

Appendices

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Appendix 1: Findings and Assessment from the Previous Studies

Findings and recommendations from previous traffic and transportation studies related to the BRAC relocation action to the Mark Center have been reviewed as part of Task 1. The following studies were reviewed in detail:

- a) BRAC 133 Transportation Management & Improvement Plan (July 2008 - Wells & Associates)
- b) VDOT Mark Center (BRAC) Transportation Study (April 2009 - VDOT & PB)
- c) I-95/I-395 HOV/Bus/HOT Lanes Interchange Justification Report (IJR) (January 2009 - HNTB)
- d) I-95/I-395 Transit/TDM Study (February 2008 - Technical Advisory Committee)
- e) Seminary – Beaugard Corridor Study (January 2007 - Wilbur Smith Associates)
- f) 2003 Mark Center Traffic Impact Study (March 2003 - Wells & Associates)
- g) Ongoing VDOT I-395 IJR at Seminary Road Study

These studies were reviewed to assess the consistency of findings with current Mark Center development plans and parking plans. A summary of the findings and recommendations from the previous studies, along with the assumptions related to land use, trip generation, mode choice, and parking spaces for the Mark Center project site is presented in **Table A-1**.

The BRAC 133 Transportation Management and Improvement Plan (TMIP) prepared by Wells & Associates in July 2008 and the Mark Center (BRAC) Transportation Study prepared by VDOT & PB in April 2009 assume the latest land use proposed for the Mark Center site. This memo specifically addresses the findings from the review of these two studies, including the future baseline volume estimation, trip generation, trip distribution, mode choice, and parking assumptions. Also, proposed values to be used for the future condition analyses as part this effort are also included for review and approval by the City of Alexandria. Other studies included in **Table A-1** were not relevant for detailed review of these parameters since they either assumed different land use at the project site or the study had a different purpose.

Table A-1. Summary of the Findings and Recommendations from the Previous Studies

Assumption	BRAC 133 Transportation Management & Improvement Plan (TMIP) (July 2008 - Wells & Associates)	VDOT Mark Center (BRAC) Transportation Study (April 2009 - VDOT & PB)	2003 Mark Center TIA (March 2003 - Wells & Associates)	Seminary-Beauregard Corridor Traffic Study (January 2007 - Wilbur Smith Associates)	I-95/I-395 HOV/Bus/HOT Lanes IJR (January 2009 - HNTB)	I-95/I-395 Transit/TDM Study (February 2008 - Technical Advisory Committee)	VDOT I-395 IJR at Seminary Rd Study
Land Use Assumed for the Mark Center	<ul style="list-style-type: none"> WHS Gross square foot (GSF): 1,750,000 Floor Area - Net Square footage: 1,386,438 Number of employees: 6,409 IDA Building 5 (two buildings) Gross Floor Area: 368,400 sq. ft. Number of employees: 600 	Same information as used in the BRAC 133 TMIP report (July 2008 - Wells & Associates).	<ul style="list-style-type: none"> Phase 1 A remaining development Gross square foot (GSF): 1,368,500 Phase 1 B development Gross square foot (GSF): 374,616 Combined Total: 1,743,116 sq. ft. Floor Area - Net Square footage: 1,382,730 	Same information as used in the 2003 Mark Center TIA report (March 2003 - Wells & Associates).	Not Known.	Not Applicable	Study On-going (Not Known)
Trip Generation	<p>Trips derived based on number of employees (where # of employees were provided)</p> <ul style="list-style-type: none"> AM Peak Hour <ul style="list-style-type: none"> 1,288 (WHS Vehicle Trips) 470 (IDA Building 5 Vehicle Trips) Total: 1,758 Vehicle Trips PM Peak Hour <ul style="list-style-type: none"> 1,357 (WHS Vehicle Trips) 433 (IDA Building 5 Vehicle Trips) Total: 1,790 Vehicle Trips 	Same information as used in the BRAC 133 TMIP report. 40 percent of 831 trips were added - AM and PM peak hour conditions.	<p>Trips derived based on standard ITE trip generation rates based on sq. ft. for office land use; number of employees not provided.</p> <ul style="list-style-type: none"> AM Peak Hour <ul style="list-style-type: none"> 1,350 (Phase 1 A Vehicle Trips) 481 (Phase 1 B Vehicle Trips) Total: 1,831 Vehicle Trips PM Peak Hour <ul style="list-style-type: none"> 1,451 (Phase 1 A Vehicle Trips) 449 (Phase 1 B Vehicle Trips) Total: 1,900 Vehicle Trips 	Same information as used in the 2003 Mark Center TIA report (March 2003 - Wells & Associates).	Not Known.	Not Applicable	Study On-going (Not Known)
Mode Choice	<ul style="list-style-type: none"> Auto-drivers: 60% Auto passengers: 12% Public Transit: 5% Shuttle Bus: 20% Walk/Bike/Other: 3% 40% transportation management plan trip reduction assumed for WHS trips. 10% transportation management plan trip reduction assumed for IDA Bldg 5 trips. 	Same information as used in the BRAC 133 TMIP report, but revised project traffic volumes for the opening year. This was to account for the availability of 831 additional parking spaces not accounted for in the BRAC 133 TMIP report (July 2008 - Wells & Associates) trip generation process.	10% transportation management plan trip reduction assumed.	Same information as used in the 2003 Mark Center TIA report (March 2003 - Wells & Associates).	Not Known.	Not Applicable	Study On-going (Not Known)
Parking	<ul style="list-style-type: none"> WHS - 3,904 spaces (60% of employees) IDA Building 5 (two buildings) - 817 spaces 	Same information as used in the BRAC 133 TMIP report.	4,839 spaces	Same information as used in the 2003 Mark Center TIA report (March 2003 - Wells & Associates).	Not Known.	Not Applicable	Study On-going (Not Known)
Findings	<ul style="list-style-type: none"> With the recommended improvements, all study intersections are forecasted to operate at LOS D or better during AM and PM peak hours with the additional traffic generated by full build out and occupancy. No micro-simulation analysis performed. None of these studies include analysis for future traffic with existing lane configuration. 	<ul style="list-style-type: none"> The improvements recommended in the BRAC 133 TMIP report are not adequate to handle the additional site generated traffic. Micro-simulation (SimTraffic) analysis was performed to identify impacts to the adjacent intersections. 	<ul style="list-style-type: none"> With the recommended improvements, all study intersections are forecasted to operate at LOS D or better during AM and PM peak hours with the additional traffic generated by full build out and occupancy of parcels 1A and 1B. No micro-simulation performed. 	<ul style="list-style-type: none"> With the different assumption set for the signal timing (cycle length of 120 seconds assumed all across), Seminary Rd/N. Beauregard St is failing during PM peak hour conditions with LOS F. The results are contrary to the 2003 Mark Center TIA report, even with the recommended improvements. Micro-simulation (CORSIM) analysis was performed, throughput from CORSIM used as MOE for comparison. 	<ul style="list-style-type: none"> Forecast volumes for 2015 and 2030 with and w/o HOT lanes are provided along the Seminary Ramps with I-395 and Seminary Rd/Mark Center Dr intersection. Analysis results show that Seminary Rd/Mark Center Dr intersection would operate at LOS E for 2015 & 2030 No Build and Build conditions during AM Peak hour conditions. 	<p>Pertaining to routes serving the study area, the service modifications recommended in the fiscally constrained program included increasing frequency on WMATA 7B by adding one bus (reduce headway from 35 minutes to 17 minutes). In-line Bus Rapid Transit (BRT) station in Lorton and four in-line BRT stations along HOT lane corridor proposed.</p>	Study On-going (Not Known)
Recommended Improvements	<ul style="list-style-type: none"> Addition of a third left-turn lane at Seminary Road onto westbound North Beauregard Street; Addition of a second left-turn lane at westbound North Beauregard onto southbound Mark Center Drive; and Installation of a new traffic signal at the intersection of Mark Center Drive with the western access road to the BRAC 133 site. 	Direct access to Mark Center from I-395 general purpose and HOT lanes is desirable as it would provide an additional alternative for vehicular access. No analysis performed for this direct access.	<ul style="list-style-type: none"> Addition of a third left-turn lane at Seminary Road onto westbound North Beauregard Street; Addition of a second left-turn lane at westbound North Beauregard onto southbound Mark Center Drive; and Construction of a second eastbound-to-southbound right turn lane from Mark Center Drive to Seminary Road. 	<ul style="list-style-type: none"> Majority of recommendations are related to spot improvements, and not related to changes in lane capacity. Different improvements along Seminary Rd and N. Beauregard St tested assuming recommendation in the 2003 Mark Center TIA report as a base condition. Either widening to 4 lanes along Seminary Rd (westbound) or N. Beauregard St (southbound) within the study area would not accommodate the estimated demand. 	<ul style="list-style-type: none"> Results mainly used for Interchange Justification Report and no particular improvement recommend along the study corridor. Based on the volume comparison at Seminary Rd/Mark Center Dr Intersection, it does not seem that BRAC 133 trips are fully reflected. 		Study On-going (Not Known)

