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732 469 0600
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TRAFFIC IMPACT ASSESSMENT

FOR

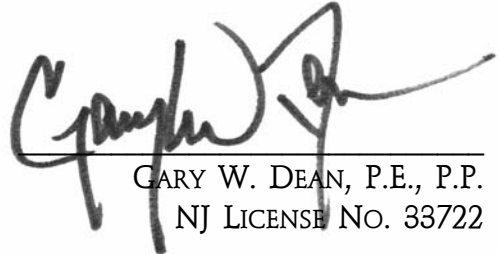
PROPOSED RESIDENTIAL DEVELOPMENT

BLOCK 291, LOT 15.01
BLOCK 292, LOT 2
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY

JANUARY 24, 2018



ELIZABETH DOLAN, P.E.
NJ LICENSE NO. 37071



GARY W. DEAN, P.E., P.P.
NJ LICENSE NO. 33722

Union\Cranford\L2A-GardenHomes\Documents\2018-01-24 TIA.doc

INTRODUCTION

This study has been prepared to evaluate the traffic impacts associated with the development of 225 residential units in the Township of Cranford, Union County New Jersey. Three new mid-rise residential buildings are proposed on the southwest side of Birchwood Avenue, between Orange Avenue and Cranford Avenue. Three driveways will provide access to the new apartments, and a minimum of 416 parking spaces are proposed on site.

Dolan & Dean Consulting Engineers, LLC (D&D) has been commissioned by Garden Homes to prepare this Traffic Impact Assessment for the proposed site redevelopment. While any development of the subject property may affect traffic conditions, both the volume and characteristics of that traffic are of important consideration in the evaluation of this application.

This traffic study estimates the quantitative increase in traffic movements along the adjacent roadway network that could occur from the development of 225 apartments. The focus of this traffic impact assessment is to identify any unique characteristics of site-generated traffic, and to evaluate the overall impacts on the local street system. Also included is an evaluation of site access and on-site circulation.



EXISTING CONDITIONS

As mentioned, the subject property is located along the southwest side of Birchwood Avenue, between Orange Avenue and Cranford Avenue. The property is designated as Block 291, Lot 15.01 and Block 292, Lot 2, and is also known as 215 and 235 Birchwood Avenue. The site had previously been occupied by office buildings totaling 50,293 square feet. The general site location is shown on appended Figure 1.

EXISTING ROADWAY CONDITIONS

Birchwood Avenue is a two-way roadway, connecting Orange Avenue to the northwest, with Cranford Avenue to the southeast. Birchwood Avenue intersects Orange Avenue opposite Birch Street, which provides access to the Orange Avenue Pool. STOP signs control the Birchwood Avenue and Birch Street approaches to Orange Avenue.

Southeast of the site, Birchwood Avenue forms a four-leg intersection with Cranford Avenue. STOP control is posted on the Cranford Avenue approaches.

Other land use along Birchwood Avenue includes a Verizon office building, the Cranford Conservation Center/recycling center and the Cranford Health and Extended Care facility.

EXISTING TRAFFIC VOLUMES

D&D conducted a series of traffic counts along Birchwood Avenue in July 2010 and June of 2012. Manual turning movement counts had been performed at the Orange Avenue and Cranford Avenue intersections, as well as at the 235 Birchwood Avenue office driveway, the Verizon office driveways, and the Extended Care facility driveways.



Recognizing that the counts were conducted several years ago, D&D performed updated counts in January 2018 during the following periods:

Birchwood Avenue & Birch Street & Orange Avenue

- Wednesday, January 3, 2018 from 7:00 to 9:00 a.m. and from 4:00 to 6:00 p.m.

Birchwood Avenue & Birch Street & Orange Avenue

- Tuesday, January 9, 2018 from 7:00 to 9:00 a.m. and from 4:00 to 6:30 p.m.

The peak hours occur from 7:45 a.m. to 8:45 a.m. and from 4:30 p.m. to 5:30 p.m. Appended Figures 2 and 3 illustrate the 2018 morning and evening peak hour volumes, respectively.

The evening peak hour volumes recently recorded were comparable to the 2012 volumes with the exception of Orange Avenue movements. The 2018 Orange Avenue northbound movements at Birchwood Avenue/Birch Street increased by approximately 50 vehicles.



TRAFFIC CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

For this study, traffic projections were prepared by reviewing trip generation rates published by the Institute of Transportation Engineers (ITE) in the 10th Edition of Trip Generation Manual. The appropriate ITE land use for the proposed development is “Multi-Family Housing (Mid-Rise)” (Land Use Code 221). Trip generation projections are summarized in Table I.

TABLE I
TRIP GENERATION PROJECTIONS
225 MID-RISE APARTMENTS

MORNING PEAK HOUR			EVENING PEAK HOUR		
ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
21	60	81	60	39	99

The anticipated arrival and departure patterns for future site generated traffic were based upon a review of the on-street traffic patterns and volumes as revealed thru the traffic count program. Site generated traffic is shown on Figures 4 and 5.



FUTURE TRAFFIC CONDITIONS

FUTURE TRAFFIC VOLUMES

It is recognized that traffic routinely fluctuates along various state and county roadways, as well as local streets, and varies not only day-to-day, but also on a monthly and yearly basis. Normal "background" traffic increases regularly occur as attributed to continued regional growth and changes in driver demographics.

There may also be additional traffic generated by specific projects that will lead to increased demands on the roadways in the site vicinity (at least to some degree), even if no changes were to occur on the subject property. Traffic has been found to regularly increase as development continues within Cranford and neighboring communities.

Regional traffic growth patterns as compiled by the New Jersey Department of Transportation (NJDOT) were examined for this analysis. Based on NJDOT growth patterns for Union County, traffic volumes annually increase by 1.0% during peak traffic hours. A 1% growth rate was applied, compounded annually, for a two-year period, to a 2020 design year.

The resultant 2020 "no build" volumes are shown on Figures 7 and 8.

Future "build" traffic volumes were calculated by adding the new site generated traffic to the "no build" volumes. The total future "build" traffic volumes for the morning and evening peak hours are shown on Figures 9 and 10.



ANALYSIS OF FUTURE TRAFFIC CONDITIONS

Volume/capacity, Level of Service (LOS) analyses have been performed for the projected “no build” and “build” volumes, using the Highway Capacity Manual (HCM) computer software. Critical movements at the adjacent intersections will operate at acceptable LOS D or better during the peak hours, as summarized on the following tables:

TABLE III
LEVELS OF SERVICE & DELAY
BIRCHWOOD AVENUE/BIRCH STREET & ORANGE AVENUE

APPROACH	NO BUILD		BUILD	
	LOS	DELAY	LOS	DELAY
<i>MORNING PEAK HOUR</i>				
Northbound Birchwood Ave	D	26.3	D	34.4
Southbound Birch Road	B	13.6	B	13.9
Eastbound Orange Avenue Left Turn	A	7.7	A	7.7
Westbound Orange Avenue Left Turn	A	8.4	A	8.4
<i>EVENING PEAK HOUR</i>				
Northbound Birchwood Ave	B	13.9	C	15.7
Southbound Birch Road	B	10.6	B	10.8
Eastbound Orange Avenue Left Turn	A	7.9	A	7.9
Westbound Orange Avenue Left Turn	A	7.8	A	7.9

TABLE IV
LEVELS OF SERVICE & DELAY
BIRCHWOOD AVENUE & CRANFORD AVENUE

APPROACH	NO BUILD		BUILD	
	LOS	DELAY	LOS	DELAY
<i>MORNING PEAK HOUR</i>				
Northbound Birchwood Ave Left Turn	A	7.5	A	7.5
Southbound Birchwood Ave Left Turn	A	7.6	A	7.6
Eastbound Cranford Avenue	B	10.6	B	10.8
Westbound Cranford Avenue	A	9.5	A	9.6
<i>EVENING PEAK HOUR</i>				
Northbound Birchwood Ave Left Turn	A	7.4	A	7.4
Southbound Birchwood Ave Left Turn	A	7.3	A	7.4
Eastbound Cranford Avenue	A	9.4	A	9.6
Westbound Cranford Avenue	A	8.6	A	8.7



The maximum impact will occur on the northbound Birchwood Avenue approach to Orange Avenue. However, the average added delay will be only 8.1 seconds during the morning peak hour and approximately 2 seconds during the evening peak hour.

As a result of this analysis, the proposed apartments will not create a negative impact on the adjacent roadway system. Ample capacity is available to accommodate site generated traffic. No signalization or other intersection improvements are warranted as a result of the site redevelopment. This conclusion is based on a conservative projection of site and street volumes, and no credit for the trips associated with the offices formerly on site.

The site driveway intersections with Birchwood Avenue were also analyzed. As shown on the appended analyses, the site driveway movements will operate at LOS A and B.



SITE ACCESS AND CIRCULATION

The site plan prepared by L2A Land Design, LLC was reviewed with regard to site access, on-site circulation and parking supply.

Three driveways will intersect Birchwood Avenue from the south. The western driveway will be a full-movement driveway centrally located opposite the Verizon site. The center driveway will be a full-movement divided driveway, and the eastern driveway will be for emergency access only. The driveways and aisle will measure 24 feet in paved width to appropriately accommodate two-way travel, and to accommodate movements to/from the parking spaces.

Three parking garages are proposed on site providing 296 spaces, with an additional 120 non-garage spaces being provided adjacent to the proposed buildings. This provides a total of 416 parking spaces, which meets the Birchwood Avenue Redevelopment Area requirement of one 1.85 spaces per residential units.

