corridor are centered around rail stations, which will help with assessing demand to and from these areas in later Tasks.

[1] Each travel district represents a collection of Traffic Analysis Zones (TAZs) as defined the metropolitan planning organizations' travel demand models. The pre-defined boundaries of each TAZ influence the shape and borders of individual districts because insufficient data is available to split TAZs.

Population and Employment Characteristics

Recent (year 2005) and forecast (year 2030) population and employment levels for each district are presented in Exhibit 2.[2] Of the 30 districts, the major population and employment centers are within the Washington Beltway (I-495) and within the Baltimore Beltway (I-695). Population currently outnumbers jobs in all districts except the DC Central Business District (DC CBD), Jessup, West Howard County, and BWI Airport; by 2030, Alexandria is forecasted to join the list of districts where jobs outnumber population.[3] The DC CBD and BWI Airport stand out as the districts with the highest jobs-to-population ratios; however, the forecasted trend of these districts are in opposite directions. The DC CBD's job-to-population ratio is expected to decrease from 4.2 to 3.5 while the BWI district's ratio is expected to increase from 3.5 to 4.0. The DC CBD's ratio is forecasted to decrease not because of jobs loss, but rather because of an anticipated population growth rate (1.6% per year) that outpaces the increase in jobs.

Exhibit 3 shows the districts' population and employment densities in 2005 as well as the expected annual growth rates through 2030. With a population density of 9,515 persons and an employment density of 39,760 jobs per square mile, the DC CBD is by far the densest employment district and it is also the densest residential district. Population densities are also high within the Washington Beltway and Baltimore City. Jessup, Muirkirk, East Prince George's County, Howard County, Carroll County, and the DC CBD are the districts with the highest population growth rates, at 1.0% or more per year.

Although employment density is still considerably below that found at the ends of the corridor, employment within the heart of the corridor (e.g., Muirkirk, Odenton, Laurel, Jessup) is expected to grow faster than the other districts, at more than 2.0% per year. In a recent assessment of activity clusters in the Washington region, MWCOG identified Greenbelt / College Park as well as Konterra / Route 1 (a sub-area of the Muirkirk district) as new regional activity clusters with high job growth and high jobs-to-household ratios. Forecast job growth and concentration are particularly high in the area near the Muirkirk MARC station.[4]

Median household incomes tend to be higher in the north central part of the Corridor (e.g., Columbia, Howard County) and in the southeastern part of the Corridor (e.g., Annapolis) than in the middle portion of the Corridor (e.g., districts between DC and Baltimore containing the Penn or Camden MARC rail lines). Median household incomes are relatively lower in the City of Baltimore, and high in North Baltimore County.[5]

Corridor Travel Data

The primary sources for data on the origins and destinations of person trips within the corridor were trip distribution tables supplied by the metropolitan planning organizations (MPOs).[6] Neither the Metropolitan Washington Council of Governments (MWCOG) nor the Baltimore Metropolitan Council (BMC) travel models include the entire corridor, so the BWIC analysis combined the two data sets (avoiding double-counting) to develop trip tables for the Corridor. Separate trip tables, obtained for different trip purposes, were aggregated to two primary purposes: commuter trips (i.e., the Home-Based-Work category of trips

[2] Year 2005 is used to represent current conditions because it is the base year in the BMC travel demand model. Despite BMC having a forecast available for 2035, the longest forecast year in the MWCOG travel demand model is 2030, so the latter was used for the BWIC analysis to maintain consistency.

[3] This forecast does not account for the impacts of Base Realignment and Closure (BRAC). BRAC is expected to remove more jobs from Virginia than it adds.

[4] MWCOG, "Regional Activity Centers and Clusters," June 2007.

[5] BMC, Figure VIII-6 in "Transportation 2030," December 2004. Analysis based on 2030 Median Household Income in 1993 dollars.

[6] The person trip distribution tables were obtained from MWCOG and BMC. MWCOG data was available for years 2002, 2010, and 2030; interpolation between 2002 and 2010 was used to develop a 2005 base year estimate for MWCOG data to maintain consistency with the BMC years of 2005 and 2030.

or those trips that have one trip end as home and the other as work-place) and non-commuter trips (all other kinds of trips). The MPOs' data was aggregated to the 30 districts for both a base year (2005) and a forecast year (2030).

Census Transportation Planning Package (CTPP), 2000: Initial review of the modeled travel data suggested work trips between certain district pairs were under-represented in the models, CTPP, 2000 data was obtained to augment model information on work trips. CTPP data is a special tabulation of responses to the journey-to-work trip information in the 2000 census long form asked of approximately one-sixth of all house holds. This information was obtained in the form of specially-generated trip tables conforming to the TAZ system followed by MWCOG, which in turn, were aggregated to the 30 study-area districts. Since this data corresponded to the year 2000, it was further factored up using an iterative process to match the totals of the MWCOG and BMC combined commuter trip tables for base and forecast year. The iterative procedure results in the same number of total trips in the study corridor with the district-to-district distributions reflecting the Census.

The all-day commuter and non-Commuter trip tables were then disaggregrated into time-of day trip tables (a 3-hr a.m. peak period, a 6-hr mid-day off-peak period, and a 3-hr p.m. peak period) [7], for the base year (2005) and forecast year (2030). Certain modifications were then made to these trip tables based on supplemental information collected on trip patterns to and from special-attractors and -generators in the study-area as discussed in the following sub-sections.