A separate memorandum will be prepared that covers the findings from the review of the Synchro files and the conceptual plans. This memorandum focuses on the findings of our evaluation of the site traffic and mode choice parameters as this information is critical to our analysis of 2011 and 2013 scenarios.

Future Baseline Volume Estimation

The process of estimating future baseline volumes was reviewed. The BRAC 133 TMIP assumed future baseline traffic volumes to be the same as existing conditions except for taking into account the addition of project trips for the proposed IDA Building 5. The reasoning was based on a comparison of traffic counts at the intersection of Seminary Road/N. Beaugard Street collected in May 2002 versus June 1994, where there was an overall decrease in peak hour traffic count of 2.74% over this eight-year period, or a reduction of 0.34% per year. Therefore, based on the historic traffic trends, no ambient traffic growth was assumed for the future baseline condition in the BRAC 133 TMIP and Mark Center (BRAC) Transportation Study.

In order to derive appropriate annual traffic growth rates for the road network within the study area, average daily traffic assignments at the roadway link level from the MWCOG travel model were reviewed and summarized. The average growth rate for the roadways within the study area from 2010 to 2020 showed 0.51% growth per year.

Therefore, VHB proposes to apply a 0.5% growth rate per year universally to the roadway links within the study area, rather than assuming no growth. In addition, we will assume that the IDA Building 5 and 4661 Kenmore Avenue developments will be fully built out by 2013 and the corresponding trips will be reflected in the 2013 baseline assignment, but not included for the 2011 baseline condition.

Trip Generation

In estimating BRAC 133 vehicle trip generation, the BRAC 133 TMIP (July 2008 - Wells and Associates) assumed approximately 75% of the total 6,409 employees to be present during the day shift and estimated trip generation during the weekday AM and PM peak hour conditions as summarized in **Table A-2**. The estimated trip generation for BRAC 133 was directly based on the

number of employees and the assumed mode choice percentages, while for IDA Building 5, the trip generation was based on the ITE trip generation rate.

