Appendix 12

Traffic Impact Study

Updated Traffic Data

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*mm-3AMbase rev JAG*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA w/ TMA rev*	Area Type	*All other areas*
Date Performed	*12/1/2010*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*Baseline Condition*
		Project ID	*Woodlands Revised Lane Geometry and phasing only*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1				*1*		*0*		*1*	*1*	*1*	*1*	
Lane Group				*L*	*LR*			*T*	*R*	*L*	*T*	
Volume, V (vph)				*646*		*48*		*430*	*399*	*236*	*401*	
% Heavy Vehicles, %HV				*2*		*2*		*2*	*2*	*2*	*2*	
Peak-Hour Factor, PHF				*0.90*		*0.90*		*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)				*A*		*A*		*P*	*P*	*A*	*A*	
Start-up Lost Time, l_1				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT				*3*	*3*			*3*	*3*	*3*	*3*	
Unit Extension, UE				*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Lane Width				*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*	*0*			*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p		*3.2*			*3.2*			*3.2*			*3.2*	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *19.0*	G =	G =	G =	G = *10.0*	G = *21.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *3*	Y = *7*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *65.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v				*431*	*340*			*478*	*443*	*262*	*446*	
Lane Group Capacity, c				*517*	*510*			*602*	*511*	*442*	*974*	
v/c Ratio, X				*0.83*	*0.67*			*0.79*	*0.87*	*0.59*	*0.46*	
Total Green Ratio, g/C				*0.29*	*0.29*			*0.32*	*0.32*	*0.58*	*0.52*	
Uniform Delay, d_1				*21.5*	*20.2*			*20.0*	*20.7*	*9.3*	*9.7*	
Progression Factor, PF				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k				*0.37*	*0.24*			*0.50*	*0.50*	*0.18*	*0.11*	
Incremental Delay, d_2				*11.2*	*3.3*			*10.4*	*17.7*	*2.1*	*0.3*	
Initial Queue Delay, d_3				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay				*32.8*	*23.5*			*30.4*	*38.4*	*11.5*	*10.1*	
Lane Group LOS				*C*	*C*			*C*	*D*	*B*	*B*	
Approach Delay					*28.7*			*34.2*			*10.6*	
Approach LOS					*C*			*C*			*B*	
Intersection Delay		*25.5*			X_C *= 0.95*			Intersection LOS			*C*	

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*mm-3AMbase rev JAG*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA w/ TMA rev*	Area Type	*All other areas*
Date Performed	*12/1/2010*	Jurisdiction	*North Salem, NY*
Time Period	*Peak PM Hour*	Analysis Year	*Baseline Condition*
		Project ID	*Woodlands Revised Lane Geometry and phasing only*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1				1		0		1	1	1	1	
Lane Group				L	LR			T	R	L	T	
Volume, V (vph)				326		85		770	132	178	615	
% Heavy Vehicles, %HV				2		2		2	2	2	2	
Peak-Hour Factor, PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Pretimed (P) or Actuated (A)				A		A		P	P	A	A	
Start-up Lost Time, l_1				2.0	2.0			2.0	2.0	2.0	2.0	
Extension of Effective Green, e				2.0	2.0			2.0	2.0	2.0	2.0	
Arrival Type, AT				3	3			3	3	3	3	
Unit Extension, UE				3.0	3.0			3.0	3.0	3.0	3.0	
Filtering/Metering, I				1.000	1.000			1.000	1.000	1.000	1.000	
Initial Unmet Demand, Q_b				0.0	0.0			0.0	0.0	0.0	0.0	
Ped / Bike / RTOR Volumes	0	0		0	0	0	0	0	0	0	0	
Lane Width				12.0	12.0			12.0	12.0	12.0	12.0	
Parking / Grade / Parking	N	0	N	N	0	N	N	0	N	N	0	N
Parking Maneuvers, N_m												
Buses Stopping, N_B				0	0			0	0	0	0	
Min. Time for Pedestrians, G_p	3.2			3.2			3.2			3.2		

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *19.0*	G =	G =	G =	G = *10.0*	G = *21.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *3*	Y = *7*	Y =	Y =
Duration of Analysis, T = *0.25*					Cycle Length, C = *65.0*			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v				253	203			856	147	198	683	
Lane Group Capacity, c				517	493			602	511	387	974	
v/c Ratio, X				0.49	0.41			1.42	0.29	0.51	0.70	
Total Green Ratio, g/C				0.29	0.29			0.32	0.32	0.58	0.52	
Uniform Delay, d_1				19.0	18.5			22.0	16.4	11.3	11.7	
Progression Factor, PF				1.000	1.000			1.000	1.000	1.000	1.000	
Delay Calibration, k				0.11	0.11			0.50	0.50	0.12	0.27	
Incremental Delay, d_2				0.7	0.6			199.5	1.4	1.2	2.3	
Initial Queue Delay, d_3				0.0	0.0			0.0	0.0	0.0	0.0	
Control Delay				19.7	19.1			221.5	17.8	12.4	14.0	
Lane Group LOS				B	B			F	B	B	B	
Approach Delay				19.4			191.6			13.6		
Approach LOS				B			F			B		
Intersection Delay	91.0			X_c = 1.01			Intersection LOS			F		

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*mm-3AMno-build rev JAG*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA w/ TMA rev*	Area Type	*All other areas*
Date Performed	*12/1/2010*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*No Build Condition*
		Project ID	*Woodlands Revised Lane Geometry and phasing only*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1				*1*		*0*		*1*	*1*	*1*	*1*	
Lane Group				*L*	*LR*			*T*	*R*	*L*	*T*	
Volume, V (vph)				*685*		*51*		*456*	*423*	*251*	*425*	
% Heavy Vehicles, %HV				*2*		*2*		*2*	*2*	*2*	*2*	
Peak-Hour Factor, PHF				*0.90*		*0.90*		*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)				*A*		*A*		*P*	*P*	*A*	*A*	
Start-up Lost Time, l_1				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT				*3*	*3*			*3*	*3*	*3*	*3*	
Unit Extension, UE				*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Lane Width				*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*	*0*			*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *19.0*	G =	G =	G =	G = *10.0*	G = *21.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *3*	Y = *7*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *65.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v				*457*	*361*			*507*	*470*	*279*	*472*	
Lane Group Capacity, c				*517*	*510*			*602*	*511*	*419*	*974*	
v/c Ratio, X				*0.88*	*0.71*			*0.84*	*0.92*	*0.67*	*0.48*	
Total Green Ratio, g/C				*0.29*	*0.29*			*0.32*	*0.32*	*0.58*	*0.52*	
Uniform Delay, d_1				*21.9*	*20.5*			*20.5*	*21.2*	*10.0*	*9.9*	
Progression Factor, PF				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k				*0.41*	*0.27*			*0.50*	*0.50*	*0.24*	*0.11*	
Incremental Delay, d_2				*16.5*	*4.5*			*13.4*	*24.2*	*4.0*	*0.4*	
Initial Queue Delay, d_3				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay				*38.5*	*25.0*			*33.9*	*45.4*	*14.0*	*10.3*	
Lane Group LOS				*D*	*C*			*C*	*D*	*B*	*B*	
Approach Delay				*32.5*			*39.4*			*11.7*		
Approach LOS				*C*			*D*			*B*		
Intersection Delay	*29.0*			X_c = *1.00*			Intersection LOS			*C*		

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*mm-3AMno-build rev JAG*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA w/ TMA rev*	Area Type	*All other areas*
Date Performed	*12/1/2010*	Jurisdiction	*North Salem, NY*
Time Period	*Peak PM Hour*	Analysis Year	*No Build Condition*
		Project ID	*Woodlands Revised Lane Geometry and phasing only*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1				*1*		*0*		*1*	*1*	*1*	*1*	
Lane Group				*L*	*LR*			*T*	*R*	*L*	*T*	
Volume, V (vph)				*346*		*90*		*816*	*140*	*189*	*652*	
% Heavy Vehicles, %HV				*2*		*2*		*2*	*2*	*2*	*2*	
Peak-Hour Factor, PHF				*0.90*		*0.90*		*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)				*A*		*A*		*P*	*P*	*A*	*A*	
Start-up Lost Time, l_1				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT				*3*	*3*			*3*	*3*	*3*	*3*	
Unit Extension, UE				*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Lane Width				*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*	*0*			*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *19.0*	G =	G =	G =	G = *10.0*	G = *21.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *3*	Y = *7*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *65.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v				*269*	*215*			*907*	*156*	*210*	*724*	
Lane Group Capacity, c				*517*	*493*			*602*	*511*	*387*	*974*	
v/c Ratio, X				*0.52*	*0.44*			*1.51*	*0.31*	*0.54*	*0.74*	
Total Green Ratio, g/C				*0.29*	*0.29*			*0.32*	*0.32*	*0.58*	*0.52*	
Uniform Delay, d_1				*19.2*	*18.7*			*22.0*	*16.5*	*11.4*	*12.1*	
Progression Factor, PF				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k				*0.13*	*0.11*			*0.50*	*0.50*	*0.14*	*0.30*	
Incremental Delay, d_2				*0.9*	*0.6*			*236.6*	*1.5*	*1.6*	*3.1*	
Initial Queue Delay, d_3				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay				*20.1*	*19.3*			*258.6*	*18.1*	*12.9*	*15.2*	
Lane Group LOS				*C*	*B*			*F*	*B*	*B*	*B*	
Approach Delay				*19.8*			*223.3*			*14.7*		
Approach LOS				*B*			*F*			*B*		
Intersection Delay	*105.0*			X_C = *1.07*			Intersection LOS			*F*		

HCS+™ DETAILED REPORT

General Information		***Site Information***	
Analyst	*mm-3AMbuild rev JAG*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA w/ TMA rev*	Area Type	*All other areas*
Date Performed	*12/1/2010*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*Build Condition*
		Project ID	*Woodlands Revised Lane Geometry and phasing only*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1				*1*		*0*		*1*	*1*	*1*	*1*	
Lane Group				*L*	*LR*			*T*	*R*	*L*	*T*	
Volume, V (vph)				*685*		*54*		*460*	*423*	*268*	*435*	
% Heavy Vehicles, %HV				*2*		*2*		*2*	*2*	*2*	*2*	
Peak-Hour Factor, PHF				*0.90*		*0.90*		*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)				*A*		*A*		*P*	*P*	*A*	*A*	
Start-up Lost Time, l_1				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT				*3*	*3*			*3*	*3*	*3*	*3*	
Unit Extension, UE				*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Lane Width				*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*	*0*			*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *19.0*	G =	G =	G =	G = *10.0*	G = *21.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *3*	Y = *7*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *65.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v				*457*	*364*			*511*	*470*	*298*	*483*	
Lane Group Capacity, c				*517*	*510*			*602*	*511*	*416*	*974*	
v/c Ratio, X				*0.88*	*0.71*			*0.85*	*0.92*	*0.72*	*0.50*	
Total Green Ratio, g/C				*0.29*	*0.29*			*0.32*	*0.32*	*0.58*	*0.52*	
Uniform Delay, d_1				*21.9*	*20.6*			*20.5*	*21.2*	*10.3*	*10.0*	
Progression Factor, PF				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k				*0.41*	*0.28*			*0.50*	*0.50*	*0.28*	*0.11*	
Incremental Delay, d_2				*16.5*	*4.7*			*13.9*	*24.2*	*5.8*	*0.4*	
Initial Queue Delay, d_3				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay				*38.5*	*25.3*			*34.5*	*45.4*	*16.1*	*10.4*	
Lane Group LOS				*D*	*C*			*C*	*D*	*B*	*B*	
Approach Delay				*32.6*			*39.7*			*12.6*		
Approach LOS				*C*			*D*			*B*		
Intersection Delay	*29.2*			$X_c = 1.00$			Intersection LOS			*C*		

