Wallbrook Development Traffic Impact Analysis

February 13, 2020

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Sign-off Sheet

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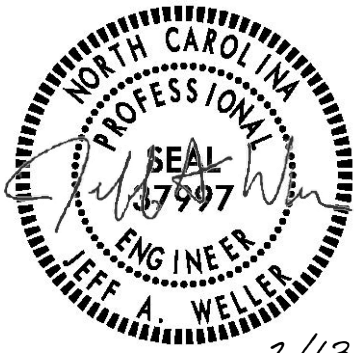

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Executive Summary

Wallbrook is a proposed mixed-use development project located along US 401 Business (S. Main Street) in Rolesville, NC. In general, the site encompasses areas along both sides of US 401 Business, between Burlington Mills Road and Hampton Lake Drive/Jonesville Road. It is anticipated that the residential homes to the east of US 401 Business will be the first to develop. The remainder of the site, expected to be completed in 2025, consists of the North Site (West of US 401 Business), the East Site (east of US 401 Business across from Burlington Mills Road), and the South Site (east of 401 Business and north of Jonesville Road). The residential parcel of the East Site is anticipated to be completed in 2021. The sites will provide a mix of uses as follows:

East Site

- 155 townhomes;
- 20,000 square feet of office; and
- 20,000 square feet of retail.

North Site

- 60,000 square feet of medical office;
- 8,000 square feet of retail; and
- 6,000 square feet of fast-food restaurant.

South Site

- 10,000 square feet of day care center;
- 34,000 square feet of retail;
- 50,000 square feet of grocery;
- 4,000 square feet of bank;
- 7,000 square feet of restaurant;
- 4,000 square feet of fast-food restaurant; and,
- 16 fuel position gas station.

At full build out, the development project is anticipated to generate 22,252 new trips per average weekday. In the AM and PM peak hours, the combined redevelopment will generate approximately 1,467 AM peak hour trips (846 entering and 621 exiting) and 2,053 PM peak hour trips (963 entering and 1,090 exiting).

Ten access points are proposed for the development. Access points A, B, C, and D will connect to US 401 Business, access points E, F, G, H and I will be connected to the extended Virginia Waters Drive / realigned Burlington Mills Road. The last access point J will be connected to the original Burlington Mills Road. These access points are shown on the site plan in Figure ES-1.

The purpose of this report is to evaluate development in terms of projected vehicular traffic conditions, evaluate the ability of the adjacent roadways and multimodal facilities to accommodate the additional traffic and to recommend transportation improvements needed to mitigate congestion that may result from additional site traffic. This report presents trip generation, trip distribution, traffic analyses, and recommendations for improvements needed to meet anticipated traffic demands. This report examines the following scenarios for the AM and PM peak hours:

- 2019 Existing
- 2025 No-Build
- 2025 Build
- 2025 Build with Improvements

Capacity analyses for the AM and PM peak hours in each scenario were performed for the following intersections:

- US 401 Business at US 401;
- US 401 Business at Hampton Lake Drive / Jonesville Road;
- US 401 Business at Burlington Mills Realigned / Virginia Waters Drive;
- US 401 Business at (Old) Burlington Mills Road;
- US 401 Business at Rogers Road / Redford Place;
- Burlington Mills Road at Old Burlington Mills Road;
- Burlington Mills Road at Barrington Hall/Access J;
- Jonesville Road at Vineyard Pine Lane;
- US 401 Business at Access A;
- US 401 Business at Access B;
- US 401 Business at Access C;
- US 401 Business at Access D;
- Virginia Waters Drive at Access E;
- Virginia Waters Drive at Access F;
- Virginia Waters Drive at Access G;
- Virginia Waters Drive at Access H; and
- Burlington Mills Realigned at Access I.

Table ES-1 shows a summary of the delays and levels of service for the study area intersections.

The study shows that the traffic generated by both phases of the Wallbrook Development project will have an impact on surrounding roadways and intersections. With the recommended improvements, the signalized intersections operate at an overall level of service (LOS) of D or better during both peak hours in the build improved scenario. Sidestreet approaches to these intersections are shown to operate at LOS D or better during both peak hours across all scenarios. The eastbound approach of Old Burlington Mills Road and US 401 Business operates at LOS E in the AM Build with Improvements scenario but has minor traffic volumes compared to those on US 401 Business.

Figure ES-1: Site Plan

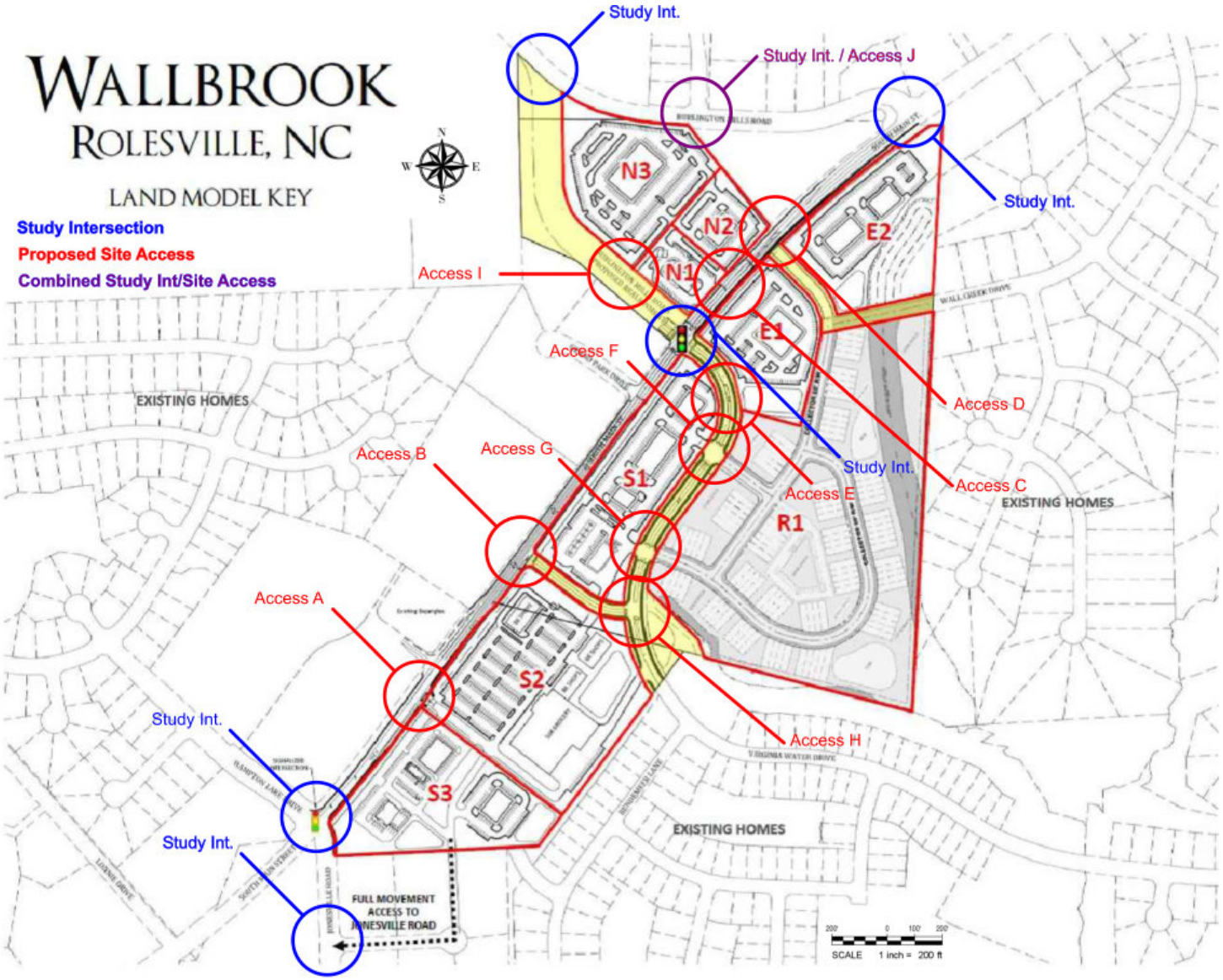


Table ES-1: Level of Service & Delay Summary

Intersection	Peak Hour	Existing (2019)	No-Build (2025)	Build (2025)	Build Imp (2025)
US 401 Business at US 401 (Signalized)	AM Overall	C (22.1)	C (21.4)	D (40.7)	D (42.5)
	PM Overall	C (20.2)	B (16.3)	B (17.6)	B (18.9)
US 401 Business at Hampton Lake Drive / Jonesville Road (Signalized)	AM Overall	C (33.1)	D (41.4)	F (138.0)	C (28.5)
	PM Overall	C (27.4)	C (27.3)	F (99.8)	C (23.7)
US 401 Business at Burlington Mills Realigned / VA Waters Dr (Signalized)	AM Overall	-	C (23.4)	E (69.9)	D (44.8)
	PM Overall	-	B (13.5)	C (32.9)	C (30.8)
US 401 Business at (Old for Build) Burlington Mills Road (Signalized to Unsignalized)	AM EBR	C (26.3) Overall	C (19.4)	E (38.8)	E (38.8)
	PM EBR	C (26.2) Overall	B (13.2)	C (17.4)	C (17.4)
US 401 Business at Rogers Road / Redford Place (Signalized)	AM Overall	D (36.9)	D (41.8)	D (45.0)	D (49.0)
	PM Overall	C (33.7)	D (36.9)	D (54.8)	D (46.0)
Burlington Mills Road at Old Burlington Mills Road (Unsignalized)	AM WBL	-	C (18.6)	C (20.9)	C (20.9)
	PM WBL	-	B (11.2)	B (11.7)	B (11.7)
Old Burlington Mills Road at Barrington Hall Drive/Access J (Unsignalized)	AM NBL	C (16.1)	B (12.5)	B (13.4)	B (13.4)
	PM NBL	A (9.7)	A (9.4)	B (10.7)	B (10.7)
Jonesville Road at Vineyard Pine Lane (Unsignalized)	AM SBL	B (10.4)	B (10.8)	B (11.3)	B (11.3)
	PM SBL	A (9.6)	A (9.8)	B (10.8)	B (10.8)
US 401 Business at Access A (Unsignalized)	AM WBL	-	-	C (23.3)	C (21.2)
	PM WBL	-	-	C (22.3)	C (19.2)
	AM Overall	-	-	F (##) WBL	B (15.6)
US 401 Business at Access B (Signalized)	PM Overall	-	-	F (##) WBL	B (19.2)
US 401 Business at Access C (Unsignalized)	AM EBL	-	-	C (19.5)	C (18.9)
	PM EBL	-	-	C (16.5)	C (16.1)
US 401 Business at Access D (Unsignalized)	AM WBL	-	-	C (18.1)	C (17.8)
	PM WBL	-	-	C (24.2)	C (23.4)
Virginia Waters Dr at Access E (Unsignalized)	AM WBL	-	-	B (10.0)	B (10.0)
	PM WBL	-	-	B (10.5)	B (10.5)
Virginia Water Dr at Access F (Unsignalized)	AM EBL	-	-	B (10.9)	B (10.9)
	PM EBL	-	-	B (11.4)	B (11.4)
Virginia Waters Dr at Access G (Unsignalized)	AM EBL	-	-	B (11.8)	B (11.8)
	PM EBL	-	-	B (12.6)	B (12.6)
Virginia Waters Dr at Access H (Unsignalized)	AM EBL	-	-	B (10.4)	B (10.4)
	PM EBL	-	-	B (10.5)	B (10.5)
Burlington Mills Road at Access I (Unsignalized)	AM SBL	-	-	C (16.4)	B (14.7)
	PM SBL	-	-	B (13.9)	B (13.0)

LOS is reported as the letter grade with the seconds of delay per vehicle shown in parentheses.

indicates delay longer than 300 seconds.

- Approach or movement does not exist in this scenario

Based on the findings of this study, specific improvements have been identified and are recommended to be completed as part of the proposed development. These improvements are listed below.

RECOMMENDATIONS

Except where noted, all intersections are recommended to operate under two-way stop control (TWSC), with the site accesses serving as the minor movement(s).

US 401 Business at Access A

Construct Access A as a limited-movement intersection onto US 401 Business restricting southbound and westbound lefts. Construct a northbound right-turn lane with 100 feet of full-width storage.

US 401 Business at Access B

Construct Access B as a full-movement signalized intersection onto US 401 Business with an exclusive northbound right-turn lane with 100 feet of full-width storage and appropriate taper. Construct an exclusive southbound left-turn lane with 100 feet of full-width storage and appropriate taper on US 401 Business. Construct westbound egress with an exclusive left-turn lane with full storage and an exclusive right-turn lane with 150 feet of full-width storage.

US 401 Business at Access C

Construct Access C as a limited-movement intersection on to US 401 Business restricting northbound and eastbound left-turns. Construct an exclusive southbound right-turn lane with 100 feet of full-width storage and appropriate taper on US 401 Business.

US 401 Business at Access D

Construct Access D as a limited-movement intersection on to US 401 Business allowing all movements but a westbound left. Construct an exclusive northbound right-turn lane and southbound left-turn lane with 100 feet of full-width storage and appropriate taper.

Virginia Waters Drive at Access E

Construct Access E as a full-movement intersection on Virginia Water Drive.

Virginia Waters Drive at Access F

Construct Access F as a full-movement intersection on Virginia Water Drive.

Virginia Waters Drive at Access G

Construct Access G as a full-movement intersection on Virginia Water Drive.

Virginia Waters Drive at Access H

Construct Access H as a full-movement intersection on Virginia Water Drive.

Burlington Mills Realigned at Access I

Construct Access I as a full-movement intersection on Burlington Mills Road. Construct an exclusive westbound right-turn lane that is continuous from receiving the second northbound left-turn lane at US 401 Business and Burlington Mills Road.

Old Burlington Mills Road at Barrington Hall/Access J

Construct Access J as a full-movement intersection on Old Burlington Mills Road.

US 401 Business at Burlington Mills Realigned

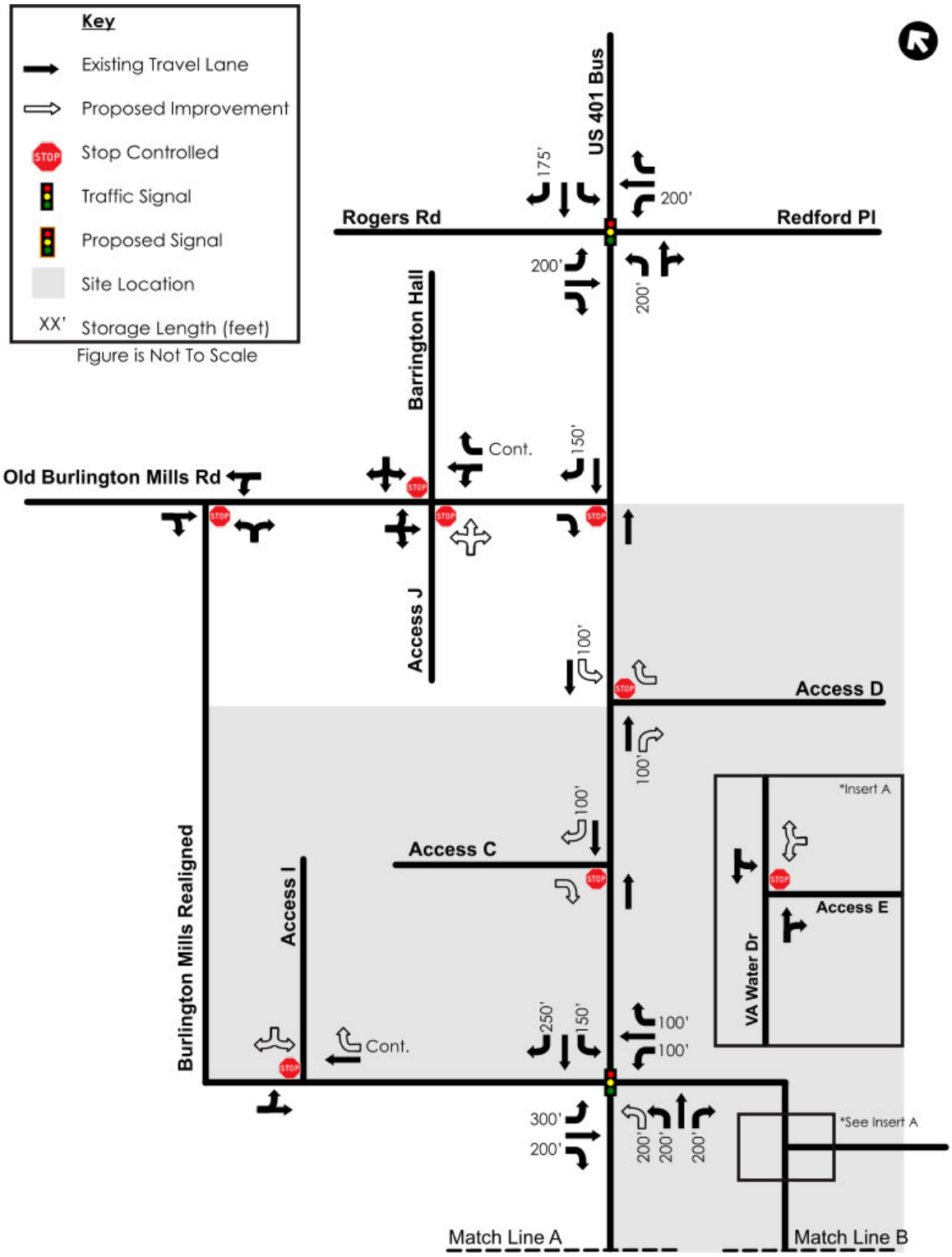
Construct a second northbound left-turn lane with 250 feet of full-width storage and appropriate taper.

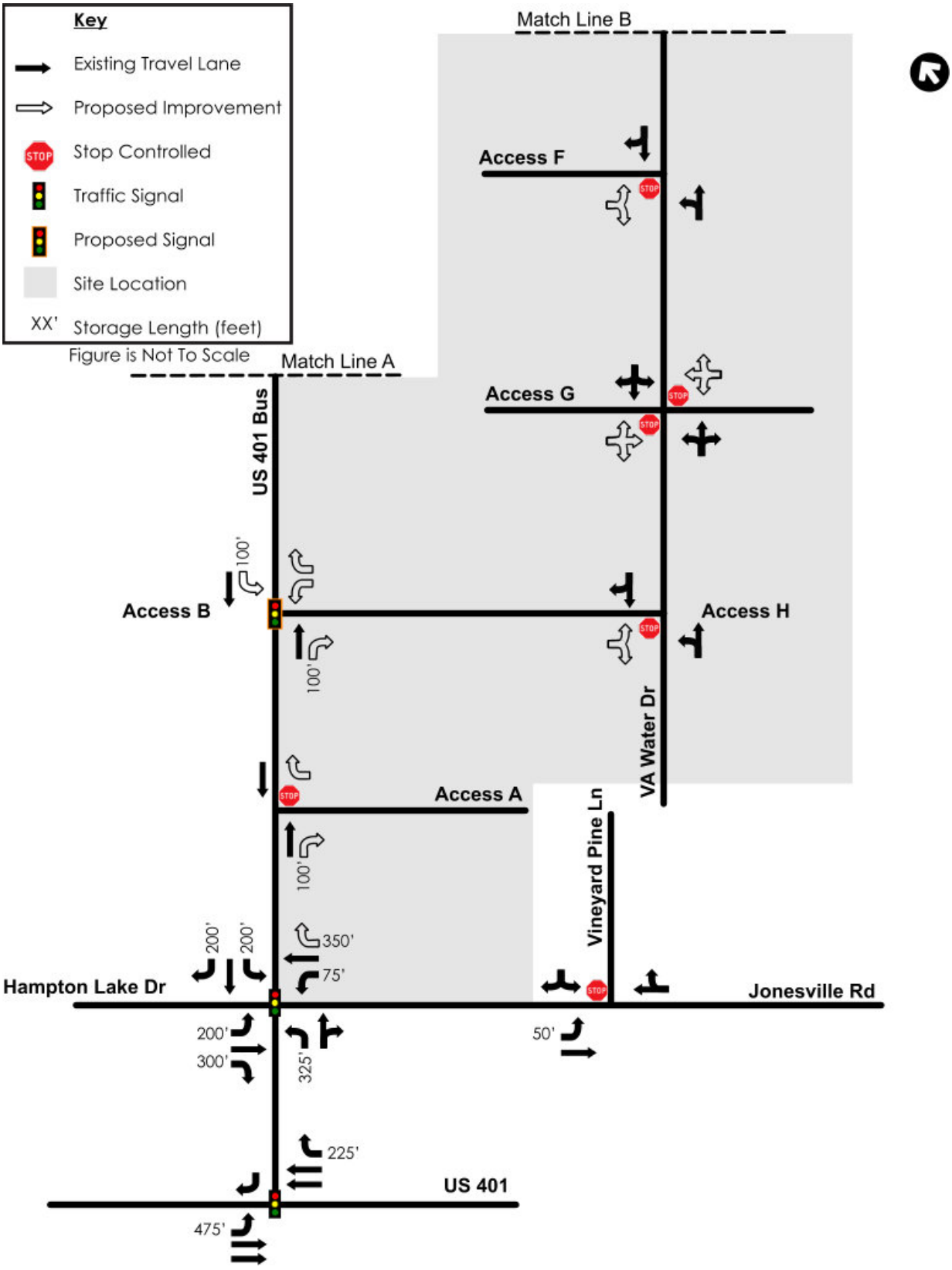
US 401 Business at Hampton Lake Drive/Jonesville Road

Construct a westbound right-turn lane with 350 feet of full-width storage and appropriate taper. Allow permitted + protected signal phasing.