Table A-2. Trip Generation - BRAC 133 TMIP

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
BRAC 133	1,195	79	1,274	148	1,195	1,343
IDA Building 5	413	57	470	74	359	433
Total	1,608	136	1,744	222	1,554	1,776

Table 3-8 of the BRAC 133 Transportation Management & Improvement Plan (TMIP) (July 2008 - Wells & Associates)

The VDOT Mark Center (BRAC) Transportation Study also assumed the same number of employees, but assumed more project trips would be generated due to the number of vacant parking spaces being provided. Following the assumptions outlined in the BRAC 133 TMIP report, this study pointed out that there will be approximately 831 vacant parking spaces that are not accounted for in the trip generation, and concluded that the availability of these additional parking spaces would encourage more people to drive to the facility rather than use other TMIP options. To account for the vacant parking spaces, the Mark Center (BRAC) Transportation study assumed additional project trips on top of what was initially assumed in the BRAC 133 TMIP to account for the case where the vacant 831 parking spaces for the BRAC 133 site would be completely occupied. It was assumed that 40% of these additional project trips will occur during peak hour conditions. **Table A-3** summarizes the number of trips that were assumed in the VDOT Mark Center (BRAC) Transportation Study.

Table A-3. Trip Generation - VDOT Mark Center (BRAC) Transportation Study

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
BRAC 133	1,195	79	1,274	148	1,195	1,343
IDA Building 5	413	57	470	74	359	433
Additional project trips occupying the available 831 parking spaces	324	0	324	0	330	330
Total	1,932	136	2,068	222	1,884	2,106

Out of the total number of 6,409 employees that would occupy the BRAC 133 site, a key factor that would determine the number of project-generated trips would be the number of employees that would be present during the day shift.

It was assumed in the BRAC 133 TMIP that the percent schedules for the work day shift was 83% with an additional 10% reduction which brings the percentage down to approximately 75 % to account for absence due to illness, vacation, travel, etc; in estimating the trip generation. In terms of the number of parking spaces, the BRAC 133 TMIP proposed that 60% of the total number of employees would be provided with a parking space, totaling approximately 3,845 spaces. The VDOT Mark Center (BRAC) Transportation Study estimates the number of occupied parking spaces based on the number of employees present during the day shift along with the assumed TMP measures to be in place. The assumption that the additional project trips would be generated to fully utilize all the parking spaces may be too drastic when considering the following characteristics of the proposed project site:

- Unlike general building complexes, the BRAC 133 site may impose certain parking restrictions and allow parking to authorized employees and issue parking permits to only those employees, as is the case for other military facilities, even though the facility is not being fully utilized.
- The BRAC 133 site may intentionally operate the parking facility at less than maximum utilization in order to provide some reserve parking spaces for cases when a high percentage of employees are reporting during the day shift; when there is an overlap in shift hours; when there is a need for extended work hours for certain employees; or when emergency circumstances occur.

However, depending on the actual number of employees working during the day shift, there is some validity to the assumption noted in the VDOT Mark Center (BRAC) Transportation Study of adding additional project trips based on the assumption that 831 parking spaces would be available.

As a sensitivity test, the number of employees working during the day shift in relation to the available parking spaces for the auto-driver employees and visitor trips were summarized as shown in **Table A-4**. At the proposed BRAC 133 site, the total number of employees is 6,409 while the north garage will have 2,044 spaces and the south garage 1,854 spaces with total of approximately 3900 spaces. Out of the total 3900 spaces, it was assumed that 95% occupancy of the parking garages would be considered as full in order to allow smooth circulation within the facility. The number of auto-driver visitors was estimated by first assuming that the visitors will be 5% of the employees present during the day shift and then assuming 60% of those visitors will be driving a vehicle to the facility. Therefore, the total parking spaces occupied for each scenario were calculated by combining the auto-driver employee and visitor occupied spaces.

Table A-4. Percentage of Employees During the Day Shift in Relation to Available Parking Spaces

Percentage of Total Employees Present During the Day Shift	Number of Employees Present During the Day Shift	Auto-Driver Employee with TMP (40% vehicle reduction in Place)	Number of Visitors (Assumes 5% of employee present)	Auto-Driver Visitor with TMP (40% vehicle reduction in Place)	Total Occupied Spaces	Available Parking Spaces (assuming 95% occupancy as being full)
95%	6,089	3,653	304	183	3,836	0
90%	5,768	3,461	288	173	3,634	71
85%	5,448	3,269	272	163	3,432	273
80%	5,127	3,076	256	154	3,230	475
75%	4,807	2,884	240	144	3,028	677

The initial assumption in the BRAC 133 TMIP was that the percent scheduled to work during the day shift was 83% with an additional 10% absentee reduction in estimating site trip generation. Based on the results from the sensitivity test, this seems to be on the low end. In order to be more conservative, a further reduction of 10% will not be applied. Therefore, it is proposed that 85% of the total employees will be assumed to be present during the day shift for VHB's analysis

of the future conditions, as shaded in **Table A-4**. This assumption will be in the mid-range between the trip generation proposed in the BRAC 133 TIMP, where the percent scheduled to work the day shift is 75%, and in the VDOT Mark Center (BRAC) Transportation Study where the percent scheduled to work the day shift equated to 96%. Therefore, the revised trip generation estimates shown in **Table A-5** are being proposed to be used by VHB in analyzing the future conditions (2013).

Table A-5. Proposed Trip Generation

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
BRAC 133 including Employees and Visitors	1,195	79	1,274	148	1,195	1,343
Additional Project Trips Occupying the Available 273 Parking Spaces (40% during peak hour)	110	0	110	0	110	110
IDA 5	413	57	470	74	359	433
4661 Kenmore Avenue Development (Medical Office Bldg)	205	55	260	89	241	330
Total	1,923	191	2,114	311	1,905	2,216

To determine the reasonableness of these project trips, ITE trip generation rates (Land Use: General office building, Land Use Code: 710) were applied as a final cross check, and the range of the project generated trips based on the number of employees was obtained and compared. As shown in **Table A-6**, when assuming the same number of employees, the comparison shows that trips generated by the site are fairly consistent with the trip generation proposed to be used in the future analysis.

