

Appendix D

Traffic Data

Attachment 1

Photo Figures



The Falcon

Dock Road

U.S. Route 9W

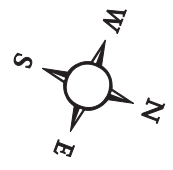


Figure D-1: U.S. Route 9W at Dock Road
Dockside at Marlborough
Town of Marlborough, Ulster County, NY
Source: Tim Miller Associates, Inc., 2011



Figure D-2: Western Avenue at U.S. Route 9W
Dockside at Marlborough
Town of Marlborough, Ulster County, NY
Source: Tim Miller Associates, Inc., 2011



King Street

U.S. Route 9W

Sunoco
Gas Station

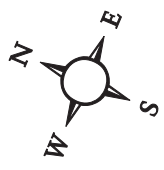
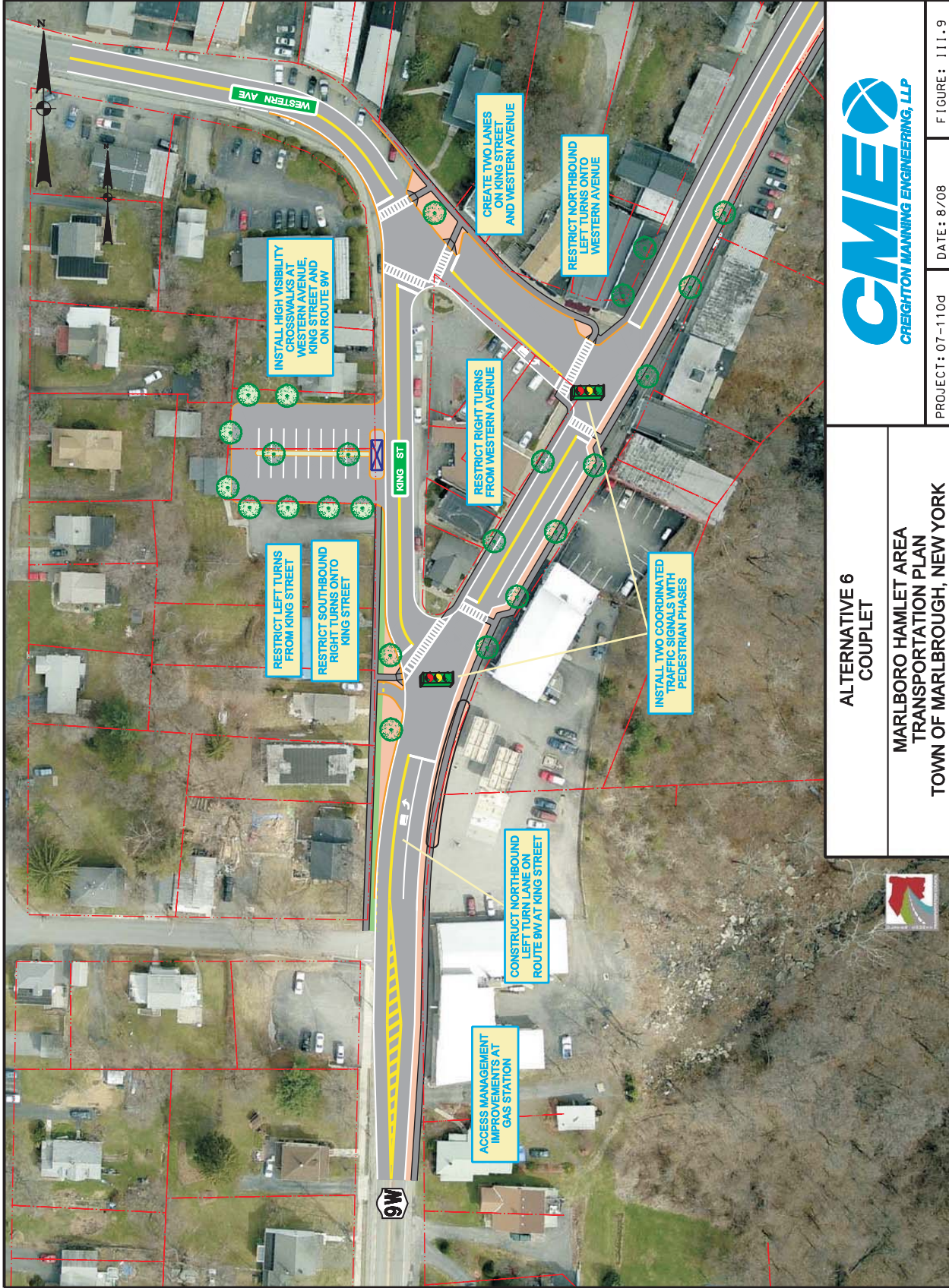


Figure D-3: King Street at U.S. Route 9W
Dockside at Marlborough
Town of Marlborough, Ulster County, NY
Source: Tim Miller Associates, Inc., 2011



Figure D-4: Young Avenue at U.S. Route 9W
Dockside at Marlborough
Town of Marlborough, Ulster County, NY
Source: Tim Miller Associates Inc. 2011



**ALTERNATIVE 6
COUPLET**

**MARLBORO HAMLET AREA
TRANSPORTATION PLAN
TOWN OF MARLBROUGH, NEW YORK**



PROJECT: 07-110G DATE: 8/08 FIGURE: III.9

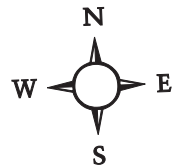


Figure D-6: U.S. Route 9W Alternative 6
Dockside at Marlborough
Town of Marlborough, Ulster County, NY

Source: Creighton Manning, LLP, "Marlboro Hamlet Area Transportation Plan Final Report", December 2008



Figure D-7: Intersection Box NYS Route 9D
Dockside at Marlborough
Town of Marlborough, Ulster County, NY
Source: Tim Miller Associates, Inc., 2011

Attachment 2

Bayside Trip Tables

Table D-1 Bayside Trip Rate Summary				
Land Uses {ITE Code}	Trip Rates			
	A.M. Weekday Peak Hour		P.M. Weekday Peak Hour	
	IN (Trips/ Units*)	OUT (Trips/ Units*)	IN (Trips/ Units*)	OUT (Trips/ Units*)
Low rise apartments 10 Dwelling units {221}	0.175	0.657	0.579	0.312
Townhouses 91 dwelling units {230}	0.089	0.437	0.410	0.202
Retail shopping center 12,600 square feet {820}	2.197	1.407	6.175	6.427
Institute of Transportation Engineers, <u>Trip Generation</u> , 8th edition, Washington, D.C., 2008.				
* Units are dwelling units for residential uses or 1000 square feet for retail use.				

Table D-2 Bayside Trips						
Land Uses (ITE Code)	Trips					
	A.M. Weekday Peak Hour			P.M. Weekday Peak Hour		
	IN (Trips)	OUT (Trips)	Total Trips	IN (Trips)	OUT (Trips)	Total Trips
Low rise apartments 10 Dwelling units {221}	2	7	9	6	3	9
Townhouses 91 dwelling units {230}	8	40	28	37	18	55
Retail shopping center 12,600 square feet {820}	28	18	46	78	81	159
Total Trips	38	65	83	121	102	223
Retail Pass-by trips (34%) ¹	(8)	(8)	(16)	(27)	(27)	(54)
New Trips	30	57	67	94	75	169
¹ Average rate for shopping centers although smaller centers tend to have even pass-by higher rates. Source: Institute of Transportation Engineers, <u>Trip Generation Handbook</u> , 2nd edition, Washington, DC., 2004.						
See trip rate Table D-1.						

Traffic assignment to Young Avenue five percent in the a.m. peak hour and one percent in the p.m. peak hour.

Attachment 3

Traffic Performance Measures

Traffic: Performance Measures

Introduction

The Highway Capacity Manual¹ and the *Highway Capacity Software*² procedures document the methodology used for modeling levels of service, average vehicle delay, and volume-to-capacity ratios at both signalized and unsignalized intersections. Level of service is a measure of the operational quality of an intersection; level of service A is the highest, most efficient level, and level of service F is the lowest level. The operational quality of an intersection for the automobile mode is based on the average amount of time a vehicle is delayed. Levels of service are examined by 'lane group', the set of lanes allowing common movement(s) on an approach. Approaches to intersections are assigned primary directions for clarity as depicted on the traffic volume figures.

The *Highway Capacity Software* modeled results are applied to peak hour periods only. During off peak periods, which is the majority of the time, drivers typically will find operations better than the modeled peak hour results. During peak periods the experience of individual drivers can vary, because the model calculates average delay.