These recommendations are illustrated on Figure ES-2.

Figure ES-2: Recommended Improvements




Key
Existing Travel Lane
Proposed Improvement
Stop Controlled
Traffic Signal
Proposed Signal
Site Location
XX' Storage Length (feet)
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access H
Access B
Access A
US 401 Bus
VA Water Dr
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
100'
200'
200'
350'
75'
50'
325'
225'
475'

1.0 INTRODUCTION

The purpose of this report is to evaluate the traffic impacts of the proposed Wallbrook Development located in Rolesville, NC. This development is located along US 401 Business between Burlington Mills Road and Hampton Lake Drive / Jonesville Road. The development's location is shown in Figure 1.

This site is bounded by Burlington Mills Road and Hampton Lake Drive / Jonesville Road. Currently, the 68.54-acre site consists of undeveloped forested land. Construction of the site is anticipated to be completed in 2025; therefore, the analysis year will be 2025. At full build-out the site is envisioned to provide the following land uses and densities:

- 155 townhomes;
- 17,000 square feet of restaurant;
- 10,000 square feet of day care center;
- 4,000 square feet of bank;
- 16 fuel position gas station;
- 112,000 square feet of retail; and
- 80,000 square feet of office.

The proposed development is to be bisected by public roadways (US 401 Business, Burlington Mills Road Realigned, Virginia Waters Drive Extension) resulting in North, East, and South sites comprising the full site.

The North site consists of 60,000 square feet of medical-dental office, 8,000 square feet of retail, and 6,000 of restaurant West of US 401 Business between Old Burlington Mills Road and Realigned Burlington Mills Road. The East site consists of 155 townhomes, 20,000 square feet of office, and 20,000 square feet of retail in the area bounded by US 401 Business and Virginia Waters Drive Extension. The South site consists of 10,000 square feet of daycare space, 34,000 square feet of retail, 50,000 square feet of grocery store, 4,000 square feet of a bank, 7,000 square feet of restaurant, 4,000 square feet of fast-food restaurant, and 16 fuel positions at a gas station bordered by US 401 Business to the west and Virginia Waters Drive Extension to the north and east.

Figure 2 shows the conceptual site plan prepared by ARK Consulting, with 10 access points shown. The North site has accesses C, I and J to be constructed off US 401 Business, Burlington Mills Road Realigned, and Old Burlington Mills Road, respectively. The East site utilizes access D from US 401 Business and accesses E and G from Virginia Waters Drive. The South site has accesses F, G, and H connecting to Virginia Waters Drive and accesses A and B connecting to US 401 Business.

The purpose of this report is to evaluate the development in terms of projected vehicular traffic conditions, evaluate the ability of the adjacent roadways to accommodate the additional traffic and to recommend transportation improvements needed to mitigate congestion that may result from additional site traffic. This report presents trip generation, trip distribution, traffic analyses, and recommendations for improvements needed to meet anticipated traffic demands. The analysis examines the AM and PM peak hours for the 2019 Existing, 2025 No-Build, 2025 Build and 2025 Build with Improvements.

Figure 1: Site Location and Study Area Map

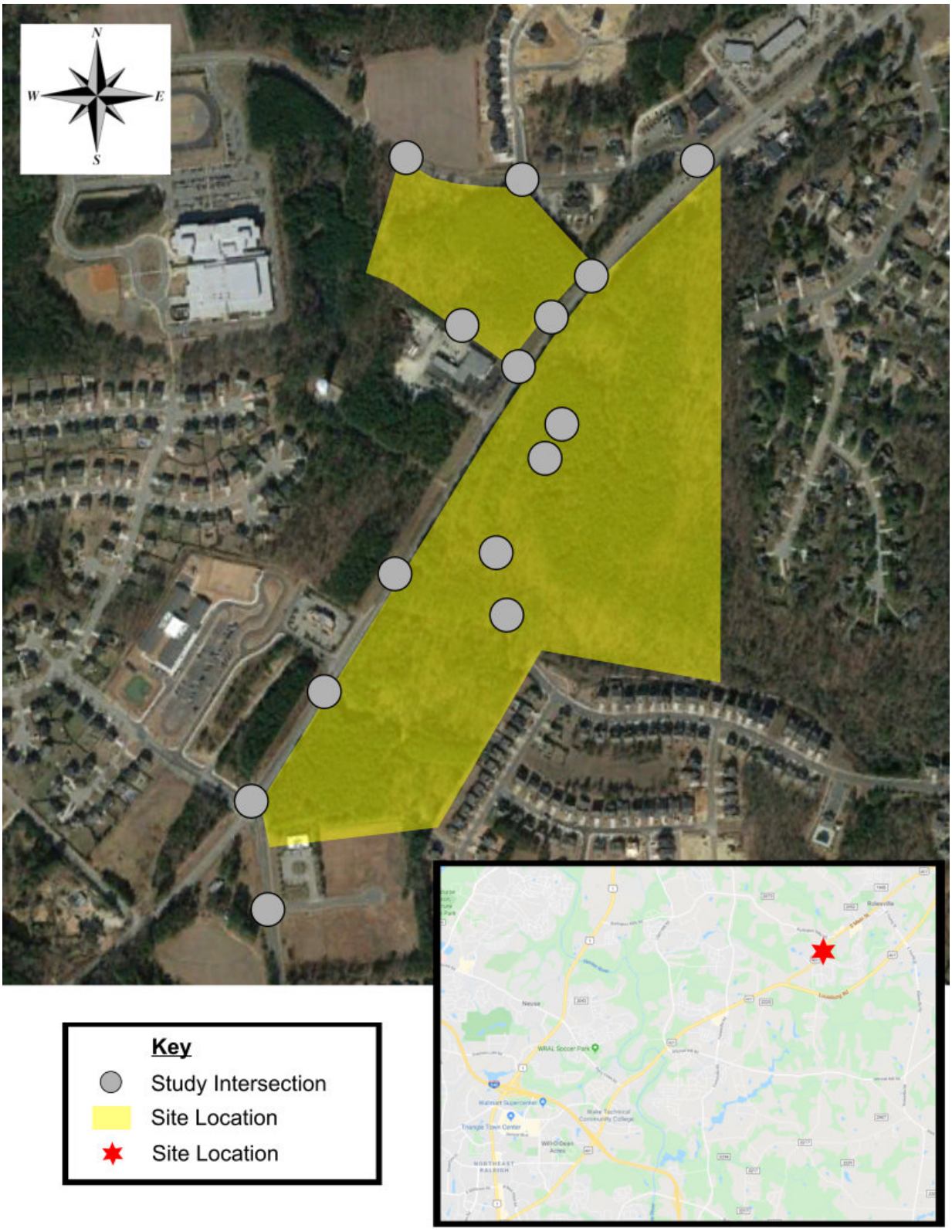
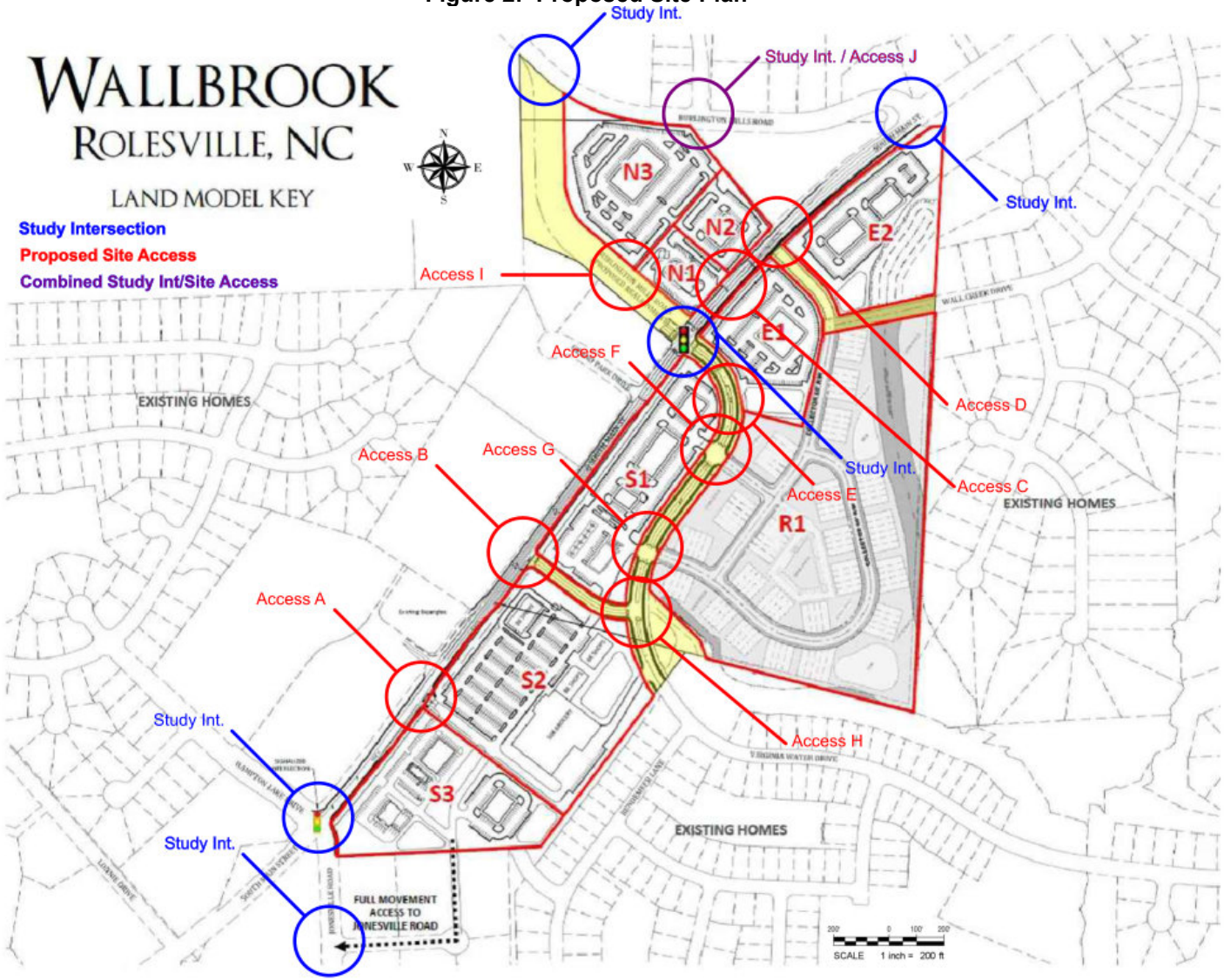


Figure 2: Proposed Site Plan



2.0 INVENTORY OF TRAFFIC CONDITIONS

2.1 STUDY AREA

Stantec coordinated with the Town of Rolesville and the North Carolina Department of Transportation (NCDOT) Division 5, District 1 to determine the appropriate study area and assumptions for this study. The final scoping document is included in the Appendix. The following intersections were agreed upon to be analyzed to determine the associated impacts from the proposed development.

- US 401 Business at US 401 *existing signalized intersection*
- US 401 Business at Hampton Lake Drive / Jonesville Road *existing signalized intersection*
- US 401 Business at Burlington Mills Road *existing signalized intersection*
- US 401 Business at Rogers Road / Redford Place *existing signalized intersection*
- Jonesville Road at Vineyard Pine Lane *existing two-way stop-controlled intersection*
- Burlington Mills Road at Barrington Hall/Access J *existing two-way stop-controlled intersection*

As part of the Locally Administered Projects Program (LAPP) Burlington Mills Road will be realigned south of its current location and connect with an extended Virginia Waters Drive. It is proposed to be constructed in 2021 and a signal installed; Old Burlington Mills Road and US 401 Business will remain and become stop controlled.

The proposed development is envisioned to construct the following intersections and driveways:

- US 401 Business at Access A *proposed two-way stop-controlled driveway*
- US 401 Business at Access B *proposed two-way stop-controlled driveway*
- US 401 Business at Access C *proposed two-way stop-controlled driveway*
- US 401 Business at Access D *proposed two-way stop-controlled driveway*
- Virginia Waters Drive at Access E *proposed two-way stop-controlled driveway*
- Virginia Waters Drive at Access F *proposed two-way stop-controlled driveway*
- Virginia Waters Drive at Access G *proposed two-way stop-controlled driveway*
- Virginia Waters Drive at Access H *proposed two-way stop-controlled driveway*
- Burlington Mills Realigned at Access I *proposed two-way stop-controlled driveway*
- Burlington Mills Road at Old Burlington Mills Road *proposed two-way stop-controlled driveway*

Figure 3 shows a diagram of the existing lane configurations, geometry, and traffic control features in the study area.

2.2 EXISTING ROADWAY CONDITIONS

Table 1 provides a detailed description of the existing study area roadway network. All functional classification and average annual daily traffic (AADT) information, where available, was obtained from NCDOT via the NCDOT.gov website.

Table 1: Existing Conditions

Road Name	Road Number	Primary Cross-Section	Functional Classification[1]	2018 AADT[2] (vpd)	Speed Limit (mph)	Maintenance Agency
Louisburg Road / S. Main Street	US 401 Business	3-Lane Section	Other Principal Arterial	12,000	35	NCDOT
Rolesville Bypass	US 401	4-Lane Divided	Other Principal Arterial	21,250	55	NCDOT
Hampton Lake Drive	N/A	2-Lane Undivided	Local Road	None Provided	25	Private
Jonesville Road	SR 2226	2-Lane Undivided	Local Road	3,100	35	NCDOT
Burlington Mills Road	SR 2051	2-Lane Undivided	Major Collector	3,700	35	NCDOT
Rogers Road	SR 2052	5-Lane Section	Local Road	None Provided	45	NCDOT
Redford Place	N/A	3-Lane Section	Local Road	None Provided	25	Town of Rolesville
Vineyard Pine Lane	N/A	2-Lane Undivided	Local Road	None Provided	25	Private
Barrington Hall Drive	N/A	2-Lane Undivided	Local Road	None Provided	25	Private

2.3 FUTURE NO-BUILD ROADWAY CONDITIONS

Burlington Mills Road at Old Burlington Mills Road

This intersection is planned to be constructed as part of the Burlington Mills Road realignment project. The westbound approach, Old Burlington Mills Road, is proposed to operate under stop control.

US 401 Business at Burlington Mills Road Realigned

As part of the Burlington Mills Road realignment project Burlington Mills Road will connect to US 401 Business south of where it currently intersects. The signal will also be relocated to this new intersection. The current plans include exclusive turn lanes for all approaches ranging from 100 to 250 feet of full-width storage and appropriate taper.

US 401 Business at Old Burlington Mills Road

This intersection is planned to be converted to a right-in/right-out (RIRO) intersection with full movement operations being relocated to the intersection of US 401 Business and Burlington Mills Road Realigned.

Figure 3: 2019 Existing Lane Configurations and Traffic Control

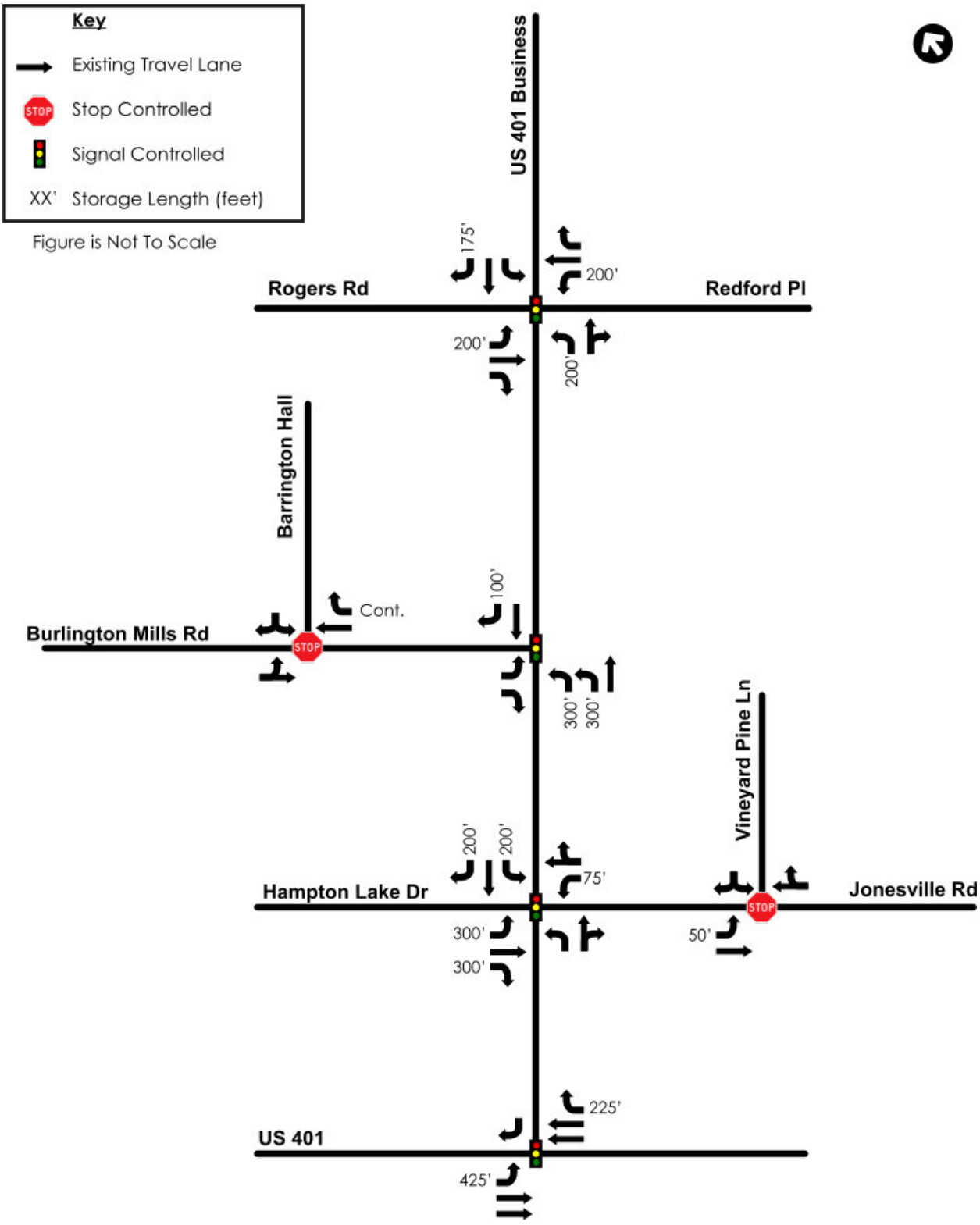
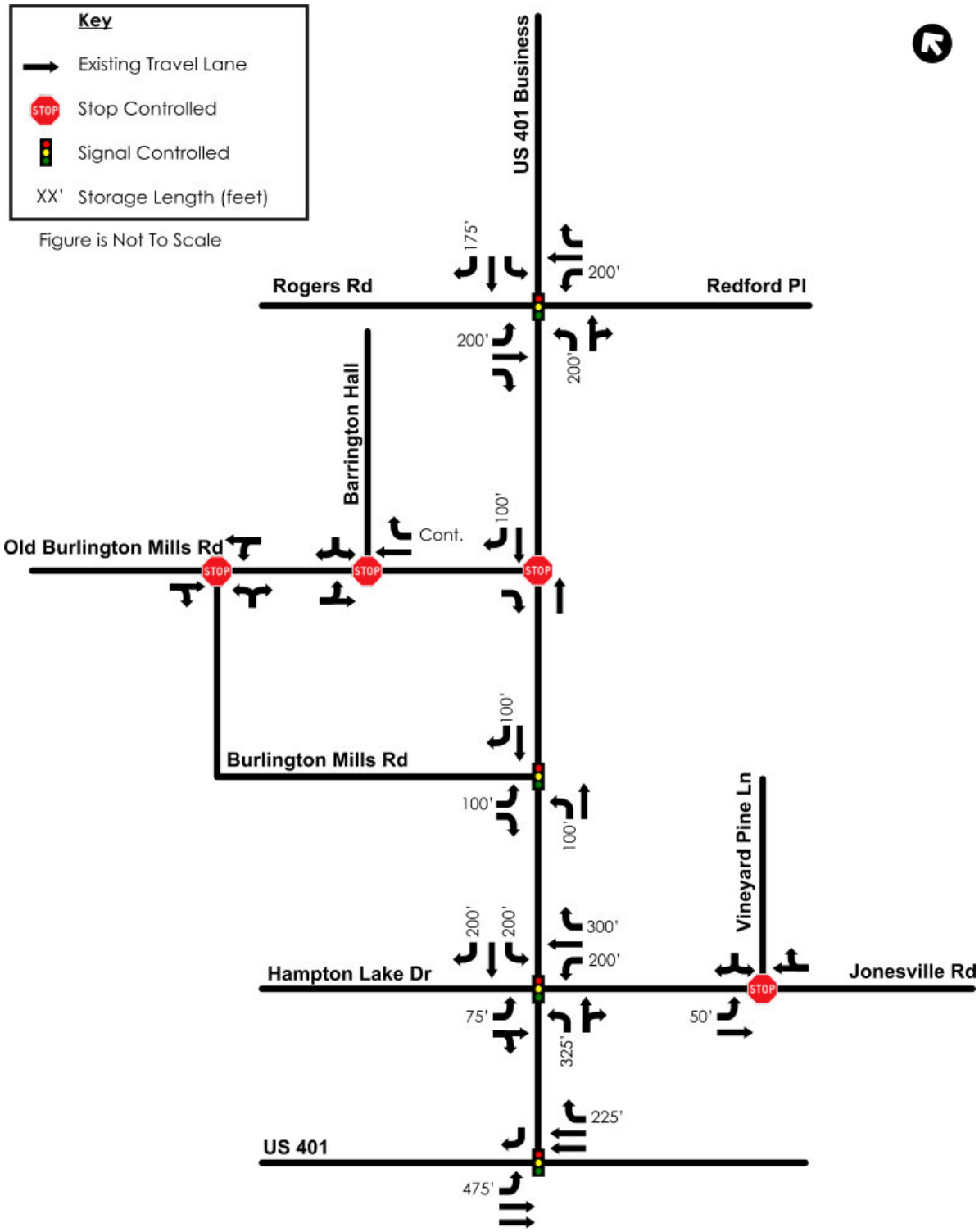