Table A-6. Trip Generation Using the ITE Trip Rates

	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
BRAC 133 Employee Auto-drivers (85 % percent scheduled to work day shift with 40% TMP – 3,269 employees)	1,381	188	1,569	256	1,248	1,504
IDA Building 5 (with 10% TMP - 540 employees)	228	31	259	42	206	248
BRAC 133 Visitor Auto-drivers (5% of employee present with 40% TMP – 163 visitors)	69	9	78	13	62	75
Total	1,678	228	1,906	311	1,516	1,827

Trip Distribution

Trip distribution percentages were revisited based on the current residential distribution of potential BRAC 133 employees provided in the BRAC FEIS report¹, as shown in **Figure A-1**. The current residential distribution was derived based on payroll data that also included employee density within zip code boundaries (employees/square mile). It was assumed that the current BRAC employees, in the short term, would maintain their current residential distribution after relocating to the Mark Center.

¹ BRAC FEIS. Current Residential Distribution of WHS Employees, June 2007, Figure 4.3 – 18

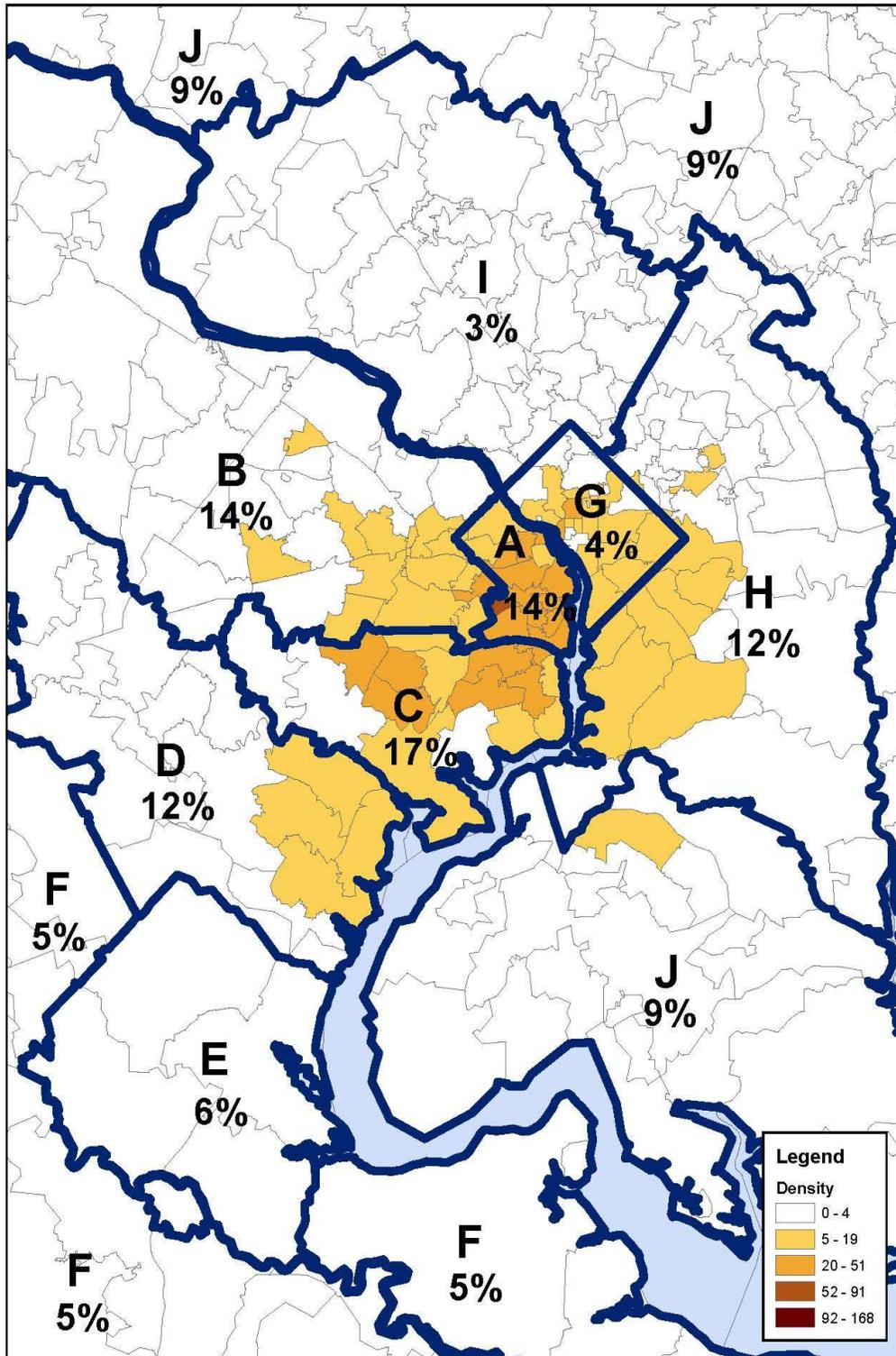


Figure A-1. Current Residential Distribution of WHS Employees²

² BRAC FEIS. Current Residential Distribution of WHS Employees, June 2007, Figure 4.3 – 18

Using this information, project trip distributions were established in order to assess the direction of arrivals and departures by the BRAC 133 employees. Based on the current residential distribution information as shown in **Figure A-1**, a detailed breakout of the trip distribution percentages are summarized in **Table A-7**.