Level of Service Criteria Signalized Intersections

When analyzing activity at signalized intersections, an understanding of the definition of level of service for the Automobile mode is essential:

Automobile Mode

Level of service can be characterized for the entire intersection, each intersection approach, and each lane group. Control delay alone is used to characterize level of service for the entire intersection or an approach. Control delay and volume-to-capacity ratio are used to characterize level of service for a lane group. Delay quantifies the increase in travel time due to traffic signal control. It is also a surrogate measure to driver discomfort and fuel consumption. The volume-to-capacity ratio quantifies the degree to which a phase's capacity is utilized by a lane group. The following paragraphs describe each level of service.

Level of service A describes operations with a control delay of 10 seconds per vehicle or less and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is exceptionally favorable or the cycle length is very short. If it is due to favorable progression, most vehicles arrive during the green indication and travel through the intersection without stopping.

Level of service B describes operations with control delay between 10 and 20 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is low and either progression is highly favorable or the cycle length is short. More vehicles stop than with Level of service A.

Level of service C describes operations with control delay between 20 and 35 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when progression is favorable or the cycle length is moderate. Individual cycle failures (i.e., one or more queued vehicles are not able to depart as a result of depart as a result of insufficient capacity during the cycle) may begin to appear at this level. The number of

¹ Transportation Research Board of the National Academies, Highway Capacity Manual, Washington D.C. , 2010.

² Highway Capacity Software, Computer software, Version 5.6, Mctrans, Gainesville, Florida, 2011.

vehicles stopping is significant, although many vehicles still pass through the intersection without stopping.

Level of service D describes operations with control delay between 35 and 55 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is higher and either progression is ineffective or the cycle length is long. Many vehicles stop and individual cycle failures are noticeable.

Level of service E describes operations with control delay between 55 and 80 seconds per vehicle and a volume-to-capacity ratio no greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is high, progression is unfavorable, and the cycle length is long. Individual cycle failures are frequent.

Level of service F describes operations with control delay exceeding 80 seconds per vehicle or a volume-to-capacity ratio greater than 1.0. This level is typically assigned when the volume-to-capacity ratio is very high, progression is very poor, and the cycle length is long. Most cycles fail to clear the queue.

A lane group can incur a delay less than 80 seconds per vehicle when the volume-to-capacity ratio exceeds 1.0. This condition typically occurs when the cycle length is short, the signal progression is favorable, or both. As a result, both the delay and volume-to-capacity ratio are considered when lane group level of service is established. A ratio of 1.0 or more indicates that cycle capacity is fully utilized and represents failure from a capacity perspective (just as delay in excess of 80 seconds per vehicle represents failure from a delay perspective).

Exhibit 18-4 lists the level of service thresholds established for the automobile mode at a signalized intersection.³

Signalized Intersections Level of Service Criteria Automobile Mode For Lane Groups		
Average Control Delay (Seconds Per Vehicle)	Volume-to-capacity Ratio less than or equal to one Level of Service	Volume-to-capacity Ratio greater than one Level of Service
less than or equal to 10	A	F
greater than 10 and less than or equal to 20	B	F
greater than 20 and less than or equal to 35	C	F
greater than 35 and less than or equal to 55	D	F
greater than 55 and less than or equal to 80	E	F
greater than 80	F	F

¹ From Transportation Research Board of the National Academies, *Highway Capacity Manual*, Washington D.C. , Volume 3 page 18-6, Exhibit 18-4, 2010. Abbreviations and mathematical symbols have been replaced for reader clarity. Table limited to lane groups (lane or group of lanes sharing a common movement)

The New York State Department of Transportation (NYS DOT) generally seeks in urban areas for a level of service D or better (delay of 55 seconds or less for a signalized intersection) for all lane groups however:

³ From Transportation Research Board of the National Academies, *Highway Capacity Manual*, Washington D.C. , Volume 3 page 18-6, 2010. Abbreviations and mathematical symbols have been replaced for reader clarity.

In some cases, it may be necessary to accept level of service E or F on individual lane groups due to unreasonable costs or impacts associated with improving the level of service.⁴

The methodology for evaluating bicycle and pedestrian modes at signalized intersections considers a wide variety of factors. Some factors are performance measures and others descriptors of intersection character.

The methodology for evaluating each mode provides a procedure for mathematically combining these factors into a score. This score is then used to determine the level of service that is provided.⁵

The association between score value and level of service is based on traveler perception research.⁶

Signalized Intersections Level of Service Criteria Pedestrian and Bicycle Modes	
Level of Service Score	Level of Service
less than or equal to 2.00	A
greater than 2 and less than or equal to 2.75	B
greater than 2.75 and less than or equal to 3.50	C
greater than 3.50 and less than or equal to 4.25	D
greater than 4.25 and less than or equal to 5.00	E
greater than 5.00	F

Source: Transportation Research Board of the National Academies, Highway Capacity Manual, Washington D.C. , Volume 3 page 18-7, Exhibit 18-5, 2010. Abbreviations and mathematical symbols have been replaced for reader clarity.

Level of Service Criteria for Two Way Stop Controlled intersections

The Highway Capacity Manual⁷ describes the level of service criteria as:

Level of service for two way stop controlled intersections is determined by the computed or measure control delay. For motor vehicles, level of service is determined for each minor-street movement (or shared movement) as well as major-street left turns by using criteria given in Exhibit 19-1 . Level of service is not defined for the intersection as a whole or for the major street-street approaches for three primary reasons: (a) major-street through vehicles are assumed to experience zero delay; (b) the disproportionate number of major-street through vehicles at a typical two way stopped controlled intersection skews the weighted average of all movements, resulting in a very low overall average delay for all vehicles; and (c) the

⁴ From NYS DOT, Highway Design Manual, Revision 62, April 13, 2011, (page 5-103) with abbreviations replaced for reader clarity.

⁵ From Transportation Research Board of the National Academies, Highway Capacity Manual, Washington D.C. , Volume 3 page 18-7, 2010. Abbreviations have been replaced for reader clarity.

⁶ Ibid.

⁷ From Transportation Research Board of the National Academies, Highway Capacity Manual, Washington D.C. , Volume 3 page 19-1 and 19-2, 2010. Abbreviations and mathematical symbols have been replaced for reader clarity.

resulting low delay can mask important level of service deficiencies for minor movements. As Exhibit 19-1 notes, level of service is assigned to the movements if the volume-to-capacity ratio for the movement exceeds 1.0, regardless of the control delay.

The level of service criteria for two-way stop-controlled intersections are somewhat different from the criteria used in Chapter 18 for signalized intersections, primarily because user perceptions differ among transportation facility types. The expectation is that a signalized intersection is designed to carry higher traffic volumes and will present greater delay than unsignalized intersection. Unsignalized intersections are also associated with more uncertainty for users, as delays are less predictable than they are at signals, which can reduce user's delay tolerance.

The Highway Capacity Manual⁸ includes the following concerning level of service F at two-way stop-controlled intersection lane groups:

Level of service F occurs when there are not enough gaps of suitable size to allow minor street vehicles to enter or cross through traffic on the major-street, resulting in long average control delays (greater than 50 seconds per vehicle). Depending on the demand on the approach, long queues on the minor approaches may result...

Level of service F may also appear in the form of drivers on the minor street selecting smaller-than-usual gaps...

Even with a level of service F estimate, most low-volume minor-street approaches would not meet any of the Manual on Uniform Traffic Control Devices volume or delay warrants for signalization...

In some cases, the delay equations predict delays greater than 50 seconds for minor -street movements under very low volumes conditions on the minor street (fewer than 25 vehicles per hour). On the basis of the first term of the delay equation, the level of service F threshold is reached with a movement capacity of approximately 85 vehicles per hour or less, regardless of the minor-street movement volume.

⁸ From Transportation Research Board of the National Academies, *Highway Capacity Manual*, Washington D.C. , Volume 3 page 19-40, 2010. Abbreviations and mathematical symbols have been replaced for reader clarity.

Two Way Stop Delay (Unsignalized) Intersections Level of Service Criteria Automobile Mode For Lane Groups		
Average Control Delay (Seconds Per Vehicle)	Volume-to-capacity Ratio less than or equal to one Level of Service	Volume-to-capacity Ratio greater than one Level of Service
less than or equal to 10	A	F
greater than 10 and less than or equal to 15	B	F
greater than 15 and less than or equal to 25	C	F
greater than 25 and less than or equal to 35	D	F
greater than 35 and less than or equal to 50	E	F
greater than 50	F	F

Modified from Transportation Research Board of the National Academies, Highway Capacity Manual, Washington D.C. , Volume 3 page 19-2, Exhibit 19-1, 2010. Abbreviations and mathematical symbols have been replaced for reader clarity.

Level of service is not calculated for major street approaches or for the intersection as a whole. Major Street through vehicles are assumed to experience no delay.