HCS+™ DETAILED REPORT

General Information		**Site Information**	
Analyst	*mm-3AMbuild rev JAG*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA w/ TMA rev*	Area Type	*All other areas*
Date Performed	*12/1/2010*	Jurisdiction	*North Salem, NY*
Time Period	*Peak PM Hour*	Analysis Year	*Build Condition*
		Project ID	*Woodlands Revised Lane Geometry and phasing only*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of Lanes, N_1				*1*		*0*		*1*	*1*	*1*	*1*	
Lane Group				*L*	*LR*			*T*	*R*	*L*	*T*	
Volume, V (vph)				*346*		*95*		*823*	*140*	*206*	*662*	
% Heavy Vehicles, %HV				*2*		*2*		*2*	*2*	*2*	*2*	
Peak-Hour Factor, PHF				*0.90*		*0.90*		*0.90*	*0.90*	*0.90*	*0.90*	
Pretimed (P) or Actuated (A)				*A*		*A*		*P*	*P*	*A*	*A*	
Start-up Lost Time, l_1				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Extension of Effective Green, e				*2.0*	*2.0*			*2.0*	*2.0*	*2.0*	*2.0*	
Arrival Type, AT				*3*	*3*			*3*	*3*	*3*	*3*	
Unit Extension, UE				*3.0*	*3.0*			*3.0*	*3.0*	*3.0*	*3.0*	
Filtering/Metering, I				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Initial Unmet Demand, Q_b				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Ped / Bike / RTOR Volumes	*0*	*0*		*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	
Lane Width				*12.0*	*12.0*			*12.0*	*12.0*	*12.0*	*12.0*	
Parking / Grade / Parking	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*	*N*	*0*	*N*
Parking Maneuvers, N_m												
Buses Stopping, N_B				*0*	*0*			*0*	*0*	*0*	*0*	
Min. Time for Pedestrians, G_p	*3.2*			*3.2*			*3.2*			*3.2*		

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = *19.0*	G =	G =	G =	G = *10.0*	G = *21.0*	G =	G =
	Y = *5*	Y =	Y =	Y =	Y = *3*	Y = *7*	Y =	Y =
Duration of Analysis, T = *0.25*						Cycle Length, C = *65.0*		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Adjusted Flow Rate, v				*269*	*221*			*914*	*156*	*229*	*736*	
Lane Group Capacity, c				*517*	*493*			*602*	*511*	*387*	*974*	
v/c Ratio, X				*0.52*	*0.45*			*1.52*	*0.31*	*0.59*	*0.76*	
Total Green Ratio, g/C				*0.29*	*0.29*			*0.32*	*0.32*	*0.58*	*0.52*	
Uniform Delay, d_1				*19.2*	*18.7*			*22.0*	*16.5*	*11.5*	*12.2*	
Progression Factor, PF				*1.000*	*1.000*			*1.000*	*1.000*	*1.000*	*1.000*	
Delay Calibration, k				*0.13*	*0.11*			*0.50*	*0.50*	*0.18*	*0.31*	
Incremental Delay, d_2				*0.9*	*0.7*			*241.7*	*1.5*	*2.4*	*3.4*	
Initial Queue Delay, d_3				*0.0*	*0.0*			*0.0*	*0.0*	*0.0*	*0.0*	
Control Delay				*20.1*	*19.4*			*263.7*	*18.1*	*13.9*	*15.7*	
Lane Group LOS				*C*	*B*			*F*	*B*	*B*	*B*	
Approach Delay				*19.8*			*227.9*			*15.2*		
Approach LOS				*B*			*F*			*B*		
Intersection Delay	*106.2*			$X_c = 1.09$			Intersection LOS			*F*		

STATION: **870194**

New York State Department of Transportation
Traffic Count Hourly Report

ROUTE #: **NY 22** ROAD NAME: **22**
DIRECTION: Northbound FACTOR GROUP: 30
STATE DIR CODE: 1 WK OF YR: 16
DATE OF COUNT: 04/13/2009
NOTES LANE 1: Week 15-Nb

FROM: **END RT 116 OLAP**
REC. SERIAL #: 0078
PLACEMENT: .4 S of Mahopae Ave
@ REF MARKER: 22 87024248
ADDL DATA:
COUNT TYPE: AXLE PAIRS
PROCESSED BY: ORG CODE: DOT INITIALS: jh

TO: **CR 138 HARDSCRABBLE RD**
FUNC. CLASS: 14
NHS: no
JURIS: NYSDOT
CC Stn:
BATCH ID: R07-R08cww15

COUNTY: **Westchester**
TOWN: **NORTH SALEM**
LION#:
BIN: 1017370
RR CROSSING:
HPMS SAMPLE:

COUNT TAKEN BY: ORG CODE: TST INITIALS: JSV

DATE	DAY	AM 12 TO 1	1 TO 2	2 TO 3	3 TO 4	4 TO 5	5 TO 6	6 TO 7	7 TO 8	8 TO 9	9 TO 10	10 TO 11	11 TO 12	PM 12 TO 1	1 TO 2	2 TO 3	3 TO 4	4 TO 5	5 TO 6	6 TO 7	7 TO 8	8 TO 9	9 TO 10	10 TO 11	11 TO 12	DAILY TOTAL	DAILY HIGH COUNT	DAILY HIGH HOUR
1	W																											
2	T																											
3	F																											
4	S																											
5	S																											
6	M																											
7	T																											
8	W																											
9	T																											
10	F																											
11	S																											
12	S																											
13	M												**148**	**197**	**198**	**242**	**328**	**487**	**701**	**358**	**247**	**102**	**54**	**43**	**30**			
14	T	**17**	**10**	**3**	**3**	**8**	**17**	**63**	**128**	**154**	**150**	**110**	**166**	**156**	**161**	**264**	**328**	**511**	**626**	**400**	**241**	**126**	**72**	**47**	**31**	3792	626	17
15	W	**9**	**15**	**7**	**6**	**5**	**14**	**86**	**125**	**146**	**145**	**138**	**136**	**194**	**176**	**251**	**367**	**475**	**599**	**346**	**277**	**121**	**82**	**58**	**39**	3817	599	17
16	T	**14**	**4**	**7**	**2**	**6**	**17**	**61**	**137**	**155**	**148**	**146**																
17	F																											
18	S																											
19	S																											
20	M																											
21	T																											
22	W																											
23	T																											
24	F																											
25	S																											
26	S																											
27	M																											
28	T																											
29	W																											
30	T																											

AVERAGE WEEKDAY HOURS (Axle Factored, Mon 6AM to Fri Noon)

																								ADT
13	**10**	**6**	**4**	**6**	**16**	**68**	**127**	**149**	**145**	**128**	**147**	**178**	**174**	**246**	**333**	**480**	**628**	**360**	**249**	**113**	**67**	**48**	**32**	**3727**

DAYS Counted	HOURS Counted	WEEKDAYS Counted	WEEKDAY Hours	AVERAGE WEEKDAY High Hour	AVERAGE WEEKDAY % of day	Axle Adj. Factor	Seasonal/Weekday Adjustment Factor
4	72	4	72	628	17%	0.978	1.056

ESTIMATED (one way)

AADT
3529

STATION: **870194**

New York State Department of Transportation
Traffic Count Hourly Report

ROUTE #: **NY 22** ROAD NAME: **22**
DIRECTION: Southbound FACTOR GROUP: 30
STATE DIR CODE: 2 WK OF YR: 16
DATE OF COUNT: 04/13/2009
NOTES LANE 1: Week 15-Sb

COUNT TAKEN BY: ORG CODE: TST INITIALS: JSV

FROM: **END RT 116 OLAP**
REC. SERIAL #: 0050
PLACEMENT: .4 S of Mahapae Ave
@ REF MARKER: 22 87024248
ADDL DATA:
COUNT TYPE: AXLE PAIRS
PROCESSED BY: ORG CODE: DOT INITIALS: jh

TO: **CR 138 HARDSCRABBLE RD**
FUNC. CLASS: 14
NHS: no
JURIS: NYSDOT
CC Stn:
BATCH ID: R07-R08cww15

COUNTY: **Westchester**
TOWN: **NORTH SALEM**
LION#:
BIN: 1017370
RR CROSSING:
HPMS SAMPLE:

DATE	DAY	12 TO 1 (AM)	1 TO 2	2 TO 3	3 TO 4	4 TO 5	5 TO 6	6 TO 7	7 TO 8	8 TO 9	9 TO 10	10 TO 11	11 TO 12	12 TO 1 (PM)	1 TO 2	2 TO 3	3 TO 4	4 TO 5	5 TO 6	6 TO 7	7 TO 8	8 TO 9	9 TO 10	10 TO 11	11 TO 12	DAILY TOTAL	DAILY HIGH COUNT	DAILY HIGH HOUR
1	W																											
2	T																											
3	F																											
4	S																											
5	S																											
6	M																											
7	T																											
8	W																											
9	T																											
10	F																											
11	S																											
12	S																											
13	M												**142**	**180**	**170**	**191**	**164**	**210**	**208**	**158**	**101**	**74**	**59**	**39**	**22**			
14	T	**8**	**6**	**5**	**5**	**28**	**63**	**309**	**839**	**686**	**244**	**160**	**156**	**178**	**158**	**168**	**153**	**235**	**283**	**171**	**100**	**82**	**59**	**31**	**26**	4153	839	7
15	W	**6**	**9**	**10**	**9**	**28**	**68**	**299**	**896**	**854**	**256**	**152**	**147**	**194**	**173**	**184**	**188**	**169**	**190**	**171**	**113**	**81**	**58**	**44**	**23**	4322	896	7
16	T	**9**	**1**	**5**	**8**	**25**	**65**	**284**	**907**	**718**	**286**	**151**																
17	F																											
18	S																											
19	S																											
20	M																											
21	T																											
22	W																											
23	T																											
24	F																											
25	S																											
26	S																											
27	M																											
28	T																											
29	W																											
30	T																											
AVERAGE WEEKDAY HOURS (Axle Factored, Mon 6AM to Fri Noon)		**8**	**5**	**7**	**7**	**26**	**64**	**290**	**862**	**736**	**256**	**151**	**145**	**180**	**163**	**177**	**164**	**200**	**222**	**163**	**103**	**77**	**58**	**37**	**23**	**ADT 4124**		

DAYS Counted	HOURS Counted	WEEKDAYS Counted	WEEKDAY Hours	AVERAGE WEEKDAY High Hour	AVERAGE WEEKDAY % of day	Axle Adj. Factor	Seasonal/Weekday Adjustment Factor
4	72	4	72	862	21%	0.978	1.056

ESTIMATED (one way)

AADT
3905

WEEKEND PEAK 15 MINUTE COUNTS

PROJECT Woodlands at North Salem
LOCATION 01 I 684 SB at Hardscrabble Road
DATE September 22, 2010
TIME 7:00AM to 9:00 AM

TIM MILLER ASSOCIATES, INC.