Table A-7. BRAC 133 Trip Origination Estimate

Origin		Total Percentage	From North	From South	From East	From West
A	Arlington Co./City of Alexandria	14%	8%		6%	
B	Northern Fairfax Co.	12%	4%	2%		6%
B	Loudoun Co.	2%				2%
C	Southern Fairfax Co.	17%		9%	6%	2%
D	Prince William Co.	12%		9%		3%
E	Near South (Fredericksburg/Stafford Co.)	6%		6%		
F	Remainder of Virginia	5%	1%	4%		
G	District of Columbia	4%	3%		1%	
H	Prince Georges Co.	12%	2%	5%	5%	
I	Montgomery Co.	3%	1%			2%
J	Remainder of Maryland	9%	5%	2%	2%	
K	Non DC, MD, VA	4%	2%	1%		1%
Total		100%	24%	38%	20%	16%

When compared with the trip distribution assumed in the BRAC 133 TMIP, as shown in **Table A-8**, the trip distribution percentage generally shows a similar range with the estimated trip distribution based on the payroll data, except in the BRAC 133 TMIP, trips from the south on I-395 seem to be underestimated (18%) while trips from the south on N. Beaugard St are overestimated (20%). When assuming at minimum, half of the project trips originating from Fairfax and Prince William Counties would be traveling along I-395 to get to and from the project site, revised trip distributions (shaded in gray) are being proposed for the VHB future year analysis, as shown in **Table A-8**.

Table A-8. Proposed Trip Distribution

Origin	BRAC 133 TMIP	Proposed Trip
	Assumed Trip Distribution	Distribution
To/From the North on I-395	20%	20%
To/From the South on I-395	18%	23%
To/From the East on Seminary Rd	20%	20%
To/From the West on Seminary Rd	15%	15%
To/From the North of N. Beauregard St	5%	5%
To/From the South of N. Beauregard St	20%	15%
To/From the North from Southern Towers	2%	2%
Total	100%	100%

This same distribution will be used by VHB for the trips associated with IDA Building 5. For the 4661 Kenmore Avenue Development (Medical Office Bldg), trip distribution established as part of the 4661 Kenmore Avenue Traffic Impact Study will be assumed.

Mode Choice and Parking

The reasonableness of the 40% Transportation Management Plan (TMP) trip reduction assumed in the BRAC 133 TMIP was reviewed. BRAC 133 agencies have included a parking policy as part of their relocation that limits the number of parking spaces to be constructed to 60 percent of the number of employees and would include shuttle bus service to Metro.

Mark Center currently provides access to Metrorail via bus or shuttle to the Van Dorn Street, King Street, Pentagon City, and Pentagon Metro Stations on the Blue and Yellow Lines. In addition, Duke Realty provides a regularly scheduled shuttle bus service to tenants of Mark Center directly to the Pentagon City Metro Station, located five miles north via I-395, which also provides access to both the Blue and Yellow Lines. If additional shuttle bus connections to the Metro station can be arranged in a timely manner for the tenants of BRAC 133 site along with limiting the usage of parking spaces via permit based operation where the agency has the control over the parking space occupancy, a 40% trip reduction with the TMP measure should be feasible.

Parking ratio guidelines were also reviewed in order to determine whether providing parking spaces for only 60 percent of the total employees would be conforming to the established guidelines or City ordinances. Guidance comes from two primary sources, the National Capital Planning Commission (NCPCC) and the City of Alexandria. According to the guidelines provided in the “Comprehensive Plan for the National Capital: Federal Elements”³ adopted on August 5, 2004, it is stated that for suburban areas beyond 2,000 feet of Metrorail, when HOV lanes exist along or are included in the CLRP for the major highway corridor in proximity to a federal facility in this category, and the completion of the HOV lanes coincides with the federal facility’s build-out schedule, then one parking space for every two employees (1:2) is recommended. Therefore, providing parking spaces for 60% of the employees at the BRAC 133 site meets the requirement of this NCPCC guideline.

In addition, based on Article VIII - Off-Street Parking and Loading specified in the zoning ordinance for the City of Alexandria⁴, for office buildings, including commercial, governmental and professional, the required number of parking spaces is one per 475 square feet of floor area for Parking District 5, which is where the project site is located. Therefore, providing parking spaces for only 60 percent of the total employees, which equate to 3,845 spaces, exceeds the required parking space target of 3,684.

Based on this review, the number of proposed parking spaces exceeds the minimum required spaces per established guidelines and ordinances. The 40% Transportation Management Plan (TMP) trip reduction assumed in the BRAC 133 TMIP will be applied for VHB’s analysis of future scenarios.

³ <http://www.ncpc.gov/publication/pg.asp?p=comprehensiveplanforthenationalcapitalfederalelements>

⁴ <http://www.municode.com/Resources/gateway.asp?pid=12429&sid=46>

Appendix 2: Assessment of Synchro files from the Previous Mark Center (BRAC) Transportation Studies

This memorandum covers the findings from the review of the existing and future opening year (2011) Synchro files prepared as part of the BRAC 133 Transportation Management and Improvement Plan (TMIP) prepared by Wells & Associates in July 2008 and the Mark Center (BRAC) Transportation Study prepared by VDOT & PB in April 2009.

Review of the Synchro Files Prepared for the Existing Conditions

The signal timing information for the study intersections were provided from the City of Alexandria and VDOT. Also, Synchro files that were used for the analyses in the BRAC 133 TMIP and the VDOT Mark Center (BRAC) Transportation Study were obtained. These files used for the existing and future condition analyses in the previous studies were reviewed for their reasonableness, particularly the lane geometry and the signal timing information. However, Synchro files for the existing conditions were only available for the VDOT Mark Center (BRAC) Transportation Study while Synchro files from the both studies were available for the future condition analyses. Therefore, for the existing condition Synchro files from the VDOT Mark Center (BRAC) Transportation Study were only reviewed and the findings from the review of the existing conditions are summarized in **Table A-9**.