Attachment 4
Level of Service Calculations

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JAG			Intersection	Dock and Rt 9W		
Agency/Co.	TMA			Jurisdiction	Town of Marlborough		
Date Performed	6/3/2011			Analysis Year	Existing Condition		
Analysis Time Period	AM Peak Hour						
Project Description							
East/West Street: Dock Road				North/South Street: U.S. Route 9W			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)		766	5	6	768		
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00	
Hourly Flow Rate, HFR (veh/h)	0	806	5	6	808	0	
Percent Heavy Vehicles	0	--	--	5	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	0	
Configuration			TR	LT			
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)				1		2	
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95	
Hourly Flow Rate, HFR (veh/h)	0	0	0	1	0	2	
Percent Heavy Vehicles	0	0	0	5	0	5	
Percent Grade (%)		0			4		
Flared Approach		N			Y		
Storage		0			1		
RT Channelized			0			0	
Lanes	0	0	0	0	0	0	
Configuration					LR		
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration		LT		LR			
v (veh/h)		6		3			
C (m) (veh/h)		802		228			
v/c		0.01		0.01			
95% queue length		0.02		0.04			
Control Delay (s/veh)		9.5		28.0			
LOS		A		D			
Approach Delay (s/veh)	--	--	28.0				
Approach LOS	--	--	D				

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JAG			Intersection	US Rt 9W and Western		
Agency/Co.	TMA			Jurisdiction	Town of Marlborough		
Date Performed	6/3/2011			Analysis Year	Existing Condition		
Analysis Time Period	AM Peak Hour						
Project Description							
East/West Street: Western Avenue (CR 14)				North/South Street: U.S. Route 9W			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	62	771			615	154	
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95	
Hourly Flow Rate, HFR (veh/h)	65	811	0	0	647	162	
Percent Heavy Vehicles	5	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	0	
Configuration	LT						TR
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)							
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	0	0	
Configuration							
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT						
v (veh/h)	65						
C (m) (veh/h)	804						
v/c	0.08						
95% queue length	0.26						
Control Delay (s/veh)	9.9						
LOS	A						
Approach Delay (s/veh)	--	--					
Approach LOS	--	--					

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and King			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/3/2011			Analysis Year	Existing Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: King Street				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		700			615			
Peak-Hour Factor, PHF	1.00	0.95	1.00	1.00	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	736	0	0	647	0		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration		T			T			
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	133		102					
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	140	0	107	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration						L		R
v (veh/h)						140		107
C (m) (veh/h)						156		466
v/c						0.90		0.23
95% queue length						6.31		0.88
Control Delay (s/veh)						104.3		15.0
LOS						F		C
Approach Delay (s/veh)	--	--				65.6		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Young and Rt 9W			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/14/2011			Analysis Year	Existing Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: Young Avenue				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		705	115	79	712			
Peak-Hour Factor, PHF	1.00	0.90	0.90	0.90	0.90	1.00		
Hourly Flow Rate, HFR (veh/h)	0	783	127	87	791	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				40		40		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.90	1.00	0.90		
Hourly Flow Rate, HFR (veh/h)	0	0	0	44	0	44		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	1	0	1		
Configuration				L		R		
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		87	44		44			
C (m) (veh/h)		736	75		358			
v/c		0.12	0.59		0.12			
95% queue length		0.40	2.56		0.42			
Control Delay (s/veh)		10.5	106.0		16.5			
LOS		B	F		C			
Approach Delay (s/veh)	--	--	61.2					
Approach LOS	--	--	F					

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Dock and Rt 9W			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/3/2011			Analysis Year	Existing Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: Dock Road				North/South Street: U.S. Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		796	6	1	765			
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	837	6	1	805	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				5		8		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	5	0	8		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)		0			4			
Flared Approach		N			Y			
Storage		0			1			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		1		13				
C (m) (veh/h)		780		192				
v/c		0.00		0.07				
95% queue length		0.00		0.22				
Control Delay (s/veh)		9.6		32.0				
LOS		A		D				
Approach Delay (s/veh)	--	--	32.0					
Approach LOS	--	--	D					

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JAG			Intersection	US Rt 9W and Western		
Agency/Co.	TMA			Jurisdiction	Town of Marlborough		
Date Performed	6/3/2011			Analysis Year	Existing Condition		
Analysis Time Period	PM Peak Hour						
Project Description							
East/West Street: Western Avenue (CR 14)				North/South Street: U.S. Route 9W			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	104	827			593	175	
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95	
Hourly Flow Rate, HFR (veh/h)	109	870	0	0	624	184	
Percent Heavy Vehicles	5	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	0	
Configuration	LT						TR
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)							
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	0	0	
Configuration							
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT						
v (veh/h)	109						
C (m) (veh/h)	804						
v/c	0.14						
95% queue length	0.47						
Control Delay (s/veh)	10.2						
LOS	B						
Approach Delay (s/veh)	--	--					
Approach LOS	--	--					

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and King			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/3/2011			Analysis Year	Existing Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: King Street				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		828			595			
Peak-Hour Factor, PHF	1.00	0.95	1.00	1.00	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	871	0	0	626	0		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0					0
Lanes	0	1	0	0	1	0		
Configuration		T			T			
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	103		85					
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	108	0	89	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0					0
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration						L		R
v (veh/h)						108		89
C (m) (veh/h)						133		479
v/c						0.81		0.19
95% queue length						4.99		0.68
Control Delay (s/veh)						97.8		14.2
LOS						F		B
Approach Delay (s/veh)	--	--				60.1		
Approach LOS	--	--				F		

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Young and Rt 9W			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/14/2011			Analysis Year	Existing Condition			
Analysis Time Period	M Peak Hour							
Project Description								
East/West Street: Young Avenue				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		817	6	2	764			
Peak-Hour Factor, PHF	1.00	0.90	0.90	0.90	0.90	1.00		
Hourly Flow Rate, HFR (veh/h)	0	907	6	2	848	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				4		4		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.90	1.00	0.90		
Hourly Flow Rate, HFR (veh/h)	0	0	0	4	0	4		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	1	0	1		
Configuration				L		R		
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
v (veh/h)		2	4		4			
C (m) (veh/h)		734	91		328			
v/c		0.00	0.04		0.01			
95% queue length		0.01	0.14		0.04			
Control Delay (s/veh)		9.9	46.4		16.1			
LOS		A	E		C			
Approach Delay (s/veh)	--	--	31.2					
Approach LOS	--	--	D					

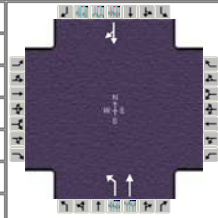
TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information						
Analyst	JAG	Intersection	Dock and Rt 9W					
Agency/Co.	TMA	Jurisdiction	Town of Marlborough					
Date Performed	6/13/2011	Analysis Year	No Build Condition					
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: Dock Road		North/South Street: U.S. Route 9W						
Intersection Orientation: North-South		Study Period (hrs): 0.25						
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		852	5	7	867			
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	896	5	7	912	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				1		2		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	1	0	2		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			4				
Flared Approach		N			Y			
Storage		0			1			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		7		3				
C (m) (veh/h)		742		165				
v/c		0.01		0.02				
95% queue length		0.03		0.06				
Control Delay (s/veh)		9.9		35.2				
LOS		A		E				
Approach Delay (s/veh)	--	--	35.2					
Approach LOS	--	--	E					

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JAG			Intersection	US Rt 9W and Western		
Agency/Co.	TMA			Jurisdiction	Town of Marlborough		
Date Performed	6/13/2011			Analysis Year	No Build Condition		
Analysis Time Period	AM Peak Hour						
Project Description							
East/West Street: Western Avenue (CR 14)				North/South Street: U.S. Route 9W			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	68	857			691	176	
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95	
Hourly Flow Rate, HFR (veh/h)	71	902	0	0	727	185	
Percent Heavy Vehicles	5	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	0	
Configuration	LT						TR
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)							
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	0	0	
Configuration							
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT						
v (veh/h)	71						
C (m) (veh/h)	735						
v/c	0.10						
95% queue length	0.32						
Control Delay (s/veh)	10.4						
LOS	B						
Approach Delay (s/veh)	--	--					
Approach LOS	--	--					

2010 HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 17, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	AM Peak Hour		PHF	0.90	
Intersection	US Rt 9W & Western	Analysis Year	No Build		Analysis Period	1 > 7:00	
File Name	11 western mnbam.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h							68	857			691	176

Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	Off	Green	5.0	55.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	Off	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

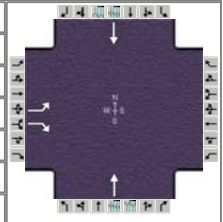
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7		3		5	2	1	6
Case Number	0.0		0.0		1.0	4.0	0.0	4.0
Phase Duration, s	0.0		0.0		10.0	70.0	0.0	60.0
Change Period, (Y+R _c), s	5.0		5.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	0.0		0.0		3.2	0.0	0.0	0.0
Queue Clearance Time (g _s), s					2.0			
Green Extension Time (g _e), s	0.0		0.0		0.1	0.0	0.0	0.0
Phase Call Probability					1.00			
Max Out Probability					0.00			