Four driveways currently serve the two lots. As a result of site redevelopment, the number of driveways will be reduced, resulting in fewer vehicle conflict points along Birchwood Avenue.

The site plan has been designed in accordance with recognized design guidelines, and to promote safe and efficient access and on-site circulation.



TECHNICAL APPENDIX



PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



FIGURE 1

SITE LOCATION MAP

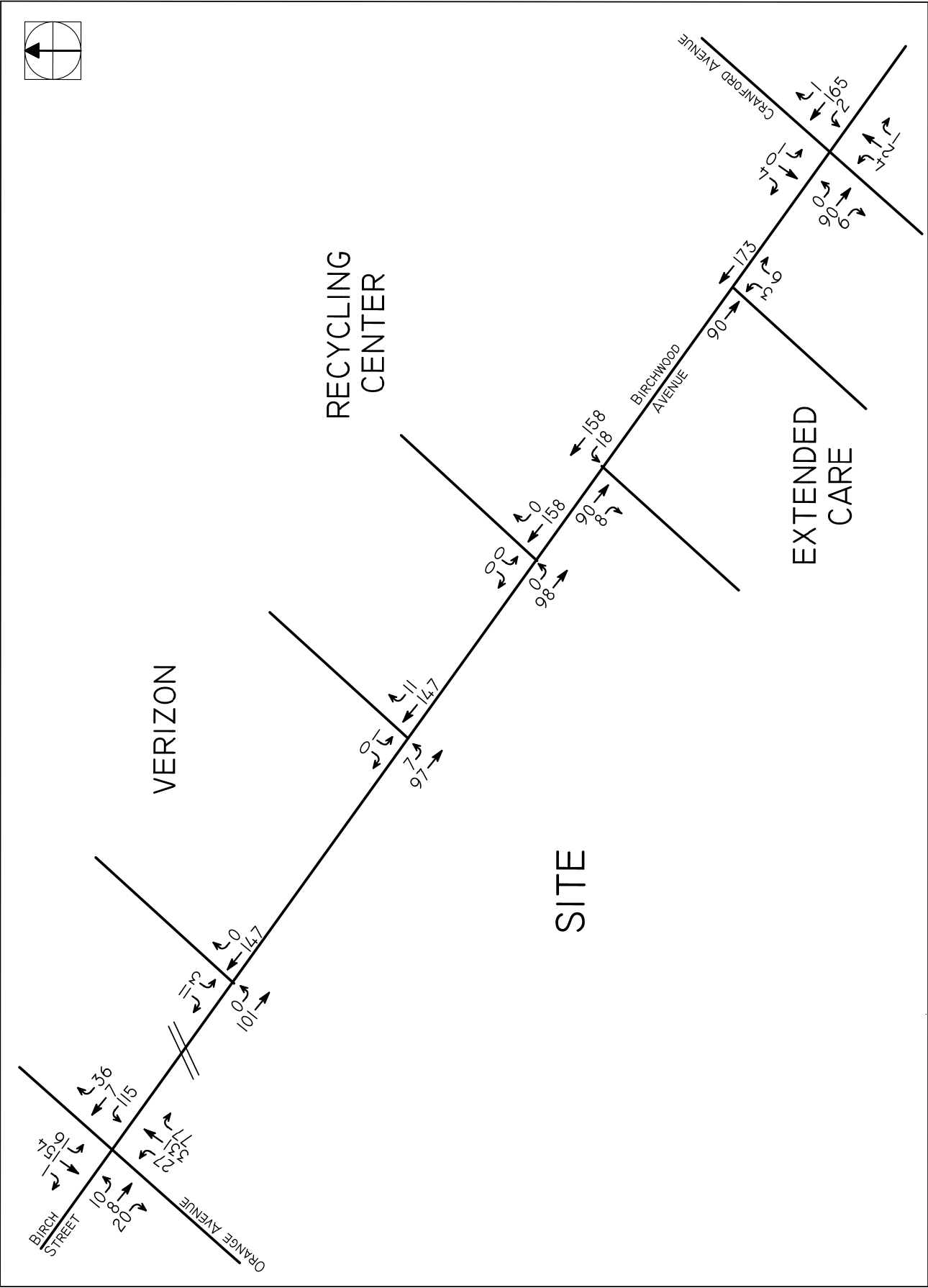
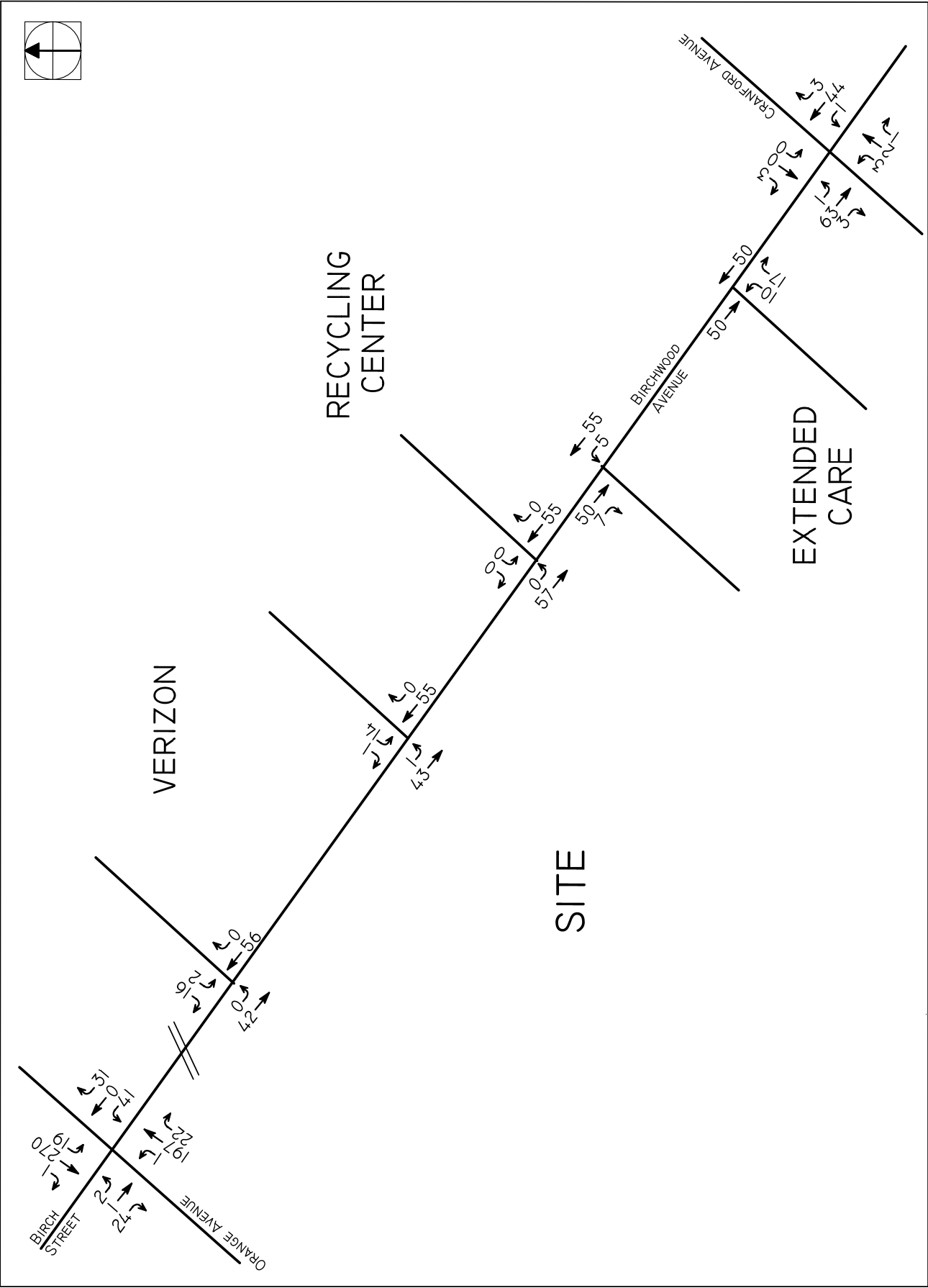


FIGURE 2

EXISTING TRAFFIC VOLUMES
MORNING PEAK HOUR
(7:45 AM TO 8:45 AM)

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TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