As shown in Table A-9, the right turn channelization for certain movements are not reflected accurately at the intersections of Seminary Road / N. Beaugard Street and Seminary Road / Mark Center Drive. In addition, significant discrepancies in the Levels of Service (LOS) were found at the intersection of I-395 Northbound Off-Ramp/Seminary Road, where what was reported in the VDOT Mark Center (BRAC) Transportation Study differed by two letter grades for the AM peak and by one letter grade for the PM peak hour conditions as compared to what was reported in the Synchro network files used for their analysis. The VDOT Mark Center (BRAC) Transportation Study reports this intersection to be operating at LOS E or better but based on the review of the Synchro file used in the analyses, this intersection is reported to be failing at LOS F for both AM and PM peak hour conditions. Since Synchro 7 (Build 771 Rev 3) was used for this review, the difference in the version of the Synchro software used in the actual analysis may

have attributed the discrepancy in the analysis results. However, comparison of the other intersections revealed that the LOS noted in the report and from the Synchro files were fairly consistent except for the intersection pointed out above.

Table A-9. Findings from the Existing Condition Synchro Network Review

Intersection	VDOT Mark Center (BRAC) Transportation Study (April, 2009 - VDOT & PB)
Seminary Road / N. Beaugard Street	<ul style="list-style-type: none"> • Right turn channelization not reflected for the N. Beaugard Street northbound and Seminary Road eastbound and westbound approaches. These approaches were coded as shared through plus right turn lane. • N. Beaugard Street northbound right turn exclusive receiving lane is not reflected. • Seminary Road eastbound approach is coded as three lanes while it is two lanes with one right turn channelization.
Seminary Road / Mark Center Drive	<ul style="list-style-type: none"> • Right turn channelization is not correctly reflected for the Seminary Road eastbound right turn approach. • Along Mark Center Drive, south leg receiving lane shown as one lane while in reality the lane width is wide enough to accommodate two lanes. • Timing of the Seminary Road/Mark Center Drive differ for AM peak hour conditions in the Synchro file prepared for the VDOT Mark Center study versus the signal timing provided by the City of Alexandria. Synchro file from VDOT has less green time allocated for Seminary Road westbound left turn movement.
I-395 Northbound Off-Ramp/Seminary Road	<ul style="list-style-type: none"> • Levels of Service (LOS) differs significantly from what was reported in the VDOT Mark Center (BRAC) Transportation Study versus what is from the Synchro network used for the analysis, which was provided by VDOT. • LOS reported in the report: AM D (52.9) / PM E (67.9) LOS directly from the Synchro file: AM F (93.6) / PM F (98.9)
I-395 Northbound On-Ramp/Seminary Road	<ul style="list-style-type: none"> • Left turn lane shown as full lane while there is no separate turn bay provided for the northbound left turn movement.

Review of the Synchro Files Prepared for the Future Opening Year 2011 Conditions

Synchro files used for analyzing the future opening year 2011 conditions for the BRAC 133 TMIP and VDOT Mark Center (BRAC) Transportation Study were obtained. The Synchro files related to the VDOT Mark Center (BRAC) Transportation Study were provided via email on June 18, 2009 and latest revised files by Wells and Associates related to the BRAC 133 TMIP study, which reflects most current conditions and forecasts for the 2011 conditions, were provided on July 15, 2009 via email. Findings, discrepancies and issues based on the review of these files are summarized in Table A-10.

Table A-10. Findings from the Future Opening Year (2011) Condition Synchro Network Review