15 Minute Traffic

START TIME	END TIME	Hardscrabble Road SB left 6	thru 5	right	Total	I 684 SB Ramp left 7	thru	right 9	Total	Hardscrabble Road NB left	thru 11	right 12	Total	left	thru	right	Total	GRAND TOTAL
07:00 AM	07:15 AM	42	34		76	91		13	104		67	28	95					275
07:15 AM	07:30 AM	52	50		102	95		6	101		68	13	81					284
07:30 AM	07:45 AM	40	60		100	126		2	128		60	89	149					377
07:45 AM	08:00 AM	39	53		92	125		10	135		79	72	151					378
08:00 AM	08:15 AM	33	45		78	123		6	129		73	93	166					373
08:15 AM	08:30 AM	41	56		97	109		11	120		70	61	131					348
08:30 AM	08:45 AM	44	59		103	101		8	109		84	79	163					375
08:45 AM	09:00 AM	26	40		66	100		4	104		83	61	144					314
TOTAL		317	397		714	870		60	930		584	496	1080					2724

WEEKEND PEAK HOURLY APPROACH VOLUMES

PROJECT Woodlands at North Salem

LOCATION 01 I 684 SB at Hardscrabble Road

DATE September 22, 2010

TIME 7:00AM to 9:00 AM

TIM MILLER ASSOCIATES, INC.

HOURLY SUMMARY

		Hardscrabble Road SB				I 684 SB Ramp				Hardscrabble Road NB								
START TIME	END TIME	left 6	thru 5	right	Total	left 7	thru	right 9	Total	left	thru 11	right 12	Total	left	thru	right	Total	GRAND TOTAL
07:00 AM	08:00 AM	173	197		370	437		31	468		274	202	476					1314
07:15 AM	08:15 AM	164	208		372	469		24	493		280	267	547					1412
07:30 AM	**08:30 AM**	**153**	**214**		**367**	**483**		**29**	**512**		**282**	**315**	**597**					**1476**
07:45 AM	08:45 AM	157	213		370	458		35	493		306	305	611					1474
08:00 AM	09:00 AM	144	200		344	433		29	462		310	294	604					1410
07:30 AM	**08:30 AM**	**153**	**214**		**367**	**483**		**29**	**512**		**282**	**315**	**597**					**1476**
Peak 15 Minutes					**100**				**135**				**166**					
Peak Hour Factor					**0.92**				**0.95**				**0.90**					

WEEKEND PEAK 15 MINUTE COUNTS

PROJECT Woodlands at North Salem

LOCATION 01 I 684 SB at Hardscrabble Road

DATE September 22, 2010

TIME 4:30 PM to 6:30 PM

TIM MILLER ASSOCIATES, INC.

15 Minute Traffic

		Hardscrabble Road SB				I 684 SB Ramp				Hardscrabble Road NB								
START TIME	END TIME	left 6	thru 5	right	Total	left 7	thru	right 9	Total	left	thru 11	right 12	Total	left	thru	right	Total	GRAND TOTAL
04:30 PM	04:45 PM	22	95		117	67		8	75		115	30	145					337
04:45 PM	**05:00 PM**	**25**	**110**		**135**	**50**		**13**	**63**		**106**	**37**	**143**					**341**
05:00 PM	**05:15 PM**	**26**	**99**		**125**	**62**		**3**	**65**		**121**	**37**	**158**					**348**
05:15 PM	**05:30 PM**	**36**	**102**		**138**	**57**		**10**	**67**		**144**	**45**	**189**					**394**
05:30 PM	**05:45 PM**	**15**	**92**		**107**	**69**		**7**	**76**		**106**	**50**	**156**					**339**
05:45 PM	06:00 PM	20	104		124	44		6	50		114	37	151					325
06:00 PM	06:15 PM	17	96		113	54		5	59		97	33	130					302
06:15 PM	06:30 PM	18	92		110	50		10	60		91	21	112					282
TOTAL		179	790		969	453		62	515		894	290	1184					2668

WEEKEND PEAK HOURLY APPROACH VOLUMES

PROJECT	Woodlands at North Salem	TIM MILLER ASSOCIATES, INC.
LOCATION	01 I 684 SB at Hardscrabble Road	
DATE	September 22, 2010	
TIME	4:30 PM to 6:30 PM	

HOURLY SUMMARY

		Hardscrabble Road SB				I 684 SB Ramp				Hardscrabble Road NB								
START TIME	END TIME	left 6	thru 5	right	Total	left 7	thru	right 9	Total	left	thru 11	right 12	Total	left	thru	right	Total	GRAND TOTAL
04:30 PM	05:30 PM	109	406		515	236		34	270		486	149	635					1420
04:45 PM	**05:45 PM**	**102**	**403**		**505**	**238**		**33**	**271**		**477**	**169**	**646**					**1422**
05:00 PM	06:00 PM	97	397		494	232		26	258		485	169	654					1406
05:15 PM	06:15 PM	88	394		482	224		28	252		461	165	626					1360
05:30 PM	06:30 PM	70	384		454	217		28	245		408	141	549					1248
04:45 PM	05:45 PM	102	403		505	238		33	271		477	169	646					1422
Peak 15 Minutes					138				76				189					
Peak Hour Factor					0.91				0.89				0.85					

TRAFFIC IMPACT STUDY

WOODLANDS DEVELOPMENT
Town of North Salem
Westchester County, New York

PREPARED FOR: JOFLO OF NORTH SALEM, INC.

MICHAEL MARIS ASSOCIATES, INC.

Traffic and Parking Consultants
Highway and Signal Design
MICHAEL MARIS ASSOCIATES, INC.

TRAFFIC IMPACT STUDY

WOODLANDS DEVELOPMENT
Town of North Salem, Westchester County, New York

PREPARED FOR: **Joflo of North Salem, Inc.**
300 East 74th Street
New York, New York 10021

Project No. 04-841
April 2005

125 State Street, Suite 103, Hackensack, NJ 07601 • (201) 343-0993 • FAX (201) 343-1080

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APPENDIX B: CAPACITY ANALYSIS

SECTION A

INTRODUCTION

SECTION A

INTRODUCTION

A-1 PROJECT DESCRIPTION

JOFLO of North Salem, Inc. proposes to construct a residential development, to be known as the Woodlands, in the Town of North Salem, Westchester County, New York. The Woodlands will be constructed on a site located northwest of the Interstate Route 684 (I-684) and Hardscrabble Road interchange and have access from Reed Road, a local roadway (the site location is identified on Exhibit No. 1 in Appendix A of this report).

Current plans for the Woodlands development include about 49 detached single-family homes and 76 attached Senior Adult homes. It is expected that the development would be complete and occupied by the Year 2007.

A-2 SCOPE OF STUDY

Michael Maris Associates, Inc. (MMA) was previously retained by JOFLO to perform a Traffic Impact Study for a larger development on the same site, known as Highgate, which consisted of 49 detached homes and 250,000 square feet of office space. Due to the change of the development plans, and the number of years elapsed since the last study, MMA was requested to perform a new study assessing Woodlands' traffic impact on the surrounding roadway network.

Prior to the preparation of this Traffic Impact Study, MMA met with Town representatives to agree upon the scope of the study. The following reflects the approved scope:

1. Sight distances at the Hardscrabble Road/Reed Road and Reed Road/Site Driveway intersections were analyzed. In addition, three-year accident data for the Hardscrabble Road/Reed Road intersection was collected and summarized.

2. The Year 2007 Build traffic volumes for the morning and afternoon peak commuter hours presented in a recent study by Adler Consulting were used as the Year 2007 Base Traffic Volumes for this study.

3. The 2007 Base Traffic Volumes were increased by an annual growth rate to the Design Year 2010, resulting in the Year 2010 No-build Traffic Volumes for this study. Because the Adler projections include the traffic generations of several other proposed developments in the area, it was not necessary to increase the No-build volumes by any other development's generations.

4. Traffic counts were performed at two intersections not included in the Adler study. The counted volumes at these locations were then increased to reflect the Adler projections and further increased to reflect the general growth rate.

5. The traffic generations of the Woodlands development, and their distributions on the surrounding roadways, were estimated and added to the No-build volumes to identify the Year 2010 Build Traffic Volumes.

6. Capacity analyses were performed comparing the 2007 Base, 2010 No-build and 2010 Build volumes to intersection capacities in order to identify future traffic conditions.

7. Where the analyses indicated potential problems, additional analyses were performed to identify feasible improvements.

SECTION B

DESCRIPTION OF ROADWAY NETWORK AND MASS TRANSIT

SECTION B

DESCRIPTION OF ROADWAY NETWORK AND MASS TRANSIT

B-1 DESCRIPTION OF ROADWAY NETWORK

Following are brief descriptions that would provide access to the Woodlands development:

1. Interstate Route 684 (I-684)

I-684 is a major north/south expressway extending from the Cross Westchester Expressway to the south to I-84 to the north. In the vicinity of the site, I-684 is a six-lane, divided, limited-access facility that has a posted speed limit of 55 miles per hour (mph). This roadway will provide excellent regional access to the site via a full interchange (No. 8) with Hardscrabble Road.

2. New York Route 22

NY Route 22 is a north/south State highway that in the North Salem area runs generally parallel to I-684 and is one of the primary connections between Purdy's and Croton Falls. The roadway has a posted speed limit of 50 mph and consists of one travel lane per direction, with additional turning lanes at major intersections.

3. Hardscrabble Road

Hardscrabble Road runs east/west through North Salem and connects NY Route 22 to the west and with June Road to the east. The roadway provides one travel lane per direction and has a posted speed limit of 35 mph.

4. Reed Road

Reed Road is a local street that intersects with Hardscrabble Road immediately west of I-684 and terminates at a dead end. The roadway presently serves a few single-family dwelling units and consists of one travel lane per direction. All access to the Woodlands development will be provided from Reed Road.