Travel Data Modifications as a Result of BRAC Changes: The likely impacts of U.S. Department of Defense (DOD) Base Realignment and Closure (BRAC) changes were not included in either the MWCOG or BMC models. However, given the significant addition of employment in one of the corridor districts due to BRAC relocation, it is appropriate to update the employment and commuter trip forecasts with these changes for this study. The BRAC changes at Fort Meade are expected to result in the addition of almost 675 military jobs, 15,000 civilian jobs and 10,000 contractor jobs at Fort George G. Meade, along with an addition of approximately 500 family members.[8] Fort Meade is located within the Odenton district, east of the Odenton MARC station.

This change was accommodated in the analysis by translating additional BRAC-related employment into equivalent additional A.M. peak period commuter trips that were added to the trip table for Odenton and distributed proportionally over the districts within the corridor in proportion to existing commuter trips destined to the Odenton district.

Travel Data Modifications due to Employee and Passenger Trips to BWI Airport: Trips to the BWI Airport follow a time-of-day pattern different from those to other economic centers, since flight schedules and airport work shifts impact of the time of passenger and employee trips. As the MWCOG and BMC models do not specifically capture or account for these trips, data was obtained from BWI authorities, the Maryland Aviation administration (MAA), other on-request, and publicly available sources. The data was processed to align with the districts and time-of-day segments defined for this study and was used to either replace (as in the case of employee) trips estimated by MWCOG and BMC, or to append (as in the case of passengers) the estimates, as appropriate.

(a) Air-Passenger Trips (2005 Adjustment)

The total number of average daily passengers that used the airport in the year 2005 was 54,088.[9] Approximately 20% of these passengers were connecting between flights. Accordingly, the number of average daily passengers in 2005, which arrived from outside the airport or left the premises after arrival,

[7] Trip time-of-day splits from the BMC travel model were used to develop the trip tables. The time-of-day splits are presented in Exhibit 4.

[8] Fort Meade, Community Profile, BRAC, December, 2007

[9] http://www.bwiairport.com/about_bwi/general_statistics/

was 43,270.[10] The following procedures were followed to estimate passenger trips to from BWI Airport for each study-area district:

(i) District shares: The primary source of data regarding origins of BWI Airport passengers was the *Washington-Baltimore Regional Air Passenger Survey, 2007*, conducted jointly by the Metropolitan Washington Airports Authority (MWAA), and the Maryland Aviation Administration (MAA) of the Maryland Department of Transportation (MDOT). The survey reports origin zones of over 8 million passengers enplaning from the BWI Airport over a period of three weeks in 2005. These origins were aggregated to the level of our study-area districts, and a passenger share for each of these districts computed as the percentage of air passengers surveyed that originated in the respective district. These passenger shares were applied to the average daily number of 43,270 passengers in 2005, to obtain a daily Airport Passenger Trip Table.[11]

(ii) Time-of-day shares: The times of arrival and departure of the air passengers were estimated using BWI Airport's daily flight schedule.[12] The daily departure and arrival schedule of flights was used to calculate number of flights departing from and arriving at the airport in hourly intervals during a 24-hour day. This was then used to derive hourly shares of flights, and hence that of passengers at the airport (assuming all flights have comparable occupancy). To account for time required to access the airport, flight departure times were adjusted by 1.5 hours to represent the time at which departing passengers would be traveling to the airport. This assumes a typical practice of arriving an hour to an hour and a half in advance of the flight departure time. Similarly, for arriving passengers, the time lag was assumed to be half an hour to account for de-boarding time (See Exhibit 1 for the departing passengers and arriving passengers time-of-day shares). These time-of-day shares were then applied to the daily Airport Passenger Trip Table computed previously, to give AM Peak, mid-day Off Peak and Early Morning passenger trips to the BWI airport. These time-of-day Passenger Trip Tables were then simply added to the respective time-of day trip tables for non-commuters for the whole study area. (See Exhibit 7 for BWI passenger trip tables in production attraction format by time-of-day).

Available survey data covered enplaning passengers only, the total umber of annual passengers was doubled (to account for both enplaning and deplaning passengers), and the shares of origin zones were applied to average daily passengers at the airport (net of connecting passengers). The underlying assumption is that the number and origin-destination profile of enplaning and deplaning passengers is roughly the same.

The above described adjustments lead to a net addition of 6,194 trips to the A.M. peak period and 14,445 trips to the mid-day off-peak period trip tables for non-commuters (see Exhibit 8). Additionally, 2,986 passengers were found to be traveling to the airport between the hours of 4:00 am and 6:30 am for early morning flights from other districts in the study area. These adjustments are net of the intra-district trips. Approximately 40% of the total daily air passenger travel to/from the airport occurs after 3:30 pm, nearly half of which occurs during the P.M. peak hour.

(b) Air-Passenger Trips (2030 Adjustment)

The 2006 BWI Long-Range Needs Assessment estimates the total number of annual passengers using the BWI Airport in 2030 will be 30,669,400.[13] implying 84,026 average daily passengers in 2030[14]

[10] According to the 2006 BWI Long-Range Needs Assessment, the number of connecting passengers is estimated to be approximately equal to 20% of the total passengers through the airport, through 2030.

[11] Although the survey included only enplaning passengers, it was assumed that the number and origin-destination profile of both enplaning and deplaning passengers is roughly the same.

[12] http://www.bwiairport.com/flight_status/arrivals_departures/

[13] This number excludes connecting passengers

Assuming the same district, and time-of-day shares as in the case of 2005 Airport Passenger trips, the 2030 BWI Passenger Trip Tables by time-of-day were computed. These were then added to the 2030 model forecast trip tables.