Figure 4: 2025 No-Build Lane Configurations and Traffic Control



3.0 TRIP GENERATION

Trip generation for the proposed development was performed for the proposed development in three parts, with the North site, the East site, and the South site each being calculated separately. Trips were estimated using the 10th Edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual[3]. The manual provides means for calculating trips across four setting-types. That is, city center core, dense multi-use urban, general urban/suburban, and rural. Internal capture was also performed independently for the North, East, and South sites using the National Cooperative Highway Research Program (NCHRP) Report 684 spreadsheet model[4]. This trip generation, submitted to the Town and NCDOT for review, and including internal capture and trip generation methodology is located in the appendix.

3.1 NORTH SITE

The North site of the development is expected to consist of 60,000 square feet of medical-dental office, 8,000 square feet of retail, and 6,000 square feet of fast-food restaurant. Table 2 shows the number of anticipated trips that will be generated by the North site of the proposed development (Daily, AM Peak, and PM Peak entering and exiting).

Table 2: North Site ITE Trip Generation

North Site Trip Generation (N1, N2, N3)													
Land Use	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Medical-Dental Office Bldg.	720	60	1000 GFA	2088	1044	1044	167	130	37	208	58	150	
Shopping Center	820	8	1000 GLA	1079	540	539	156	97	59	84	40	44	
Fast-Food Rest. w/ Drive-Thru	934	6	1000 GFA	2826	1413	1413	241	123	118	196	102	94	
				5993	2997	2996	564	350	214	488	200	288	
Internal Capture	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Medical-Dental Office Bldg.	720	60	1000 GFA					-24	-33		-3		
Shopping Center	820	8	1000 GLA					-18	-13		-20	-14	
Fast-Food Rest. w/ Drive-Thru	934	6	1000 GFA					-31	-26		-13	-23	
Pass-Bys	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Shopping Center	820	8	1000 GLA								-7	-10	
Fast-Food Rest. w/ Drive-Thru	934	6	1000 GFA					-45	-91		-44	-36	
Adjusted Trip Generation	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Medical-Dental Office Bldg.	720	60	1000 GFA	2088	1044	1044	167	106	4	208	55	150	
Shopping Center	820	8	1000 GLA	1079	540	539	156	79	46	84	13	20	
Fast-Food Rest. w/ Drive-Thru	934	6	1000 GFA	2826	1413	1413	241	47	1	196	45	35	
Total Trips Generated				5993	2997	2996	564	232	51	488	113	205	

3.2 EAST SITE

The East site of the development is expected to consist of 155 townhomes, 20,000 square feet of office, and 20,000 square feet of retail. Table 3 shows the number of anticipated trips that will be generated by the East site of the proposed development (Daily, AM Peak, and PM Peak entering and exiting).

Table 3: East Site ITE Trip Generation

East Site Trip Generation (E1, E2, R1)													
Land Use	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Multifamily Housing (Mid-Rise)	221	155	Units	843	422	421	53	14	39	67	41	26	
General Office Building	710	20	1000 GFA	223	111	112	40	35	5	87	16	71	
Shopping Center	820	20	1000 GLA	2012	1006	1006	162	100	62	165	79	86	
				3078	1539	1539	255	149	106	319	136	183	
Internal Capture	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Multifamily Housing (Mid-Rise)	221	155	Units						-1		-2	-2	
General Office Building	710	20	1000 GFA					-2	-1		-2	-1	
Shopping Center	820	20	1000 GLA					-2	-2		-2	-3	
Pass-Bys	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Shopping Center	820	20	1000 GLA								-26	-28	
Adjusted Trip Generation	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**			
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	
Multifamily Housing (Mid-Rise)	221	155	Units	843	422	421	53	14	38	67	39	25	
General Office Building	710	20	1000 GFA	223	111	112	40	33	4	87	14	70	
Shopping Center	820	20	1000 GLA	2012	1006	1006	162	98	60	165	51	55	
Total Trips Generated				3078	1539	1539	255	145	102	319	104	150	

3.3 SOUTH SITE

The South site of the development is expected to consist of a 10,000 square foot day care center, 84,000 square feet of retail, a 4,000 square-foot bank, 7,000 square feet of restaurant, 4,000 square feet of fast-food restaurant, and a gas station with 16 fuel positions. Table 4 shows the number of anticipated trips that will be generated by the South site of the proposed development (Daily, AM Peak, and PM Peak entering and exiting).

Table 4: South Site ITE Trip Generation

South Site Trip Generation (S1, S2, S3)												
Land Use	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**		
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**
Day Care Center	565	10	1000 GFA	476	238	238	110	58	52	111	52	59
Shopping Center	820	34	1000 GLA	2887	1443	1444	169	105	64	245	117	128
Supermarket	850	50	1000 GFA	5339	2670	2669	191	115	76	462	236	226
Drive-In Bank	912	4	1000 GFA	400	200	200	38	22	16	82	41	41
High-Turnover (Sit-Down) Rest.	932	7	1000 GFA	785	393	392	98	56	42	122	63	59
Fast-Food Rest. w/ Drive-Thru	934	4	1000 GFA	1884	942	942	161	82	79	131	68	63
Gas./ Serv. Station w/ Conv. Market	945	16	Fuel Pos.	3286	1643	1643	200	102	98	224	114	110
				15057	7529	7528	967	540	427	1377	691	686
Internal Capture	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**		
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**
Shopping Center	820	34	1000 GLA					-8	-8		-17	-14
Supermarket	850	50	1000 GFA					-9	-10		-33	-25
High-Turnover (Sit-Down) Rest.	932	7	1000 GFA					-7	-6		-18	-24
Fast-Food Rest. w/ Drive-Thru	934	4	1000 GFA					-11	-11		-20	-26
Pass-Bys	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**		
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**
Shopping Center	820	34	1000 GLA								-34	-39
Supermarket	850	50	1000 GFA								-73	-72
Drive-In Bank	912	4	1000 GFA					-6	-5		-14	-14
High-Turnover (Sit-Down) Rest.	932	7	1000 GFA								-19	-15
Fast-Food Rest. w/ Drive-Thru	934	4	1000 GFA					-35	-33		-24	-18
Gas./ Serv. Station w/ Conv. Market	945	16	Fuel Pos.					-63	-61		-64	-62
Adjusted Trip Generation	**ITE LUC**	**Size**		**Daily**			**AM Peak**			**PM Peak**		
				Total	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**
Day Care Center	565	10	1000 GFA	476	238	238	110	58	52	111	52	59
Shopping Center	820	34	1000 GLA	2887	1443	1444	169	97	56	245	66	75
Supermarket	850	50	1000 GFA	5339	2670	2669	191	106	66	462	130	129
Drive-In Bank	912	4	1000 GFA	400	200	200	38	16	11	82	27	27
High-Turnover (Sit-Down) Rest.	932	7	1000 GFA	785	393	392	98	49	36	122	26	20
Fast-Food Rest. w/ Drive-Thru	934	4	1000 GFA	1884	942	942	161	36	35	131	24	19
Gas./ Serv. Station w/ Conv. Market	945	16	Fuel Pos.	3286	1643	1643	200	39	37	224	50	48
			Total Trips Generated	15057	7529	7528	967	401	293	1377	375	377

4.0 TRAFFIC DISTRIBUTION

4.1 SITE TRIP DISTRIBUTION

In order to accurately determine the effect of the proposed development on the surrounding roadway network, an estimate of the expected distribution of traffic entering and exiting the site is needed. The following percentages were used in the AM and PM peak hours for the proposed site.

These percentages were developed using a combination of existing traffic volume counts, historic AADTs provided by NCDOT, and engineering judgment. This trip distribution was submitted to the Town and NCDOT for review.

4.2 PASS-BY TRIPS

According to NCDOT standards, the retail shopping center (LUC 820), supermarket (LUC 850), bank (LUC 912), restaurant (LUC 934), and gas station (LUC 945) allow for the use of pass-by trips for this land use of 34% in the PM, 36% in the PM, 29% in the AM and 35% in the PM, 49% in the AM and 50% in the PM, and 62% in the AM and 56% in the PM peak hour, respectively. The calculated pass-by trips are greater than 10% of the peak hour traffic on US 401 Business (Main Street) for the intersection of Access B. With the southern section of the site including a grocery store, a gas station, a bank, food, and general retail, coupled with the moderate traffic volumes on Main Street, it is reasonable for the pass-by trips to exceed the 10% threshold.

Pass-by trip distribution is shown in Figure 17 in the appendix.

5.0 TRAFFIC VOLUMES

Morning (7:00 – 9:00 am) and evening (4:00 – 6:00 pm) turning movement counts were collected on the days respectively listed at the intersections below:

- US 401 Business at US 401 (12/3/2019)
- US 401 Business at Hampton Lake Drive / Jonesville Road (12/13/2018)
- US 401 Business at Burlington Mills Road (12/13/2019)
- US 401 Business at Rogers Road / Redford Place (9/10/2019)
- Jonesville Road at Vineyard Pine Lane (11/12/2019)
- Burlington Mills Road at Barrington Hall (11/12/2019)

The count data is categorized by cars, heavy trucks, bicycles, and pedestrians. Raw count data for these locations as well as all traffic volume calculations are included in the appendix.

5.1 VOLUME BALANCING

Traffic volumes for the AM and PM peak hours were balanced between all study intersections with the exception of Redford Place Drive and Burlington Mills Road on US 401 Business due to the distance and numerous accesses between the two signalized intersections. To be conservative, volumes were only added to the network and not subtracted. The balanced existing (2019) volumes are shown in Figure 4.

5.2 FUTURE TRAFFIC GROWTH

Future traffic growth is the increase in traffic volumes due to usage increases and non-specific growth throughout the area. The 2019 Existing volumes were grown by a 2.5% annual rate to estimate the 2025 volumes. The growth in vehicles as a result of background growth in 2025 is shown in Figure 5.

5.3 APPROVED DEVELOPMENT TRAFFIC

There are two (2) approved development within the study area. Redford Place is a mixed-use development comprised of a single 19,500 square foot building located in the northeast quadrant of the US 401 Business intersection with Rogers Road and Redford Place. With the anticipated completion date for this development occurring in 2023, the associated site traffic for Redford Place was distributed and assigned to the study intersections included in all future-year analyses.

The other approved development is Jonesville Road Townhomes which is expected to consist of 53 townhomes. This development, located in the southeastern quadrant of Jonesville Road and Louisburg Road, is expected to be completed in 2021.

Trips associated with the Redford Place and Jonesville Road Townhome developments are shown in Figure 10 in the appendix.

5.4 NO-BUILD TRAFFIC VOLUMES

The historical growth and approved development traffic volumes were added to the existing volumes to determine the No-Build traffic volumes. The 2025 No-Build traffic volumes are shown in Figure 6.

5.5 TOTAL BUILD TRAFFIC WITH PROPOSED DEVELOPMENT

To obtain the total 2025 Build traffic volumes, the distributed site traffic was added to the respective no-build traffic volumes. The total AM and PM peak hour turning movement volumes for the study intersections were then calculated and analyzed for the 2025 traffic scenarios. The 2025 Build-out traffic volumes are shown in Figure 7.