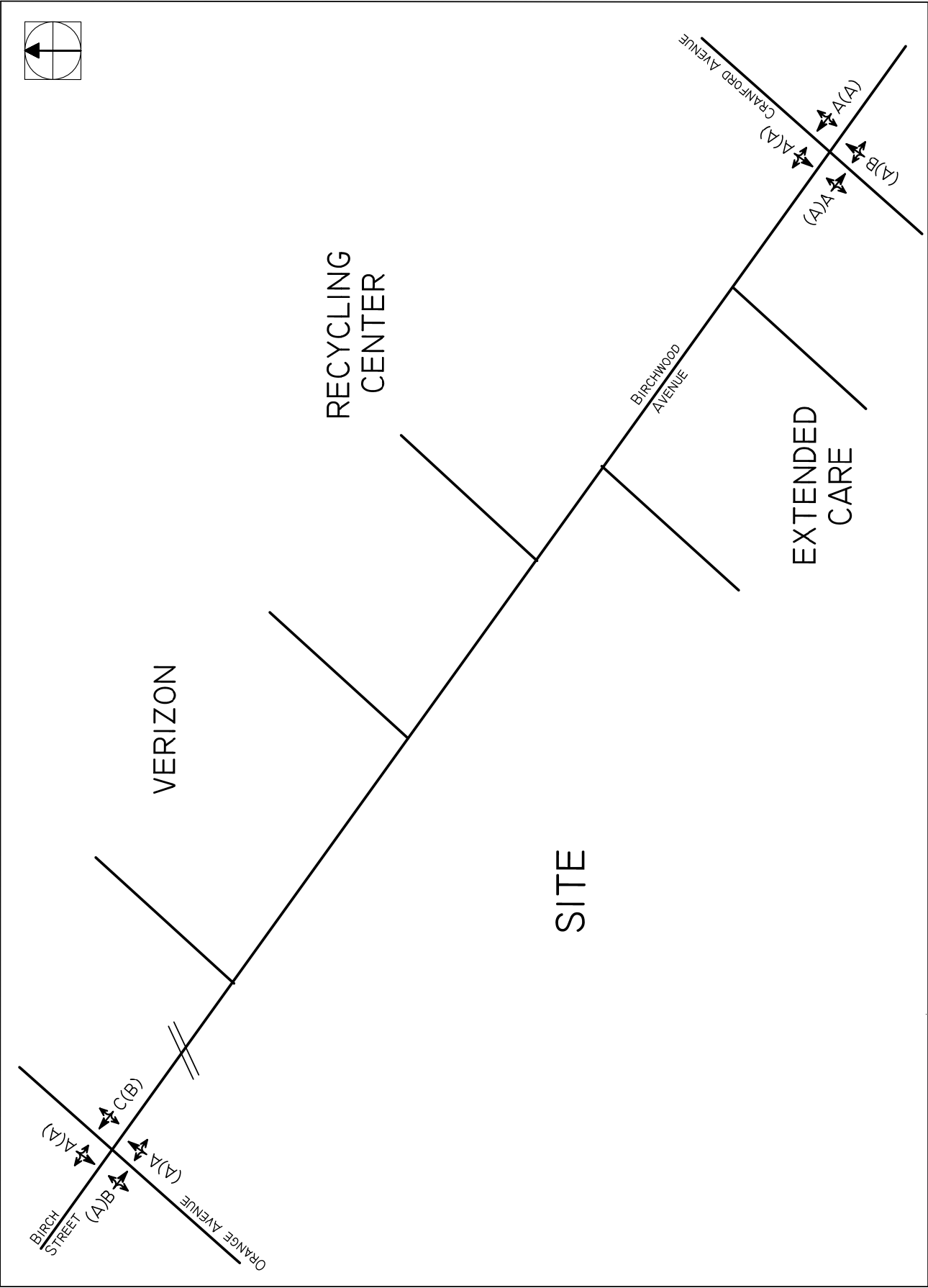


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



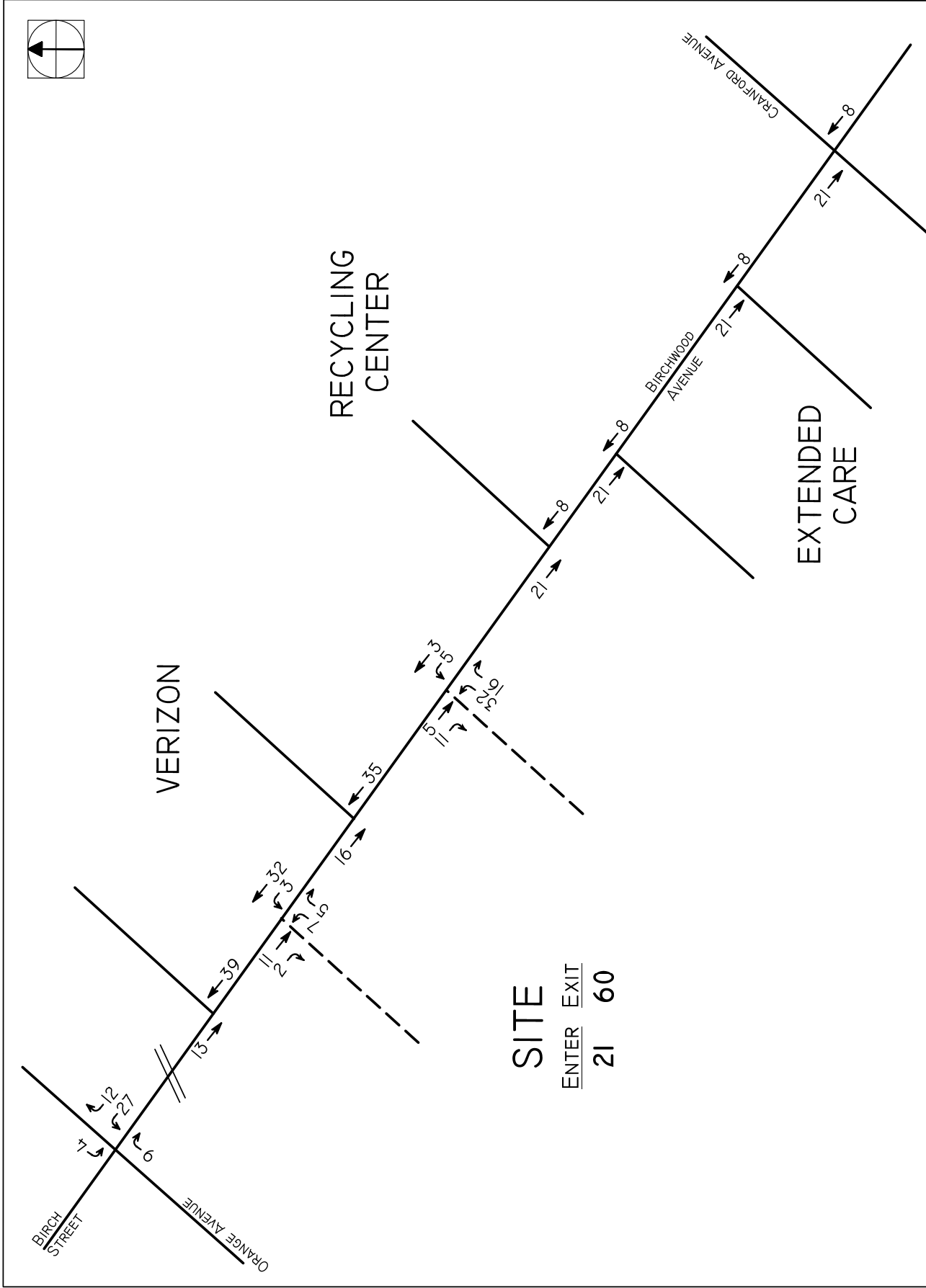
FIGURE 3

EXISTING TRAFFIC VOLUMES
EVENING PEAK HOUR
(4:30 PM TO 5:30 PM)



PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY

FIGURE 4

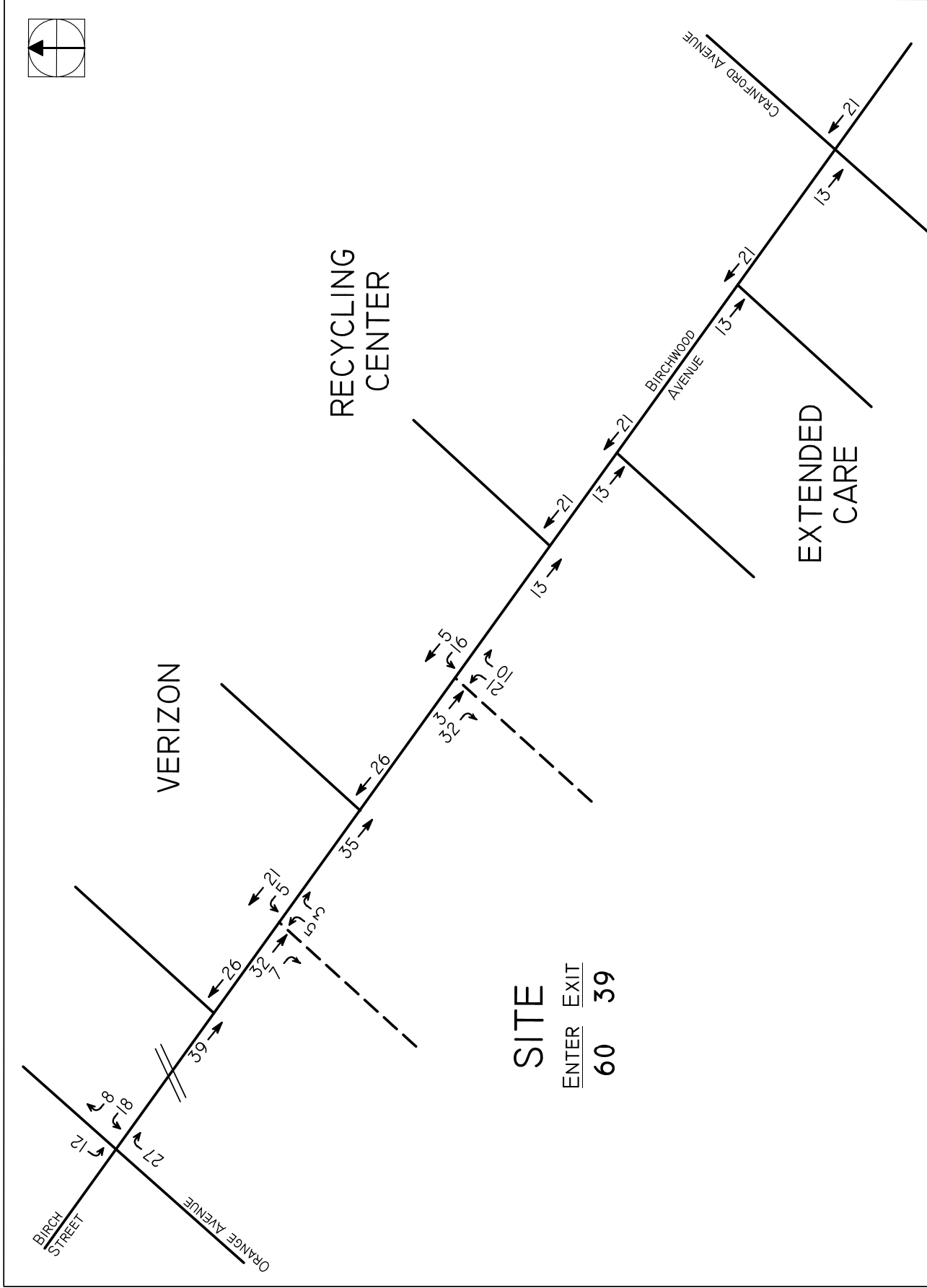


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



FIGURE 5

SITE GENERATED TRAFFIC VOLUMES
MORNING PEAK HOUR
(7:45 AM TO 8:45 AM)

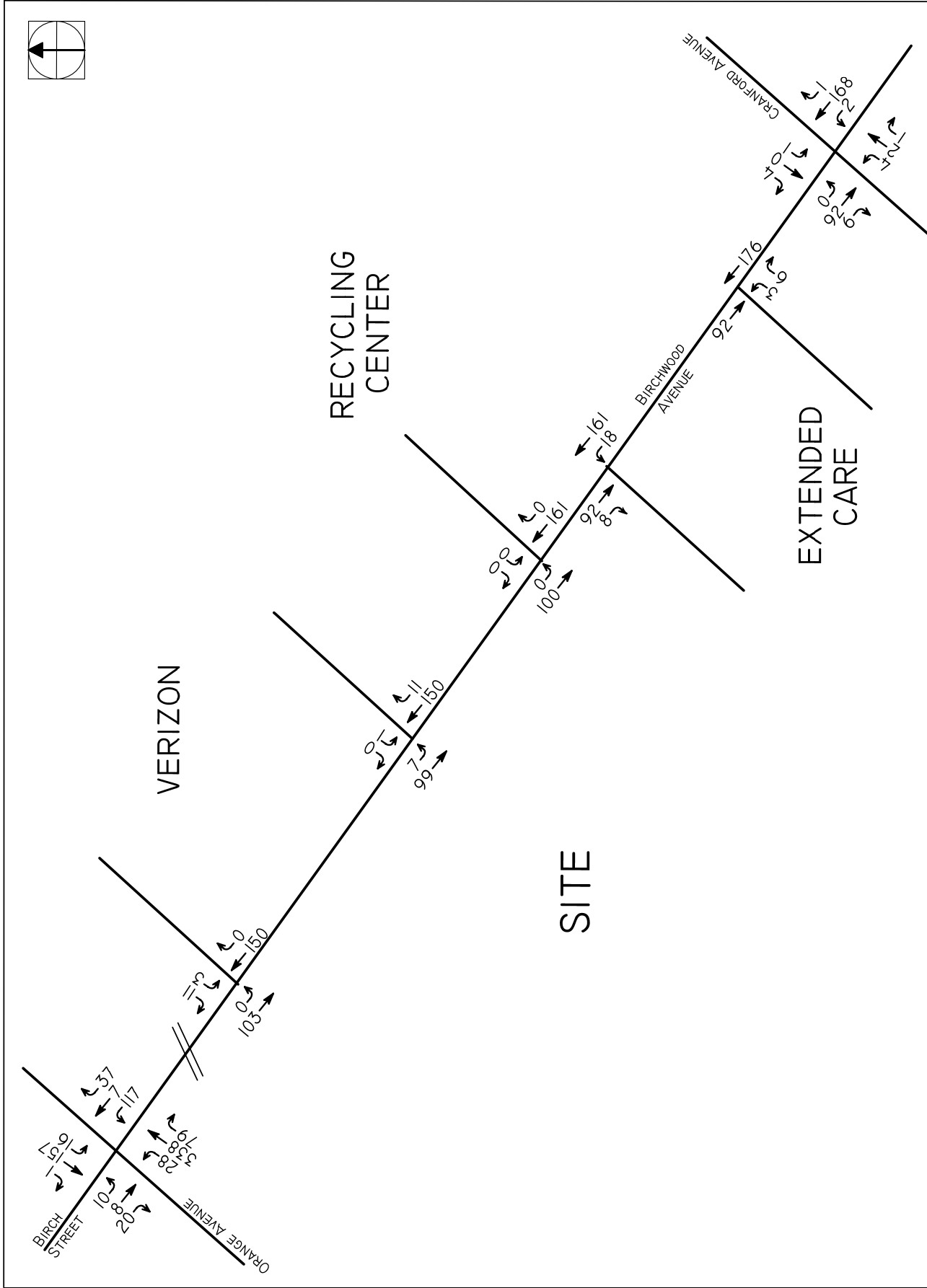


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



FIGURE 6

SITE GENERATED TRAFFIC VOLUMES
EVENING PEAK HOUR
(4:30 PM TO 5:30 PM)

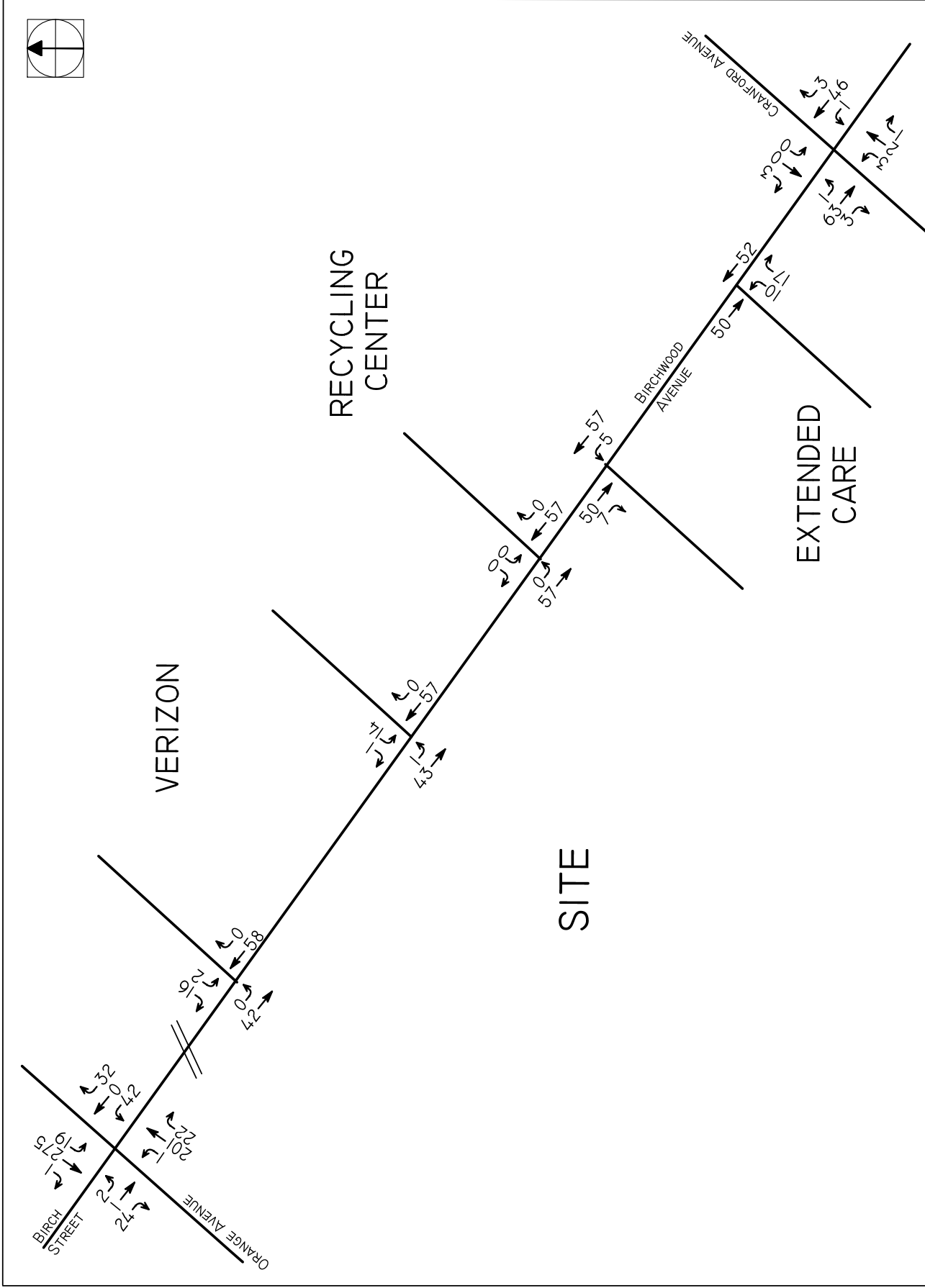


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



FIGURE 7

NO-BUILD TRAFFIC VOLUMES
MORNING PEAK HOUR
(7:45 AM TO 8:45 AM)