B-2 DESCRIPTION OF TRAIN SERVICE

The Metro-North Railroad's Harlem Line provides service between Grand Central Terminal in New York City and Brewster. In the vicinity of the site, stations have been provided in the Hamlet of Croton Falls and at Purdy's.

The Croton Falls Station is located approximately 1.2 miles southwest of the site in the vicinity of NY Route 22 and Mahopac Avenue/Croton Falls Road. About 15 trains per day stop at this station. The Purdy's Station is located approximately 2.0 mile south of the site. Train stops at this Station are of the same frequency as those at Croton Falls.

B-3 DESCRIPTION OF PEDESTRIAN ACTIVITY

Observations regarding pedestrian activity in the study area show that the pedestrian traffic is generally limited to the Croton Falls business district and the Croton Falls train station. Negligible pedestrian activity was observed along other roadways.

SECTION C

2007 BASE AND NO-BUILD TRAFFIC VOLUMES

SECTION C

2007 BASE AND 2010 NO-BUILD TRAFFIC VOLUMES

C-1 KEY INTERSECTIONS

Based upon the approved Scope, traffic flow through the following intersections was analyzed in detail.

1. Hardscrabble Road and I-684 Northbound Ramps
2. Hardscrabble Road and Reed Road
3. Hardscrabble Road and I-684 Southbound Ramps
4. Hardscrabble Road and NY Route 22
5. NY Route 22 and Front Street
6. Reed Road and Site Driveway

C-2 PEAK PERIODS OF ANALYSES

To analyze the impact of any development, it is necessary to compare hourly traffic volumes to intersection capacities during those hours when the combined roadway and development traffic will be at its highest.

Since residential developments generate their peak volumes during the peak morning and afternoon commuter periods when residents travel to and from work, it was agreed that traffic volumes during the Peak AM and PM Highway Hours would be identified and analyzed. It is noted that these are the same hours when traffic on the surrounding roadways is also at its highest,

C-3 INTERSECTION GEOMETRY AND PEAK HOURS

Field surveys were performed by representatives of MMA in order to collect updated data regarding intersection and roadway geometry, traffic controls, and signal operations.

In addition, peak-hour manual turning movement counts were performed at two intersection not included in the Adler study (Hardscrabble Road/Reed Road and NY Route 22/Front Street) on February 23, 2005 and April 5, 2005, respectively. A review of the counts, which were performed from 6:45 to 9:00 AM and from 4:30 to 7:00 PM, shows that the Peak AM Highway Hour occurred from 7:45 to 8:45 AM, while the Peak PM Highway Hour occurred from 5:45 to 6:45 PM.

C-4 YEAR 2007 BASE TRAFFIC VOLUMES

As previously noted, the Year 2007 traffic volumes obtained from the Adler study include the generations of all other developments in the area and required no adjustments. However, since the Adler study did not include projections for the Hardscrabble Road/Reed Road and NY Route 22/Front Street intersections, the traffic volumes counted by MMA at these locations were increased to conform to the Adler projections. The resulting Year 2007 Base Traffic Volumes are presented on Exhibits No. 2 and 3 in Appendix A of this report.

C-5 YEAR 2010 NO-BUILD TRAFFIC VOLUMES

To identify the Year 2010 No-build Traffic Volumes (without the Woodlands traffic), it was necessary to increase the 2007 Base Traffic Volumes by annual growth rate that does not reflect the generations of any particular development.

The annual growth rate was calculated based on a comparison of the Year 2004 Adler traffic counts to traffic counts performed in 1994 by MMA. Following is a summary of the comparison at Key Intersections where counts were performed in 1994 and 2004:

Intersection	Counted Volumes		Percent Increase	
	1994	2004	Total	Annual
Peak AM Highway Hour				
Hardscrabble Rd. & I-684 N/B Ramps	742	964	30	3.0
Hardscrabble Rd. & I-684 S/B Ramps	1734	1815	5	0.5
Hardscrabble Rd. & NY Route 22	1928	2432	26	2.6
Peak PM Highway Hour				
Hardscrabble Rd. & I-684 N/B Ramps	1293	1641	27	2.7
Hardscrabble Rd. & I-684 S/B Ramps	1408	1702	21	2.1
Hardscrabble Rd. & NY Route 22	1656	1857	12	1.2

The above comparison shows an average growth rate of 2.0 percent. Therefore, the Year 2007 Base Traffic Volumes were increased by 6.0 percent, resulting in the Year 2010 No-build Traffic Volumes presented on Exhibits No. 4 and 5.

SECTION D

WOODLANDS GENERATIONS & 2010 BUILD TRAFFIC VOLUMES

SECTION D

WOODLANDS GENERATIONS AND 2010 BUILD TRAFFIC VOLUMES

D-1 TRAFFIC GENERATIONS

In accordance to the approved Scope, the amount of traffic that would be generated by Woodlands was estimated based on information contained in a report published by the Institute of Transportation Engineers (ITE) entitled "Trip Generation," Seventh Edition. The ITE report is based on numerous surveys of similar developments and presents trip generation rates that can be applied to new developments to estimate their generations.

Exhibit No. 6 presents the Woodlands generation estimates based on 49 detached single-family homes and 76 attached adult units. The Exhibit shows that the Woodlands will generate about 51 vehicle trips during the Peak AM Hour and 59 trips during the Peak PM Hour. It is noted that no reductions were made for mass transit use since the residents would likely drive to the station anyway. It is also noted that, per the ITE data, the attached adult units will generate very little traffic. While adults of this age work, they tend to travel during off-peak hours, reducing peak hour generations. Further, they generally do not have young children that would to necessitate trips to and from school, after-school activities, etc.

D-2 TRAFFIC DISTRIBUTIONS

The Arrival and Departure Distributions of the Woodlands traffic were determined based on a review of the existing traffic volumes and travel patterns in the general site area. The results of this analysis are presented on Exhibits No. 7 and 8.

Exhibits No. 7 and 8 show the following general distributions of the Woodlands traffic:

Route	Percent	AM Trips	PM Trips
I-684 to/from North	20	10	12
I-684 to/from South	45	23	26
NY Route 22 to/from South	17	9	10
Hardscrabble Road to/from East	8	4	5
Mahopac Ave./Croton Falls Rd. to/from West	10	5	6
Totals	100	51	59

D-3 YEAR 2010 BUILD TRAFFIC VOLUMES

The Woodlands traffic was assigned to the Key Intersections in accordance with the Traffic Distributions and added to the 2010 No-Build Traffic Volumes, resulting in the 2010 Build Traffic Volumes presented on Exhibits No. 9 and 10.

SECTION E

TRAFFIC ANALYSES, FINDINGS AND CONCLUSIONS

SECTION E

TRAFFIC ANALYSES, FINDINGS AND CONCLUSIONS

E-1 ANALYSES SCENARIOS

To accurately define the future traffic conditions and the traffic impact of the Woodlands development, Intersection Capacity Analyses were performed for the following scenarios:

1. The 2007 Base Traffic Volumes were compared to the existing intersection geometry (2007 Base Traffic Conditions).

2. The 2010 No-build Traffic Volumes (without the Woodlands traffic) were compared to the existing intersection geometry (2010 No-build Traffic Conditions).

3. The 2010 Build Traffic Volumes (with the Woodlands traffic) were compared to the existing intersection geometry (2010 Build Traffic Conditions).

4. Where the Capacity Analyses indicated potential traffic flow problems and a need for intersection improvements, appropriate improvements were identified and additional analyses were performed comparing the 2010 Build Traffic Volumes to intersection geometries with the improvements (2010 Build-with-Improvements Traffic Conditions).

E-2 DESCRIPTION OF ANALYSES

The methodology and terminology used in the Capacity Analyses are described in the Highway Capacity Manual, 2000, published by the Transportation Research Board. Following are brief descriptions of these analyses:

1. Signalized Intersection Capacity Analyses

For signalized intersections, Level of Service is defined in terms of delay, which is a measure of loss of travel time. Levels of Service criteria are stated in terms of the Average Control Delay per vehicle for the peak 15-minute period within the hour analyzed. Delay is dependent on a number of factors, including number of lanes, turning volumes, truck volumes, Green to Cycle Length Ratio, and Volume to Capacity ratio for each approach. The criteria for the Level of Service designations are given in the following Table:

Level of Service	Description	Average Delay Per Vehicle (seconds)
A	Free Flow	10.0 or less
B	Mostly Free Flow	10.1 to 20.0
C	Somewhat Restricted	20.1 to 35.0
D	Some short Delays	35.1 to 55.0
E	At Capacity	55.1 to 80.0
F	Congestion	80.1 or greater

2. Unsignalized Intersection Capacity Analyses

The unsignalized intersection analyses are based on the gap acceptance theory, which relies on three basic elements, including the size and distribution of gaps in the major traffic stream, the usefulness of the gaps to the minor stream drivers, and the relative priority of the various traffic streams. Level of Service criteria are stated in terms of the Average Control Delay per vehicle for the peak 15-minute period within the hour by the following Level of Service designations:

Level of Service	Expected Delay to Minor Street Traffic	Average Total Delay (sec/veh)
a	Little or no delay	10.0 or Less
b	Short traffic delays	10.1 to 15.0
c	Average traffic delays	15.1 to 25.0
d	Long traffic delays	25.1 to 35.0
e	Very long traffic delays	35.1 to 50.0
f	Demand exceeds Capacity	50.1 or greater

3. Sight Distance Analyses

The methodology used to perform sight distance analyses consists of field observations to identify the available sight distances on the minor approaches to an intersection and comparison of the required sight distances recommended by the American Association of State Highway and Transportation Official's (AASHTO) in a publication entitled, A Policy on Geometric Design of Highways and Streets, 2001.

E-3 FINDINGS

Following are brief descriptions of each of the Key Intersections, including intersection geometry and traffic controls, the amount of traffic to be added by Woodlands, the results of the Capacity Analyses for each scenario, and feasible solutions where required to eliminate projected problems. Copies of the Capacity Analyses are provided in Appendix B of this report.