These adjustments lead to a net addition of 12,027 trips to the A.M. peak period and 28,050 trips to the mid-day off peak period trip tables for Non-commuters (see Exhibit 9). Additionally, assuming that flight schedules remain roughly the same as in 2005, with only frequency of flights increasing to accommodate greater demand, 5,798 passengers would travel to the airport between the hours of 4:00am to 6:30 am for early morning flights, from other districts in the study area in 2030. These adjustments are net of intra-district trips.

(c) Airport Employee Trips (2005 Adjustment)

(i) District shares: The number and trip origins of BWI Airport employees were obtained from a zip-code database of all security-badge holding employees.[15] According to the most recent data, the total number of employees at the airport is 13,418.[16] Assuming that, on an average, each of these employees have a five-day work-week, five-sevenths of the total number employees (i.e. 9,584 employees) could be expected to be traveling to work on any given day. Accounting for trips to/from work, this would amount to an average of 19,168 worker trips on any given day. This number is significantly larger than the 6,544 and 11,812 worker trips to and from the BWI Airport TAZ estimated by the MWCOG and BMC models, respectively.

(ii) Time-of-day shares: The time of arrival of the workers to the airport was obtained from a survey of 35 BWI Airport employers regarding their workers' shift times.[17] Using the sample, shares of workers arriving in various time-slots during the 24-hour day were computed. To identify the time of travel to/ from the airport in order to maintain the surveyed shift schedule, arriving workers were assumed to be traveling to the airport in the hour prior to the starting of the shift time. This assumption was based on an average travel time of 30 minutes to the nearest transit station or to the BWI employee parking lot and the shuttle ride of 15 to 20 minutes from the transit station or the parking lot to the terminal. Similarly, worker travel from the airport (returning home) was assumed to be taking place in the hour post 15 minutes from the time the work sift ends. The resulting shares of workers traveling to/from BWI Airport during various time-slots in the 24-hour day are shown in Exhibit 10.

This new information regarding workers traveling to and from the airport by time of day was appended to the commuter trip tables after subtracting the model estimates of worker trip to the Airport to avoid double-counting.

This adjustment lead to an increase of 1,447/ 395 and 4,737/ 9,936 trips to/ from the BWI Airport district in the A.M. and mid-day off-peak periods, respectively. These adjustments are net of intra-district trips (see Exhibit 11).

(d) Airport Employee Trips (2030 Adjustment)

To estimate the number of worker trips to the BWI Airport in 2030, it was assumed that employees at the airport would grow at the same rate as the rate of growth of passengers. In other words, the ratio of number of employees to the number of passengers at the airport would remain constant over the forecast period. In 2005 this employee to daily passenger ratio was calculated to be 0.25, i.e., there

[14] Assuming a 365 day year with all days and a flat seasonal distribution curve

[15] BWI Business Partnership data, sent January 3, 2008

[16] According to the database of zip codes of employees, there are 13,418 badge-holding employees working at the BWI airport, which would imply at least twice that number of one-way work-trips in a day.

[17] BWI Business Partnership data, sent on January 3, 2008

were four passengers per day for every employee at the airport in 2005.[18] Applying the same ratio to the forecast average daily passengers in 2030 (i.e. 100,298[19]) the number of employees at the airport in 2030 is estimated to be 24,881. Again assuming a five-day work week for an average employee, this would amount to 17,772 workers traveling to the airport daily resulting in 35,544 one-way trips in a day in 2030.

The travel pattern of employees over the study area was also assumed to remain constant over the time frame. The A.M. Peak and off peak shares for 2030 workers were computed and replaced in the 2030 forecast Commuter trip tables in the same manner as for the year 2005 (see Exhibit 12).

Transportation and Land Use Plans Reviewed

Several transportation and land use plans have been obtained and reviewed to provide context for the BWIC study. A brief summary of major plans in the Corridor is as follows:

BWI Airport: Land use around BWI is undergoing significant changes, with recent moves toward a mixed-use, higher density development (including hotels) around the airport. The MAA has begun the process of updating the master plan; however, a short list of alternatives for a new master plan will not be available until the Fall 2008 timeframe.[20]

Odenton Town Center: A master plan for Odenton Town Center was approved in 2004, before BRAC recommendations were made in 2005. This plan would increase density and pedestrian friendliness as well as develop a town center around the MARC Station. Specifically, the core of the town center would be established west of the MARC station and east of Route 32 and Ft Meade. The mix of land uses would be strengthened considerably (increasing the amount of retail) and a significant amount of new development is planned.[21]

Columbia Master Plan: Howard County's Department of Planning and Zoning drafted a new Master plan for the revitalization of downtown Columbia, MD. The plan focuses on densification of the downtown through mixed use development, improved provision of utilities and services, and improvements in transportation infrastructure, aimed at creating a more pedestrian friendly environment. The Master Plan identifies development potential over 490 acres of downtown area, involving the addition of 4,350 more dwelling units, 3.9 million square feet of office space, and 590,000 square feet of retail space.

Annapolis Comprehensive Plan: The most recently published Annapolis plan aims to manage congestion and parking demand in its downtown using the implementation of better parking management strategies. It would also aim to make transit more accessible by improving bicycle and pedestrian linkages as well as by instating a shuttle service to West Annapolis, the only mixed-use center designated on the plan's Future Land Use Map not served by transit.[22]

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[18] While the average daily passengers at the BWI Airport in 2005 were obtained from BWI Airport website (www.bwiairport.com) (i.e. 54,088 including connecting passengers), the number of employees were assumed to be the same as obtained from the more recent employee zip-code database (i.e. 13, 418). It was assumed that the same number of employees worked at the airport in 2005.