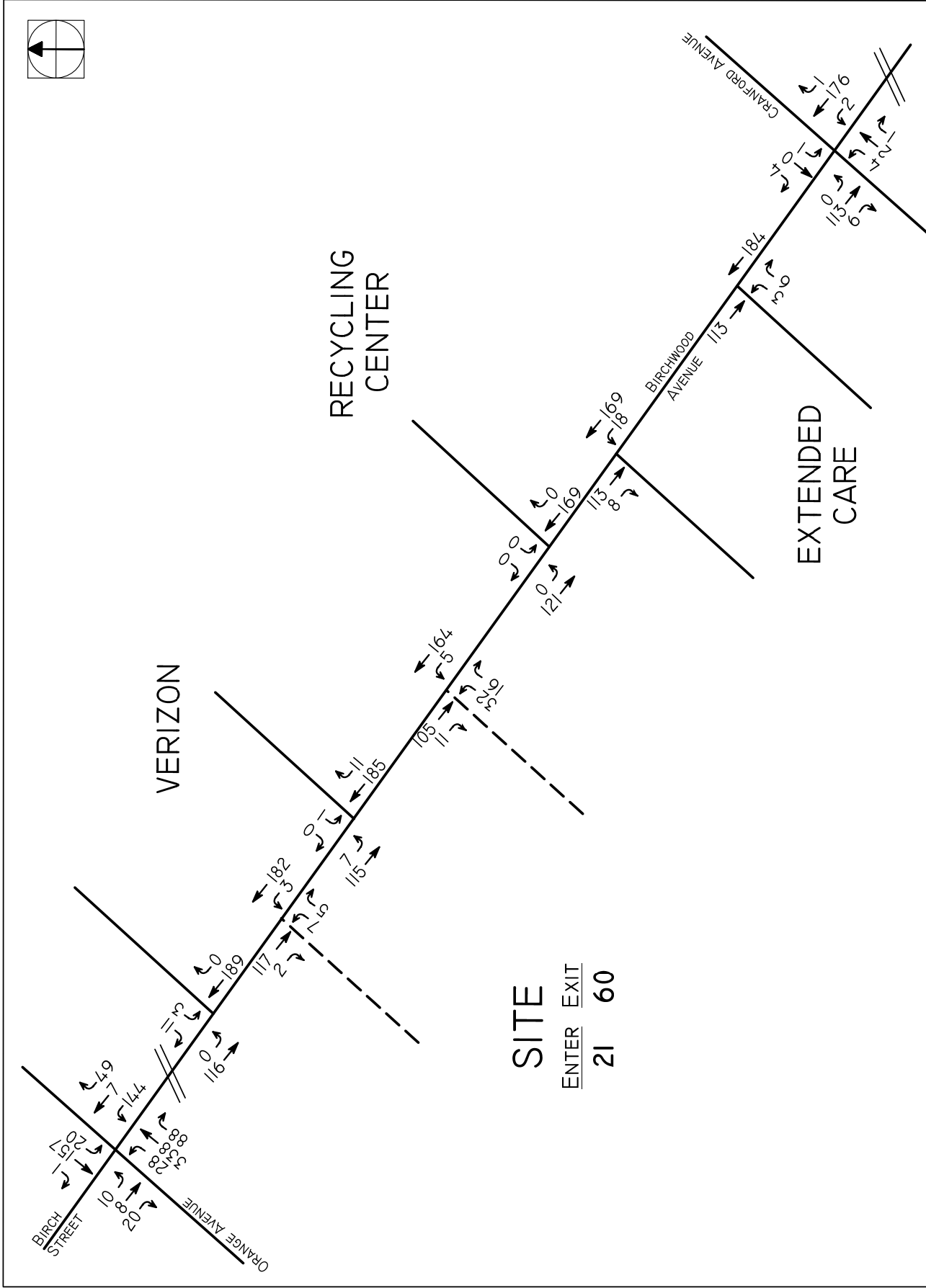


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



FIGURE 8

NO-BUILD TRAFFIC VOLUMES
EVENING PEAK HOUR
(4:30 PM TO 5:30 PM)

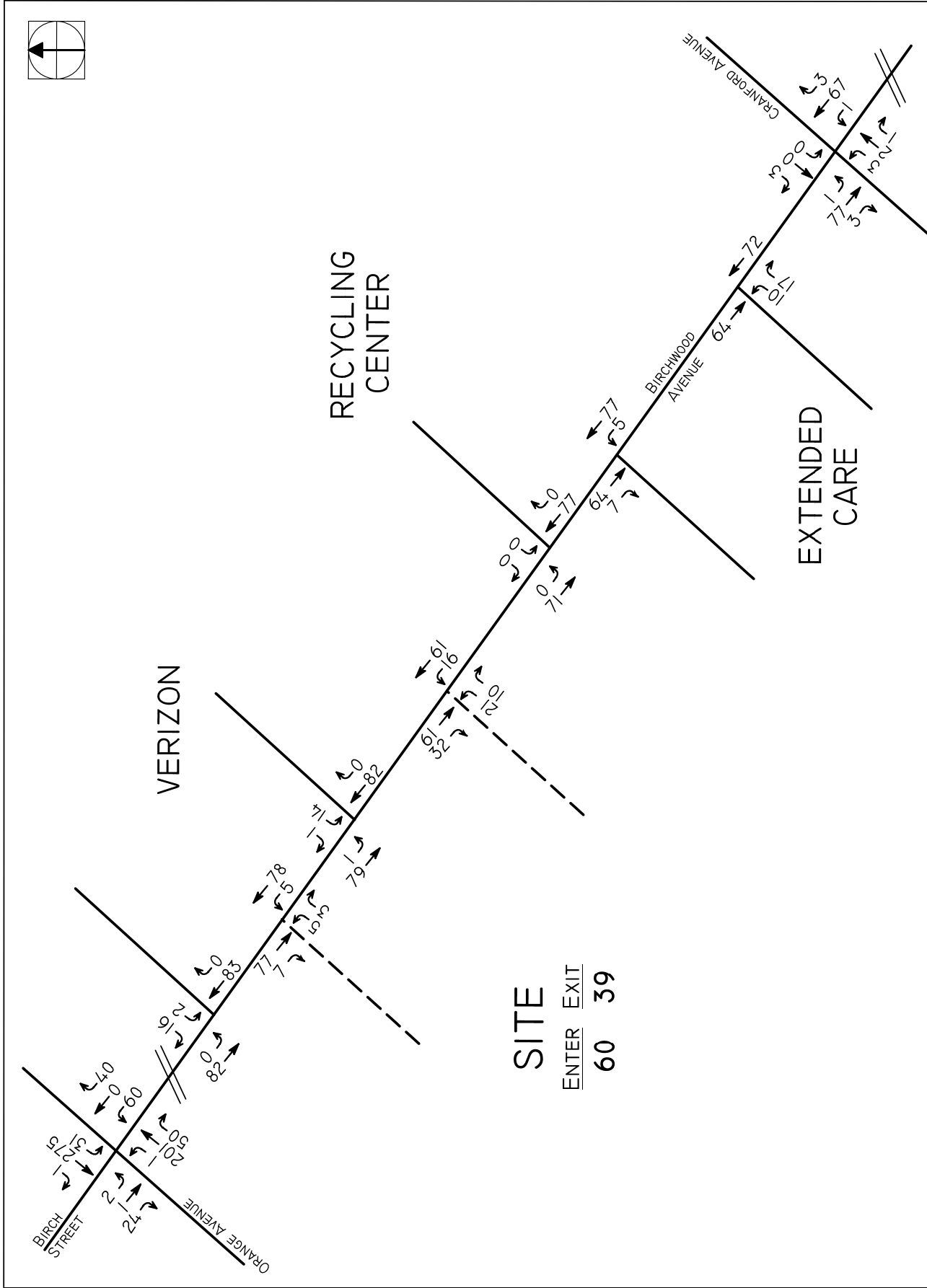


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



FIGURE 9

BUILD TRAFFIC VOLUMES
MORNING PEAK HOUR
(7:45 AM TO 8:45 AM)