1. Hardscrabble Road and I-684 Northbound Ramps

a. Existing Geometry

The I-684 ramps form a four-leg intersection with Hardscrabble Road. The eastbound and westbound Hardscrabble Road approaches consist of one lane permitting all turning movements, while the I-684 northbound exit ramp consist of a left turn lane and a through/right turn lane. The intersection is unsignalized with "Stop" signs facing the I-684 exit ramp.

b. Year 2007 Base Traffic Conditions

Unsignalized Intersection Capacity Analyses with the 2007 Base Traffic Volumes indicate that the movements along Hardscrabble Road and the right turns from the I-684 exit ramp will operate at acceptable Level of Service C or better. However, the left turns from the I-684 ramp will experience very long delays and operate at unacceptable Level of Service F.

c. Year 2010 No-Build Traffic Conditions

Capacity Analyses with the 2010 No-build Traffic Volumes indicate similar operating conditions as those with the Base Traffic Volumes.

d. Year 2010 Build Traffic Conditions

The Woodlands development will add 18 and 24 new trips to this intersection during the Peak AM and PM Highway Hours, respectively, which would represent less than 1.5 percent of the total intersection traffic. This percent of increase is not considered significant and would not be noticeable to the general driving public. Capacity Analyses with the 2010 Build Traffic Volumes indicate similar traffic operations as those with the Base and No-build Traffic Volumes.

e. Potential Traffic Improvements

A review of the existing and future traffic volumes at the intersection indicate that the Base Condition delays could be eliminated by the installation of a traffic signal and by re-striping and/or widening of the eastbound and westbound approaches to provide separate right and left turn lanes. Analyses comparing the 2010 Build Traffic Volumes to the intersection geometry with the suggested improvements indicate that the delays would be eliminated and that the intersection would operate at Level of Service D or better during the Peak Hours.

2. Hardscrabble Road and Reed Road

a. Existing Geometry

Reed Road forms the north leg of an unsignalized intersection with Hardscrabble Road, which forms the east and west legs. The Hardscrabble Road eastbound approach consists of one left turn/through lane and the westbound approach of one through/right turn lane. The southbound Reed Road approach consists of one left/right turn lane that is controlled by a "Stop" sign.

b. Sight Distance Analyses

The required sight distances for traffic exiting Reed Road, based on a 40 mph speed for Hardscrabble Road traffic, would be a distance of 445 feet in both directions. Field measurements show that the available sight distance to the east is about 485 feet and distance to the west is approximately 500 feet. Therefore, it is concluded that the traffic exiting Reed Road would have acceptable sight distances.

c. Accident History

Accident data received from the New York State Department of Transportation shows one accident occurring at this intersection July 18, 1999. The accident occurred when a van traveling in the east direction made a left turn and apparently hit a fixed object. The van that was occupied by two passengers, one of which reported an injury. The accident occurred daylight hours under dry roadway conditions and the report states that there were no apparent factors causing the accident (human error).

d. Year 2007 Base Traffic Conditions

Unsignalized Intersection Capacity Analyses with the 2007 Base Traffic Volumes indicate that all movements at the intersection would operate at acceptable Level of Service C or better during both Peak Hours.

e. Year 2010 No-build Traffic Conditions

Capacity Analyses with the 2010 No-build Traffic Volumes indicate that all movements would continue to operate at acceptable Levels of Service during the Peak Hours.

f. Year 2010 Build Traffic Conditions

All of the Woodlands traffic would pass through this intersection, which would represent an increase of 51 and 59 new trips during the Peak AM and PM Highway Hours, respectively, representing between 3.3 and 4.3 percent of the total intersection traffic. Capacity Analyses with the 2010 Build Traffic Volumes indicate that the traffic exiting Reed Road traffic would not experience long and unacceptable delays during the Peak Hours.

3. Hardscrabble Road and I-684 Southbound Ramps

a. Existing Geometry

The I-684 southbound exit and entrance ramps form a "T" intersection with Hardscrabble Road, which forms the north and south legs of the intersection. The northbound approach consists of one through lane and one right turn lane, the southbound approach of one through and one left turn lane, and the westbound approach of one left and one right turn lane. The intersection is controlled by a traffic signal that provides an advance phase for the southbound approach.

b. Year 2007 Base Traffic Conditions

Signalized Intersection Capacity Analyses with the 2007 Base Traffic Volumes indicate that the westbound left turns would experience long delays and Level of Service F during the Peak AM Hour, while the southbound through traffic would experience long delays and Level of Service F during the Peak PM Hour.

c. Year 2010 No-Build Traffic Conditions

Capacity Analyses with the 2010 No-build Traffic Volumes indicate similar operating conditions as those with the Base Traffic Volumes.

d. Year 2010 Build Traffic Conditions

The Woodlands development will add 34 and 39 new trips to this intersection during the Peak AM and PM Highway Hours, respectively, which would represent less than 2.0 percent of the total intersection traffic. This increase is not significant and Capacity Analyses with the Build Traffic Volumes indicate similar traffic operating conditions as those with the Base and No-build Traffic Volumes.

e. Potential Traffic Improvements

A review of the existing and future traffic volumes at the intersection indicate that the Base Condition delays could be eliminated by re-striping and/or widening of the westbound ramp approach to provide a double left turn lane and by adjusting the signal operations. Analyses comparing the 2010 Build Traffic Volumes to the intersection geometry with the suggested improvements show that the intersection would operate at acceptable Level of Service D or better during the Peak Hours.

4. Hardscrabble Road and NY Route 22

a. Existing Geometry

Hardscrabble Road forms the east leg and NY Route 22 the south and west legs of this "T" intersection. The westbound Hardscrabble Road approach consists of a left turn lane and a through lane, the northbound Route 22 approach of a left turn lane and a right turn lane, and the Route 22 eastbound approach of a through lane and a channelized right turn lane. The intersection is controlled by a traffic signal that provides an advance phase for the westbound approach.

b. Year 2007 Base Traffic Conditions

Signalized Intersection Capacity Analyses with the 2007 Base Traffic Volumes indicate that the eastbound and westbound approaches will experience long delays and Level of Service F during the Peak AM Hour, while all movements will operate at acceptable Level of Service C or better during the Peak PM Hour.

c. Year 2010 No-Build Traffic Conditions

Capacity Analyses with the 2010 No-build Traffic Volumes indicate similar operating conditions as those with the Base Traffic Volumes.

d. Year 2010 Build Traffic Conditions

The Woodlands development will add 16 and 18 new trips to this intersection during the Peak AM and PM Highway Hours, respectively, which would represent less than 1.0 percent of the total intersection traffic. This increase is not significant and Capacity Analyses with the Build Traffic Volumes indicate similar traffic operating conditions as those with the Base and No-build Traffic Volumes.

e. Potential Traffic Improvements

A review of the existing and future traffic volumes at the intersection indicates that the delays during the Peak AM Hour will be caused by the very heavy left turns (843 trips) on southbound Hardscrabble Road onto Route 22 that would be opposed by very heavy through (701 trips) on the eastbound Route 22 approach. It does not appear that the Peak AM Hour delays could be completely eliminated without very extensive roadway widening. However, the delays could be reduced substantially by changing the signal cycle and the green time allocation.

5. NY Route 22 and Front Street

a. Existing Geometry

Front Street forms the south leg and NY Route 22 the north and east legs of this "T" intersection. Both NY Route 22 approaches consist of one lane permitting all turns, while the Front Street approach consists of one left turn lane and one right turn lane. The intersection is controlled by a "Stop" sign facing the Front Street approach. A Metro North line overpass parallels Front Street just east of the intersection, which limits visibility to vehicles on Front Street.

b. Year 2007 Base Traffic Conditions

Unsignalized Intersection Capacity Analyses with the 2007 Base Traffic Volumes indicate that all approaches to the intersection will operate at acceptable Level of Service D or better. However, during field observations, problems were observed at the intersection to the north, with left-turning vehicles from NY Route 22 to Croton Falls Road queuing and blocking traffic at this intersection. In addition, problems were observed due to the poor visibility caused by the railroad overpass and by the sharp turns to/from Front Street and Route 22.

c. Year 2010 No-Build Traffic Conditions

Capacity Analyses with the 2010 No-build Traffic Volumes indicate similar operating conditions as those with the Base Traffic Volumes.

d. Year 2010 Build Traffic Conditions

The Woodlands development will add 6 and 7 new trips to this intersection during the Peak AM and PM Highway Hours, respectively, which would represent about 0.5 percent of the total intersection traffic. This percent of increase is also not significant and Capacity Analyses with the Build Traffic Volumes indicate similar traffic operations as those with the Base and No-build Traffic Volumes.

e. Potential Traffic Improvements

Traffic counts and analyses were not performed for the NY Route 22 and Croton Falls Road intersection to determine what improvements would be required to eliminate the problems at that location. Regarding the NY Route 22 and Front Street intersection, a signal installation might eliminate the problems. However, a review of the projected traffic volumes indicates that they would not meet the required signal warrants for NYSDOT to approve the installation.

6. Reed Road and Woodlands Driveway

a. Existing Geometry

Reed Road at the location of the proposed Woodlands driveway consists of one lane per direction, while the Woodlands driveway will consist of one entering and one exiting lane that will be under "Stop" sign control.

b. Sight Distances

Sight distance measurements were taken at the location of the proposed driveway and compared to the AASHTO guidelines. Per AASHTO, with traffic traversing along Reed Road at 30 mph, vehicles exiting the Woodlands driveway will require a 335-foot sight distance in each direction. Based on the field measurements, the available sight distance exceeds 500 feet along both directions of Reed Road and is, therefore, considered acceptable.

c. Year 2010 Build Traffic Conditions

All of the Woodlands traffic would pass through this intersection. However, it would be about 50 vehicle trips during each of the Peak Hours, less than one vehicle per minute. Unsignalized Intersection Capacity Analyses with 2010 Build Traffic Volumes show that all movements will operate at very acceptable Levels of Service A during both Peak Hours.

E-4 CONCLUSIONS

The following conclusions are reached based on the analyses presented in this report:

1. The Woodlands development would generate a relatively small amount of traffic that, on the average, would be less than one vehicle per minute.

2. The Woodlands traffic would generally represent less than 2.0 percent of the projected Year 2010 traffic volumes in the area, which is considered insignificant

3. Due to the I-684 interchange, some of the busier intersections in the area experience congestion and delays during the peak commuter hours.

4. Reasonable improvements have been identified herein that could eliminate or reduce the traffic delays.

Respectfully submitted,
MICHAEL MARIS ASSOCIATES, INC.