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	0			0			76	952	0	0	0	963
Adjusted Saturation Flow Rate (s), veh/h/ln	0			0			1723	1810	0	0	0	1651
Queue Service time (g _s), s	0.0			0.0			0.0	5.6	0.0	0.0	0.0	21.0
Cycle Queue Clearance Time (g _c), s	0.0			0.0			0.0	5.6	0.0	0.0	0.0	21.0
Capacity (c), veh/h							226	1680				1297
Volume-to-Capacity Ratio (X)	0.000			0.000			0.334	0.567	0.000	0.000	0.000	0.743
Available Capacity (c _a), veh/h							472	1680				1297
Back of Queue (Q), veh/ln							1.4					4.4
Overflow Queue (Q ₃), veh/ln							0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.0			0.0			0.3	0.0	0.0	0.0	0.0	0.5
Uniform Delay (d ₁), s/veh							30.2	0.4				3.9
Incremental Delay (d ₂), s/veh	0.0			0.0			0.2	1.0	0.0	0.0	0.0	3.9
Initial Queue Delay (d ₃), s/veh							0.0	0.0	0.0		0.0	0.0
Control Delay (d), s/veh							30.4	1.4				7.7
Level of Service (LOS)							C	A				A
Approach Delay, s/veh / LOS	0.0			0.0			3.5	A		7.7		A
Intersection Delay s/veh / LOS	5.5						A					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.6	B	2.6	B	0.7	A	0.8	A
Bicycle LOS Score / LOS					3.8	D	3.7	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and King			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	No Build Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: King Street				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		775			691			
Peak-Hour Factor, PHF	1.00	0.95	1.00	1.00	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	815	0	0	727	0		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration		T			T			
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	149		112					
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	156	0	117	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration						L		R
v (veh/h)						156		117
C (m) (veh/h)						125		419
v/c						1.25		0.28
95% queue length						9.83		1.13
Control Delay (s/veh)						228.5		16.9
LOS						F		C
Approach Delay (s/veh)	--	--				137.8		
Approach LOS	--	--				F		

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 16, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	AM Peak Hour		PHF	0.95	
Intersection	US Route 9W & King		Analysis Year	No Build		Analysis Period	1 > 7:00
File Name	13 king mnbam.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	149		112					775				691

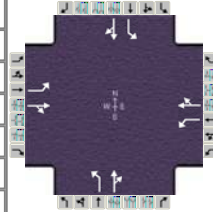
Signal Information												
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On	Green	45.0	15.0	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0		
				Red	1.0	1.0	0.0	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	0		5	2	1	6
Case Number	9.0	9.0	0.0		0.0	4.0	0.0	4.0
Phase Duration, s	20.0	20.0	0.0		0.0	70.0	0.0	70.0
Change Period, (Y+R _c), s	5.0	5.0	0.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.3	3.3	0.0		0.0	0.0	0.0	0.0
Queue Clearance Time (g _s), s	17.0	17.0						
Green Extension Time (g _e), s	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00						
Max Out Probability	1.00	1.00						

Movement Group Results	EB			WB			NB			SB					
	L	T	R	L	T	R	L	T	R	L	T	R			
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16			
Adjusted Flow Rate (v), veh/h	157	0	118	0			0	816	0	0	727	0			
Adjusted Saturation Flow Rate (s), veh/h/ln	1723	0	1533	0			0	1810	0	0	1810	0			
Queue Service time (g _s), s	5.5	15.0	4.6	0.0			0.0	20.5	0.0	0.0	16.8	0.0			
Cycle Queue Clearance Time (g _c), s	5.5	15.0	4.6	0.0			0.0	20.5	0.0	0.0	16.8	0.0			
Capacity (c), veh/h	369	0	329					1163			1163				
Volume-to-Capacity Ratio (X)	0.425	0.000	0.359	0.000			0.000	0.701	0.000	0.000	0.625	0.000			
Available Capacity (c _a), veh/h	369	0	329					1163			1163				
Back of Queue (Q), veh/ln	2.2		1.6					7.2			5.4				
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0					0.0	0.0		0.0	0.0			
Queue Storage Ratio (RQ)	0.3	0.0	0.3	0.0			0.0	0.3	0.0	0.0	0.7	0.0			
Uniform Delay (d ₁), s/veh	23.8	0.0	23.4					8.1			7.5				
Incremental Delay (d ₂), s/veh	0.3	0.0	0.2	0.0			0.0	3.5	0.0	0.0	1.5	0.0			
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0					0.0	0.0		0.0	0.0			
Control Delay (d), s/veh	24.1	0.0	23.7					11.7			9.0				
Level of Service (LOS)	C			C			B			A					
Approach Delay, s/veh / LOS	23.9			C			0.0			11.7			B		
Intersection Delay s/veh / LOS	12.4						B								

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.5	B	2.8	C	0.7	A	1.8	A
Bicycle LOS Score / LOS		F			3.4	C	3.2	C

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 14, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	AM Peak Hour		PHF	0.90	
Intersection	US Rte 9W & Young Av.	Analysis Year	No Build		Analysis Period	1 > 7:00	
File Name	14young nbamw.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	103	3	31	44	2	44	18	695	126	86	775	18

Signal Information				Signal Timing Diagram								
Cycle, s	83.4	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	Off									
Force Mode	Fixed	Simult. Gap N/S	Off									
Green	5.0	50.0	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	8	8	5	2	1	6
Case Number	6.0	6.0	6.0	6.0	1.1	4.0	1.1	4.0
Phase Duration, s	18.4	18.4	18.4	18.4	10.0	55.0	10.0	55.0
Change Period, (Y+R _c), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.4	3.4	3.4	3.4	3.2	3.1	3.2	3.1
Queue Clearance Time (g _s), s	11.6	11.6	6.6	6.6	2.3	38.1	3.7	34.0
Green Extension Time (g _e), s	0.2	0.2	0.1	0.1	0.0	2.0	0.1	2.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.01	0.01	0.00	0.00	0.00	0.06	0.02	0.01

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	114	0	38	49	0	51	20	0	912	96	0	881
Adjusted Saturation Flow Rate (s), veh/h/ln	1275	0	1510	1289	0	1498	1723	0	1758	1723	0	1802
Queue Service time (g _s), s	7.1	0.0	1.8	2.8	0.0	2.5	0.3	0.0	36.1	1.7	0.0	32.0
Cycle Queue Clearance Time (g _c), s	9.6	0.0	1.8	4.6	0.0	2.5	0.3	0.0	36.1	1.7	0.0	32.0
Capacity (c), veh/h	254		243	266		241	321		1054	288		1080
Volume-to-Capacity Ratio (X)	0.451	0.000	0.155	0.184	0.000	0.212	0.062	0.000	0.866	0.331	0.000	0.816
Available Capacity (c _a), veh/h	354		362	368		359	424		1054	392		1080
Back of Queue (Q), veh/ln	2.4		0.6	0.9		0.9	0.2		14.9	1.1		13.1
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (RQ)	0.7	0.0	0.2	0.4	0.0	0.1	0.1	0.0	0.7	0.4	0.0	0.5
Uniform Delay (d ₁), s/veh	34.6		30.1	32.1		30.4	11.3		13.9	14.4		13.1
Incremental Delay (d ₂), s/veh	0.5	0.0	0.1	0.1	0.0	0.2	0.0	0.0	9.5	0.2	0.0	6.8
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	35.0		30.2	32.2		30.6	11.3		23.4	14.7		19.9
Level of Service (LOS)	D		C	C		C	B		C	B		B
Approach Delay, s/veh / LOS	33.8		C	31.4		C	23.2		C	19.4		B
Intersection Delay s/veh / LOS	22.6						C					

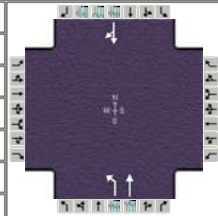
MultiModal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.7		B	2.8		C	2.5		B	2.4		B
Bicycle LOS Score / LOS	2.4		B	2.3		B	3.6		D	3.7		D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Dock and Rt 9W			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	No Build Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: Dock Road				North/South Street: U.S. Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		917	7	1	873			
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	965	7	1	918	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				5		9		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	5	0	9		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)		0			4			
Flared Approach		N			Y			
Storage		0			1			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		1		14				
C (m) (veh/h)		697		140				
v/c		0.00		0.10				
95% queue length		0.00		0.33				
Control Delay (s/veh)		10.2		42.3				
LOS		B		E				
Approach Delay (s/veh)	--	--	42.3					
Approach LOS	--	--	E					