[19] 2006 BWI Long-Range Needs Assessment

[20] December 12, 2007 Phone Conversation with Sean Ames of MAA.

[21] Anne Arundel County, "Odenton Town Center Master Plan," 2003. http://www.aacounty.org/PlanZone/MasterPlans/OTC/Index.cfm.

[22] "Annapolis Comprehensive Plan" 1997. http://www.annapolis.gov/info.asp?page=2950. Accessed November 30, 2007.

Montgomery County 10-year Transportation Plans: The County is planning a 50% increase in bus service and a substantial increase in Metrorail service in its jurisdiction over the next 10 years. The County Council has approved a land use approach recommended by the County Planning Board that incrementally will amend master plans over time to locate more jobs and less additional housing in the eastern portion of the County and place more housing and fewer additional jobs in the I-270 corridor, thus encouraging more people to live closer to where they work. These changes would increase jobs within a half-mile of rail stations from 40 percent in 1998 to 60 percent in 2050 and would increase housing within a half-mile of transit from 12 percent in 1998 to 33 percent in 2050.[23]

Purple Line: The proposed Purple Line could link Bethesda with Silver Spring, College Park, and New Carrolton.

MARC Growth & Investment Plan: The plan identifies the existing capacity issues facing MARC and presents a financially unconstrained list of major program investments needed to continue base service as well as investments that could support additional ridership. MARC's current ridership of 30,000 daily riders exceeds its peak period capacity of 27,000 daily trips, and many parking lots are also at or near capacity. The plan identifies a series of phased capital investments and service improvements (e.g., more frequent and weekend service) through 2035 that could allow the MARC growth trend over the last 10 years to continue, reaching a capacity of 90,000 by 2035.[24]

[23] Montgomery County Council, "10-Year Transportation Plan," Fall 2007.
[24] MTA, "MARC Growth & Investment Plan" (PowerPoint Presentation), August 2007.

Appendix A - Exhibits

Exhibit 1: BWIC Travel Districts

District No.	District Name
1	DC CBD
2	North DC
3	Alexandria
4	Arlington
5	Silver Spring-Bethesda
6	Capital Heights
7	East Prince George's County
8	College Park
9	New Carrollton
10	Greenbelt
11	Bowie
12	Muirkirk
13	Odenton
14	Annapolis
15	East Montgomery County
16	Laurel
17	Jessup
18	East Anne Arundel
19	West Howard County
20	East Howard County
21	Columbia
22	BWI Airport
23	Glen Burnie
24	Carroll County
25	West Baltimore County
26	Southwest Baltimore County
27	West Baltimore City
28	East Baltimore City
29	North Baltimore County
30	East Baltimore County

(Illustration on following page)

Exhibit 2: Pre-Adjustment Population and Employment

No.	District Name	Population 2005	Population 2030	Employment 2005	Employment 2030
1	DC CBD	132,666	195,395	554,386	653,977
2	North DC	242,333	293,692	134,916	146,535
3	Alexandria	200,027	250,940	183,811	262,673
4	Arlington	218,148	270,835	173,442	237,746
5	Silver Spring-Bethesda	244,042	308,133	175,374	203,190
6	Capital Hgts	286,155	326,920	84,889	108,016
7	East PG Co	88,700	120,596	27,920	40,130
8	College Park	153,404	167,425	63,581	92,666
9	New Carrollton	161,897	176,618	66,774	100,066
10	Greenbelt	43,101	51,066	30,215	41,345
11	Bowie	47,025	53,238	20,528	25,238
12	Muirkirk	28,505	36,172	37,686	79,980
13	Odenton	108,445	129,775	69,247	113,804
14	Annapolis	138,716	149,366	92,821	105,948
15	East Mont Co	112,544	115,328	33,309	46,884
16	Laurel	69,952	79,511	27,439	49,564
17	Jessup	28,342	42,430	48,427	88,451
18	East Anne Arundel	118,667	124,955	30,193	33,869
19	West Howard Co	18,622	23,754	23,964	26,648
20	East Howard Co	54,250	70,739	25,525	41,815
21	Columbia	151,280	161,000	104,800	130,987
22	BWI Airport	16,221	19,784	56,765	78,519
23	Glen Burnie	92,830	102,817	56,419	59,991
24	Carroll Co	169,522	226,738	76,308	90,301
25	West Balt Co	93,775	111,880	49,578	65,154
26	Southwest Balt Co	144,864	149,560	81,361	84,936
27	West Balt City	176,765	178,932	67,358	66,123
28	East Balt City	466,044	490,619	382,692	403,545
29	North Balt Co	265,899	292,050	210,287	228,246
30	East Balt Co	264,901	291,534	108,808	124,694