Michael Maris
President

Dimitri G. Dellis, P.E.
Vice President

John Maris
Project Manager
mm

APPENDIX A

EXHIBITS

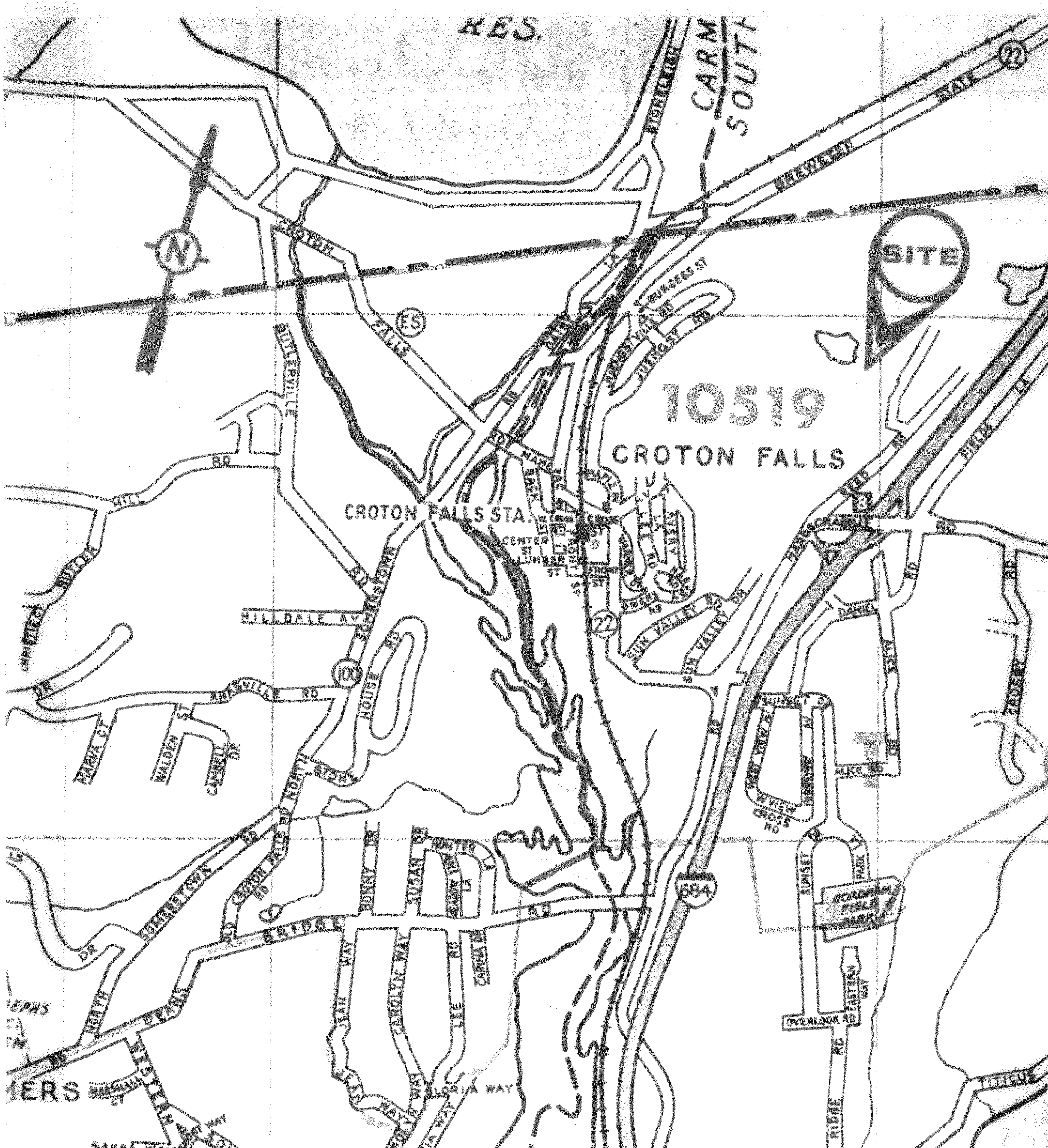

EXHIBIT NO. 1

SITE LOCATION MAP

MICHAEL MARIS ASSOCIATES, INC.

Woodlands Development
Town of North Salem, New York

Project No. 04-841

April, 2005

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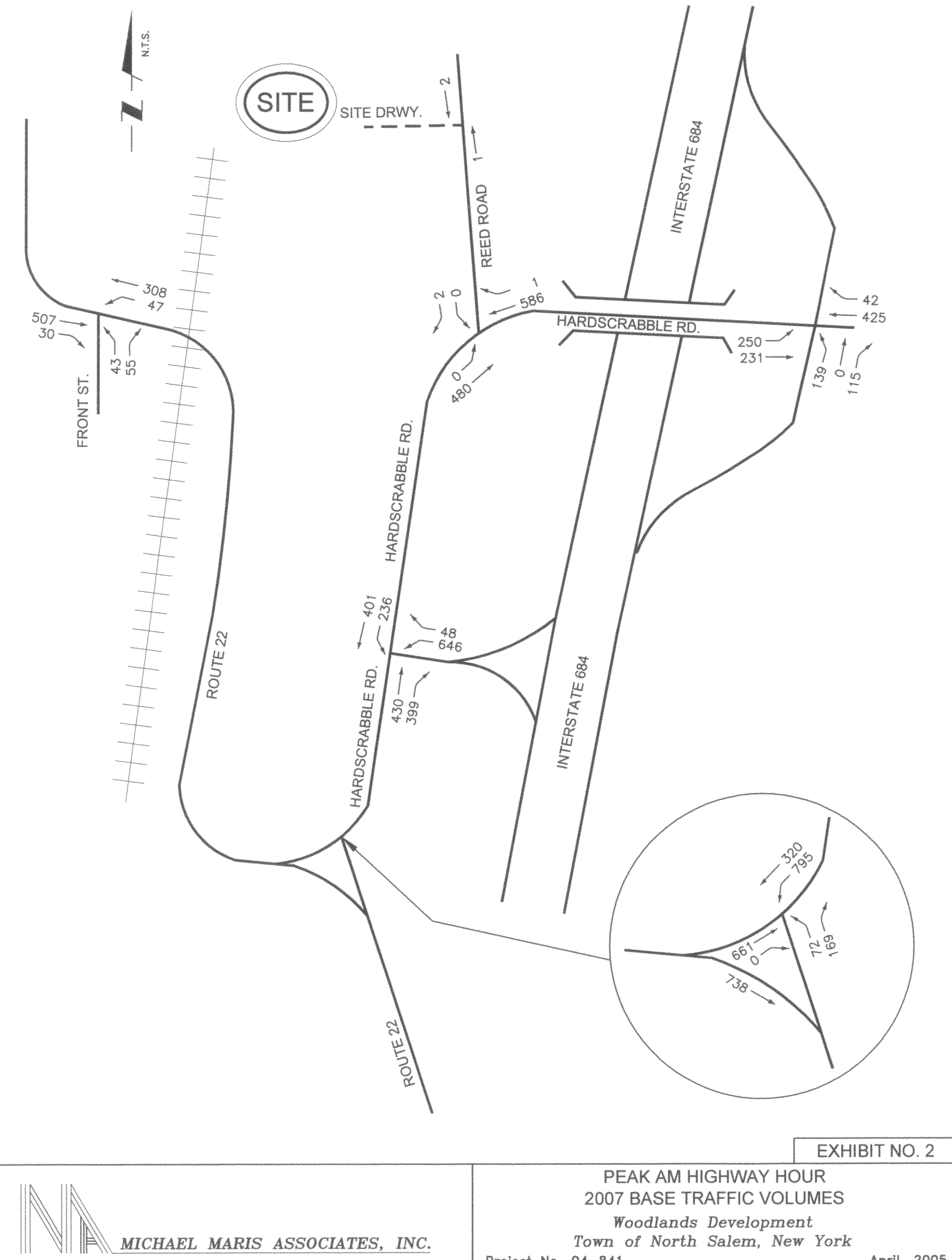

EXHIBIT NO. 2

FILE: G:\Data\CAD\04841\ld.dwg

MICHAEL MARIS ASSOCIATES, INC.

PEAK AM HIGHWAY HOUR
2007 BASE TRAFFIC VOLUMES

Woodlands Development
Town of North Salem, New York

Project No. 04-841

April, 2005

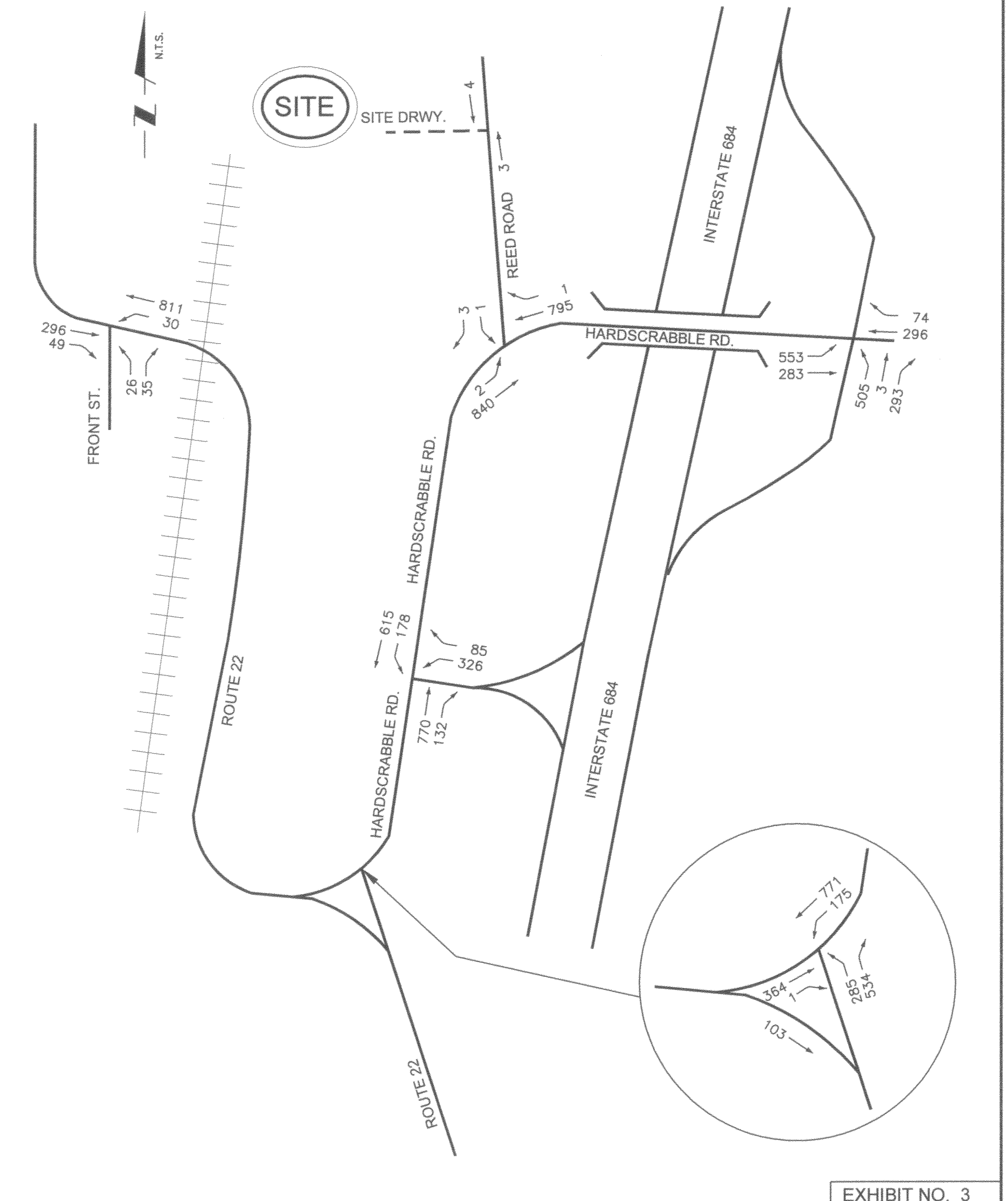

EXHIBIT NO. 3

MICHAEL MARIS ASSOCIATES, INC.