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JAG			Intersection	US Rt 9W and Western		
Agency/Co.	TMA			Jurisdiction	Town of Marlborough		
Date Performed	6/13/2011			Analysis Year	No Build Condition		
Analysis Time Period	PM Peak Hour						
Project Description							
East/West Street: Western Avenue (CR 14)				North/South Street: U.S. Route 9W			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	114	951			677	202	
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95	
Hourly Flow Rate, HFR (veh/h)	120	1001	0	0	712	212	
Percent Heavy Vehicles	5	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	0	
Configuration	LT						TR
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)							
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	0	0	
Configuration							
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT						
v (veh/h)	120						
C (m) (veh/h)	727						
v/c	0.17						
95% queue length	0.59						
Control Delay (s/veh)	10.9						
LOS	B						
Approach Delay (s/veh)	--	--					
Approach LOS	--	--					

2010 HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 17, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	PM Peak Hour		PHF	0.90	
Intersection	US Rt 9W & Western	Analysis Year	No Build		Analysis Period	1 > 7:00	
File Name	17 western mnbpm.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h							114	951			677	202

Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	Off	Green	5.0	55.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	Off	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

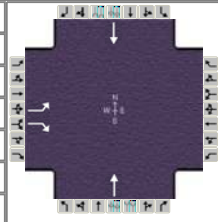
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7		3		5	2	1	6
Case Number	0.0		0.0		1.0	4.0	0.0	4.0
Phase Duration, s	0.0		0.0		10.0	70.0	0.0	60.0
Change Period, (Y+R _c), s	5.0		5.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	0.0		0.0		3.2	0.0	0.0	0.0
Queue Clearance Time (g _s), s					2.6			
Green Extension Time (g _e), s	0.0		0.0		0.2	0.0	0.0	0.0
Phase Call Probability					1.00			
Max Out Probability					0.00			

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	0			0			127	1057	0	0	0	977
Adjusted Saturation Flow Rate (s), veh/h/ln	0			0			1723	1810	0	0	0	1642
Queue Service time (g _s), s	0.0			0.0			0.6	7.0	0.0	0.0	0.0	22.0
Cycle Queue Clearance Time (g _c), s	0.0			0.0			0.6	7.0	0.0	0.0	0.0	22.0
Capacity (c), veh/h							226	1680				1290
Volume-to-Capacity Ratio (X)	0.000			0.000			0.561	0.629	0.000	0.000	0.000	0.757
Available Capacity (c _a), veh/h							472	1680				1290
Back of Queue (Q), veh/ln							2.3					4.6
Overflow Queue (Q ₃), veh/ln							0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.0			0.0			0.5	0.0	0.0	0.0	0.0	0.5
Uniform Delay (d ₁), s/veh							30.2	0.4				4.0
Incremental Delay (d ₂), s/veh	0.0			0.0			0.4	0.9	0.0	0.0	0.0	4.2
Initial Queue Delay (d ₃), s/veh							0.0	0.0	0.0		0.0	0.0
Control Delay (d), s/veh							30.6	1.3				8.1
Level of Service (LOS)							C	A				A
Approach Delay, s/veh / LOS	0.0			0.0			4.5	A		8.1		A
Intersection Delay s/veh / LOS	6.1						A					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.7	B	2.6	B	0.7	A	0.9	A
Bicycle LOS Score / LOS					4.1	D	3.7	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and King			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	No Build Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: King Street				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		938			677			
Peak-Hour Factor, PHF	1.00	0.95	1.00	1.00	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	987	0	0	712	0		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration		T			T			
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	127		93					
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	133	0	97	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration						L		R
v (veh/h)						133		97
C (m) (veh/h)						100		427
v/c						1.33		0.23
95% queue length						9.42		0.86
Control Delay (s/veh)						279.7		15.9
LOS						F		C
Approach Delay (s/veh)	--	--				168.5		
Approach LOS	--	--				F		

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 16, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	PM Peak Hour		PHF	0.95	
Intersection	US Route 9W & King		Analysis Year	No Build		Analysis Period	1 > 7:00
File Name	19 king mnbpm.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	127		93					938				677

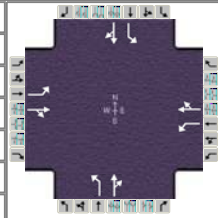
Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	45.0	15.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	0		5	2	1	6
Case Number	9.0	9.0	0.0		0.0	4.0	0.0	4.0
Phase Duration, s	20.0	20.0	0.0		0.0	70.0	0.0	70.0
Change Period, (Y+R _c), s	5.0	5.0	0.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.3	3.3	0.0		0.0	0.0	0.0	0.0
Queue Clearance Time (g _s), s	17.0	17.0						
Green Extension Time (g _e), s	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00						
Max Out Probability	1.00	1.00						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	134	0	98	0			0	987	0	0	713	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1723	0	1533	0			0	1810	0	0	1810	0
Queue Service time (g _s), s	4.6	15.0	3.8	0.0			0.0	30.0	0.0	0.0	16.2	0.0
Cycle Queue Clearance Time (g _c), s	4.6	15.0	3.8	0.0			0.0	30.0	0.0	0.0	16.2	0.0
Capacity (c), veh/h	369	0	329					1163			1163	
Volume-to-Capacity Ratio (X)	0.362	0.000	0.298	0.000			0.000	0.849	0.000	0.000	0.613	0.000
Available Capacity (c _a), veh/h	369	0	329					1163			1163	
Back of Queue (Q), veh/ln	1.8		1.3					11.3			5.2	
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0					0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.3	0.0	0.2	0.0			0.0	0.5	0.0	0.0	0.7	0.0
Uniform Delay (d ₁), s/veh	23.4	0.0	23.1					9.8			7.4	
Incremental Delay (d ₂), s/veh	0.2	0.0	0.2	0.0			0.0	7.8	0.0	0.0	1.4	0.0
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0					0.0	0.0		0.0	0.0
Control Delay (d), s/veh	23.6	0.0	23.3					17.6			8.7	
Level of Service (LOS)	C			C			B			A		
Approach Delay, s/veh / LOS	23.5		C	0.0			17.6		B	8.7		A
Intersection Delay s/veh / LOS	15.0						B					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.1	B	2.1	B	0.7	A	1.7	A
Bicycle LOS Score / LOS		F			3.5	D	3.2	C

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 14, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	PM Peak Hour		PHF	0.90	
Intersection	US Rte 9W & Young Av.	Analysis Year	No Build		Analysis Period	1 > 7:00	
File Name	20 young nbpm.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	72	1	51	4	1	4	60	858	7	2	821	60

Signal Information				Signal Timing Diagram								
Cycle, s	79.8	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	Off									
Force Mode	Fixed	Simult. Gap N/S	Off									
Green	5.0	50.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	8	8	5	2	1	6
Case Number	6.0	6.0	6.0	6.0	1.1	4.0	1.1	4.0
Phase Duration, s	14.8	14.8	14.8	14.8	10.0	55.0	10.0	55.0
Change Period, (Y+R _c), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.4	3.4	3.4	3.4	3.2	3.1	3.2	3.1
Queue Clearance Time (g _s), s	6.8	6.8	5.1	5.1	3.0	35.9	2.0	38.1
Green Extension Time (g _e), s	0.2	0.2	0.0	0.0	0.0	2.2	0.0	2.2
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.07

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	80	0	58	4	0	6	67	0	961	2	0	979
Adjusted Saturation Flow Rate (s), veh/h/ln	1310	0	1476	1260	0	1528	1723	0	1807	1723	0	1786
Queue Service time (g _s), s	4.6	0.0	2.9	0.3	0.0	0.3	1.0	0.0	33.9	0.0	0.0	36.1
Cycle Queue Clearance Time (g _c), s	4.8	0.0	2.9	3.1	0.0	0.3	1.0	0.0	33.9	0.0	0.0	36.1
Capacity (c), veh/h	246		181	199		187	295		1132	313		1120
Volume-to-Capacity Ratio (X)	0.325	0.000	0.319	0.022	0.000	0.030	0.226	0.000	0.849	0.007	0.000	0.874
Available Capacity (c _a), veh/h	414		370	361		383	403		1132	421		1120
Back of Queue (Q), veh/ln	1.5		1.0	0.1		0.1	0.7		13.6	0.0		14.6
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (RQ)	0.5	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.6	0.0	0.0	0.5
Uniform Delay (d ₁), s/veh	33.0		32.0	33.4		30.8	13.3		11.9	11.0		12.3
Incremental Delay (d ₂), s/veh	0.3	0.0	0.4	0.0	0.0	0.0	0.1	0.0	8.0	0.0	0.0	9.6
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	33.2		32.3	33.4		30.8	13.4		19.9	11.1		21.9
Level of Service (LOS)	C		C	C		C	B		B	B		C
Approach Delay, s/veh / LOS	32.9		C	32.0		C	19.4		B	21.8		C
Intersection Delay s/veh / LOS	21.5						C					