Figure 5: Existing (2019) Traffic Volumes

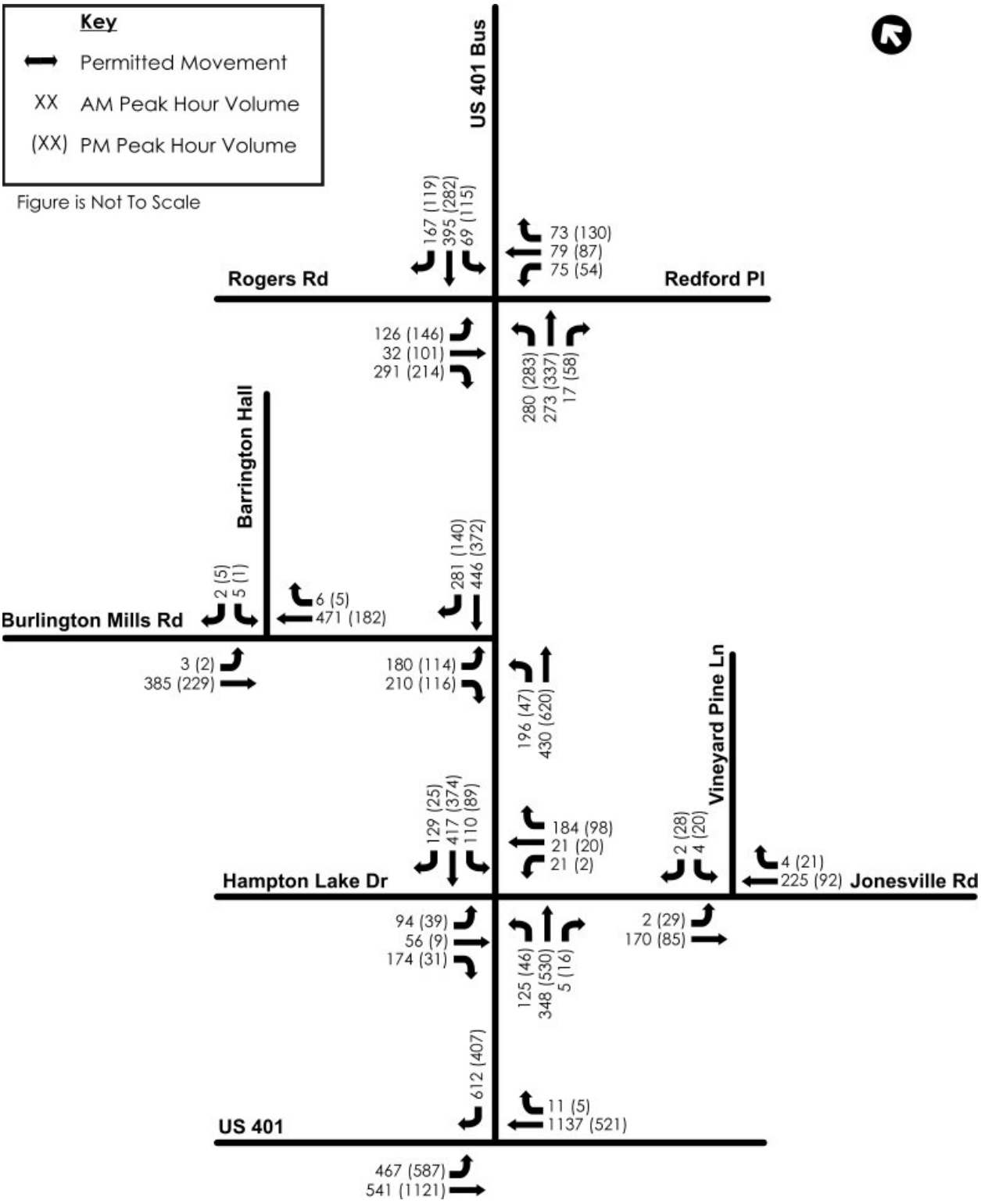


Figure 6: 2025 Historic Growth Traffic Volumes

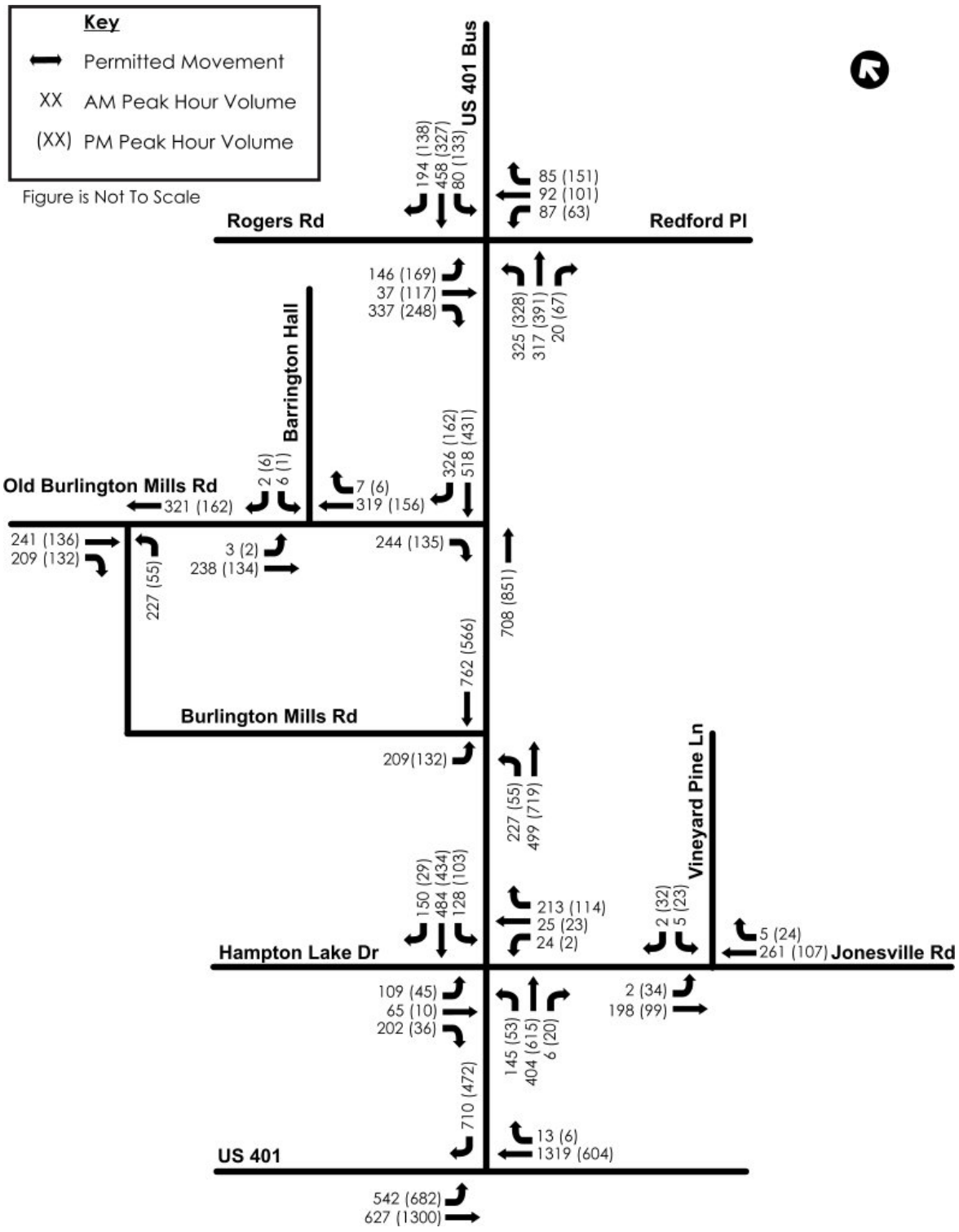


Figure 7: 2025 No-Build Traffic Volumes

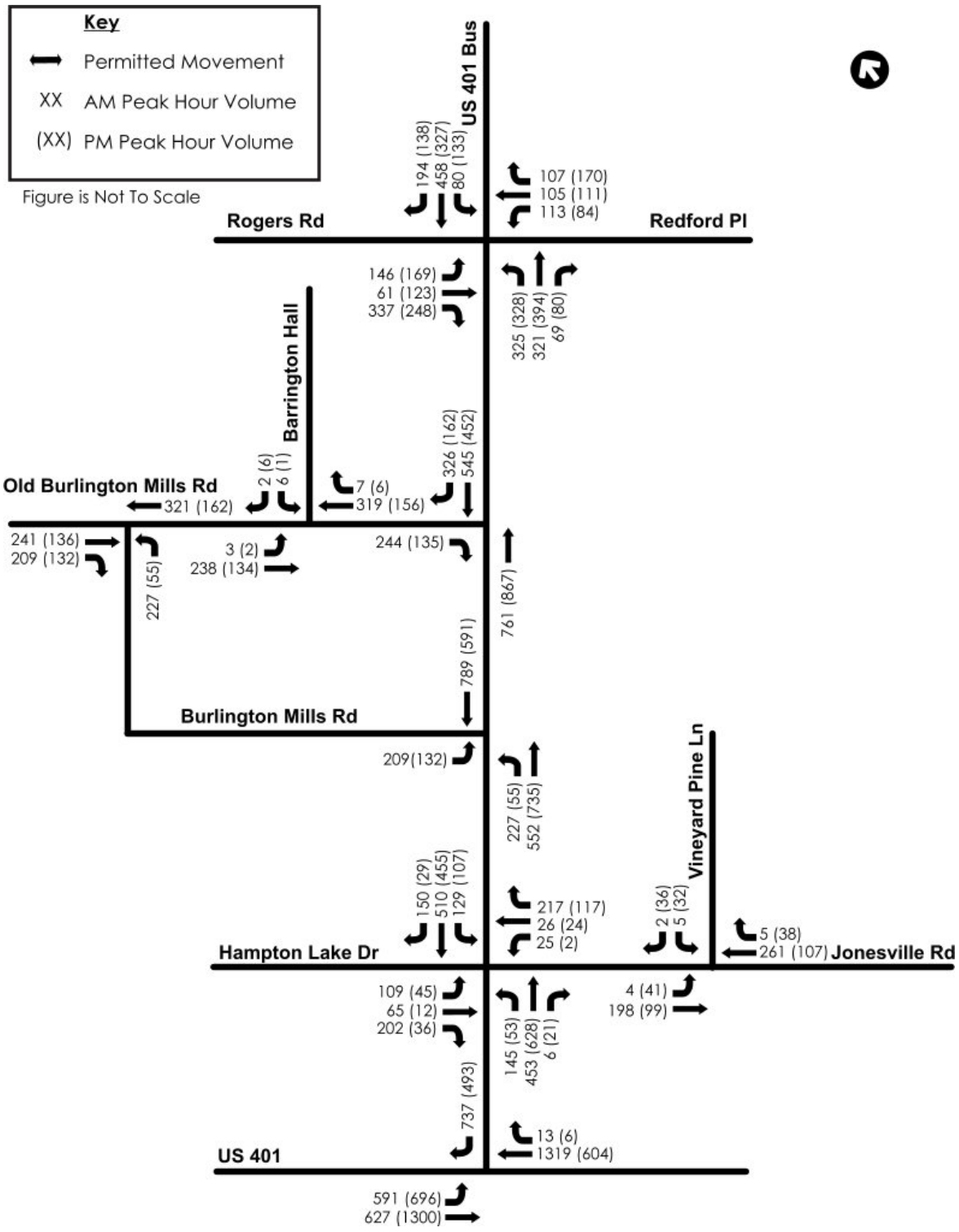
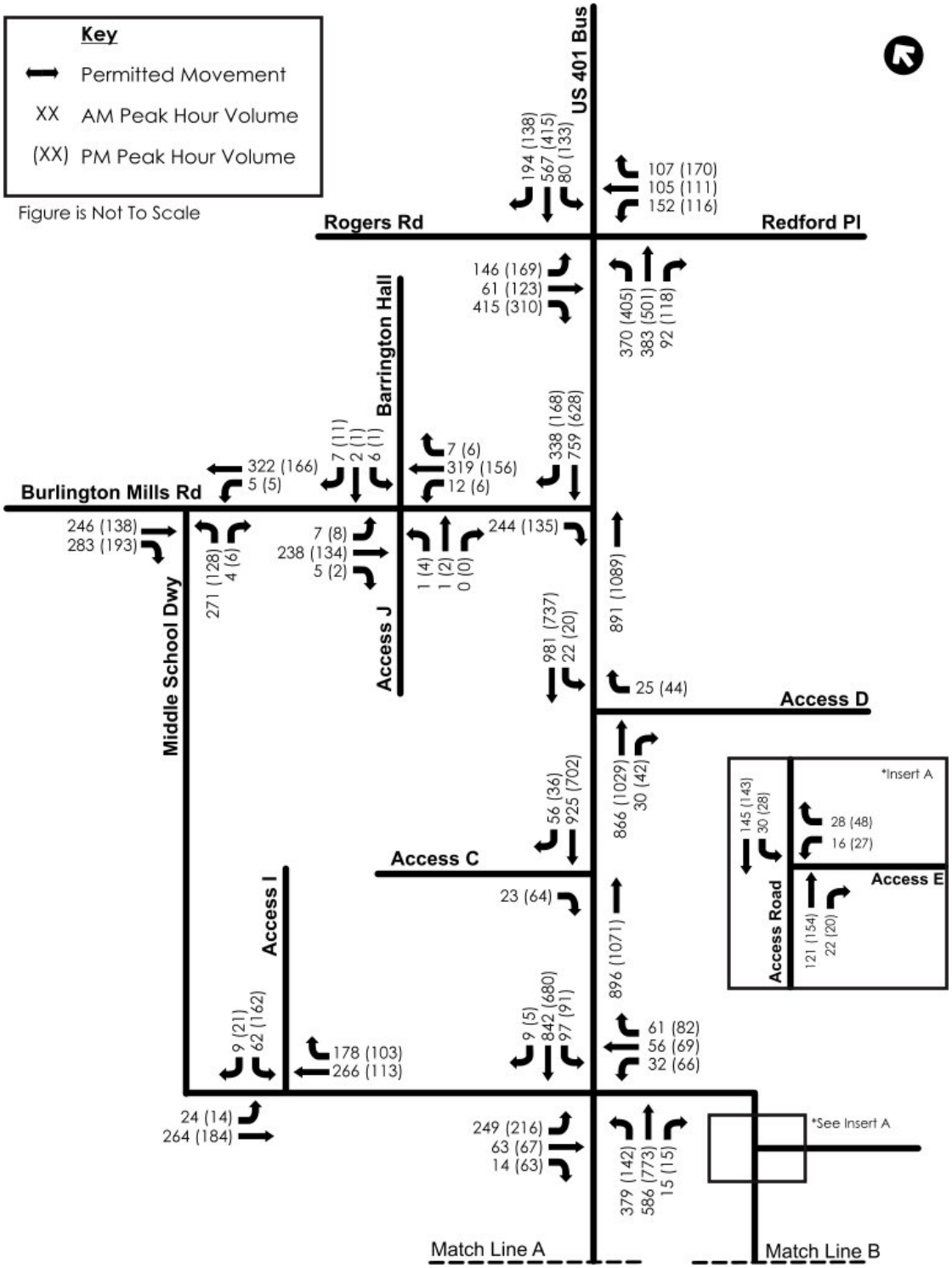
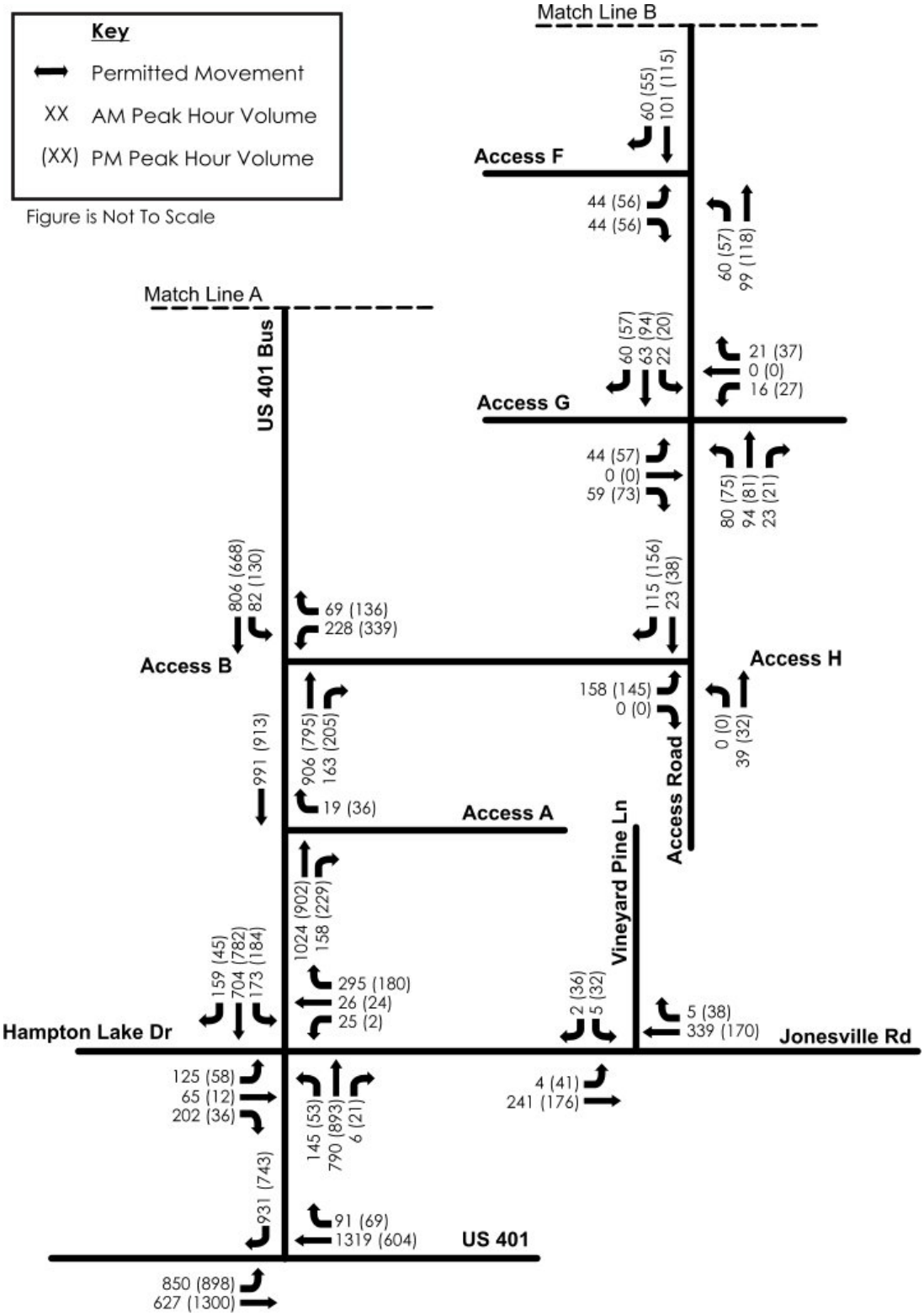


Figure 8: 2025 Build Traffic Volumes



Traffic Volumes
February 13, 2020



6.0 TRAFFIC ANALYSIS

Capacity analyses were performed for the roadway network in the project study area. The traffic analysis program Synchro Version 10 was used to analyze all signalized and stop-controlled intersections according to methods put forth by the Transportation Research Board's Highway Capacity Manual (HCM)[5]. The Highway Capacity Manual defines capacity as "the maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform section of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per lane per hour."

Level of service (LOS) is a term used to describe different traffic conditions and is defined as a "qualitative measure describing operational conditions within a traffic stream, and their perception by motorists/ or passengers." LOS varies from Level A, representing free flow, to Level F where traffic breakdown conditions are evident. At an unsignalized intersection, the primary traffic on the main roadway is virtually uninterrupted. Therefore, the overall delay for the intersection is usually less than what is calculated for the minor street movements. The overall intersection delay and the delay for the intersection's minor movement(s) are reported in the summary tables of this report. Generally, LOS D is acceptable for signalized intersections in suburban areas during peak periods. The ITE Recommended Practice Manual, "*Designing Walkable Urban Thoroughfares: A Context Sensitive Approach*"[6] states, "Often in urban areas, thoroughfare capacity is a lower priority than other factors such as economic development or historical preservation, and higher levels of congestion are considered acceptable." With the current method of reporting LOS for unsignalized intersections, it is not uncommon for some of the minor street movements to be operating at a LOS F during peak hour conditions and that is not necessarily indicative of an area that requires improvements.

Capacity analyses were completed in accordance with *NCDOT Congestion Management Capacity Analysis Guidelines*[7] . It should be noted that the 2025 Build with Improvements analyses includes permitted + protected signal phasing at the US 401 Business intersection with Hampton Lake Drive/Jonesville Road. This provided results more indicative of field conditions as the signal currently operates with a flashing yellow arrow. Table 5 presents the criteria of each LOS as indicated in the *HCM*[5].

Table 5: Level of Service Criteria

Level of Service (LOS)	Signalized Intersection Control Delay (seconds / vehicle)	Unsignalized Intersection Control Delay (seconds / vehicle)
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	>20 and ≤ 35	>15 and ≤ 25
D	>35 and ≤ 55	>25 and ≤ 35
E	>55 and ≤ 80	>35 and ≤ 50
F	>80	>50

Capacity analyses were performed for the following conditions.

- Existing (2019)
- Future Year (2025) No-Build
- Future Year (2025) Build
- Future Year (2025) Build with Improvements

The following intersections were included in the capacity analysis for the above scenarios; where applicable:

- US 401 Business at US 401;
- US 401 Business at Hampton Lake Drive / Jonesville Road;
- US 401 Business at Burlington Mills Realigned / Virginia Waters Drive;
- US 401 Business at Burlington Mills Road;
- US 401 Business at Rogers Road / Redford Place;
- Jonesville Road at Vineyard Pine Lane;
- Burlington Mills Road at Old Burlington Mills:
- US 401 Business at Access A;
- US 401 Business at Access B;
- US 401 Business at Access C;
- US 401 Business at Access D;
- Virginia Waters Drive at Access E;
- Virginia Waters Drive at Access F;
- Virginia Waters Drive at Access G;
- Virginia Waters Drive at Access H;
- Burlington Mills Realigned at Access I; and
- Old Burlington Mills Road at Barrington Hall / Access J.

SimTraffic runs were completed for all scenarios to observe the predicted traffic operations throughout the study area during each of the peak hours. As is standard practice, ten (10) SimTraffic analysis runs were performed for each scenario. Detailed SimTraffic queuing and blocking reports can be found on the Appendix CD. Queues for the exclusive turn-lanes are summarized in tables for each study intersection. Queues are not reported for intersections that do not have exclusive turn-lanes. For simplicity, the greater of the 95th percentile queue as reported by Synchro or the maximum observed queue as reported by SimTraffic are shown in the tables.

All Synchro files and detailed printouts can be found in the appendix. A brief summary of the results of the analyses is provided in the following sub-sections.

6.1 2019 EXISTING CAPACITY ANALYSIS

The 2019 Existing scenario results show that all intersections and approaches currently operate at LOS D or better in both peak periods with the exception of the westbound approach at US 401 Business and Hampton Lake Drive/Jonesville Road which can be attributed to school traffic. The level of service and delay for the existing traffic conditions is listed below in Table 6.

Table 6: Level of Service and Delay for 2019 Existing Conditions

Intersection/Approach	Peak Hour	Overall (LOS)	Eastbound	Westbound	Northbound	Southbound
US 401 Business at US 401 (Signalized)	AM	C (22.1)	-	B (14.6)	D (37.3)	C (24.5)
	PM	C (20.2)	-	B (12.2)	C (26.3)	C (21.6)
US 401 Business at Hampton Lake Dr / Jonesville Rd (Signalized)	AM	C (33.1)	C (31.3)	E (61.3)	C (25.8)	C (29.5)
	PM	C (27.4)	D (35.9)	E (66.8)	C (22.0)	C (22.9)
US 401 Business at Rogers Rd / Redford Place (Signalized)	AM	D (36.9)	D (44.9)	D (40.0)	D (37.7)	C (29.4)
	PM	C (33.7)	D (38.5)	D (38.4)	C (33.2)	C (27.5)
Jonesville Rd at Vineyard Pine Lane (Unsignalized)	AM	A (0.2)	A (7.8)	A (0.0)	-	B (10.4)
	PM	A (2.5)	A (7.5)	A (0.0)	-	A (9.6)
Burlington Mills Rd at Barrington Hall / Access J (Unsignalized)	AM	A (0.2)	A (8.5)	A (0.0)	-	C (16.1)
	PM	A (0.2)	A (7.6)	A (0.0)	-	A (9.7)
US 401 Business at Burlington Mills Rd (Signalized)	AM	B (16.7)	C (26.3)	-	A (7.1)	B (19.9)
	PM	B (11.4)	C (26.2)	-	A (7.3)	B (10.1)

Key: LOS (Delay (seconds/vehicle))

6.2 2025 NO-BUILD CAPACITY ANALYSIS

The 2025 No-Build scenario results show that all intersections and approaches will operate at LOS D or better in both peak periods with the exception of the westbound approach at US 401 Business and Hampton Lake Drive/Jonesville Road and the eastbound approach at US 401 Business and Burlington Mills Road realigned. There are no queuing issues throughout the network in the 2025 No-Build scenario. The no build level of service and delay is listed below in Table 7.

Table 7: Level of Service and Delay for 2025 No-Build Conditions

Intersection/Approach	Peak Hour	Overall (LOS)	Eastbound	Westbound	Northbound	Southbound
US 401 Business at US 401 (Signalized)	AM	C (21.4)	-	C (24.6)	D (40.2)	A (1.1)
	PM	B (16.3)	-	C (20.7)	C (22.6)	A (1.4)
US 401 Business at Hampton Lake Dr / Jonesville Rd (Signalized)	AM	D (41.4)	C (31.7)	E (63.3)	C (29.6)	D (47.3)
	PM	C (27.3)	D (36.3)	E (69.6)	B (19.5)	C (24.5)
US 401 Business at Rogers Rd / Redford Place (Signalized)	AM	D (41.8)	D (53.4)	D (40.9)	D (41.9)	C (33.7)
	PM	D (36.9)	D (38.0)	D (39.0)	D (39.4)	C (31.6)
Jonesville Rd at Vineyard Pine Lane (Unsignalized)	AM	A (0.2)	A (7.9)	A (0.0)	-	B (10.8)
	PM	A (2.5)	A (7.6)	A (0.0)	-	A (9.8)
Burlington Mills Rd at Barrington Hall / Access J (Unsignalized)	AM	A (0.2)	A (8.0)	A (0.0)	-	B (12.5)
	PM	A (0.3)	A (7.6)	A (0.0)	-	A (9.4)
US 401 Business at Old Burlington Mills Rd (Unsignalized)	AM	A (3.0)	C (19.4)	-	A (0.0)	A (0.0)
	PM	A (1.1)	B (13.2)	-	A (0.0)	A (0.0)
US 401 Business at Burlington Mills Rd Realigned (Signalized)	AM	C (23.4)	F (84.5)	D (54.9)	B (14.9)	B (13.8)
	PM	B (13.5)	D (44.6)	D (39.6)	B (11.0)	A (9.0)
Burlington Mills Rd at Old Burlington Mills (Unsignalized)	AM	A (7.8)	A (0.0)	C (18.6)	A (0.0)	-
	PM	A (4.3)	A (0.0)	B (11.2)	A (0.0)	-

Key: LOS (Delay (seconds/vehicle))

6.3 2025 BUILD CAPACITY ANALYSIS

As a result of the 2025 Build analysis, all intersections are expected to operate at LOS D or better in both peak periods, with a few exceptions. The intersection of US 401 Business and Hampton Lake Drive / Jonesville Road is expected to operate at LOS F in both peak hours. Also, the intersection of US 401 Business and Burlington Mills Road Realigned/Virginia Waters Drive is expected to operate at LOS E in the AM peak hour. Additionally, the westbound approach at access B operates at LOS F in both peak hours. The analyses show that the proposed development will have an impact on the surrounding roadway network in the vicinity of the site without any improvements.