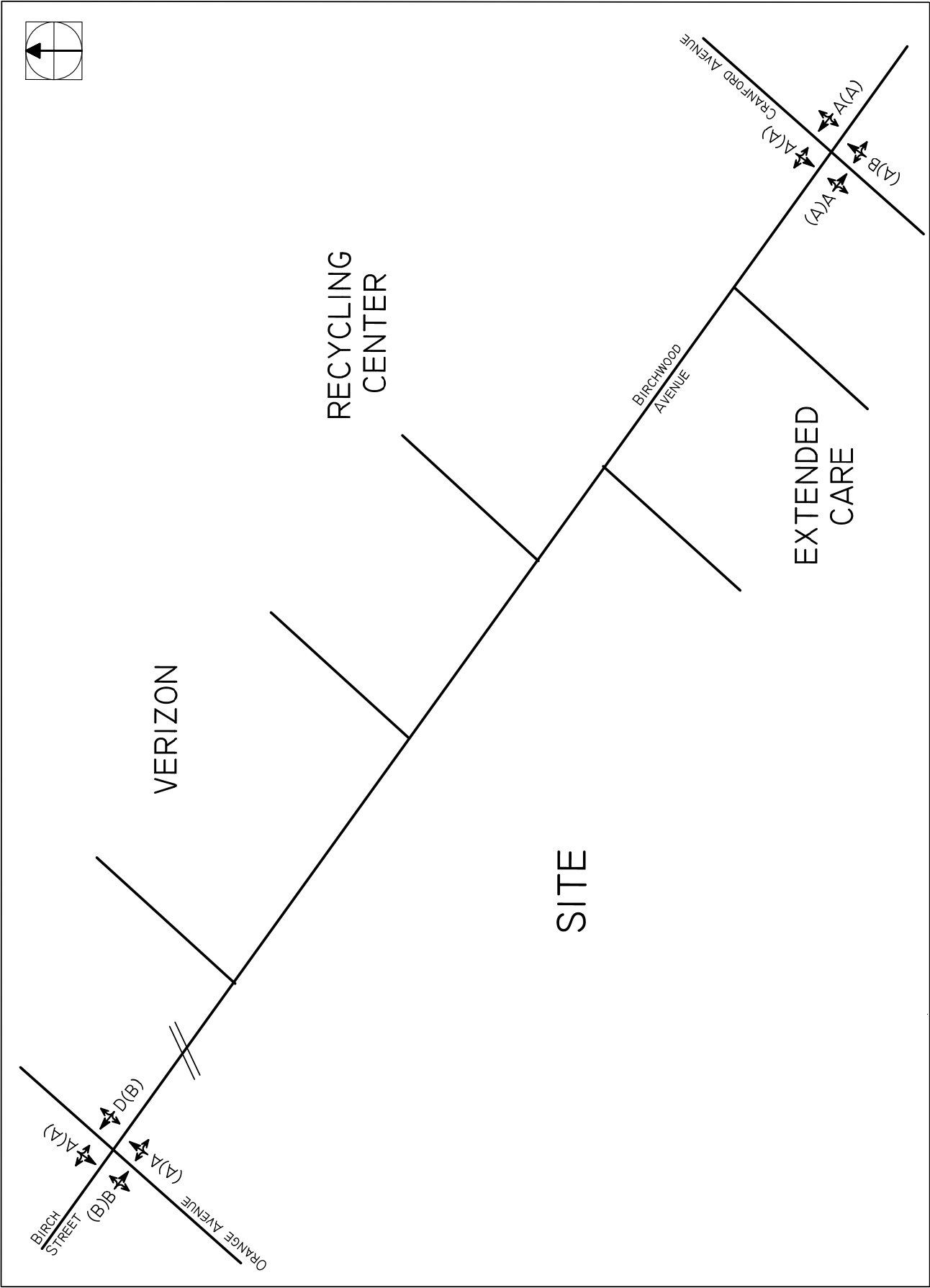


PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY



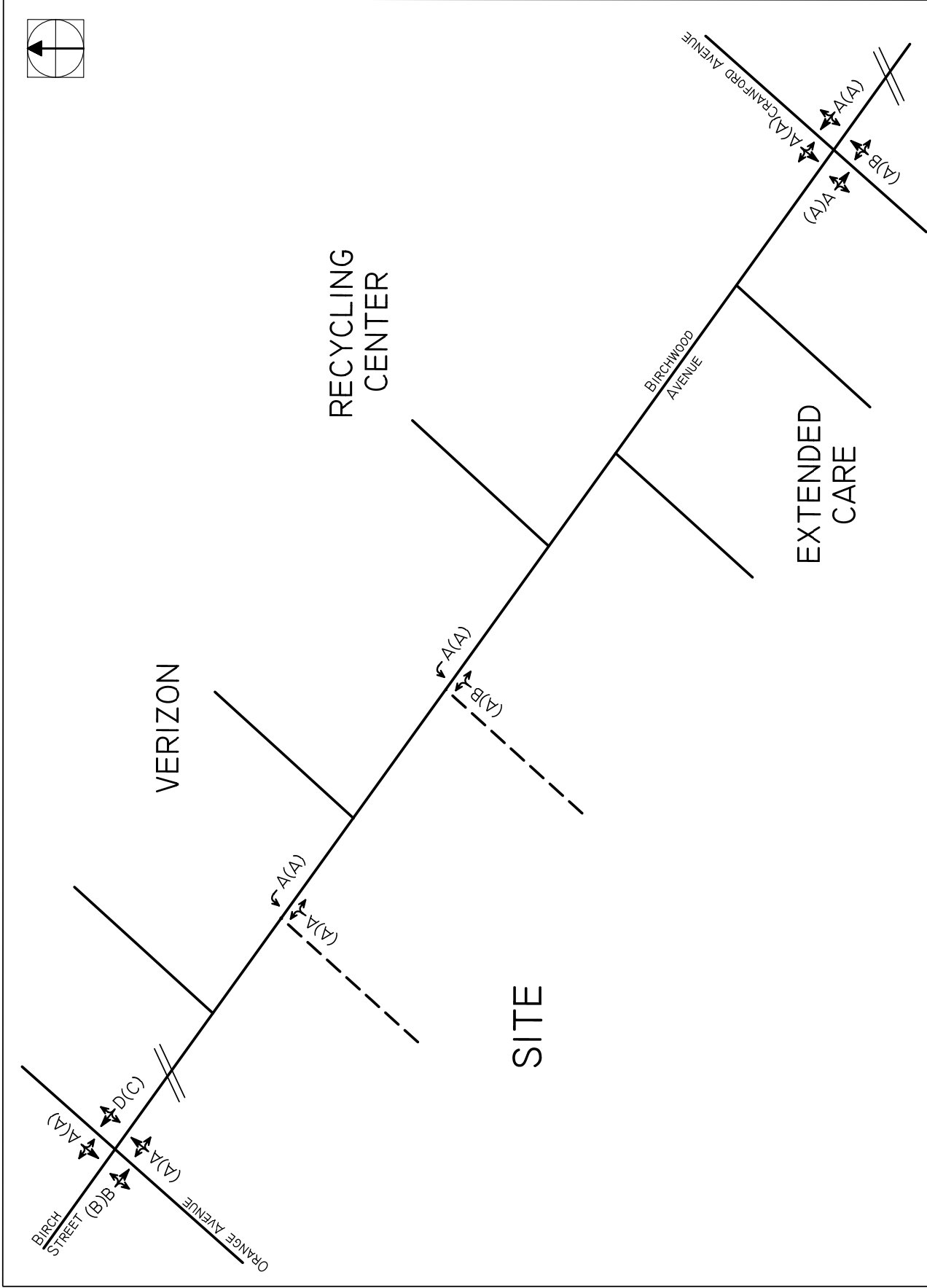
FIGURE 10

BUILD TRAFFIC VOLUMES
EVENING PEAK HOUR
(4:30 PM TO 5:30 PM)



PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY

FIGURE II



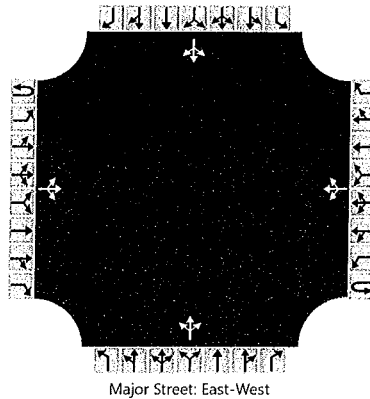
PROPOSED RESIDENTIAL DEVELOPMENT
TOWNSHIP OF CRANFORD
UNION COUNTY, NEW JERSEY

FIGURE I2

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	EC	Intersection	Orange/Birchwood/Birch
Agency/Co.	DD	Jurisdiction	
Date Performed	1/9/2018	East/West Street	Orange Avenue
Analysis Year	2018	North/South Street	Birch/Birchwood Avenue
Time Analyzed	Am Existing	Peak Hour Factor	0.87
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		27	331	66		13	154	1		115	7	36		10	7	20
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

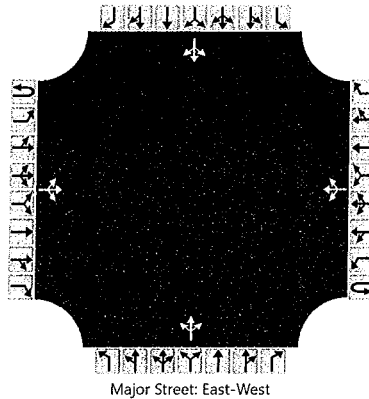
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		31				15					181				42	
Capacity, c (veh/h)		1390				1098					365				486	
v/c Ratio		0.02				0.01					0.50				0.09	
95% Queue Length, Q ₉₅ (veh)		0.1				0.0					2.6				0.3	
Control Delay (s/veh)		7.6				8.3					24.1				13.1	
Level of Service, LOS		A				A					C				B	
Approach Delay (s/veh)	0.7				0.8				24.1				13.1			
Approach LOS									C				B			

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	EC	Intersection	Orange/Birchwood/Birch
Agency/Co.	DD	Jurisdiction	
Date Performed	1/9/2018	East/West Street	Orange Avenue
Analysis Year	2018	North/South Street	Birch/Birchwood Avenue
Time Analyzed	Pm Existing	Peak Hour Factor	0.87
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		1	197	18		16	270	1		38	0	28		0	0	2
Percent Heavy Vehicles (%)		1				1				1	1	1		1	1	1
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