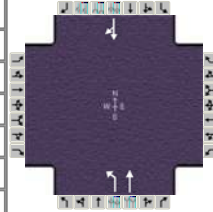
MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.7	B	2.8	C	2.3	B	2.4	B
Bicycle LOS Score / LOS	2.3	B	2.1	B	3.8	D	3.7	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Dock and Rt 9W			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	Build Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: Dock Road				North/South Street: U.S. Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		852	11	12	867			
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	896	11	12	912	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				29		29		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	30	0	30		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)		0			2			
Flared Approach		N			Y			
Storage		0			1			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		12		60				
C (m) (veh/h)		738		120				
v/c		0.02		0.50				
95% queue length		0.05		2.30				
Control Delay (s/veh)		10.0		61.8				
LOS		A		F				
Approach Delay (s/veh)	--	--	61.8					
Approach LOS	--	--	F					

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and Western			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	Build Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: Western Avenue (CR 14)				North/South Street: U.S. Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	68	863			711	184		
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95		
Hourly Flow Rate, HFR (veh/h)	71	908	0	0	748	193		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0					0
Lanes	0	1	0	0	1	0		
Configuration	LT							TR
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)								
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0		
Percent Heavy Vehicles	0	0	0	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0					0
Lanes	0	0	0	0	0	0		
Configuration								
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							
v (veh/h)	71							
C (m) (veh/h)	716							
v/c	0.10							
95% queue length	0.33							
Control Delay (s/veh)	10.6							
LOS	B							
Approach Delay (s/veh)	--	--						
Approach LOS	--	--						

2010 HCS Signalized Intersection Results Summary

General Information					Intersection Information			
Agency	TMA				Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 17, 2011		Area Type	Other		
Jurisdiction	Town of Marlborough	Time Period	AM Peak Hour		PHF	0.90		
Intersection	US Rt 9W & Western	Analysis Year	Build Condition	Analysis Period	1 > 7:00			
File Name	23 western mubam.xus							
Project Description								



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h							68	863			711	184

Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	Off	Green	5.0	55.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	Off	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

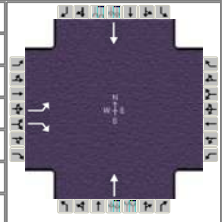
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7		3		5	2	1	6
Case Number	0.0		0.0		1.0	4.0	0.0	4.0
Phase Duration, s	0.0		0.0		10.0	70.0	0.0	60.0
Change Period, (Y+R _c), s	5.0		5.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	0.0		0.0		3.2	0.0	0.0	0.0
Queue Clearance Time (g _s), s					2.0			
Green Extension Time (g _e), s	0.0		0.0		0.1	0.0	0.0	0.0
Phase Call Probability					1.00			
Max Out Probability					0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	0			0			76	959	0	0	0	994
Adjusted Saturation Flow Rate (s), veh/h/ln	0			0			1810	1810	0	0	0	1650
Queue Service time (g _s), s	0.0			0.0			0.0	5.6	0.0	0.0	0.0	22.7
Cycle Queue Clearance Time (g _c), s	0.0			0.0			0.0	5.6	0.0	0.0	0.0	22.7
Capacity (c), veh/h							232	1680				1297
Volume-to-Capacity Ratio (X)	0.000			0.000			0.325	0.571	0.000	0.000	0.000	0.767
Available Capacity (c _a), veh/h							491	1680				1297
Back of Queue (Q), veh/ln							1.4					4.8
Overflow Queue (Q ₃), veh/ln							0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.0			0.0			0.3	0.0	0.0	0.0	0.0	0.5
Uniform Delay (d ₁), s/veh							30.2	0.4				4.0
Incremental Delay (d ₂), s/veh	0.0			0.0			0.2	1.0	0.0	0.0	0.0	4.4
Initial Queue Delay (d ₃), s/veh							0.0	0.0	0.0		0.0	0.0
Control Delay (d), s/veh							30.4	1.4				8.4
Level of Service (LOS)							C	A				A
Approach Delay, s/veh / LOS	0.0			0.0			3.5	A		8.4		A
Intersection Delay s/veh / LOS	5.9						A					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.6	B	2.6	B	0.7	A	0.8	A
Bicycle LOS Score / LOS					3.8	D	3.8	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and King			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	Build Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: King Street				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		779			711			
Peak-Hour Factor, PHF	1.00	0.95	1.00	1.00	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	820	0	0	748	0		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration		T			T			
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	151		112					
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	158	0	117	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration						L		R
v (veh/h)						158		117
C (m) (veh/h)						120		408
v/c						1.32		0.29
95% queue length						10.43		1.17
Control Delay (s/veh)						257.4		17.3
LOS						F		C
Approach Delay (s/veh)	--	--				155.3		
Approach LOS	--	--				F		

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 16, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	AM Peak Hour		PHF	0.95	
Intersection	US Route 9W & King	Analysis Year	Build Condition	Analysis Period	1 > 7:00		
File Name	25 king mubam.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	151		112					779				711

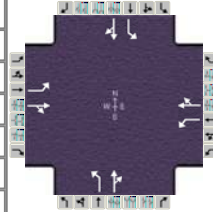
Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	45.0	15.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	0		5	2	1	6
Case Number	9.0	9.0	0.0		0.0	4.0	0.0	4.0
Phase Duration, s	20.0	20.0	0.0		0.0	70.0	0.0	70.0
Change Period, (Y+R _c), s	5.0	5.0	0.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.3	3.3	0.0		0.0	0.0	0.0	0.0
Queue Clearance Time (g _s), s	17.0	17.0						
Green Extension Time (g _e), s	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00						
Max Out Probability	1.00	1.00						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	159	0	118	0			0	820	0	0	748	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1723	0	1533	0			0	1810	0	0	1810	0
Queue Service time (g _s), s	5.6	15.0	4.6	0.0			0.0	20.7	0.0	0.0	17.6	0.0
Cycle Queue Clearance Time (g _c), s	5.6	15.0	4.6	0.0			0.0	20.7	0.0	0.0	17.6	0.0
Capacity (c), veh/h	369	0	329					1163			1163	
Volume-to-Capacity Ratio (X)	0.430	0.000	0.359	0.000			0.000	0.705	0.000	0.000	0.643	0.000
Available Capacity (c _a), veh/h	369	0	329					1163			1163	
Back of Queue (Q), veh/ln	2.2		1.6					7.3			5.7	
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0					0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.3	0.0	0.3	0.0			0.0	0.3	0.0	0.0	0.8	0.0
Uniform Delay (d ₁), s/veh	23.8	0.0	23.4					8.2			7.6	
Incremental Delay (d ₂), s/veh	0.3	0.0	0.2	0.0			0.0	3.6	0.0	0.0	1.5	0.0
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0					0.0	0.0		0.0	0.0
Control Delay (d), s/veh	24.1	0.0	23.7					11.8			9.1	
Level of Service (LOS)	C			C			B			A		
Approach Delay, s/veh / LOS	23.9		C	0.0			11.8		B	9.1		A
Intersection Delay s/veh / LOS	12.5						B					

MultiModal Results	EB			WB			NB			SB		
Pedestrian LOS Score / LOS	2.5		B	2.8		C	0.7		A	1.8		A
Bicycle LOS Score / LOS			F				3.4		C	3.3		C

General Information				Intersection Information		
Agency	TMA			Duration, h	0.25	
Analyst	JAG	Analysis Date	Jun 14, 2011		Area Type	Other
Jurisdiction	Town of Marlborough	Time Period	AM Peak Hour		PHF	0.90
Intersection	US Rte 9W & Young Av.	Analysis Year	Build Condition	Analysis Period	1 > 7:00	
File Name	26 young ubam.xus					
Project Description						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	103	3	31	44	2	44	18	719	129	86	780	18

Signal Information				Signal Phases									
Cycle, s	83.4	Reference Phase	2	[Signal Phase Diagrams]									
Offset, s	0	Reference Point	End	[Signal Phase Diagrams]									
Uncoordinated	Yes	Simult. Gap E/W	Off	Green	5.0	50.0	13.4	0.0	0.0	0.0	[Signal Phase Diagrams]		
Force Mode	Fixed	Simult. Gap N/S	Off	Yellow	4.0	4.0	4.0	0.0	0.0	0.0	[Signal Phase Diagrams]		
				Red	1.0	1.0	1.0	0.0	0.0	0.0	[Signal Phase Diagrams]		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	8	8	5	2	1	6
Case Number	6.0	6.0	6.0	6.0	1.1	4.0	1.1	4.0
Phase Duration, s	18.4	18.4	18.4	18.4	10.0	55.0	10.0	55.0
Change Period, (Y+R _c), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.4	3.4	3.4	3.4	3.2	3.1	3.2	3.1
Queue Clearance Time (g _s), s	11.6	11.6	6.6	6.6	2.3	40.6	3.7	34.4
Green Extension Time (g _e), s	0.2	0.2	0.1	0.1	0.0	2.0	0.1	2.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.01	0.01	0.00	0.00	0.00	0.15	0.02	0.01