Table 8: Level of Service and Delay for 2025 Build Conditions

Intersection/Approach	Peak Hour	Overall (LOS)	Eastbound	Westbound	Northbound	Southbound
US 401 Business at US 401 (Signalized)	AM	D (40.7)	E (67.3)	D (50.3)	-	A (2.0)
	PM	B (17.6)	C (26.5)	C (25.6)	-	A (1.4)
US 401 Business at Hampton Lake Dr / Jonesville Rd (Signalized)	AM	F (138.0)	C (25.9)	E (69.8)	F (245.9)	F (105.1)
	PM	F (99.8)	C (27.7)	E (62.7)	F (173.4)	D (44.6)
US 401 Business at Rogers Rd / Redford Place (Signalized)	AM	D (45.0)	D (51.6)	D (35.7)	C (34.2)	D (54.9)
	PM	D (54.8)	D (36.8)	C (33.0)	F (90.9)	C (29.1)
Jonesville Rd at Vineyard Pine Lane (Unsignalized)	AM	-	A (8.1)	A (0.0)	-	B (11.3)
	PM	-	A (7.8)	A (0.0)	-	B (10.8)
Burlington Mills Rd at Barrington Hall / Access J (Unsignalized)	AM	-	A (8.0)	A (7.8)	B (13.4)	B (13.3)
	PM	-	A (7.6)	A (7.5)	B (10.7)	B (10.2)
US 401 Business at Old Burlington Mills Rd (Unsignalized)	AM	-	E (38.8)	-	A (0.0)	A (0.0)
	PM	-	C (17.4)	-	A (0.0)	A (0.0)
US 401 Business at Burlington Mills Realigned / Virginia Water Dr (Signalized)	AM	E (69.9)	F (98.5)	D (51.5)	D (53.7)	E (79.6)
	PM	C (32.9)	D (36.0)	C (26.4)	C (21.7)	D (46.7)
US 401 Business at Access A (Unsignalized)	AM	-	-	C (23.3)	A (0.0)	A (0.0)
	PM	-	-	C (22.3)	A (0.0)	A (0.0)
US 401 Business at Access B (Unsignalized)	AM	-	-	F (##)	A (0.0)	B (12.2)
	PM	-	-	F (##)	A (0.0)	B (12.4)
US 401 Business at Access C (Unsignalized)	AM	-	C (19.5)	-	A (0.0)	A (0.0)
	PM	-	C (16.5)	-	A (0.0)	A (0.0)
US 401 Business at Access D (Unsignalized)	AM	-	-	C (18.1)	A (0.0)	B (10.4)
	PM	-	-	C (24.2)	A (0.0)	B (11.4)
Virginia Water Dr at Access E (Unsignalized)	AM	-	-	B (10.0)	A (0.0)	A (7.6)
	PM	-	-	B (10.5)	A (0.0)	A (7.7)
Virginia Water Dr at Access F (Unsignalized)	AM	-	B (10.9)	-	A (7.7)	A (0.0)
	PM	-	B (11.4)	-	A (7.7)	A (0.0)
Virginia Water Dr at Access G (Unsignalized)	AM	-	B (11.8)	B (11.5)	A (7.7)	A (7.5)
	PM	-	B (12.6)	B (11.8)	A (7.7)	A (7.5)
Access Road at Access H (Unsignalized)	AM	-	B (10.4)	-	A (7.5)	A (0.0)
	PM	-	B (10.5)	-	A (7.7)	A (0.0)
Burlington Mills Realigned at Access I (Unsignalized)	AM	-	A (8.4)	A (0.0)	-	C (16.4)
	PM	-	A (7.7)	A (0.0)	-	B (13.9)
Burlington Mills Road at Old BMR (Unsignalized)	AM	-	A (0.0)	C (20.9)	A (0.0)	-
	PM	-	A (0.0)	B (11.7)	A (0.0)	-

Key: LOS (Delay (seconds/vehicle))

indicates delay longer than 300 seconds

6.4 2025 BUILD WITH IMPROVEMENTS CAPACITY ANALYSIS

The 2025 Build with Improvements analysis shows that all intersections and approaches are expected to operate at LOS D or better in both peak periods, except for Old Burlington Mills Road at US 401 Business in the AM peak hour. Although the intersections are expected to operate at acceptable level of service, the intersection of Old Burlington Mills Road at US 401 Business experiences higher delay. It is not uncommon for minor approaches at unsignalized intersections to operate with high delay during peak hours.

Improvements:

US 401 Business at Hampton Lake Drive / Jonesville Road

- Construct a westbound exclusive right-turn lane with 350 feet of storage and appropriate taper.
- Allow permitted + protected signal phasing.

US 401 Business at Burlington Mills Road

- Construct a second northbound exclusive left-turn lane with 200 feet of storage and appropriate taper.

US 401 Business at Access B

- Install a signal
- Construct a northbound exclusive right-turn lane with 100 feet of storage and appropriate taper.
- Construct a southbound exclusive left-turn lane with 100 feet of storage and appropriate taper.

US 401 Business at Access C

- Construct a southbound exclusive right-turn lane with 100 feet of storage and appropriate taper.

US 401 Business at Access D

- Construct a northbound exclusive right-turn lane with 100 feet of and appropriate taper.
- Construct a southbound exclusive left-turn lane with 100 feet of storage and appropriate taper.

Burlington Mills Road at Access I

- Construct a westbound exclusive right-turn lane that is continuous from receiving the second northbound left-turn lane at US 401 Business and Burlington Mills Road.

Table 9: Level of Service and Delay for 2025 Build with Improvements Conditions

Intersection/Approach	Peak Hour	Overall (LOS)	Eastbound	Westbound	Northbound	Southbound
US 401 Business at US 401 (Signalized)	AM	D (42.5)	E (63.5)	E (55.2)	-	A (4.2)
	PM	B (18.9)	C (26.5)	C (27.9)	-	A (3.3)
US 401 Business at Hampton Lake Dr / Jonesville Rd (Signalized)	AM	C (28.5)	D (52.8)	D (48.9)	C (22.0)	B (18.4)
	PM	C (23.7)	D (54.6)	E (61.6)	C (20.6)	B (15.7)
US 401 Business at Rogers Rd / Redford Place (Signalized)	AM	D (49.0)	E (62.5)	C (34.8)	D (53.0)	D (41.2)
	PM	D (46.0)	C (26.3)	C (28.6)	E (70.5)	D (37.0)
Jonesville Rd at Vineyard Pine Lane (Unsignalized)	AM	-	A (8.1)	A (0.0)	-	B (11.3)
	PM	-	A (7.8)	A (0.0)	-	B (10.8)
Burlington Mills Rd at Barrington Hall / Access J (Unsignalized)	AM	-	A (8.0)	A (7.8)	B (13.4)	B (13.3)
	PM	-	A (7.6)	A (7.5)	B (10.7)	B (10.2)
US 401 Business at Old Burlington Mills Rd (Unsignalized)	AM	-	E (38.8)	-	A (0.0)	A (0.0)
	PM	-	C (17.4)	-	A (0.0)	A (0.0)
US 401 Business at Burlington Mills / Virginia Water Dr (Signalized)	AM	D (44.8)	E (65.3)	D (38.0)	C (33.4)	D (50.5)
	PM	C (30.8)	D (40.5)	C (29.8)	B (20.0)	D (39.9)
US 401 Business at Access A (Unsignalized)	AM	-	-	C (21.1)	A (0.0)	A (0.0)
	PM	-	-	C (19.2)	A (0.0)	A (0.0)
US 401 Business at Access B (Unsignalized)	AM	B (15.6)	-	D (54.3)	B (10.8)	A (8.3)
	PM	B (19.2)	-	D (40.1)	A (0.0)	B (15.2)
US 401 Business at Access C (Unsignalized)	AM	-	C (18.9)	-	A (0.0)	A (0.0)
	PM	-	C (16.1)	-	A (0.0)	A (0.0)
US 401 Business at Access D (Unsignalized)	AM	-	-	C (17.8)	A (0.0)	B (10.4)
	PM	-	-	C (23.4)	A (0.0)	B (11.4)
Virginia Water Dr at Access E (Unsignalized)	AM	-	-	B (10.0)	A (0.0)	A (0.0)
	PM	-	-	B (10.5)	A (0.0)	A (0.0)
Virginia Water Dr at Access F (Unsignalized)	AM	-	B (10.9)	-	A (7.7)	A (0.0)
	PM	-	B (11.4)	-	A (7.7)	A (0.0)
Virginia Water Dr at Access G (Unsignalized)	AM	-	B (11.8)	B (11.5)	A (7.7)	A (7.5)
	PM	-	B (12.6)	B (11.8)	A (7.7)	A (7.5)
Virginia Water Dr at Access H (Unsignalized)	AM	-	B (10.4)	-	A (7.5)	A (0.0)
	PM	-	B (10.5)	-	A (7.7)	A (0.0)
Burlington Mills Realigned at Access I (Unsignalized)	AM	-	A (8.4)	A (0.0)	-	B (14.7)
	PM	-	A (7.7)	A (0.0)	-	B (13.0)
Burlington Mills Road at Old BMR (Unsignalized)	AM	-	A (0.0)	C (20.9)	A (0.0)	-
	PM	-	A (0.0)	B (11.7)	A (0.0)	-

Key: LOS (Delay (seconds/vehicle))

7.0 SIMTRAFFIC OPERATIONS

SimTraffic runs were completed for all analysis scenarios to observe the predicted traffic operations throughout the study area during each of the peak hours. As is standard practice, ten (10) SimTraffic analysis runs were performed for each scenario to get an average. Detailed SimTraffic Queuing and Blocking reports can be found in the appendix. The maximum queue for all northbound movements at US 401 Business and Hampton Lake Drive in the AM and PM are extensive but clear in a signal cycle. The eastbound left at US 401 and US 401 Business also clears in one cycle. A summary of the maximum queue lengths observed during the simulation is provided in Table 10 and Table 11.

Table 10: Maximum Queue Length Summary for Unsignalized

Intersection	Directional Movement	2019 Existing		2025 No Build		2025 Build		2025 Build w/ Imp	
		AM	PM	AM	PM	AM	PM	AM	PM
Burlington Mills Road @ Old Burlington Mills Road	EBTR	-	-	0	3	407	493	0	288
	WBLT	-	-	178	92	325	139	161	188
	NBLR	-	-	117	38	223	174	189	194
Old Burlington Mills Rd @ Barrington Hall / Access J	EBLTR	34	3	16	0	322	223	31	214
	WBLT	-	-	0	0	346	185	42	280
	WBR	0	0	0	0	267	72	2	220
	NBLTR	-	-	-	-	71	75	32	90
	SBLTR	23	23	24	24	81	76	24	109
Jonesville Rd @ Vineyard Pine Ln	EBL	15	33	18	36	39	56	9	48
	EBT	0	0	0	0	34	51	0	0
	WBTR	0	0	0	0	448	126	10	0
	SBLR	30	59	30	57	182	176	33	61
US 401 Business @ Access A	WBR	-	-	-	-	295	146	41	47
	NBT	-	-	-	-	0	0	114	0
	NBR	-	-	-	-	550	362	40	0
	SBT	-	-	-	-	276	34	6	6
US 401 Business @ Access C	EBR	-	-	-	-	228	266	211	251
	NBTR	-	-	-	-	56	35	0	25
	SBT	-	-	-	-	336	335	349	344
	SBR	-	-	-	-	336	335	200	62
US 401 Business @ Access D	WBR	-	-	-	-	49	70	58	88
	NBR	-	-	-	-	-	-	4	42
	NBTR	-	-	-	-	183	83	0	56
	SBL	-	-	-	-	595	613	184	199
	SBT	-	-	-	-	-	-	465	608
Virginia Water Drive @ Access E	WBLR	-	-	-	-	73	145	56	69
	NBTR	-	-	-	-	2	40	0	0
	SBLTR	-	-	-	-	54	70	64	67
Virgina Water Dr @ Access F	EBLR	-	-	-	-	118	211	82	80
	NBLT	-	-	-	-	64	60	49	60
	SBTR	-	-	-	-	65	165	8	2
Virginia Water Dr @ Access G	EBLTR	-	-	-	-	215	211	84	81
	WBLTR	-	-	-	-	237	291	57	71
	NBLTR	-	-	-	-	220	257	61	53
	SBLTR	-	-	-	-	262	355	51	47
Virginia Water Drive @ Access B/H	EBLR	-	-	-	-	243	303	80	68
	NBLT	-	-	-	-	220	276	16	12
	SBTR	-	-	-	-	253	267	0	2
Burlington Mills Road @ Access I	EBLT	-	-	-	-	188	121	88	57
	WBT	-	-	-	-	-	-	14	132
	WBR	-	-	-	-	34	79	21	56
	SBLR	-	-	-	-	174	176	68	123

Table 11: Maximum Queue Length Summary for Signalized

Intersection	Directional Movement	2019 Existing		2025 No Build		2025 Build		2025 Build w/ Imp	
		AM	PM	AM	PM	AM	PM	AM	PM
US 401 @ US 401 Business	EBL	136	125	318	303	375	374	375	361
	EBT	525	575	107	87	873	825	1030	683
	EBT	481	540	45	0	804	691	963	391
	WBT	245	148	408	217	1038	423	942	226
	WBT	232	113	395	184	1029	409	933	203
	WBR	5	0	32	0	325	125	325	57
	SBT	0	0	134	124	152	152	154	155
US 401 Business @ Hampton Lake Dr / Jonesville Rd	EBL	152	97	146	86	255	162	216	125
	EBT	87	37	110	43	291	200	189	54
	EBR	228	84	245	96	254	148	257	87
	WBL	136	7	104	17	175	47	146	23
	WBT	-	-	-	-	-	-	324	67
	WBTR	230	179	273	180	471	312	200	217
	NBL	115	61	145	132	425	389	399	424
	NBTR	292	378	363	410	891	885	695	691
	SBL	287	186	299	180	300	284	273	298
	SBT	404	258	498	301	594	459	470	390
	SBR	289	38	287	126	300	246	300	141
US 401 Business @ Burlington Mills Road / Virginia Water Dr	EBL	-	-	193	135	200	198	371	306
	EBT	-	-	-	-	588	527	356	209
	EBR	-	-	116	74	54	180	47	103
	WBL	-	-	-	-	102	184	96	115
	WBT	-	-	-	-	130	270	133	141
	WBR	-	-	-	-	128	117	110	121
	NBL	-	-	-	-	-	-	249	105
	NBL	-	-	197	128	200	190	300	224
	NBT	-	-	405	261	892	703	816	468
	NBR	-	-	-	-	144	103	103	133
	SBL	-	-	-	-	145	144	144	143
	SBT	-	-	283	201	233	236	241	242
	SBR	-	-	25	37	93	77	67	130
US 401 Business @ Old Burlington Mills Road (Signalized to Unsignalized)	EBL	147	130	-	-	-	-	-	-
	EBR	163	122	152	78	717	746	308	553
	NBL	114	54	-	-	-	-	-	-
	NBT	61	244	0	0	0	50	0	196
	SBT	370	214	0	0	989	1921	12	1521
	SBR	200	148	0	0	100	224	0	175
US 401 Business @ Rogers Road / Redford Pl Dr	EBL	187	200	226	213	253	232	226	234
	EBT	97	166	140	198	333	252	292	289
	EBR	312	223	321	268	488	366	446	290
	WBL	142	124	142	116	215	211	196	161
	WBT	155	159	169	173	199	262	174	179
	WBR	101	155	100	189	150	164	122	194
	NBL	283	300	300	300	299	300	300	300
	NBTR	332	498	563	616	466	1870	738	2248
	SBL	217	203	275	256	275	261	275	275
	SBT	392	289	450	379	530	453	511	488
	SBR	155	126	259	170	510	249	502	354
US 401 Business @ Access B/H (Unsignalized in Build)	WBL	-	-	-	-	-	-	200	216
	WBLR	-	-	-	-	318	301	124	143
	NBT	-	-	-	-	-	-	532	403
	NBR	-	-	-	-	786	744	200	200
	SBL	-	-	-	-	888	988	194	199
	SBT	-	-	-	-	-	-	531	410

Legend

No movement

XX Maximum queue length (feet)

8.0 RECOMMENDATIONS

Based on the findings of this study, specific improvements have been identified and should be completed as part of the proposed development. Except where noted, all intersections are recommended to operate under two-way stop control (TWSC), with the site accesses serving as the minor movement(s). These improvements are shown in Figure 9 and listed below:

US 401 Business at Access A

Construct Access A as a limited-movement intersection onto US 401 Business restricting southbound and westbound lefts. Construct a northbound right-turn lane with 100 feet of full-width storage.

US 401 Business at Access B

Construct Access B as a full-movement signalized intersection onto US 401 Business with an exclusive northbound right-turn lane with 100 feet of full-width storage and appropriate taper. Construct an exclusive southbound left-turn lane with 100 feet of full-width storage and appropriate taper on US 401 Business. Construct westbound egress with an exclusive left-turn lane with full storage and an exclusive right-turn lane with 150 feet of full-width storage.

US 401 Business at Access C

Construct Access C as a limited-movement intersection on to US 401 Business restricting northbound and eastbound left-turns. Construct an exclusive southbound right-turn lane with 100 feet of full-width storage and appropriate taper on US 401 Business.

US 401 Business at Access D

Construct Access D as a limited-movement intersection on to US 401 Business allowing all movements but a westbound left. Construct an exclusive northbound right-turn lane and southbound left-turn lane with 100 feet of full-width storage and appropriate taper.

Virginia Waters Drive at Access E

Construct Access E as a full-movement intersection on Virginia Water Drive.

Virginia Waters Drive at Access F

Construct Access F as a full-movement intersection on Virginia Water Drive.

Virginia Waters Drive at Access G

Construct Access G as a full-movement intersection on Virginia Water Drive.

Virginia Waters Drive at Access H

Construct Access H as a full-movement intersection on Virginia Water Drive.

Burlington Mills Road at Access I

Construct Access I as a full-movement intersection on Burlington Mills Road. Construct a westbound exclusive right-turn lane that is continuous from receiving the second northbound left-turn lane at US 401 Business and Burlington Mills Road.

Old Burlington Mills Road at Barrington Hall/Access J

Construct Access J as a full-movement intersection on Old Burlington Mills Road.