Category	BRAC 133 Transportation Management & Improvement Plan (TMIP) (Updated file provided in July, 2009 - Wells & Associates)	VDOT Mark Center (BRAC) Transportation Study (April, 2009 - VDOT & PB)
Geometry	<p><u>Seminary Road/N. Beaugard Street</u></p> <ul style="list-style-type: none"> Separate physical links were used to depict the channelization of the right turn volumes for the N. Beaugard Street northbound and Seminary Road eastbound approaches instead of using right turn channelization feature in the Synchro network. This assumption would not reflect the actual lane usage condition since it assumes that the right turn movement would not be impeded due to the through movement and would result in lower delay. As a mitigation measure, a triple left turn for the Seminary Road westbound approach and widening to 3 lanes for the receiving lanes along N. Beaugard Street are assumed. However, the triple left turn lanes are coded as full length lanes instead of one full left turn lane and two turn bays. N. Beaugard Street northbound right turn lane receiving lane along Seminary Road is not reflected. <p><u>Seminary Road / Mark Center Drive</u></p> <ul style="list-style-type: none"> Southbound along South tower access coded as dual left and share plus right turn lane while the actual lane configuration is a single left, one through plus left, and a right turn lane. <p><u>N. Beaugard Street/Mark Center Drive</u></p> <ul style="list-style-type: none"> As a mitigation measure, dual left turn is assumed for N. Beaugard Street southbound approach into the project site. 	<p><u>Seminary Road/N. Beaugard Street</u></p> <ul style="list-style-type: none"> Right turn channelization not reflected for the Seminary Road westbound approach, while for other approaches was reflected. Seminary Road eastbound approach is shown as three lanes while it is two lanes with one right turn channelization. As a mitigation measure, a triple left turn assumed for the Seminary Road westbound approach and widening to 3 lanes for the receiving lanes along N. Beaugard Street. N. Beaugard Street northbound right turn lane receiving lane along Seminary Road is not reflected. N. Beaugard Street southbound approach is shown to be widened to three lanes in the AM network while PM network assumes no improvement. <p><u>Seminary Road / Mark Center Drive</u></p> <ul style="list-style-type: none"> Number of receiving lanes along Mark Center Drive is shown as one lane, while in reality it is wide enough to accommodate two lanes. <p><u>N. Beaugard Street/Mark Center Drive</u></p> <ul style="list-style-type: none"> As a mitigation measure, dual left turn is assumed for N. Beaugard Street southbound approach into the project site.
Signal Timing	<p><u>Seminary Road/N. Beaugard Street</u></p> <ul style="list-style-type: none"> Cycle length set as 100 (AM) and 120 (PM) seconds with actuated-coordinate controller type. <p><u>Seminary Road / Mark Center Drive</u></p> <ul style="list-style-type: none"> Cycle length set as 100 (AM) and 120 (PM) seconds with actuated-coordinate controller type. <p><u>N. Beaugard Street/Mark Center Drive</u></p> <ul style="list-style-type: none"> Cycle length set as 100 (AM) and 120 (PM) seconds with actuated-coordinate controller type. <p><u>Intersections at I-395 ramps</u></p> <ul style="list-style-type: none"> Four intersections with the I-395 ramps are assumed to operate under pre-timed controller type with on controller for intersection with northbound ramps and another for southbound ramps. Cycle length set as 100 (AM) and 120 (PM) seconds. 	<p><u>Seminary Road/N. Beaugard Street</u></p> <ul style="list-style-type: none"> Cycle length set as 150 (AM) and 140 (PM) seconds with actuated-coordinate controller type. <p><u>Seminary Road / Mark Center Drive</u></p> <ul style="list-style-type: none"> Cycle length set as 150 (AM) and 140 (PM) seconds with actuated-coordinate controller type. <p><u>N. Beaugard Street/Mark Center Drive</u></p> <ul style="list-style-type: none"> Cycle length set as 150 (AM) and 140 (PM) seconds with actuated-coordinate controller type. <p><u>Intersections at I-395 ramps</u></p> <ul style="list-style-type: none"> Intersections at I-395 ramps are assumed to operate under actuate-uncoordinated controller type with one controller controlling for all four intersections similar as with the existing condition with permitted left turn movements assumed to operate as split phase. Cycle length set as 201.5 seconds for AM and PM conditions with actuated-uncoordinated controller type.

In addition, the peak hour factor (PHF) assumption in the Synchro files prepared as part of the VDOT Mark Center (BRAC) Transportation Study for both the AM and PM peak hour conditions showed that the uniform PHF of 1.0 was used for the analysis of the four intersections with the I-395 ramps, while PHF of 0.92 was used for the three intersections located to the north. The PHF assumption from the BRAC 133 TMIP report assumed a uniform PHF of 0.95 for the study intersections in the future opening year (2011) condition.

Appendix 3: Development in the Vicinity of the BRAC 133 Project Site

Potential developments by 2015 or earlier for parcels in the Beauregard Corridor Plan area could yield approximately 700,000 square feet of additional nonresidential floor area and 900 additional dwelling units. In most cases, the intensity of development or mix of uses in these developments would not be permitted under current zoning. The potential developments projected are consistent with mixed-use developments that are occurring in the region and with what the owners and developers are considering for these sites. According to the City of Alexandria, all of the potential developments, except the planned WRIT medical office building on Kenmore Avenue, would require a plan amendment and rezoning. The WRIT medical office building and IDA Phase 1 and 2 developments were included as 2013 future baseline growth in the Conceptual Alternatives analysis.

Potential developments in the Beauregard Corridor plan area, which may be developed in the vicinity of the Mark Center, would be expected to generate approximately 1,000 additional trips during the AM peak hour and 1,500 additional trips during the PM peak hour.

Appendix 4: Comparison of the Benefits and Disadvantages of the Conceptual Alternatives

Comparison of the benefits and disadvantages of the Conceptual Alternatives analyzed are summarized in **Table A-11**.

Table A-11. Comparison of the Benefits and Disadvantages of the Conceptual Alternatives