Source: BMC Travel Demand Model outputs; MWCOG Travel Demand Model outputs

Exhibit 3: Population and Employment Densities and Growth Prospects

		Population		Employment	
No.	District Name	Per Sq. Mile	Growth* %	Per Sq. Mile	Growth* %
1	DC CBD	9,515	1.6%	39,760	0.7%
2	North DC	8,642	0.8%	4,811	0.3%
3	Alexandria	8,636	0.9%	7,936	1.4%
4	Arlington	5,387	0.9%	4,283	1.3%
5	Silver Spring-Bethesda	6,394	0.9%	4,595	0.6%
6	Capital Hgts	5,791	0.5%	1,718	1.0%
7	East PG Co	1,202	1.2%	378	1.5%
8	College Park	6,496	0.4%	2,693	1.5%
9	New Carrollton	3,955	0.3%	1,631	1.6%
10	Greenbelt	2,564	0.7%	1,797	1.3%
11	Bowie	1,108	0.5%	484	0.8%
12	Muirkirk	1,554	1.0%	2,055	3.1%
13	Odenton	1,437	0.7%	918	2.0%
14	Annapolis	909	0.3%	608	0.5%
15	East Mont Co	2,507	0.1%	742	1.4%
16	Laurel	2,578	0.5%	1,011	2.4%
17	Jessup	1,214	1.6%	2,075	2.4%
18	East Anne Arundel	1,020	0.2%	260	0.5%
19	West Howard Co	230	1.0%	296	0.4%
20	East Howard Co	643	1.1%	302	2.0%
21	Columbia	2,562	0.2%	1,775	0.9%
22	BWI Airport	795	0.8%	2,780	1.3%
23	Glen Burnie	2,523	0.4%	1,533	0.2%
24	Carroll Co	375	1.2%	169	0.7%
25	West Balt Co	1,666	0.7%	881	1.1%
26	Southwest Balt Co	2,870	0.1%	1,612	0.2%
27	West Balt City	7,546	0.0%	2,876	-0.1%
28	East Balt City	8,157	0.2%	6,698	0.2%
29	North Balt Co	701	0.4%	554	0.3%
30	East Balt Co	1,351	0.4%	555	0.5%

* Expected annual growth rate between 2005 and 2030.

Densities based on 2005 population and employment values.

Exhibit 4: BMC Trip Time-of-Day Splits

Time of Day Splits According to Trip Purpose		
Period	Home-Based Work	Other
AM Peak	32.7%	18.5%
PM Peak	33.2%	20.8%
Off Peak	34.1%	60.7%

Source: BMC Travel Demand Model outputs

Exhibit 5: Origin of Trips to BWI Airport

Jurisdiction	Car Trips	Transit Trips	DRT trips
Maryland			
Baltimore City	4%	44%	30%
Baltimore County	8%	8%	7%
Anne Arundel County	7%	7%	15%
Carroll County	2%	<1%	<1%
Harford County	3%	<1%	<1%
Howard County	5%	5%	10%
Frederick County	3%	N/A	N/A
Montgomery County	12%	10%	17%
Prince George's County	6%		
Neighboring Jurisdictions			
Pennsylvannia	14%	3%	N/A
Virginia	19%	6%	5%
Washington D.C.	3%	14%	14%
West Virginia	1%	N/A	N/A
Others	13%	2%	1%
TOTAL	100%	100%	100%

Notes: Totals may not add to 100% due to rounding; "N/A" denotes jurisdictions where data is not available. Source: 2002 BMC surveys of BWI users.