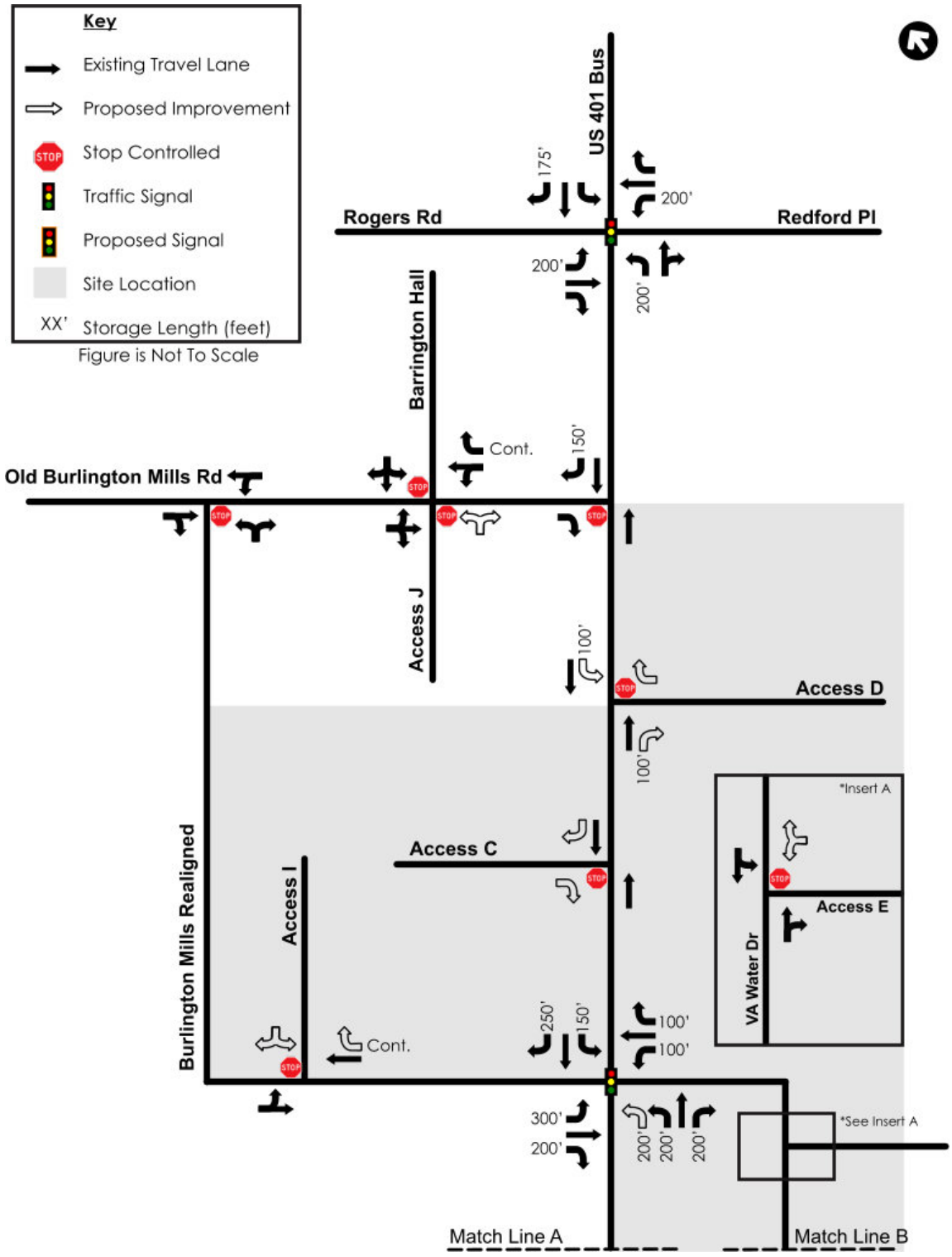
US 401 Business at Burlington Mills Road Realigned

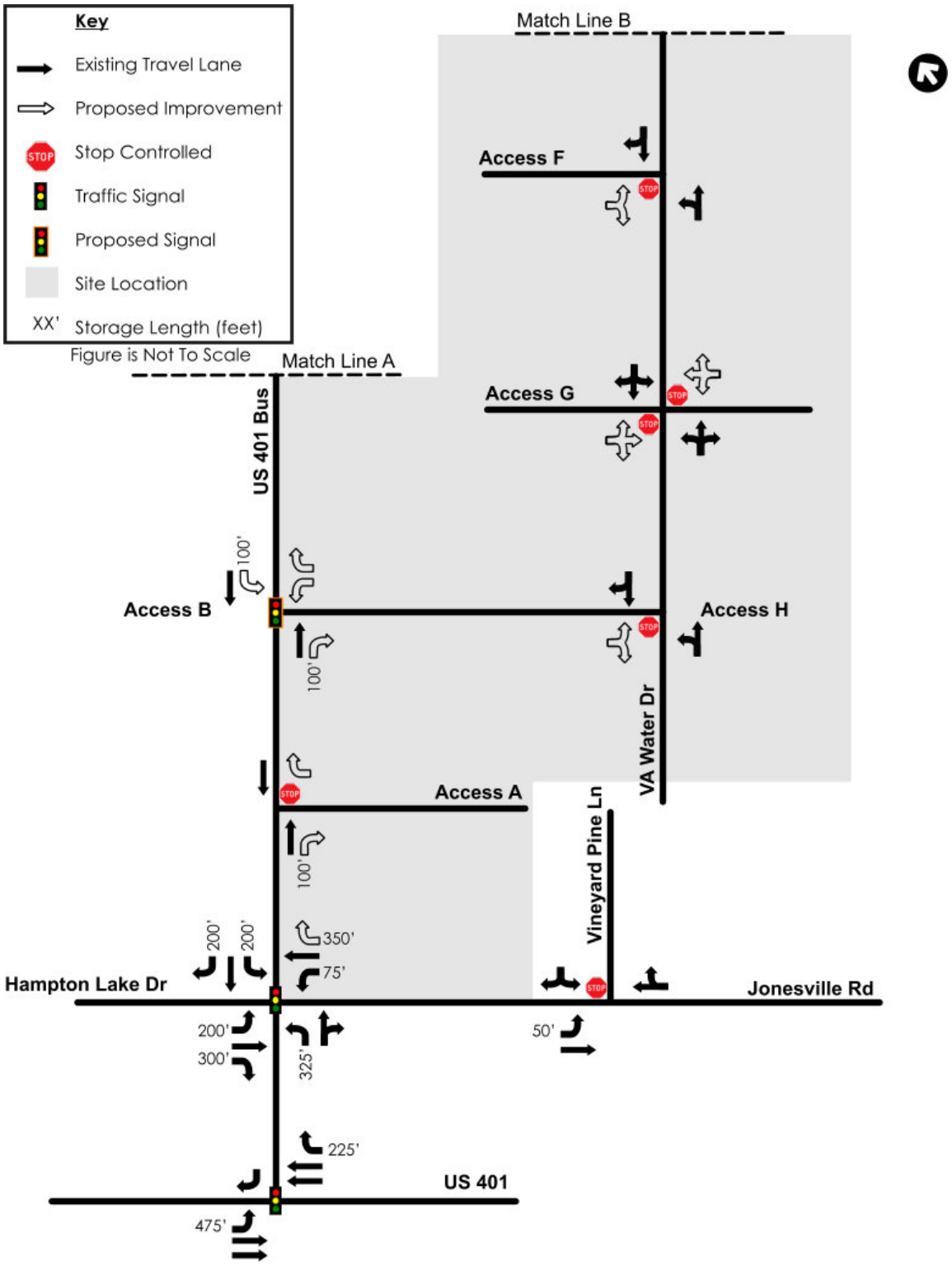
Construct a second northbound left-turn lane with 250 feet of full-width storage and appropriate taper.

US 401 Business at Hampton Lake Drive/Jonesville Road

Construct a westbound right-turn lane with 350 feet of full-width storage and appropriate taper. Allow permitted + protected signal phasing.

Figure 9: Build Recommended Lane Configurations




Key
Existing Travel Lane
Proposed Improvement
Stop Controlled
Traffic Signal
Proposed Signal
Site Location
XX' Storage Length (feet)
Figure is Not To Scale
Match Line A
Match Line B
US 401 Bus
Access F
Access G
Access B
Access H
Access A
VA Water Dr
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
100'
200'
350'
75'
50'
325'
225'
475'

9.0 CONCLUSIONS

The study shows that the traffic generated by the proposed Wallbrook Development will have a minimal impact on surrounding roadways and intersections with the recommended improvements included to mitigate the site traffic. The signalized intersections operate at an overall LOS of D or better during both peak hours across all scenarios. Sidestreet approaches to these intersections are shown to operate at LOS E or better during both peak hours across all scenarios. Approaches for the unsignalized intersection operate at LOS C or better except for the AM peak hour eastbound left-turn at US 401 Business and Old Burlington Mills Road.

10.0 REFERENCES

[1] ***NCDOT Functional Classification Map***,
http://ncdot.maps.arcgis.com/home/webmap/viewer.html?layers=029a9a9fe26e43d687d30cd3c08b1792

[2] ***2017 NCDOT Average Daily Traffic Volumes***,
https://ncdot.maps.arcgis.com/home/webmap/viewer.html?webmap=b7a26d6d8abd419f8c27f58a607b25a1

[3] ***Trip Generation (10th Edition)***, Institute of Transportation Engineers (ITE), September 2017.

[4] ***NCHRP Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments***. Washington, D.C.: Transportation Research board, 20151.

[5] ***HCM 2010: Highway Capacity Manual***. Washington D.C.: Transportation Research Board, 2010.

[6] ***Designing Walkable Urban Thoroughfares: A Context Sensitive Approach***. Institute of Transportation Engineers (ITE), 2010.

[7] ***NCDOT Congestion Management Capacity Analysis Guidelines***. North Carolina Department of Transportation (NCDOT), July 2015,
https://connect.ncdot.gov/resources/safety/Congestion%20Mngmt%20and%20Signing/Congestion%20Management/Capacity%20Analysis%20Guidelines.pdf

APPENDIX

A link containing all relevant files is electronically sent with this report:

- Traffic Signal Plans
- Site Plan
- NCDOT Scoping Checklist
- Raw Traffic Count Data
- Synchro Files
- SimTraffic Reports
- Approved Development Traffic Information

Figure 10: Approved Development Trips

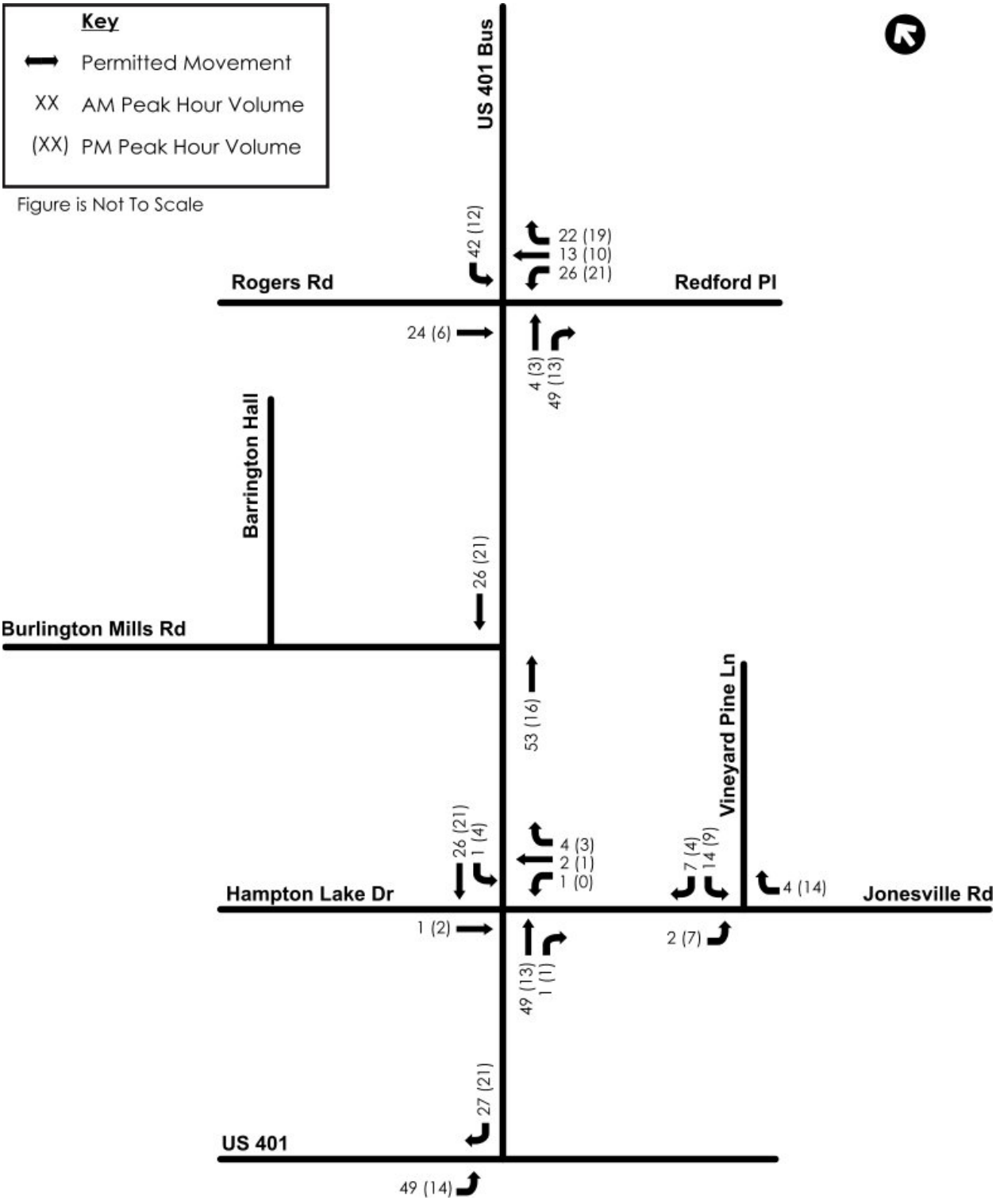
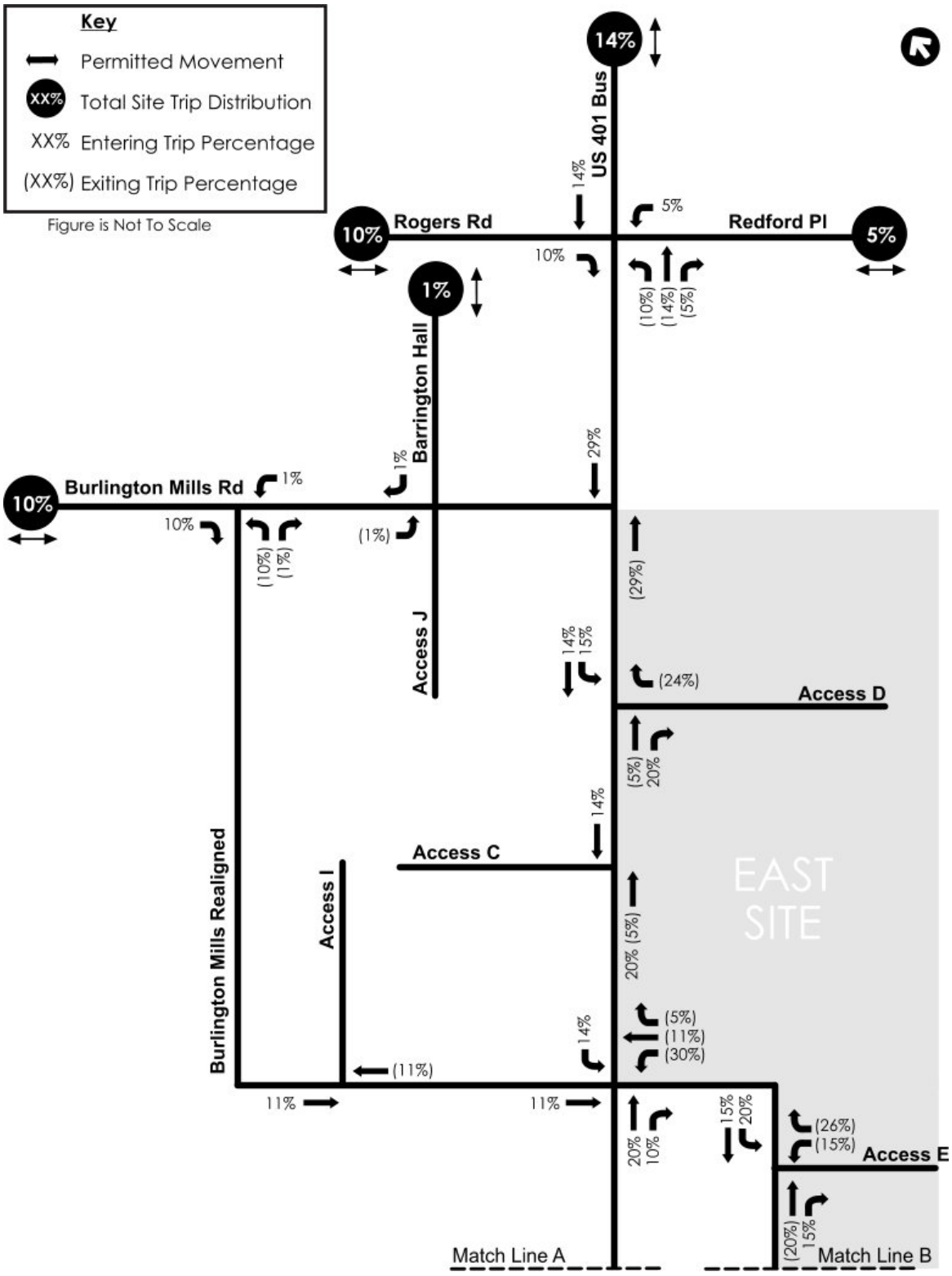


Figure 11: East Trip Distribution



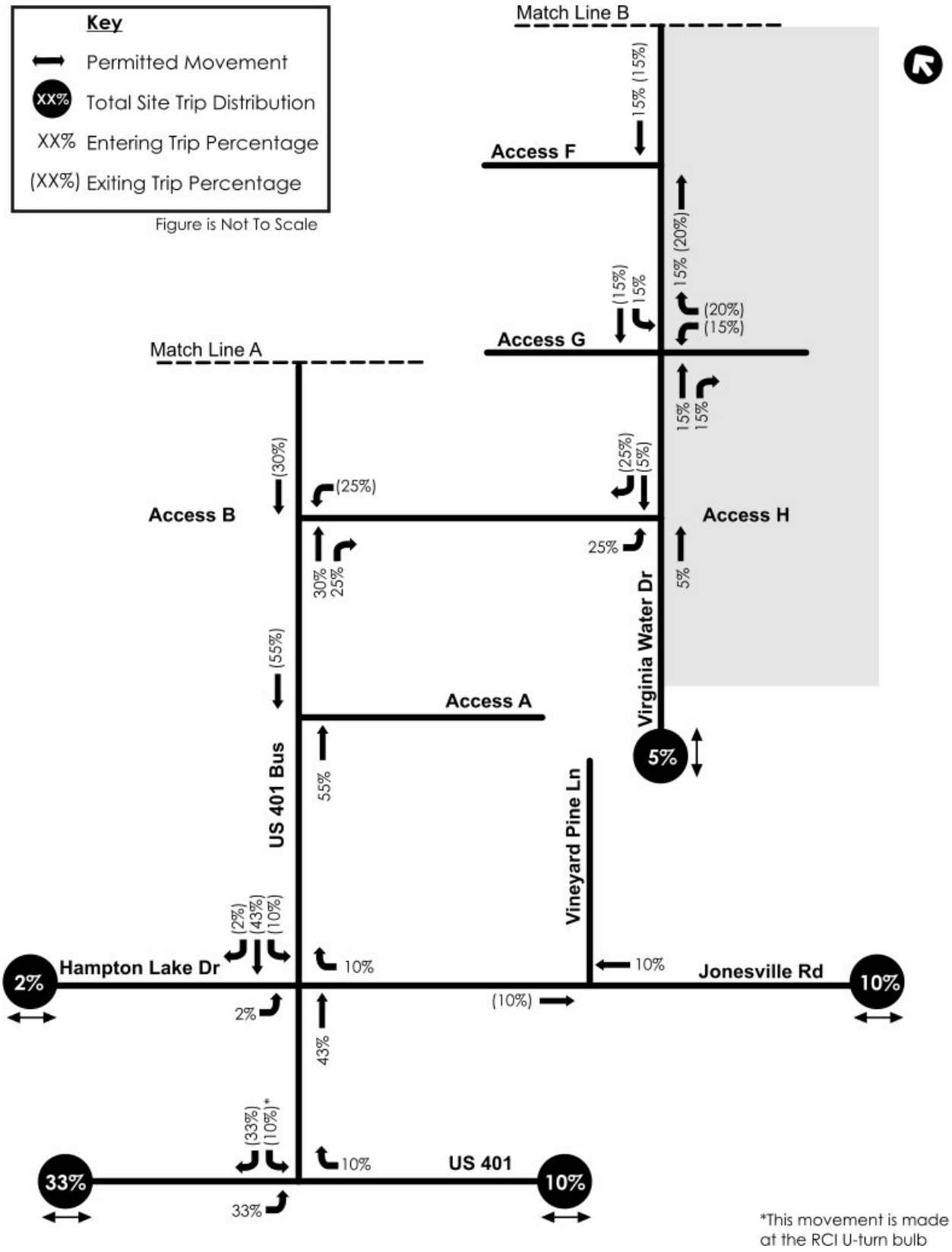
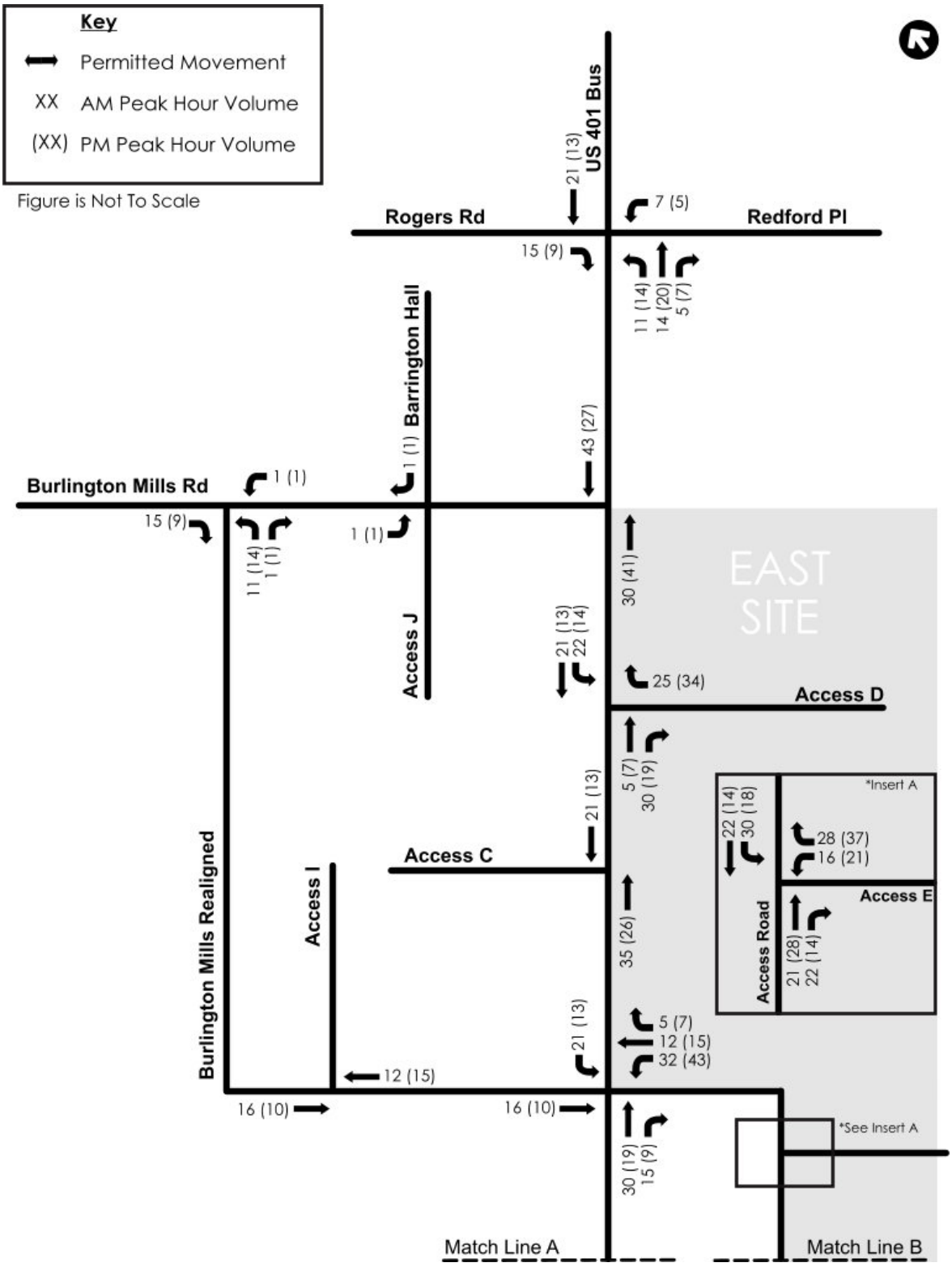