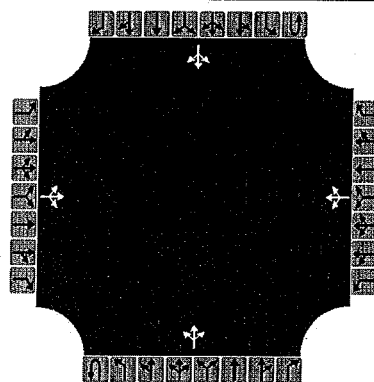
Flow Rate, v (veh/h)		1				18					76				2	
Capacity, c (veh/h)		1255				1324					523				732	
v/c Ratio		0.00				0.01					0.15				0.00	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.5				0.0	
Control Delay (s/veh)		7.9				7.8					13.1				9.9	
Level of Service, LOS		A				A					B				A	
Approach Delay (s/veh)	0.0				0.5				13.1				9.9			
Approach LOS									B				A			

HCS 2010 Two-Way Stop-Control Report

General Information

Analyst	EC	Intersection	Birchwood & Cranford
Agency/Co.	DD	Jurisdiction	
Date Performed	1/10/2018	East/West Street	Cranford Avenue
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Am Existing	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		4	2	1		1	0	4		2	165	1		0	90	6
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

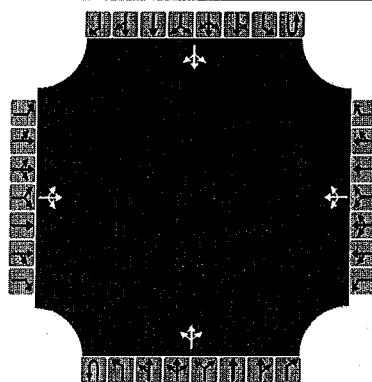
Flow Rate, v (veh/h)			8				6				2				0	
Capacity, c (veh/h)			659				806				1472				1375	
v/c Ratio			0.01				0.01				0.00				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.0				0.0				0.0	
Control Delay (s/veh)			10.5				9.5				7.4				7.6	
Level of Service, LOS			B				A				A				A	
Approach Delay (s/veh)	10.5				9.5				0.1				0.0			
Approach LOS	B				A											

HCS 2010 Two-Way Stop-Control Report

General Information

Analyst	EC	Intersection	Birchwood & Cranford
Agency/Co.	DD	Jurisdiction	
Date Performed	1/10/2018	East/West Street	Cranford Avenue
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Pm Existing	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		3	2	1		0	0	3		1	44	3		1	63	3
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6				3				1				1	
Capacity, c (veh/h)			831				1018				1530				1557	
v/c Ratio			0.01				0.00				0.00				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.0				0.0				0.0	
Control Delay (s/veh)			9.4				8.5				7.4				7.3	
Level of Service, LOS			A				A				A				A	
Approach Delay (s/veh)	9.4				8.5				0.1				0.1			
Approach LOS	A				A											

HCS 2010 Two-Way Stop-Control Report

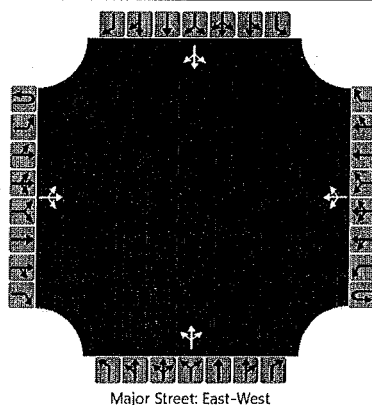
General Information

Analyst	EC
Agency/Co.	DD
Date Performed	1/9/2018
Analysis Year	2018
Time Analyzed	Am NoBuild
Intersection Orientation	East-West
Project Description	

Site Information

Intersection	Orange/Birch/Birchwood
Jurisdiction	
East/West Street	Orange Avenue
North/South Street	Birch/Birchwood Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		28	338	79		16	157	1		117	7	37		10	8	20
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

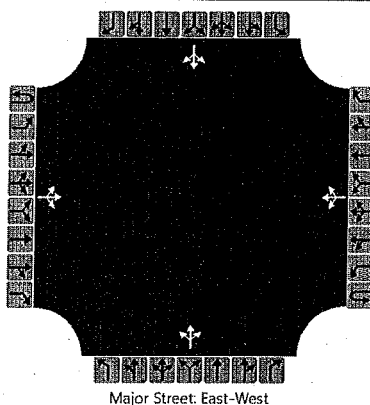
Flow Rate, v (veh/h)		32				18					185				43	
Capacity, c (veh/h)		1387				1076					350				463	
v/c Ratio		0.02				0.02					0.53				0.09	
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					2.9				0.3	
Control Delay (s/veh)		7.7				8.4					26.3				13.6	
Level of Service, LOS		A				A					D				B	
Approach Delay (s/veh)	0.7				0.9				26.3				13.6			
Approach LOS									D				B			

HCS 2010 Two-Way Stop-Control Report

General Information

Analyst	EC	Intersection	Orange/Birchwood/Birch
Agency/Co.	DD	Jurisdiction	
Date Performed	1/9/2018	East/West Street	Orange Avenue
Analysis Year	2018	North/South Street	Birch/Birchwood Avenue
Time Analyzed	Pm NoBuild	Peak Hour Factor	0.87
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		1	201	22		19	275	1		42	0	32		2	1	24
Percent Heavy Vehicles (%)		1				1				1	1	1		1	1	1
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

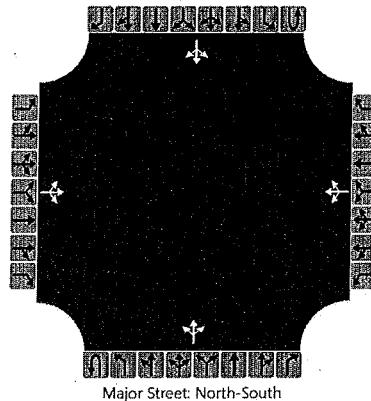
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		1				22					85				31	
Capacity, c (veh/h)		1248				1314					491				668	
v/c Ratio		0.00				0.02					0.17				0.05	
95% Queue Length, Q ₉₅ (veh)		0.0				0.1					0.6				0.1	
Control Delay (s/veh)		7.9				7.8					13.9				10.6	
Level of Service, LOS		A				A					B				B	
Approach Delay (s/veh)	0.0				0.7				13.9				10.6			
Approach LOS									B				B			

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	EC	Intersection	Birchwood & Cranford
Agency/Co.	DD	Jurisdiction	
Date Performed	1/10/2018	East/West Street	Cranford Avenue
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Am NoBuild	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		4	2	1		1	0	4		2	168	1		0	92	6
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			8			6			2				0			
Capacity, c (veh/h)			653			801			1468				1372			
v/c Ratio			0.01			0.01			0.00				0.00			
95% Queue Length, Q ₉₅ (veh)			0.0			0.0			0.0				0.0			
Control Delay (s/veh)			10.6			9.5			7.5				7.6			
Level of Service, LOS			B			A			A				A			
Approach Delay (s/veh)	10.6				9.5				0.1				0.0			
Approach LOS	B				A											

HCS 2010 Two-Way Stop-Control Report

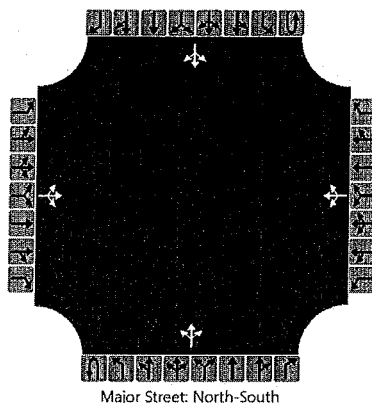
General Information

Analyst	EC
Agency/Co	DD
Date Performed	1/10/2018
Analysis Year	2018
Time Analyzed	Pm NoBuild
Intersection Orientation	North-South
Project Description	

Site Information

Intersection	Birchwood & Cranford
Jurisdiction	
East/West Street	Cranford Avenue
North/South Street	Birchwood Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		3	2	1		0	0	3		1	45	3		1	64	3
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6				3				1				1	
Capacity, c (veh/h)			829				1016				1528				1556	
v/c Ratio			0.01				0.00				0.00				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.0				0.0				0.0	
Control Delay (s/veh)			9.4				8.6				7.4				7.3	
Level of Service, LOS			A				A				A				A	
Approach Delay (s/veh)	9.4				8.6				0.1				0.1			
Approach LOS	A				A											

HCS 2010 Two-Way Stop-Control Report

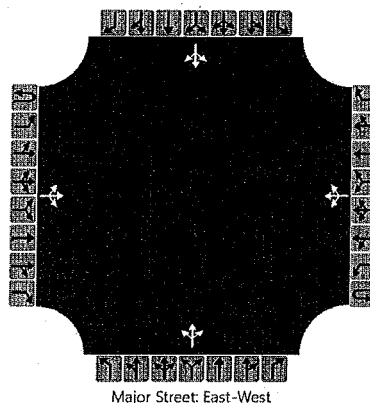
General Information

Analyst	EC
Agency/Co.	DD
Date Performed	1/9/2018
Analysis Year	2018
Time Analyzed	Am Build
Intersection Orientation	East-West
Project Description	

Site Information

Intersection	Orange/Birch/Birchwood
Jurisdiction	
East/West Street	Orange Avenue
North/South Street	Birch/Birchwood Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		28	338	88		20	157	1		144	7	49		10	8	20
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		32				23					230				43	
Capacity, c (veh/h)		1387				1067					343				447	
v/c Ratio		0.02				0.02					0.67				0.10	
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					4.6				0.3	
Control Delay (s/veh)		7.7				8.4					34.4				13.9	
Level of Service, LOS		A				A					D				B	
Approach Delay (s/veh)	0.7				1.1				34.4				13.9			
Approach LOS									D				B			