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	114	0	38	49	0	51	20	0	942	96	0	887
Adjusted Saturation Flow Rate (s), veh/h/ln	1275	0	1510	1289	0	1498	1723	0	1759	1723	0	1802
Queue Service time (g _s), s	7.1	0.0	1.8	2.8	0.0	2.5	0.3	0.0	38.6	1.7	0.0	32.4
Cycle Queue Clearance Time (g _c), s	9.6	0.0	1.8	4.6	0.0	2.5	0.3	0.0	38.6	1.7	0.0	32.4
Capacity (c), veh/h	254		243	266		241	317		1054	268		1080
Volume-to-Capacity Ratio (X)	0.451	0.000	0.155	0.184	0.000	0.212	0.063	0.000	0.894	0.356	0.000	0.821
Available Capacity (c _a), veh/h	354		362	368		359	421		1054	372		1080
Back of Queue (Q), veh/ln	2.4		0.6	0.9		0.9	0.2		16.4	1.2		13.3
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (RQ)	0.7	0.0	0.2	0.4	0.0	0.1	0.1	0.0	0.7	0.5	0.0	0.5
Uniform Delay (d ₁), s/veh	34.6		30.1	32.1		30.4	11.4		14.4	15.8		13.2
Incremental Delay (d ₂), s/veh	0.5	0.0	0.1	0.1	0.0	0.2	0.0	0.0	11.6	0.3	0.0	7.0
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	35.0		30.2	32.2		30.6	11.4		26.0	16.1		20.2
Level of Service (LOS)	D		C	C		C	B		C	B		C
Approach Delay, s/veh / LOS	33.8		C	31.4		C	25.7		C	19.8		B
Intersection Delay s/veh / LOS	23.9						C					

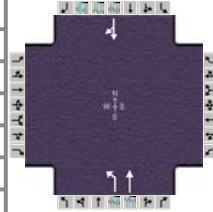
MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.7	B	2.8	C	2.5	B	2.4	B
Bicycle LOS Score / LOS	2.4	B	2.3	B	3.7	D	3.7	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Site access and Dock Road			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/14/2011			Analysis Year	Build Condition			
Analysis Time Period	AM Peak Hour							
Project Description								
East/West Street: Dock Road				North/South Street: Site Access				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	11	12			3	0		
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95		
Hourly Flow Rate, HFR (veh/h)	11	12	0	0	3	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration	LT					TR		
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				0		55		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	57		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	11						57	
C (m) (veh/h)	1600						1072	
v/c	0.01						0.05	
95% queue length	0.02						0.17	
Control Delay (s/veh)	7.3						8.5	
LOS	A						A	
Approach Delay (s/veh)	--	--					8.5	
Approach LOS	--	--					A	

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Dock and Rt 9W			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	Build Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: Dock Road				North/South Street: U.S. Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Northbound			Southbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		917	34	26	873			
Peak-Hour Factor, PHF	1.00	0.95	0.95	0.95	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	965	35	27	918	0		
Percent Heavy Vehicles	0	--	--	5	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration			TR	LT				
Upstream Signal		0			0			
Minor Street	Eastbound			Westbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				18		22		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	18	0	23		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)		0			2			
Flared Approach		N			Y			
Storage		0			1			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT		LR				
v (veh/h)		27		41				
C (m) (veh/h)		681		111				
v/c		0.04		0.37				
95% queue length		0.12		1.50				
Control Delay (s/veh)		10.5		55.3				
LOS		B		F				
Approach Delay (s/veh)	--	--	55.3					
Approach LOS	--	--	F					

TWO-WAY STOP CONTROL SUMMARY							
General Information				Site Information			
Analyst	JAG			Intersection	US Rt 9W and Western		
Agency/Co.	TMA			Jurisdiction	Town of Marlborough		
Date Performed	6/13/2011			Analysis Year	Build Condition		
Analysis Time Period	PM Peak Hour						
Project Description							
East/West Street: Western Avenue (CR 14)				North/South Street: U.S. Route 9W			
Intersection Orientation: North-South				Study Period (hrs): 0.25			
Vehicle Volumes and Adjustments							
Major Street	Northbound			Southbound			
Movement	1	2	3	4	5	6	
	L	T	R	L	T	R	
Volume (veh/h)	114	978			686	206	
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95	
Hourly Flow Rate, HFR (veh/h)	120	1029	0	0	722	216	
Percent Heavy Vehicles	5	--	--	0	--	--	
Median Type	Undivided						
RT Channelized			0				0
Lanes	0	1	0	0	1	0	
Configuration	LT						TR
Upstream Signal		0			0		
Minor Street	Eastbound			Westbound			
Movement	7	8	9	10	11	12	
	L	T	R	L	T	R	
Volume (veh/h)							
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	0	
Percent Heavy Vehicles	0	0	0	0	0	0	
Percent Grade (%)		0			0		
Flared Approach		N			N		
Storage		0			0		
RT Channelized			0				0
Lanes	0	0	0	0	0	0	
Configuration							
Delay, Queue Length, and Level of Service							
Approach	Northbound	Southbound	Westbound			Eastbound	
Movement	1	4	7	8	9	10	11
Lane Configuration	LT						
v (veh/h)	120						
C (m) (veh/h)	718						
v/c	0.17						
95% queue length	0.60						
Control Delay (s/veh)	11.0						
LOS	B						
Approach Delay (s/veh)	--	--					
Approach LOS	--	--					

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 17, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	PM Peak Hour		PHF	0.90	
Intersection	US Rt 9W & Western	Analysis Year	Build Condition	Analysis Period	1 > 7:00		
File Name	30 western mubpm.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h							114	978			686	206

Signal Information				Phase Diagram								
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	Off									
Force Mode	Fixed	Simult. Gap N/S	Off									
Green	5.0	55.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

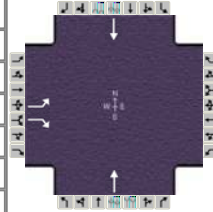
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7		3		5	2	1	6
Case Number	0.0		0.0		1.0	4.0	0.0	4.0
Phase Duration, s	0.0		0.0		10.0	70.0	0.0	60.0
Change Period, (Y+R _c), s	5.0		5.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	0.0		0.0		3.2	0.0	0.0	0.0
Queue Clearance Time (g _s), s					2.6			
Green Extension Time (g _e), s	0.0		0.0		0.2	0.0	0.0	0.0
Phase Call Probability					1.00			
Max Out Probability					0.00			

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	0			0			127	1087	0	0	0	991
Adjusted Saturation Flow Rate (s), veh/h/ln	0			0			1723	1810	0	0	0	1642
Queue Service time (g _s), s	0.0			0.0			0.6	7.5	0.0	0.0	0.0	22.8
Cycle Queue Clearance Time (g _c), s	0.0			0.0			0.6	7.5	0.0	0.0	0.0	22.8
Capacity (c), veh/h							226	1680				1290
Volume-to-Capacity Ratio (X)	0.000			0.000			0.561	0.647	0.000	0.000	0.000	0.768
Available Capacity (c _a), veh/h							472	1680				1290
Back of Queue (Q), veh/ln							2.3					4.8
Overflow Queue (Q ₃), veh/ln							0.0	0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.0			0.0			0.5	0.0	0.0	0.0	0.0	0.5
Uniform Delay (d ₁), s/veh							30.2	0.4				4.1
Incremental Delay (d ₂), s/veh	0.0			0.0			0.4	1.0	0.0	0.0	0.0	4.4
Initial Queue Delay (d ₃), s/veh							0.0	0.0	0.0		0.0	0.0
Control Delay (d), s/veh							30.6	1.4				8.5
Level of Service (LOS)							C	A				A
Approach Delay, s/veh / LOS	0.0			0.0			4.5	A		8.5		A
Intersection Delay s/veh / LOS	6.3						A					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.7	B	2.6	B	0.7	A	0.9	A
Bicycle LOS Score / LOS					4.1	D	3.7	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	US Rt 9W and King			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/13/2011			Analysis Year	Build Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: King Street				North/South Street: US Route 9W				
Intersection Orientation: North-South				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street		Northbound			Southbound			
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)		957			686			
Peak-Hour Factor, PHF	1.00	0.95	1.00	1.00	0.95	1.00		
Hourly Flow Rate, HFR (veh/h)	0	1007	0	0	722	0		
Percent Heavy Vehicles	0	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0			0		
Lanes	0	1	0	0	1	0		
Configuration		T			T			
Upstream Signal		0			0			
Minor Street		Eastbound			Westbound			
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)	135		93					
Peak-Hour Factor, PHF	0.95	1.00	0.95	1.00	1.00	1.00		
Hourly Flow Rate, HFR (veh/h)	142	0	97	0	0	0		
Percent Heavy Vehicles	5	0	5	0	0	0		
Percent Grade (%)		0			0			
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	1	0	1	0	0	0		
Configuration	L		R					
Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration						L		R
v (veh/h)						142		97
C (m) (veh/h)						95		422
v/c						1.49		0.23
95% queue length						10.80		0.88
Control Delay (s/veh)						348.8		16.1
LOS						F		C
Approach Delay (s/veh)	--	--				213.8		
Approach LOS	--	--				F		