Key
Permitted Movement
XX% Total Site Trip Distribution
XX% Entering Trip Percentage
(XX%) Exiting Trip Percentage
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access B
Access H
Access A
Virginia Water Dr
US 401 Bus
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
15% (15%)
15% (20%)
(15%) 15%
(20%) (15%)
15% 15%
(30%)
(25%)
(25%) (5%)
30% 25%
25%
5%
(55%)
55%
5%
(2%) (43%) (10%)
10%
10%
2%
(10%)
2%
43%
(33%) (10%)*
10%
33%
33%
10%
*This movement is made at the RCI U-turn bulb

Figure 12: East Site Trip Assignment



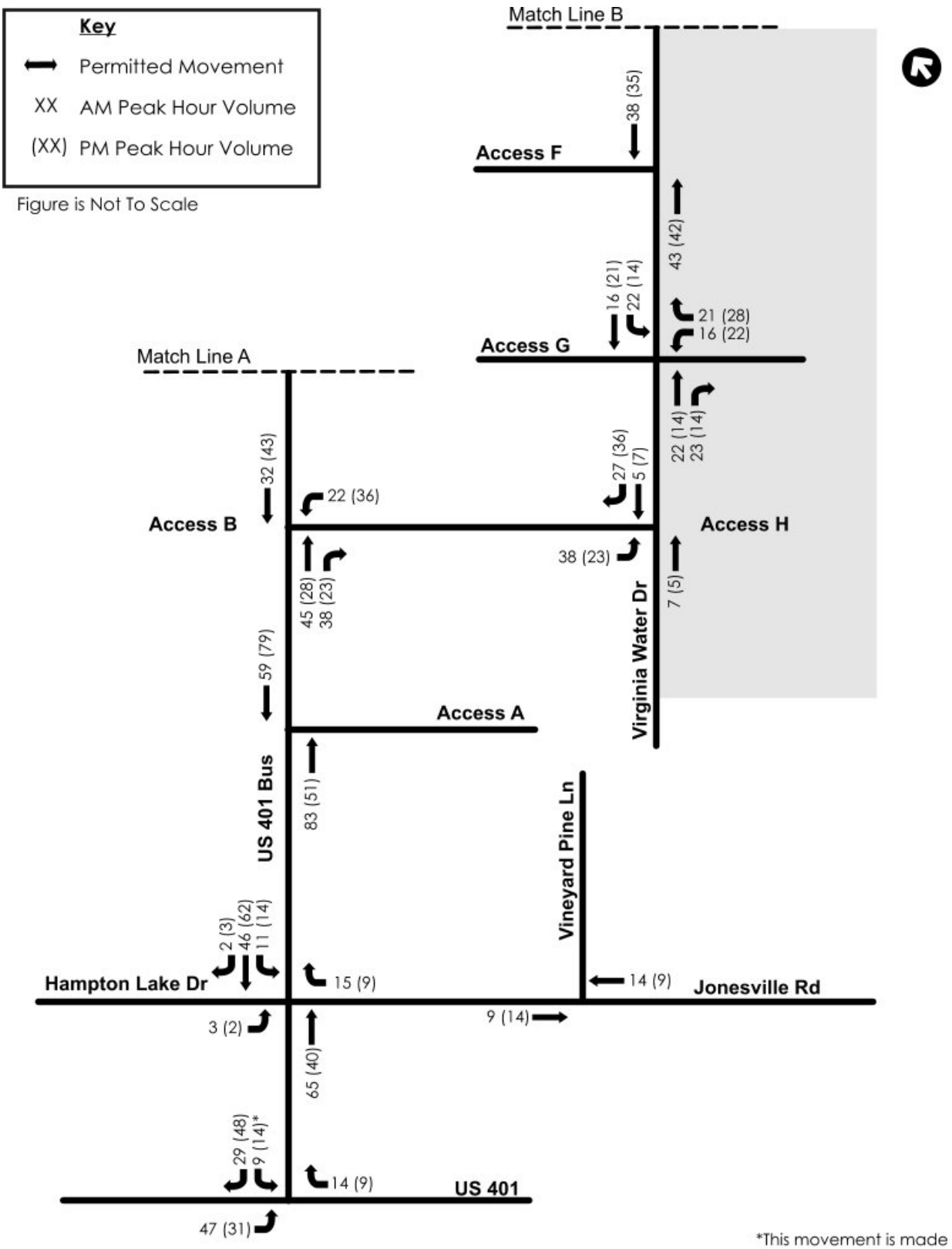
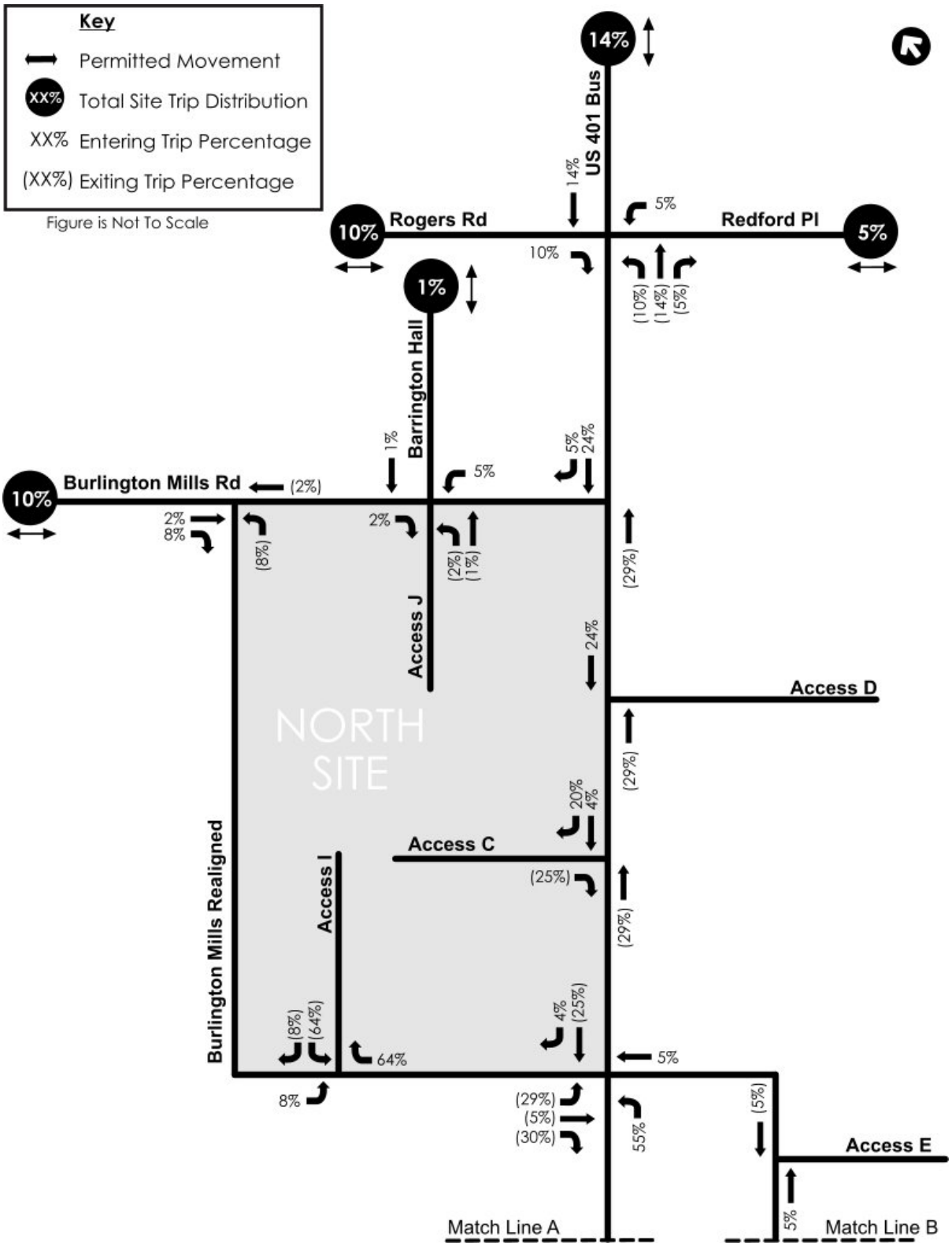

Key
Permitted Movement
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access B
Access H
Access A
Virginia Water Dr
US 401 Bus
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
38 (35)
43 (42)
16 (21)
22 (14)
21 (28)
16 (22)
22 (14)
23 (14)
27 (36)
5 (7)
32 (43)
22 (36)
38 (23)
7 (5)
45 (28)
38 (23)
59 (79)
83 (51)
2 (3)
46 (62)
11 (14)
15 (9)
14 (9)
9 (14)
3 (2)
65 (40)
29 (48)
9 (14)*
14 (9)
47 (31)
*This movement is made at the RCI U-turn bulb

Figure 13: North Site Trip Distribution



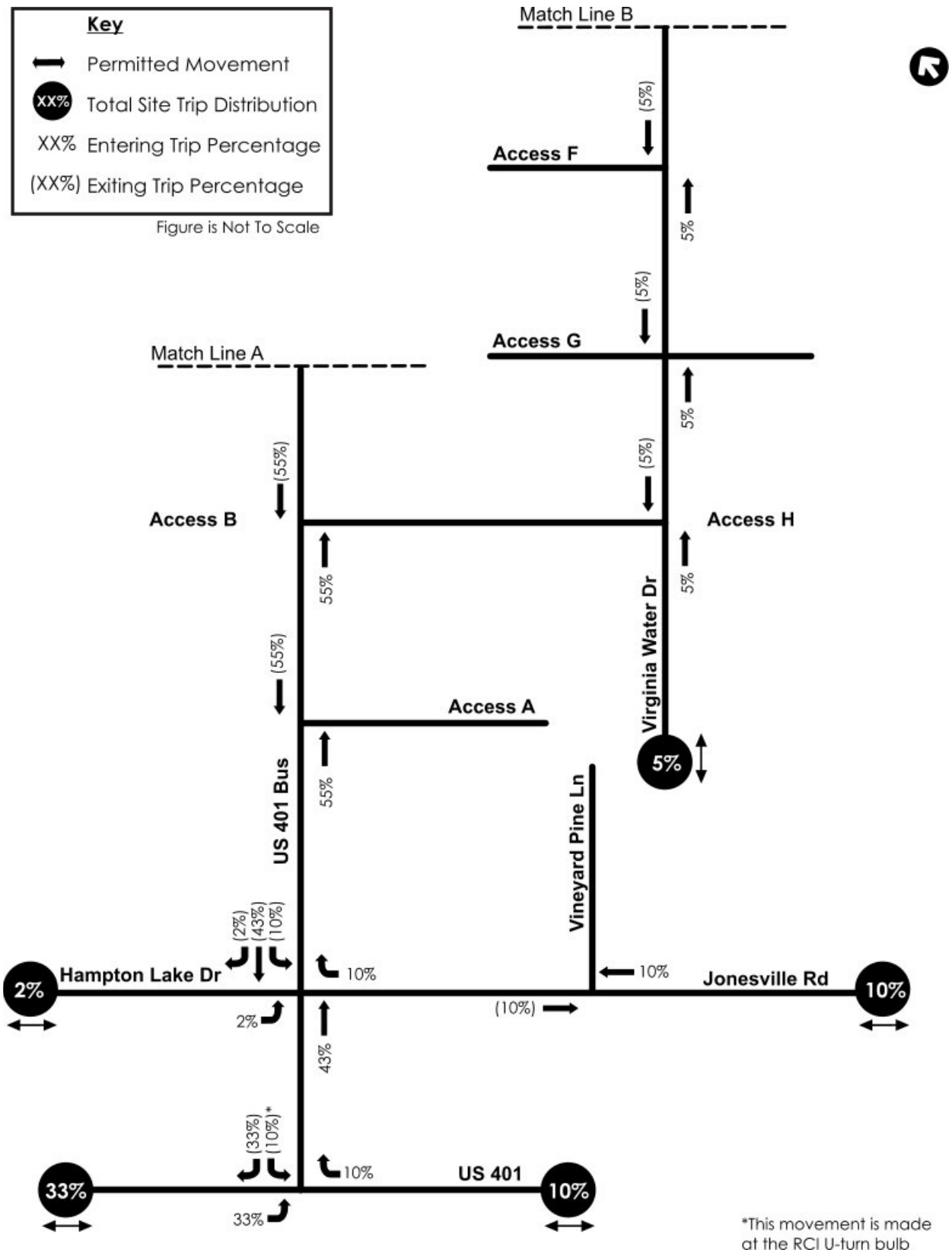
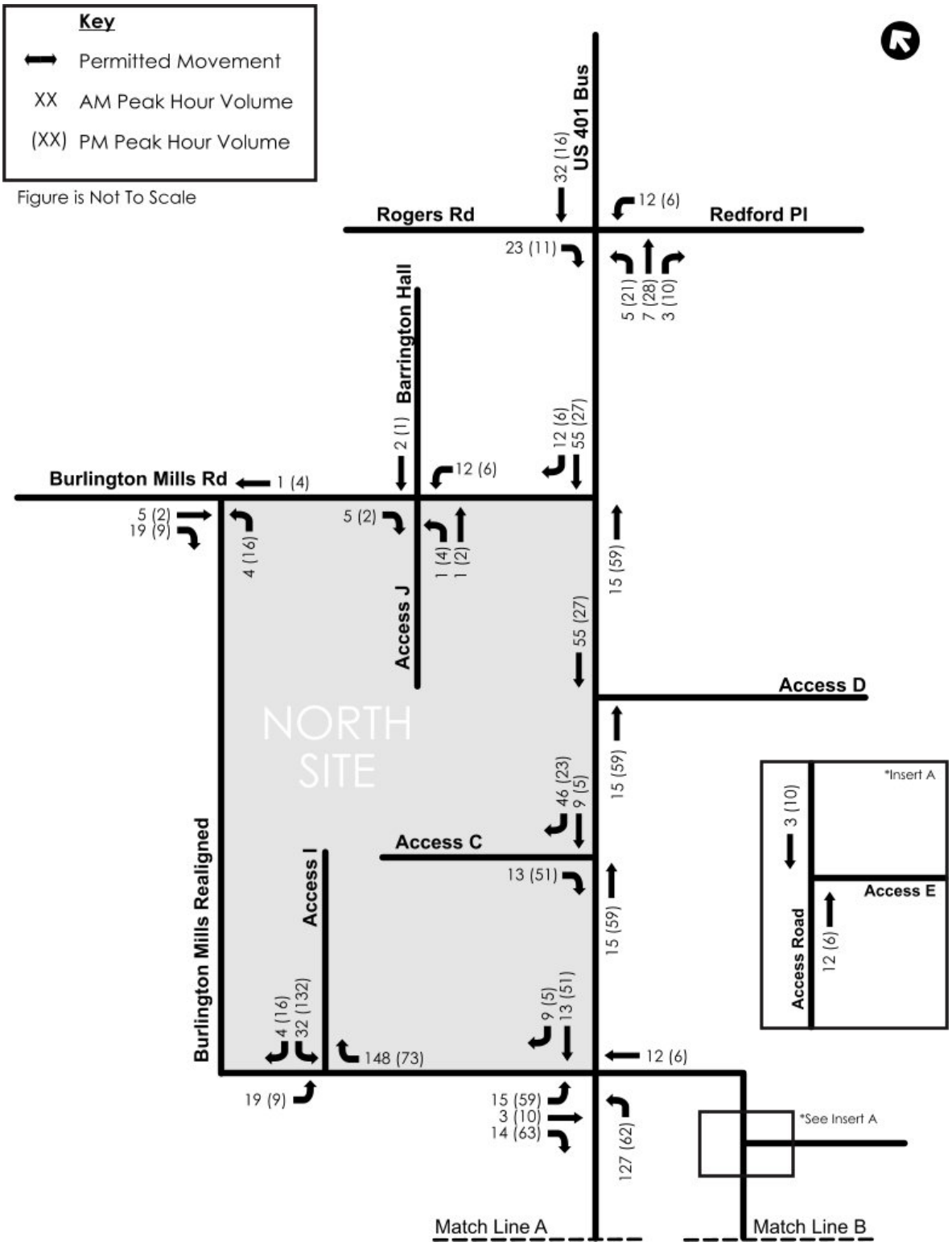

Key
Permitted Movement
XX% Total Site Trip Distribution
XX% Entering Trip Percentage
(XX%) Exiting Trip Percentage
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access B
Access H
Access A
Virginia Water Dr
US 401 Bus
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
(5%)
5%
(55%)
55%
(2%)
(43%)
(10%)
10%
2%
43%
(33%)
(10%)*
33%
*This movement is made at the RCI U-turn bulb