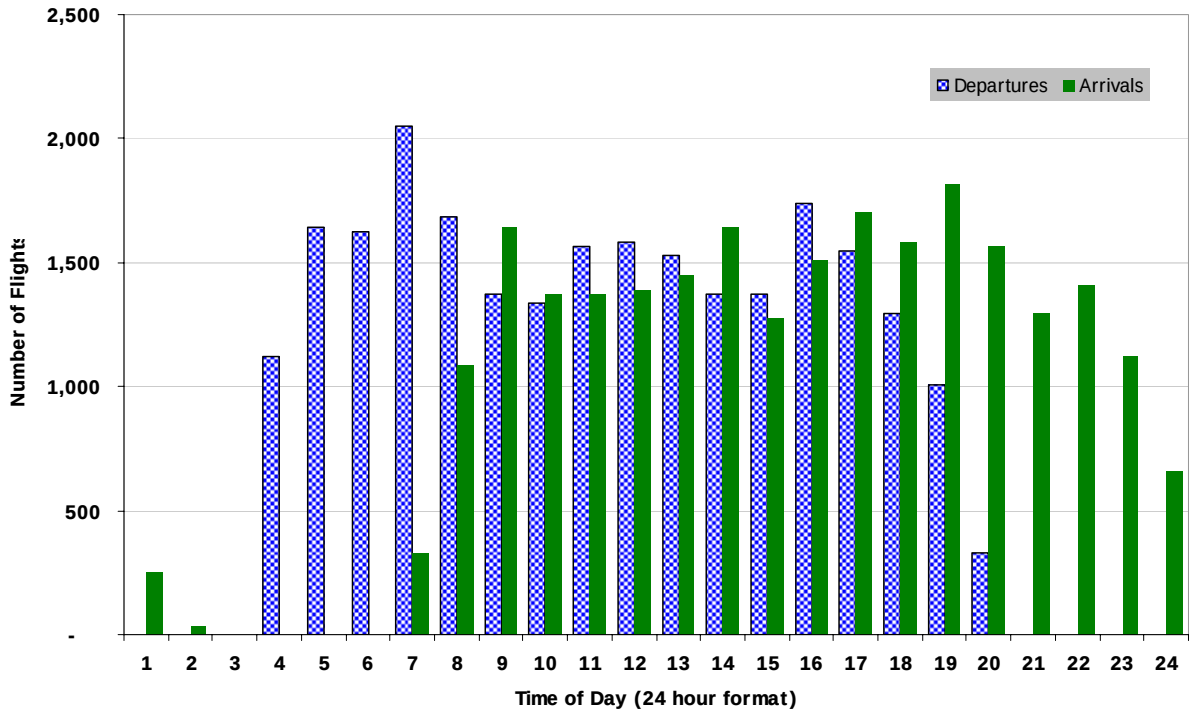
Exhibit 6: Regional Special Attractors

Attractions	Travel District	Strength
Government Special Attractors		Assigned Employment
Walter Reed Army Medical Center	Silver Spring- Bethesda	4,000
New Carrollton IRS	New Carrolton	3,987
Retail Special Attractors		Sq ft
Beltway Plaza Mall	College Park	1,000,000
Bowie Town Center	Bowie	70,000
Laurel Mall	Laurel	663,938
University /College Special Attractors		Enrollment
University of Maryland	College Park	35,369
PG County Community College (Largo Campus)	East PG County	18,596
Bowie State University	Bowie	5,454
Entertainment Special Attractors		Visitors
Six Flags	East PG County	1,300,000
		Capacity
FedEx Field	New Carrolton	91,665
Transportation Special Attractors		Passengers
Ronald Regan National Washington Airport	Arlington	18,550,785
Union Station (Amtrak)	District of Columbia	3,859,117

Source: MWCOG, "Regional Activity Centers and Clusters," June 2007.

Exhibit 7: (a) Airport Passengers traveling to/ from airport in a 24-hour Period; (b) Passenger Shares by Time of Travel to/ from the Airport

(a)



(b)

Time	Departing Passengers	Arriving Passengers	Combined
4:00am - 6:30am	15%	0%	7%
6:30am - 9:30am	22%	9%	15%
9:30am - 3:30pm	36%	35%	36%
3:30pm - 6:30pm	19%	19%	19%
6:30pm - 9:30pm	8%	22%	15%
After 9:30pm	0%	14%	7%
	100%	100%	100%

Source: PB, http://www.bwiairport.com/

Exhibit 8: 2005 Average Daily Trips to/from BWI Airport Resulting from Air Passenger Travel

#	District Name	Annual Trips* (000)	Distribu-tion	Average Daily Passengers	Early Morning Trips (4:00am to 6:30 am)		AM Peak Trips (6:30am to 9:30am)		Off Peak Trips (9:30am to 3:30pm)		Trips at all Other times	
					To Airport	From Airport	To Airport	From Airport	To Airport	From Airport	To Airport	From Airport
1	DC CBD	786	4.6%	1,978	146	-	214	90	358	350	271	549
2	North DC	376	2.2%	946	70	-	102	43	171	167	130	263
3	Alexandria	214	1.2%	538	40	-	58	25	97	95	74	149
4	Arlington	184	1.1%	463	34	-	50	21	84	82	63	128
5	Silver Spring-Bethesda	534	3.1%	1,344	99	-	145	61	243	238	184	373
6	Capital Hgts	144	0.8%	362	27	-	39	16	66	64	50	101
7	East PG Co	62	0.4%	156	12	-	17	7	28	28	21	43
8	College Park	266	1.5%	669	50	-	72	30	121	118	92	186
9	New Carrollton	88	0.5%	221	16	-	24	10	40	39	30	61
10	Greenbelt	240	1.4%	604	45	-	65	27	109	107	83	168
11	Bowie	200	1.2%	503	37	-	54	23	91	89	69	140
12	Muirkirk	144	0.8%	362	27	-	39	16	66	64	50	101
13	Odenton	450	2.6%	1,132	84	-	122	52	205	200	155	314
14	Annapolis	658	3.8%	1,656	123	-	179	75	300	293	227	459
15	East Mont Co	354	2.1%	891	66	-	96	41	161	158	122	247
16	Laurel	268	1.6%	674	50	-	73	31	122	119	92	187
17	Jessup	220	1.3%	554	41	-	60	25	100	98	76	154
18	East Anne Arundel	390	2.3%	981	73	-	106	45	178	174	134	272
19	West Howard Co	114	0.7%	287	21	-	31	13	52	51	39	80
20	East Howard Co	160	0.9%	403	30	-	43	18	73	71	55	112
21	Columbia	420	2.4%	1,057	78	-	114	48	191	187	145	293
22	BWI Airport	804	4.7%	2,023	150	-	218	92	366	358	277	561
23	Glen Burnie	190	1.1%	478	35	-	52	22	87	85	65	133
24	Carroll Co	402	2.3%	1,012	75	-	109	46	183	179	139	281
25	West Balt Co	472	2.7%	1,188	88	-	128	54	215	210	163	330
26	Southwest Balt Co	256	1.5%	644	48	-	70	29	117	114	88	179
27	West Balt City	176	1.0%	443	33	-	48	20	80	78	61	123
28	East Balt City	1,932	11.2%	4,862	360	-	525	221	880	860	666	1,349
29	North Balt Co	824	4.8%	2,073	153	-	224	94	375	367	284	575
30	East Balt Co	580	3.4%	1,459	108	-	158	66	264	258	200	405
	Outside Study Area	5,288	30.8%	13,306	985	-	1437	605	2408	2355	1823	3692
Total for Study Area Districts		**17,196**	**100.0%**	**43,270**	**3,202**	**0**	**4,673**	**1,969**	**7,832**	**7,659**	**5,928**	**12,008**

Source: PB, Washington-Baltimore Regional Air Passenger Survey, 2007,
http://www.bwiairport.com/about_bwi/general_statistics/

Notes: *The annualized estimates were obtained from a survey of enplaning passengers at the BWI airport.