General Information				Intersection Information			
Agency	TMA			Duration, h	0.25		
Analyst	JAG	Analysis Date	Jun 16, 2011		Area Type	Other	
Jurisdiction	Town of Marlborough	Time Period	PM Peak Hour		PHF	0.95	
Intersection	US Route 9W & King		Analysis Year	Build Condition	Analysis Period	1 > 7:00	
File Name	32 king mubpm.xus						
Project Description							



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	135		93						957			686

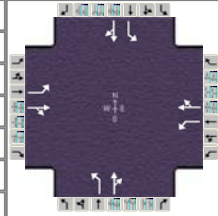
Signal Information													
Cycle, s	70.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	45.0	15.0	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	4.0	4.0	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	0		5	2	1	6
Case Number	9.0	9.0	0.0		0.0	4.0	0.0	4.0
Phase Duration, s	20.0	20.0	0.0		0.0	70.0	0.0	70.0
Change Period, (Y+R _c), s	5.0	5.0	0.0		5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.3	3.3	0.0		0.0	0.0	0.0	0.0
Queue Clearance Time (g _s), s	17.0	17.0						
Green Extension Time (g _e), s	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Phase Call Probability	1.00	1.00						
Max Out Probability	1.00	1.00						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	142	0	98	0			0	1007	0	0	722	0
Adjusted Saturation Flow Rate (s), veh/h/ln	1723	0	1533	0			0	1810	0	0	1810	0
Queue Service time (g _s), s	4.9	15.0	3.8	0.0			0.0	31.4	0.0	0.0	16.6	0.0
Cycle Queue Clearance Time (g _c), s	4.9	15.0	3.8	0.0			0.0	31.4	0.0	0.0	16.6	0.0
Capacity (c), veh/h	369	0	329					1163			1163	
Volume-to-Capacity Ratio (X)	0.385	0.000	0.298	0.000			0.000	0.866	0.000	0.000	0.621	0.000
Available Capacity (c _a), veh/h	369	0	329					1163			1163	
Back of Queue (Q), veh/ln	1.9		1.3					12.0			5.3	
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0					0.0	0.0		0.0	0.0
Queue Storage Ratio (RQ)	0.3	0.0	0.2	0.0			0.0	0.5	0.0	0.0	0.7	0.0
Uniform Delay (d ₁), s/veh	23.5	0.0	23.1					10.1			7.4	
Incremental Delay (d ₂), s/veh	0.2	0.0	0.2	0.0			0.0	8.7	0.0	0.0	1.4	0.0
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0					0.0	0.0		0.0	0.0
Control Delay (d), s/veh	23.8	0.0	23.3					18.8			8.8	
Level of Service (LOS)	C			C			B			A		
Approach Delay, s/veh / LOS	23.6		C	0.0			18.8		B	8.8		A
Intersection Delay s/veh / LOS	15.7						B					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.6	B	2.8	C	0.7	A	1.8	A
Bicycle LOS Score / LOS		F			3.7	D	3.2	C

General Information				Intersection Information		
Agency	TMA			Duration, h	0.25	
Analyst	JAG	Analysis Date	Jun 14, 2011		Area Type	Other
Jurisdiction	Town of Marlborough	Time Period	PM Peak Hour		PHF	0.90
Intersection	US Rte 9W & Young Av.	Analysis Year	Build Condition	Analysis Period	1 > 7:00	
File Name	33 young ubpm.xus					
Project Description						



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	72	1	51	5	1	4	60	871	7	2	846	60

Signal Information				Signal Timing (s)								
Cycle, s	79.8	Reference Phase	2	Green			Yellow			Red		
Offset, s	0	Reference Point	End	5.0	50.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Uncoordinated	Yes	Simult. Gap E/W	Off	4.0	4.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	Off	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	4	4	8	8	5	2	1	6
Case Number	6.0	6.0	6.0	6.0	1.1	4.0	1.1	4.0
Phase Duration, s	14.8	14.8	14.8	14.8	10.0	55.0	10.0	55.0
Change Period, (Y+R _c), s	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Max Allow Headway (MAH), s	3.4	3.4	3.4	3.4	3.2	3.1	3.2	3.1
Queue Clearance Time (g _s), s	6.8	6.8	5.2	5.2	3.0	37.0	2.0	40.4
Green Extension Time (g _e), s	0.2	0.2	0.0	0.0	0.0	2.3	0.0	2.1
Phase Call Probability	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Max Out Probability	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.16

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	80	0	58	6	0	6	67	0	976	2	0	1007
Adjusted Saturation Flow Rate (s), veh/h/ln	1310	0	1476	1260	0	1528	1723	0	1807	1723	0	1787
Queue Service time (g _s), s	4.6	0.0	2.9	0.3	0.0	0.3	1.0	0.0	35.0	0.0	0.0	38.4
Cycle Queue Clearance Time (g _c), s	4.8	0.0	2.9	3.2	0.0	0.3	1.0	0.0	35.0	0.0	0.0	38.4
Capacity (c), veh/h	246		181	199		187	277		1132	304		1120
Volume-to-Capacity Ratio (X)	0.325	0.000	0.319	0.028	0.000	0.030	0.241	0.000	0.862	0.007	0.000	0.899
Available Capacity (c _a), veh/h	414		370	361		383	385		1132	412		1120
Back of Queue (Q), veh/ln	1.5		1.0	0.1		0.1	0.8		14.2	0.0		16.0
Overflow Queue (Q ₃), veh/ln	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Queue Storage Ratio (RQ)	0.5	0.0	0.3	0.0	0.0	0.0	0.3	0.0	0.7	0.0	0.0	0.5
Uniform Delay (d ₁), s/veh	33.0		32.0	33.4		30.8	14.5		12.1	11.5		12.7
Incremental Delay (d ₂), s/veh	0.3	0.0	0.4	0.0	0.0	0.0	0.2	0.0	8.7	0.0	0.0	11.4
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	33.2		32.3	33.4		30.8	14.7		20.8	11.5		24.1
Level of Service (LOS)	C		C	C		C	B		C	B		C
Approach Delay, s/veh / LOS	32.9		C	32.1		C	20.4		C	24.1		C
Intersection Delay s/veh / LOS	22.9						C					

MultiModal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.7	B	2.8	C	2.3	B	2.4	B
Bicycle LOS Score / LOS	2.3	B	2.1	B	3.8	D	3.8	D

TWO-WAY STOP CONTROL SUMMARY								
General Information				Site Information				
Analyst	JAG			Intersection	Site access and Dock Road			
Agency/Co.	TMA			Jurisdiction	Town of Marlborough			
Date Performed	6/14/2011			Analysis Year	Build Condition			
Analysis Time Period	PM Peak Hour							
Project Description								
East/West Street: Dock Road				North/South Street: Site Access				
Intersection Orientation: East-West				Study Period (hrs): 0.25				
Vehicle Volumes and Adjustments								
Major Street	Eastbound			Westbound				
Movement	1	2	3	4	5	6		
	L	T	R	L	T	R		
Volume (veh/h)	52	8			14	0		
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95		
Hourly Flow Rate, HFR (veh/h)	54	8	0	0	14	0		
Percent Heavy Vehicles	5	--	--	0	--	--		
Median Type	Undivided							
RT Channelized			0				0	
Lanes	0	1	0	0	1		0	
Configuration	LT						TR	
Upstream Signal		0			0			
Minor Street	Northbound			Southbound				
Movement	7	8	9	10	11	12		
	L	T	R	L	T	R		
Volume (veh/h)				0		26		
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95		
Hourly Flow Rate, HFR (veh/h)	0	0	0	0	0	27		
Percent Heavy Vehicles	0	0	0	5	0	5		
Percent Grade (%)	0			0				
Flared Approach		N			N			
Storage		0			0			
RT Channelized			0			0		
Lanes	0	0	0	0	0	0		
Configuration					LR			
Delay, Queue Length, and Level of Service								
Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	54						27	
C (m) (veh/h)	1585						1057	
v/c	0.03						0.03	
95% queue length	0.11						0.08	
Control Delay (s/veh)	7.4						8.5	
LOS	A						A	
Approach Delay (s/veh)	--	--					8.5	
Approach LOS	--	--					A	