Alternatives	Concept 1	Concept 2	Concept 3	Concept 4
Description	Provides direct ramp connection from I-395 southbound on ramp to the proposed South parking garage located within the BRAC 133 site	Provides a direct ramp connection from I-395 southbound on ramp to the existing internal circulation roadways within Mark Center	The proposed direct ramp connection from I-395 southbound on ramp will be provided to the BRAC 133 South parking garage as well as to the existing internal circulation roads within Mark Center. (combines Conceptual Alternatives 1 and 2)	Provides additional capacity for the left turn lanes at the following critical approaches without any direct ramp connection from and to I-395 southbound off ramp. <ul style="list-style-type: none"> • Seminary Rd / N.Beauregard St intersection – addition of a westbound left-turn lane along Seminary Rd to improve this approach from a dual to triple left turn lane configuration. • N.Beauregard St / Mark Center Dr intersection - addition of a southbound left turn lane along N.Beauregard St to improve this approach from a single to a dual left turn lane configuration.
Benefits	o By diverting the project trips via direct access ramp, operations during AM peak hour conditions at Seminary Rd / N. Beauregard St and N.Beauregard St/Mark Center Dr intersections serving the project site would be improved.	o Further improves the operations during AM peak hour conditions than 2013 Concept 1 at the key intersections serving the project site which are the intersections at Seminary Rd / N. Beauregard St and N.Beauregard St / Mark Center Dr. Diverting not only the BRAC 133 project trips but also trips made by the existing and future Mark Center tenants via the new direct ramp would result in further operational improvement.	o By providing two separate direct ramps based on destination within Mark Center, capacity at each direct access ramps will be increased and less congestion will be anticipated at the direct access points to the Mark Center. Also the internal circulation roadways within Mark Center would be expected to perform better by providing the separate access for the BRAC 133 project trips and the rest of the Mark Center tenants.	o Improves capacity for critical left turn movements which are westbound left at Seminary Rd / N. Beauregard St intersection and southbound left at N. Beauregard St / Mark Center Dr intersection. Improves traffic operations at these intersections mostly during AM peak hour conditions compared to the 2013 Baseline conditions.
	o By providing additional egress via direct access ramp, operations during PM peak hour conditions at Seminary Rd / Mark Center Dr would be improved.	o Further improves operations compared to 2013 Baseline Concept 1 conditions at Seminary Rd / Mark Center Dr during PM peak hour conditions by additional egressing the project site via direct access ramp.	o Further improves the operations during AM peak hour conditions at the key intersections serving the project site which are the intersections at Seminary Rd / N. Beauregard St and N.Beauregard St / Mark Center Dr. This would be possible by providing additional access via direct access ramp and diverting not only the BRAC 133 project trips but also trips made by the existing and future Mark Center tenants.	o Involves relatively less ROW impacts compared to other conceptual alternatives.
	o Does not require any major reconfiguration of the geometry along existing roadways except at the new access ramp.		o Further improves operations at Seminary Rd / Mark Center Dr during PM peak hour conditions by providing additional egress via direct access ramp.	o Construction period and cost is anticipated to be less compared to other conceptual alternatives.
Disadvantages	o Involves some ROW impacts, including undergoing a rigorous interchange modification procedure for constructing the new access ramp.	o Entails significant ROW impacts at the new access ramp, including undergoing an interchange modification process.	o Entails significant ROW impacts at the two new access ramps, including undergoing Interchange modification procedure.	o Operational improvement would be limited to the project trips accessing the site during AM peak hour conditions and would not benefit operations for the project trips exiting the site during PM peak hour conditions.
	o Depending on the processing time required to clear the vehicles at the security check point at the entrance to the south parking garage, there is a possibility of vehicle spill back, which would affect the operations along the I-395 southbound on ramp and the Seminary Rd eastbound approach.	o Major construction efforts would be required due to grade separating the access ramp under tight spacing requirements.	o Major construction efforts would be required due to grade separating the access ramp under tight spacing requirements.	o Considering the additional project trips that would make left turns at the Seminary Road westbound approach, the distance needed for the merge maneuver of the project trips coming from the I-395 ramps appears to be insufficient for the crossing of two lanes to enter into the triple left lanes which may result in an adverse impact on the I-395 Seminary Road interchange and Seminary Road westbound approach.

Table A-11: Comparison of the Benefits and Disadvantages of the Conceptual Alternatives

Alternatives	Concept 1	Concept 2	Concept 3	Concept 4
Disadvantages	o Weaving maneuvers between the vehicles accessing the new direct ramp and the I-395 southbound on ramp traffic would cause some turbulence in the traffic flow.	o Current geometry of the I-395 southbound on ramp would have to be reconfigured and the free right turn channelized ramp would need to be removed and dual right turns will be added, which would deteriorate the operations at this intersection.	o Current geometry of the I-395 southbound on ramp would have to be reconfigured and the free right turn channelized ramp would need to be removed and dual right turns will be added which would deteriorate the operations at this intersection.	o Reconfiguration would potentially require longer crosswalks at the Seminary Rd / N. Beaugard St intersection due to the lane widening along Seminary Rd westbound and N. Beaugard St southbound approach. This would generally degrade the mobility for the vehicular operations by providing additional pedestrian crossing time decreased green time for the critical intersection movements.
	o Driver way finding could be confusing to traffic that is re-routed to the new direct access ramps. Rerouting could increase driver confusion due to multiple turn movements over a short distance.	o Weaving distance between the new ramp and the I-395 southbound on ramp intersection would be fairly short (approximately 200 feet) and turbulence would occur due to the weaving maneuver.	o Weaving distance between the new ramp and the I-395 southbound on ramp intersection would be fairly short and some turbulence would occur due to the weaving maneuver.	o Potential spillback at turn bays due to heavy left turn volumes.
		o Heavy diverted trips accessing/egressing via the direct ramp may cause congestion and deteriorate the operations of the Mark Center internal circulation roadways.	o Heavy diverted trips accessing / egressing via direct ramp may cause congestion of the operations of the Mark Center internal circulation roadway.	
		o Depending on the level of congestion of the internal circulation roadway, there is possibility of vehicle spill back that would affect the traffic flow along the I-395 southbound on ramps and potentially impact the operations along I-395 southbound ramps as well as the Seminary Rd eastbound approach.	o Depending on the level of congestion of the internal circulation roadway, there is possibility of vehicle spill back which would affect the traffic flow along the I-395 southbound on ramps and potentially operations along Seminary Rd eastbound approach. Also, depending on the processing time required to clear the vehicles at the security check point at the entrance to the south parking garage, there is possibility of vehicle spill back at the access point which would affect the traffic flow along the I-395 southbound on ramps and potentially operations along Seminary Rd eastbound approach.	
		o Driver wayfinding could be confusing to traffic that is re-routed to the new direct access ramps.	o In case of spillback caused by congestion on internal roads or due to increased processing time at security gate, traffic will divert to the intersections at Seminary Rd / N. Beaugard St and N. Beaugard St / Mark Center Dr.	
		o Rerouting could increase driver confusion due to multiple turn movements over a short distance.	o Driver way finding could be confusing to traffic that is re-routed to the new direct access ramps. Rerouting could increase driver confusion due to multiple turn movements over a short distance.	
		o Possibility of cut through traffic not destined to Mark Center accessing this direct access ramp therefore increasing congestion along the internal circulation roadways.	o Possibility of cut through traffic not destined to Mark Center accessing this direct access ramp therefore increasing congestion along the internal circulation roadways.	