Exhibit 9: 2030 Forecast Average Daily Trips to/from BWI Airport Resulting from Air Passenger Travel

#	District Name	Average Daily Passengers	Distribu-tion	Early Morning Trips (4:00am to 6:30 am)		AM Peak Trips (6:30am to 9:30am)		Off Peak Trips (9:30am to 3:30pm)		Trips at all Other times	
				To Airport	From Airport	To Airport	From Airport	To Airport	From Airport	To Airport	From Airport
1	DC CBD	3,841	4.6%	284	-	415	175	695	680	526	1,066
2	North DC	1,837	2.2%	136	-	198	84	333	325	252	510
3	Alexandria	1,046	1.2%	77	-	113	48	189	185	143	290
4	Arlington	899	1.1%	67	-	97	41	163	159	123	249
5	Silver Spring-Bethesda	2,609	3.1%	193	-	282	119	472	462	357	724
6	Capital Hgts	704	0.8%	52	-	76	32	127	125	96	195
7	East PG Co	303	0.4%	22	-	33	14	55	54	42	84
8	College Park	1,300	1.5%	96	-	140	59	235	230	178	361
9	New Carrollton	430	0.5%	32	-	46	20	78	76	59	119
10	Greenbelt	1,173	1.4%	87	-	127	53	212	208	161	325
11	Bowie	977	1.2%	72	-	106	44	177	173	134	271
12	Muirkirk	704	0.8%	52	-	76	32	127	125	96	195
13	Odenton	2,199	2.6%	163	-	237	100	398	389	301	610
14	Annapolis	3,215	3.8%	238	-	347	146	582	569	440	892
15	East Mont Co	1,730	2.1%	128	-	187	79	313	306	237	480
16	Laurel	1,310	1.6%	97	-	141	60	237	232	179	363
17	Jessup	1,075	1.3%	80	-	116	49	195	190	147	298
18	East Anne Arundel	1,906	2.3%	141	-	206	87	345	337	261	529
19	West Howard Co	557	0.7%	41	-	60	25	101	99	76	155
20	East Howard Co	782	0.9%	58	-	84	36	142	138	107	217
21	Columbia	2,052	2.4%	152	-	222	93	371	363	281	570
22	BWI Airport	3,929	4.7%	291	-	424	179	711	695	538	1,090
23	Glen Burnie	928	1.1%	69	-	100	42	168	164	127	258
24	Carroll Co	1,964	2.3%	145	-	212	89	356	348	269	545
25	West Balt Co	2,306	2.7%	171	-	249	105	417	408	316	640
26	Southwest Balt Co	1,251	1.5%	93	-	135	57	226	221	171	347
27	West Balt City	860	1.0%	64	-	93	39	156	152	118	239
28	East Balt City	9,440	11.2%	699	-	1,020	430	1,709	1,671	1,293	2,620
29	North Balt Co	4,026	4.8%	298	-	435	183	729	713	552	1,117
30	East Balt Co	2,834	3.4%	210	-	306	129	513	502	388	786
	Outside Study Area	25,839	30.8%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total for Study Area Districts		**84,026**	**100.0%**	**4,306**	**-**	**6,284**	**2,647**	**10,532**	**10,299**	**7,972**	**16,147**

Source: PB, Washington-Baltimore Regional Air Passenger Survey, 2007, 2006 BWI Long-Range Needs Assessment
Note: The distribution of origin/ destination zones is assumed to be the same in 2030, as in 2005.

Exhibit 10: Worker Shares by Time of Travel to/from BWI Airport based on Work Shift Times

Time Slots	To work	From Work	Combined
11:30pm - 4:30am	16%	20%	18%
4:30am - 5:30am	15%	0%	7%
5:30am - 6:30am	8%	0%	4%
6:30am - 9:30am	11%	3%	7%
9:30am - 3:30pm	36%	23%	30%
3:30pm - 6:30pm	13%	20%	16%
6:30pm - 9:30pm	0%	5%	3%
9:30pm - 11:30pm	0%	29%	15%
	100%	**100%**	**100%**

Source: PB, BWI Business Partnership data, sent January 3, 2008[25]

Exhibit 11: 2005 Average Daily Worker Trips to/from BWI Airport

#	District Name	Average Daily Workers Trips	Distribu-tion	Early Morning Trips (4:00am to 6:30 am)		AM Peak Trips (6:30am to 9:30am)		Off Peak Trips (9:30am to 3:30pm)		Trips at all Other times	
				To Airport	From Airport	To Airport	From Airport	To Airport	From Airport	To Airport	From Airport
1	DC CBD	37	0.2%	4	-	2	1	7	4	5	14
2	North DC	77	0.4%	9	-	4	1	14	9	12	28
3	Alexandria	60	0.3%	7	-	3	1	11	7	9	22
4	Arlington	39	0.2%	5	-	2	1	7	5	6	15
5	Silver Spring-Bethesda	71	0.4%	8	-	4	1	13	8	11	26
6	Capital Hgts	162	0.8%	19	-	9	2	29	19	24	60
7	East PG Co	148	0.8%	17	-	8	2	27	17	22	55
8	College Park	139	0.7%	16	-	8	2	25	16	21	51
9	New Carrollton	218	1.1%	25	-	12	3	39	25	33	81
10	Greenbelt	81	0.4%	9	-	4	1	15	9	12	30
11	Bowie	161	0.8%	18	-	9	2	29	18	24	59
12	Muirkirk	101	0.5%	12	-	6	2	18	12	15	37
13	Odenton	1,065	5.6%	122	-	59	16	192	122	160	394
14	Annapolis	628	3.3%	72	-	35	9	113	72	94	232
15	East Mont Co	143	0.7%	16	-	8	2	26	16	21	53
16	Laurel	205	1.1%	24	-	11	3	37	24	31	76
17	Jessup	155	0.8%	18	-	9	2	28	18	23	57
18	East Anne Arundel	1,165	6.1%	134	-	64	17	210	134	175	431
19	West Howard Co	78	0.4%	9	-	4	1	14	9	12	29
20	East Howard Co	249	1.3%	29	-	14	4	45	29	37	92
21	Columbia	720	3.8%	83	-	40	11	130	83	108	266
22	BWI Airport	372	1.9%	43	-	20	6	67	43	56	138
23	Glen Burnie	1,479	7.7%	170	-	81	22	266	170	222	547
24	Carroll Co	439	2.3%	51	-	24	7	79	51	66	163
25	West Balt Co	665	3.5%	76	-	37	10	120	76	100	246
26	Southwest Balt Co	1,679	8.8%	193	-	92	25	302	193	252	621
27	West Balt City	2,355	12.3%	271	-	130	35	424	271	353	871
28	East Balt City	3,663	19.1%	421	-	201	55	659	421	549	1,355
29	North Balt Co	1,090	5.7%	125	-	60	16	196	125	163	403
30	East Balt Co	1,725	9.0%	198	-	95	26	311	198	259	638
Total for Study Area Districts		**19,168**	**100%**	**2,204**	**-**	**1,054**	**288**	**3,450**	**2,204**	**2,875**	**7,092**