PEAK PM HIGHWAY HOUR
2007 BASE TRAFFIC VOLUMES
Woodlands Development
Town of North Salem, New York

Project No. 04-841 April, 2005

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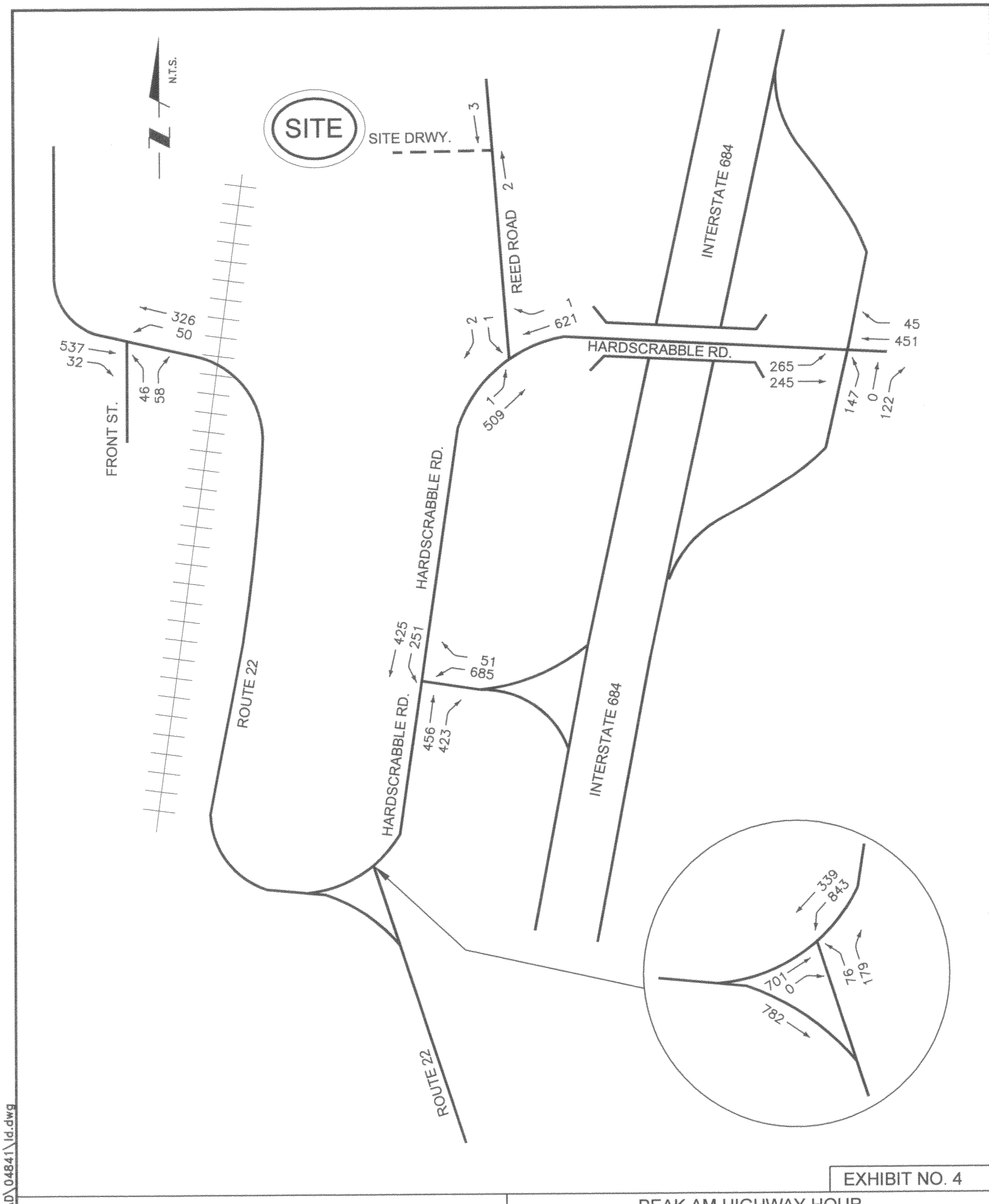

EXHIBIT NO. 4

PEAK AM HIGHWAY HOUR
2010 NO-BUILD TRAFFIC VOLUMES

Woodlands Development
Town of North Salem, New York

Project No. 04-841 April, 2005

MICHAEL MARIS ASSOCIATES, INC.

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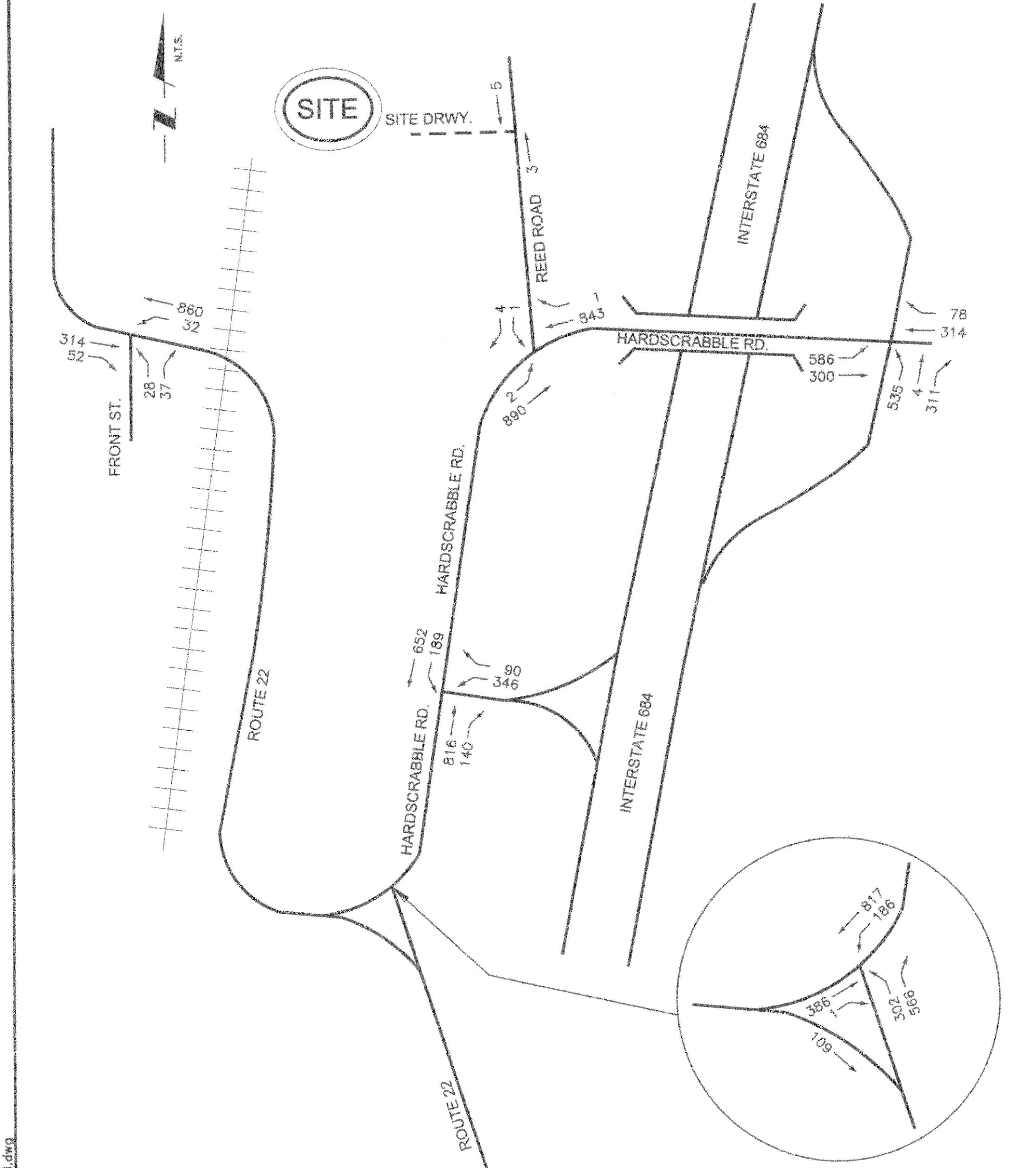

EXHIBIT NO. 5

PEAK PM HIGHWAY HOUR
2010 NO-BUILD TRAFFIC VOLUMES

Woodlands Development
Town of North Salem, New York

MICHAEL MARIS ASSOCIATES, INC.

Project No. 04-841 April, 2005

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DEVELOPMENT	PEAK AM HOUR			PEAK PM HOUR		
	In	Out	Total	In	Out	Total
49-Unit Detached *	11	33	44	18	32	50
76-Unit Senior Adult – Attached **	3	4	7	5	4	9
Total	14	37	51	23	36	59

* Based on ITE Land Use Code 210 (Single-Family Detached Housing)
** Based on ITE Land Use Code 252 (Senior Adult Housing – Attached)

EXHIBIT NO. 6

TRIP GENERATION TABLE

Woodlands Development
Town of North Salem, New York

Project No. 04-841 April, 2005

MICHAEL MARIS ASSOCIATES, INC.