HCS 2010 Two-Way Stop-Control Report

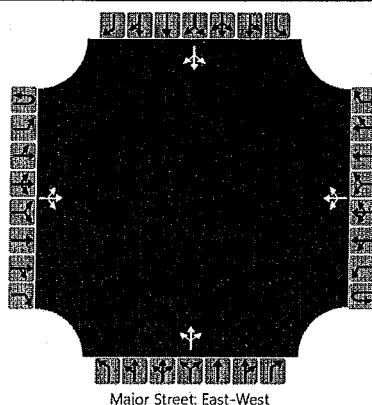
General Information

Analyst	EC
Agency/Co	DD
Date Performed	1/9/2018
Analysis Year	2018
Time Analyzed	Pm Build
Intersection Orientation	East-West
Project Description	

Site Information

Intersection	Orange/Birchwood/Birch
Jurisdiction	
East/West Street	Orange Avenue
North/South Street	Birch/Birchwood Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		1	201	50		31	275	1		60	0	40		2	1	24
Percent Heavy Vehicles (%)		1				1				1	1	1		1	1	1
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

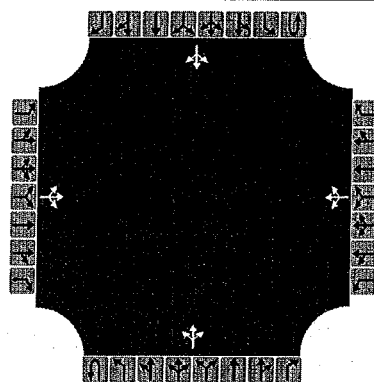
Flow Rate, v (veh/h)		1				36					115				31	
Capacity, c (veh/h)		1248				1279					450				657	
v/c Ratio		0.00				0.03					0.26				0.05	
95% Queue Length, Q ₉₅ (veh)		0.0				0.1					1.0				0.1	
Control Delay (s/veh)		7.9				7.9					15.7				10.8	
Level of Service, LOS		A				A					C				B	
Approach Delay (s/veh)	0.0				1.0				15.7				10.8			
Approach LOS									C				B			

HCS 2010 Two-Way Stop-Control Report

General Information

Analyst	EC	Intersection	Birchwood & Cranford
Agency/Co.	DD	Jurisdiction	
Date Performed	1/10/2018	East/West Street	Cranford Avenue
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Am Build	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		4	2	1		1	0	4		2	176	1		0	113	6
Percent Heavy Vehicles (%)		3	3	3		3	3	3		3				3		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

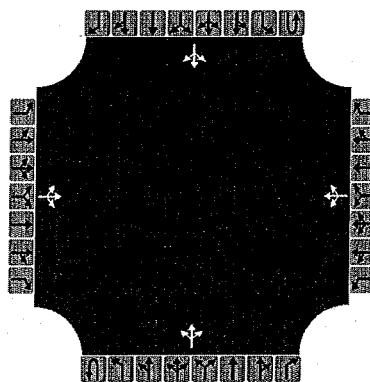
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			8				6				2				0	
Capacity, c (veh/h)			625				786				1439				1361	
v/c Ratio			0.01				0.01				0.00				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.0				0.0				0.0	
Control Delay (s/veh)			10.8				9.6				7.5				7.6	
Level of Service, LOS			B				A				A				A	
Approach Delay (s/veh)	10.8				9.6				0.1				0.0			
Approach LOS	B				A											

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	EC	Intersection	Birchwood & Cranford
Agency/Co.	DD	Jurisdiction	
Date Performed	1/10/2018	East/West Street	Cranford Avenue
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Pm Build	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		3	2	1		0	0	3		1	67	3		1	77	3
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

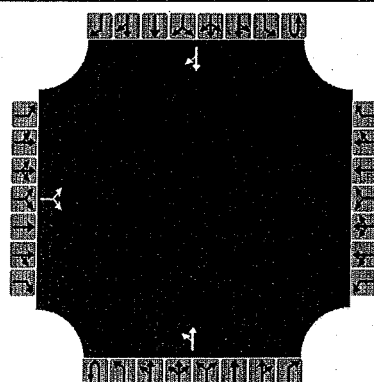
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			6				3				1				1	
Capacity, c (veh/h)			788				985				1509				1524	
v/c Ratio			0.01				0.00				0.00				0.00	
95% Queue Length, Q ₉₅ (veh)			0.0				0.0				0.0				0.0	
Control Delay (s/veh)			9.6				8.7				7.4				7.4	
Level of Service, LOS			A				A				A				A	
Approach Delay (s/veh)	9.6				8.7				0.1				0.1			
Approach LOS	A				A											

HCS 2010 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	EC	Intersection	Birchwood & North Site
Agency/Co.	DD	Jurisdiction	
Date Performed	1/16/2018	East/West Street	North Site Driveway
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Am Build	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		7		5						3	182				117	2
Percent Heavy Vehicles (%)		3		3						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			14							3						
Capacity, c (veh/h)			736							1440						
v/c Ratio			0.02							0.00						
95% Queue Length, Q ₉₅ (veh)			0.1							0.0						
Control Delay (s/veh)			10.0							7.5						
Level of Service, LOS			A							A						
Approach Delay (s/veh)	10.0								0.1							
Approach LOS	A															

HCS 2010 Two-Way Stop-Control Report

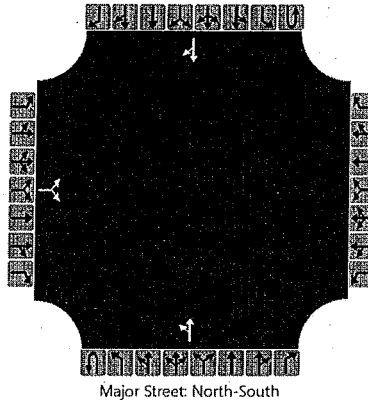
General Information

Analyst	EC
Agency/Co.	DD
Date Performed	1/16/2018
Analysis Year	2018
Time Analyzed	Pm Build
Intersection Orientation	North-South
Project Description	

Site Information

Intersection	Birchwood & North Site
Jurisdiction	
East/West Street	North Site Driveway
North/South Street	Birchwood Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		5		3						5	78				77	7
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			9							6						
Capacity, c (veh/h)			843							1502						
v/c Ratio			0.01							0.00						
95% Queue Length, Q ₉₅ (veh)			0.0							0.0						
Control Delay (s/veh)			9.3							7.4						
Level of Service, LOS			A							A						
Approach Delay (s/veh)	9.3								0.5							
Approach LOS	A															

HCS 2010 Two-Way Stop-Control Report

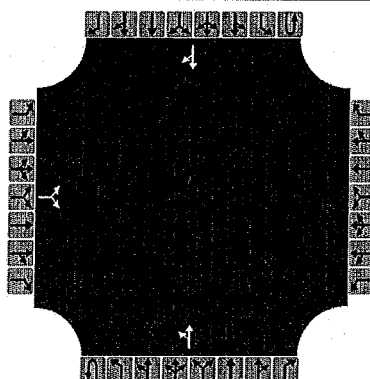
General Information

Analyst	EC
Agency/Co.	DD
Date Performed	1/16/2018
Analysis Year	2018
Time Analyzed	Am Build
Intersection Orientation	North-South
Project Description	

Site Information

Intersection	Birchwood & South Site
Jurisdiction	
East/West Street	South Site Driveway
North/South Street	Birchwood Avenue
Peak Hour Factor	0.87
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		32		16						5	164				105	11
Percent Heavy Vehicles (%)		3		3						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

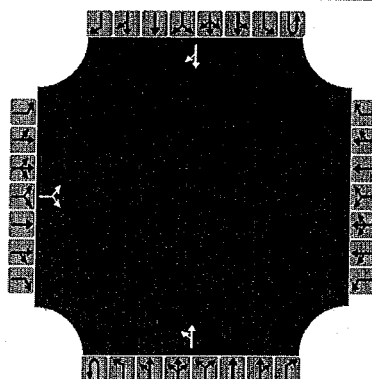
Flow Rate, v (veh/h)			55							6						
Capacity, c (veh/h)			728							1443						
v/c Ratio			0.08							0.00						
95% Queue Length, Q ₉₅ (veh)			0.2							0.0						
Control Delay (s/veh)			10.3							7.5						
Level of Service, LOS			B							A						
Approach Delay (s/veh)	10.3								0.3							
Approach LOS	B															

HCS 2010 Two-Way Stop-Control Report

General Information

Analyst	EC	Intersection	Birchwood & South Site
Agency/Co	DD	Jurisdiction	
Date Performed	1/16/2018	East/West Street	South Site Driveway
Analysis Year	2018	North/South Street	Birchwood Avenue
Time Analyzed	Pm Build	Peak Hour Factor	0.87
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description			

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		21		10						16	61				79	1
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			35							18						
Capacity, c (veh/h)			833							1509						
v/c Ratio			0.04							0.01						
95% Queue Length, Q ₉₅ (veh)			0.1							0.0						
Control Delay (s/veh)			9.5							7.4						
Level of Service, LOS			A							A						
Approach Delay (s/veh)	9.5								1.6							
Approach LOS	A															