Source: PB, BWI Business Partnership data, sent January 3, 2008

[25] BWI Airport Employment Transportation Needs Survey, 2005

Exhibit 12: 2030 Forecast Average Daily Worker Trips to/from BWI Airport

#	District Name	Average Daily Worker Trips	Early Morning Trips (4:00am to 6:30 am)		AM Peak Trips (6:30am to 9:30am)		Off Peak Trips (9:30am to 3:30pm)		Trips at all Other times	
			To Airport	From Airport	To Airport	From Airport	To Airport	From Airport	To Airport	From Airport
1	DC CBD	68	5	-	7	3	12	12	9	19
2	North DC	143	11	-	15	6	26	25	20	40
3	Alexandria	112	8	-	12	5	20	20	15	31
4	Arlington	73	5	-	8	3	13	13	10	20
5	Silver Spring-Bethesda	133	10	-	14	6	24	23	18	37
6	Capital Hgts	300	22	-	32	14	54	53	41	83
7	East PG Co	275	20	-	30	12	50	49	38	76
8	College Park	257	19	-	28	12	47	46	35	71
9	New Carrollton	404	30	-	44	18	73	72	55	112
10	Greenbelt	150	11	-	16	7	27	27	21	42
11	Bowie	298	22	-	32	14	54	53	41	83
12	Muirkirk	187	14	-	20	9	34	33	26	52
13	Odenton	1,974	146	-	213	90	357	349	270	548
14	Annapolis	1,165	86	-	126	53	211	206	160	323
15	East Mont Co	266	20	-	29	12	48	47	36	74
16	Laurel	381	28	-	41	17	69	67	52	106
17	Jessup	288	21	-	31	13	52	51	39	80
18	East Anne Arundel	2,161	160	-	233	98	391	382	296	600
19	West Howard Co	145	11	-	16	7	26	26	20	40
20	East Howard Co	461	34	-	50	21	83	82	63	128
21	Columbia	1,335	99	-	144	61	242	236	183	370
22	BWI Airport	689	51	-	74	31	125	122	94	191
23	Glen Burnie	2,742	203	-	296	125	496	485	376	761
24	Carroll Co	815	60	-	88	37	147	144	112	226
25	West Balt Co	1,233	91	-	133	56	223	218	169	342
26	Southwest Balt Co	3,113	230	-	336	142	563	551	426	864
27	West Balt City	4,367	323	-	472	199	790	773	598	1,212
28	East Balt City	6,793	503	-	734	309	1,230	1,202	931	1,885
29	North Balt Co	2,021	150	-	218	92	366	358	277	561
30	East Balt Co	3,200	237	-	346	146	579	566	438	888
Total for Study Area Districts		**35,544**	**2,630**	**-**	**3,839**	**1,617**	**6,433**	**6,291**	**4,870**	**9,863**

Source: PB, BWI Business Partnership data, sent January 3, 2008, 2006 BWI Long-Range Needs Assessment

Exhibit 13: Travel Demand and Travel Pattern Data Sources

Travel Data Source		Description	Status
1	BMC	Trip distribution base year (2005) and forecast year (2030)	Obtained
2	MWCOG	Trip distribution base year (2002) and forecast years (2010 and 2030)	Obtained
3	MWCOG	Regional Activity Centers: Data on HH and population growth and major trip attactors in the COG region	Obtained
4a	BWI (BMC)	License Plate Survey- giving car-trip origins and destinations for BWI	Obtained
4b	BWI (BMC)	Transit and Demand Responsive Survey	Obtained
4c	BWI (MAA)	BWI Master Plan	Not available until fall 2008
4d	BWI (MAA)	MAA data on enplanement forecasts & employee trips patterns; COG airport user trip survey	Requested
5	University of Maryland - CP	Trip Origin Data	Obtained
6	MTA	MARC station ridership counts	Obtained
7	MTA	On-board survey of Baltimore core-bus, LRT, commuter buses and MARC services	Not yet available
8	WMATA	Metrorail on-board survey (Origin, Exit, station line data for WMATA)	Requested
9	MWCOG	Full on-board bus (and potentially rail) survey for the DC region 2008	Not available until 2008
10	BMC / MWCOG	BRAC Travel Impacts / Origin Destination data	Not available until 2008
11	Ft Meade website	Estimates of total job and population growth resulting from BRAC	Obtained