Figure 14: North Site Trip Assignment



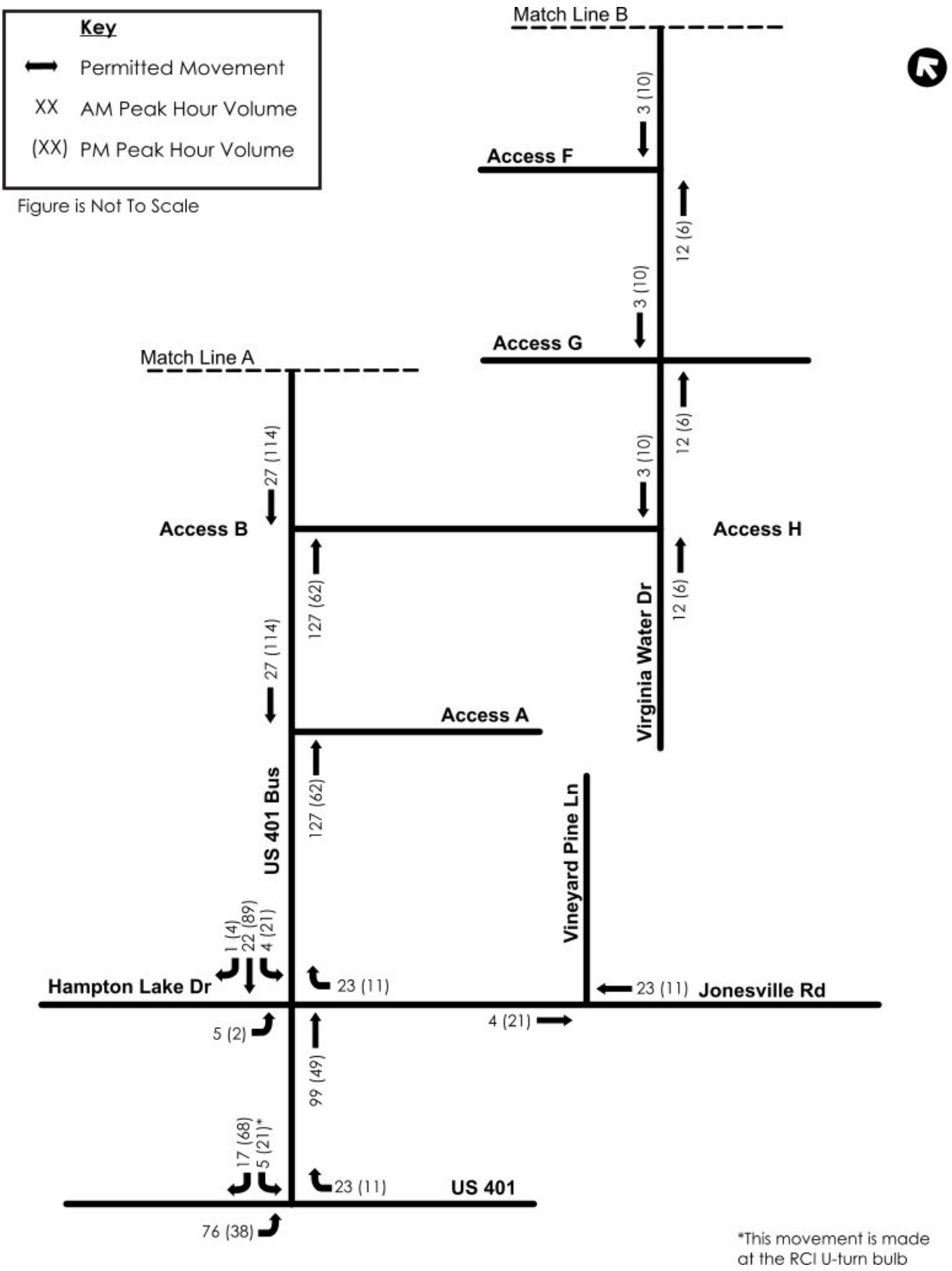
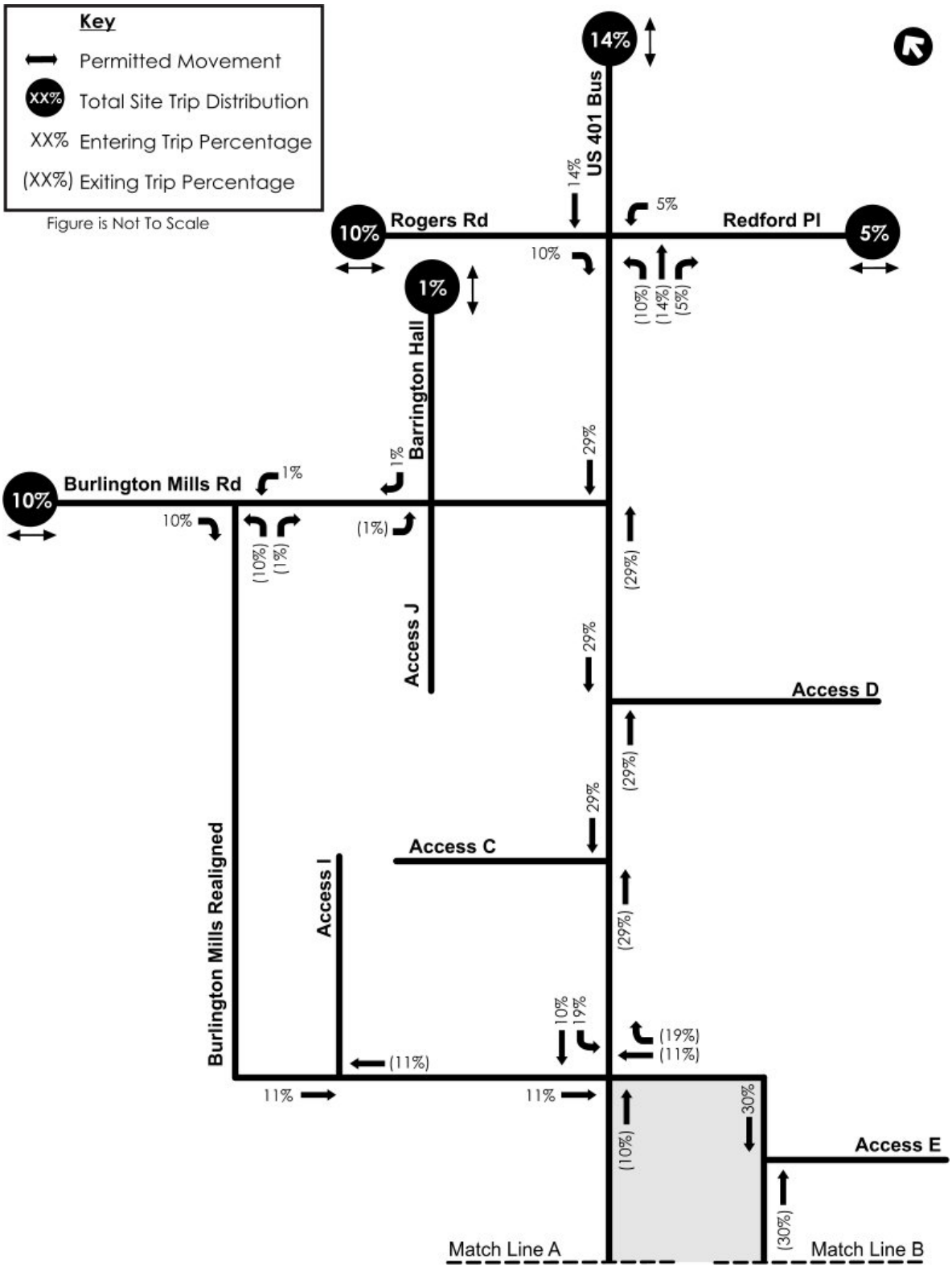

Key
Permitted Movement
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access B
Access H
Access A
Virginia Water Dr
US 401 Bus
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
3 (10)
12 (6)
27 (114)
127 (62)
1 (4)
22 (89)
4 (21)
23 (11)
5 (2)
99 (49)
17 (68)
5 (21)*
76 (38)
*This movement is made at the RCI U-turn bulb

Figure 15: South Site Trip Distribution



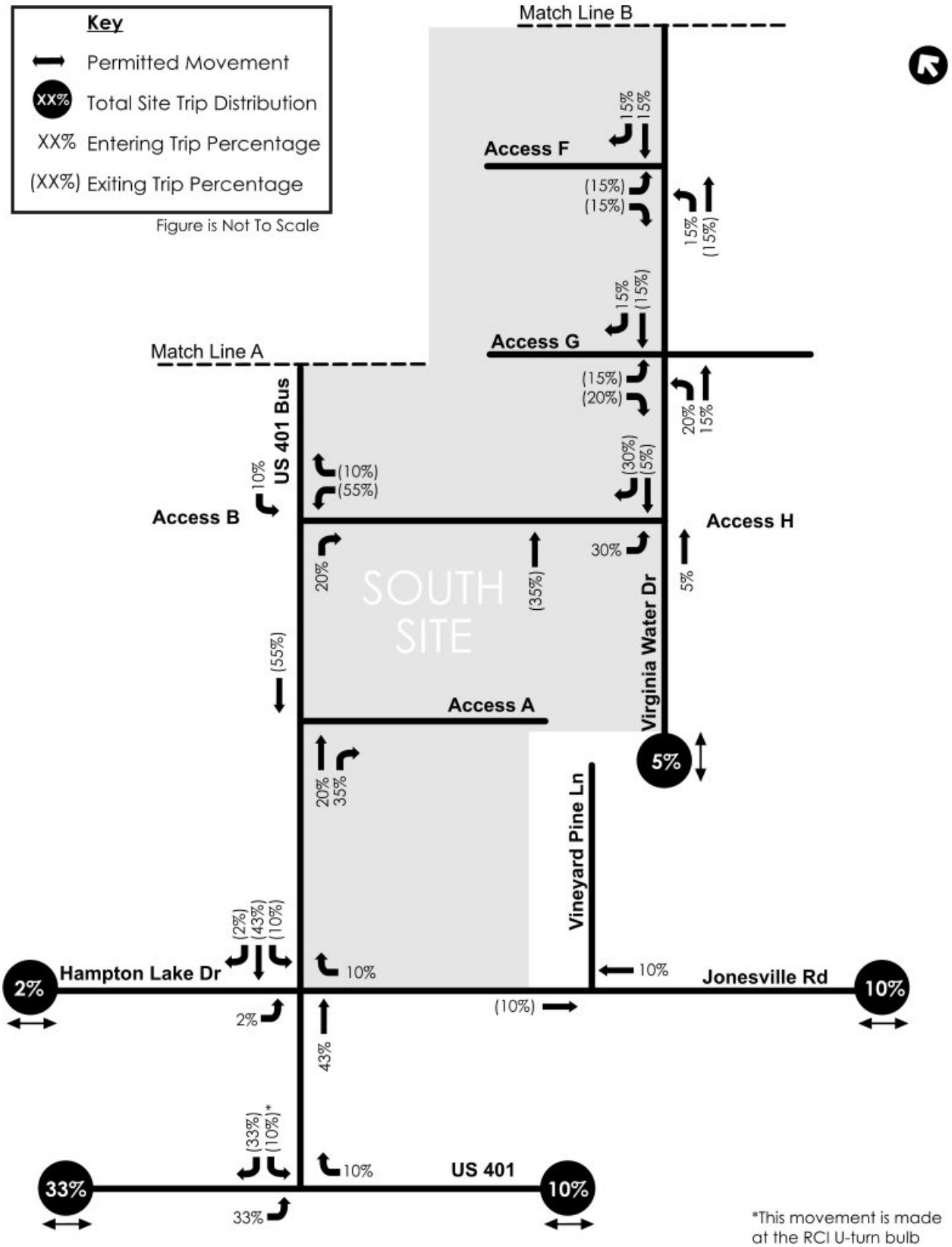
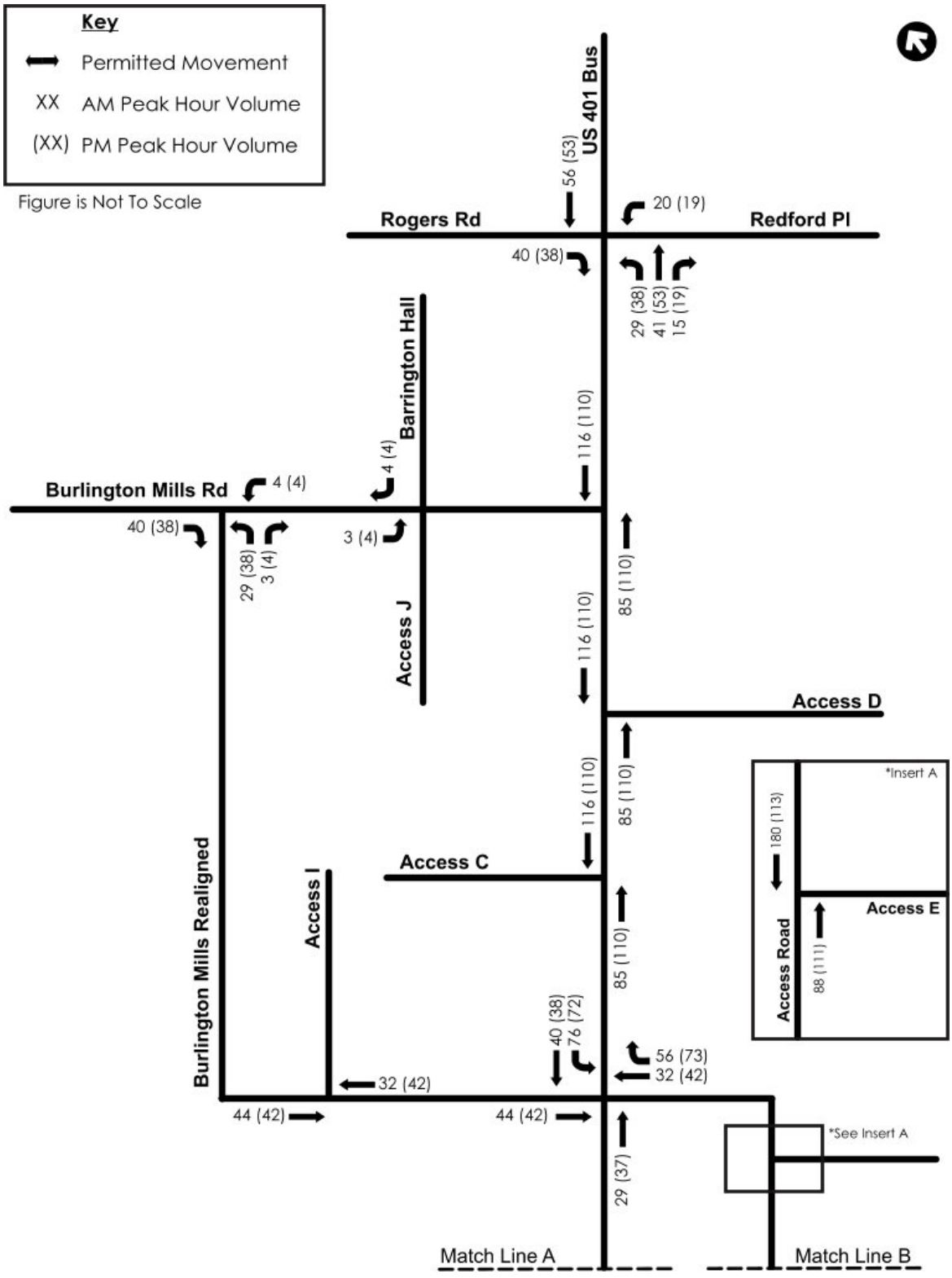

Key
Permitted Movement
XX% Total Site Trip Distribution
XX% Entering Trip Percentage
(XX%) Exiting Trip Percentage
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access H
Access B
Access A
US 401 Bus
Virginia Water Dr
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
SOUTH SITE
2%
10%
33%
10%
5%
*This movement is made at the RCI U-turn bulb

Figure 16: South Site Trip Assignment



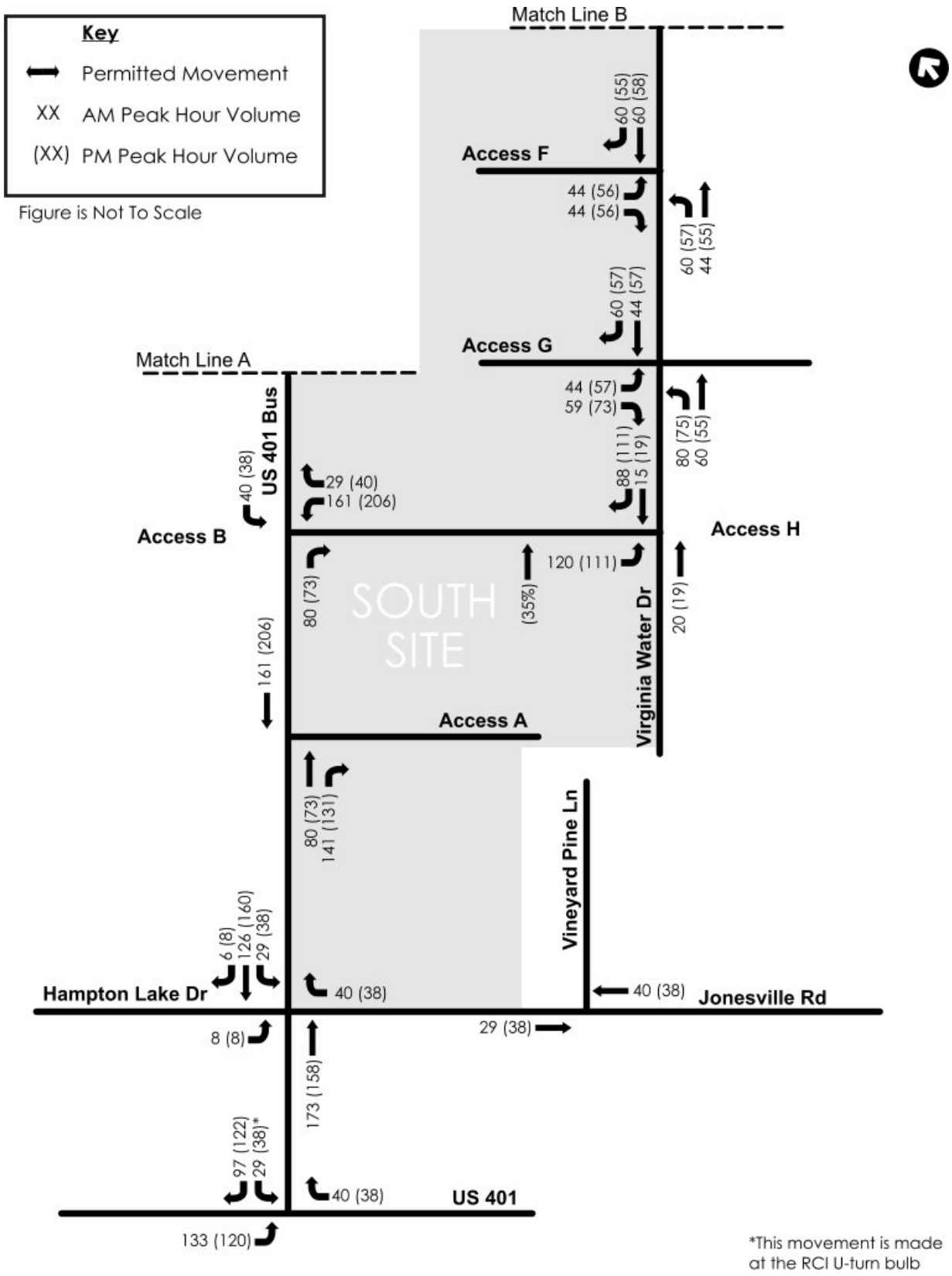

Key
Permitted Movement
XX AM Peak Hour Volume
(XX) PM Peak Hour Volume
Figure is Not To Scale
Match Line B
Match Line A
Access F
Access G
Access H
Access B
Access A
US 401 Bus
Virginia Water Dr
Vineyard Pine Ln
Hampton Lake Dr
Jonesville Rd
US 401
SOUTH SITE
60 (55)
60 (58)
44 (56)
44 (56)
60 (57)
44 (55)
60 (57)
44 (57)
44 (57)
59 (73)
80 (75)
60 (55)
88 (111)
15 (19)
40 (38)
29 (40)
161 (206)
120 (111)
(35%)
80 (73)
20 (19)
161 (206)
80 (73)
141 (131)
6 (8)
126 (160)
29 (38)
40 (38)
40 (38)
8 (8)
29 (38)
173 (158)
97 (122)
29 (38)*
40 (38)
133 (120)
*This movement is made at the RCI U-turn bulb

Figure 17: Pass-By Trips