FILE: G:\Data\CAD\04841\ld-bor.dwg

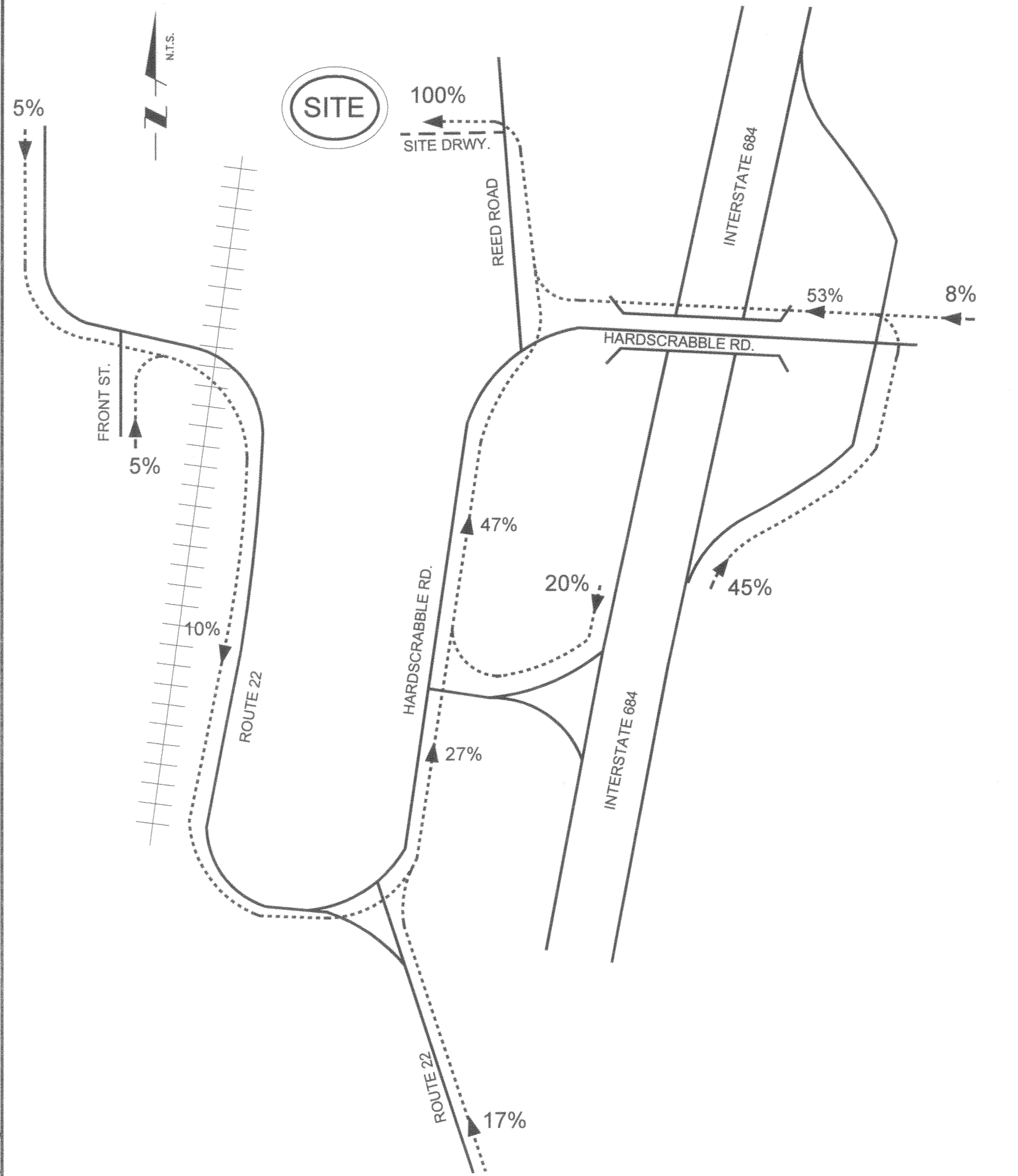

EXHIBIT NO. 7

ARRIVAL DISTRIBUTION

Woodlands Development
Town of North Salem, New York

MICHAEL MARIS ASSOCIATES, INC.

Project No. 04-841

April, 2005

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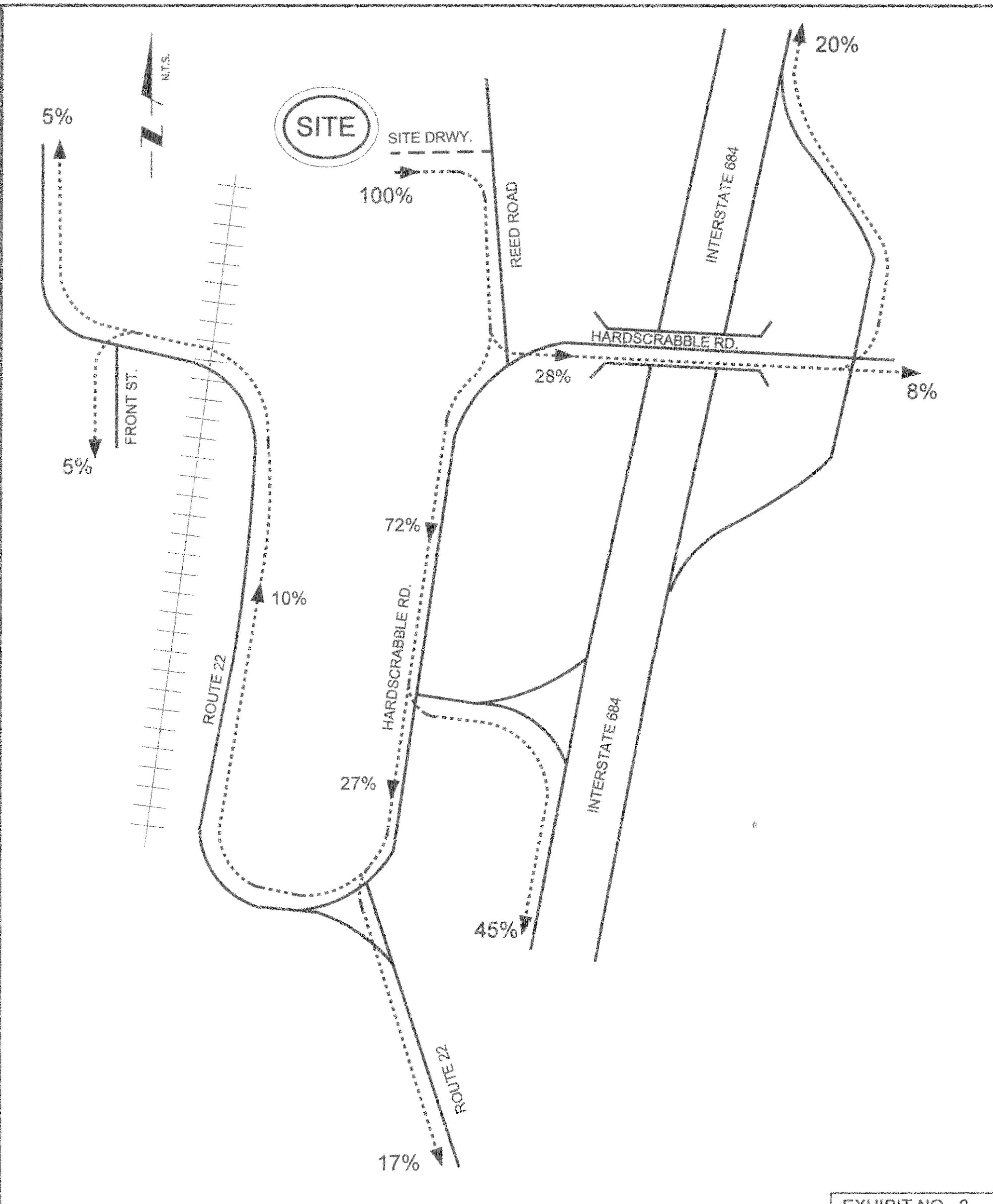

EXHIBIT NO. 8

MICHAEL MARIS ASSOCIATES, INC.

DEPARTURE DISTRIBUTION

Woodlands Development
Town of North Salem, New York

Project No. 04-841 April, 2005

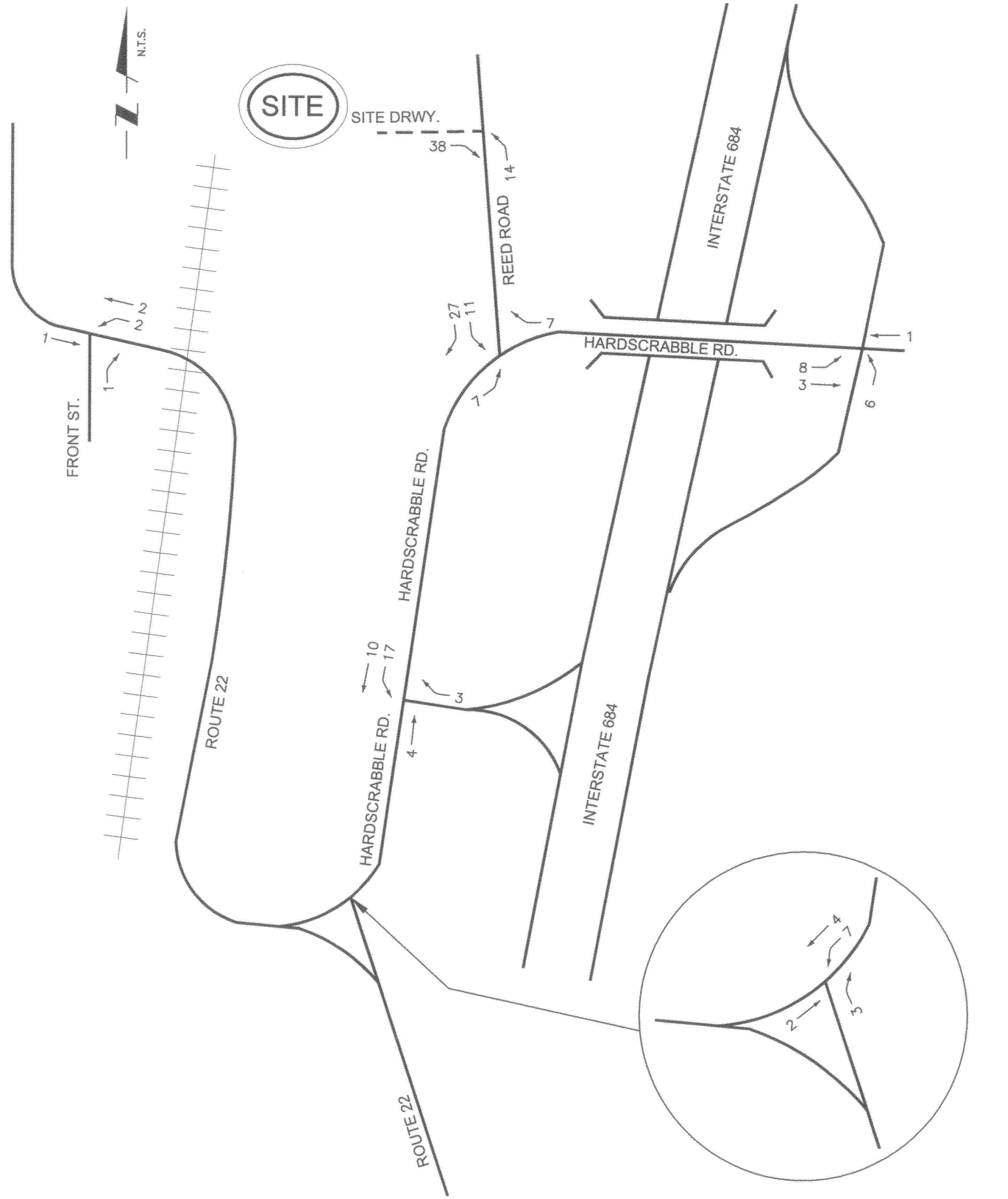

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EXHIBIT NO. 9

MICHAEL MARIS ASSOCIATES, INC.

PEAK AM HIGHWAY HOUR
2007 SITE GENERATED TRAFFIC VOLUMES

Woodlands Development
Town of North Salem, New York

Project No. 04-841

April, 2005

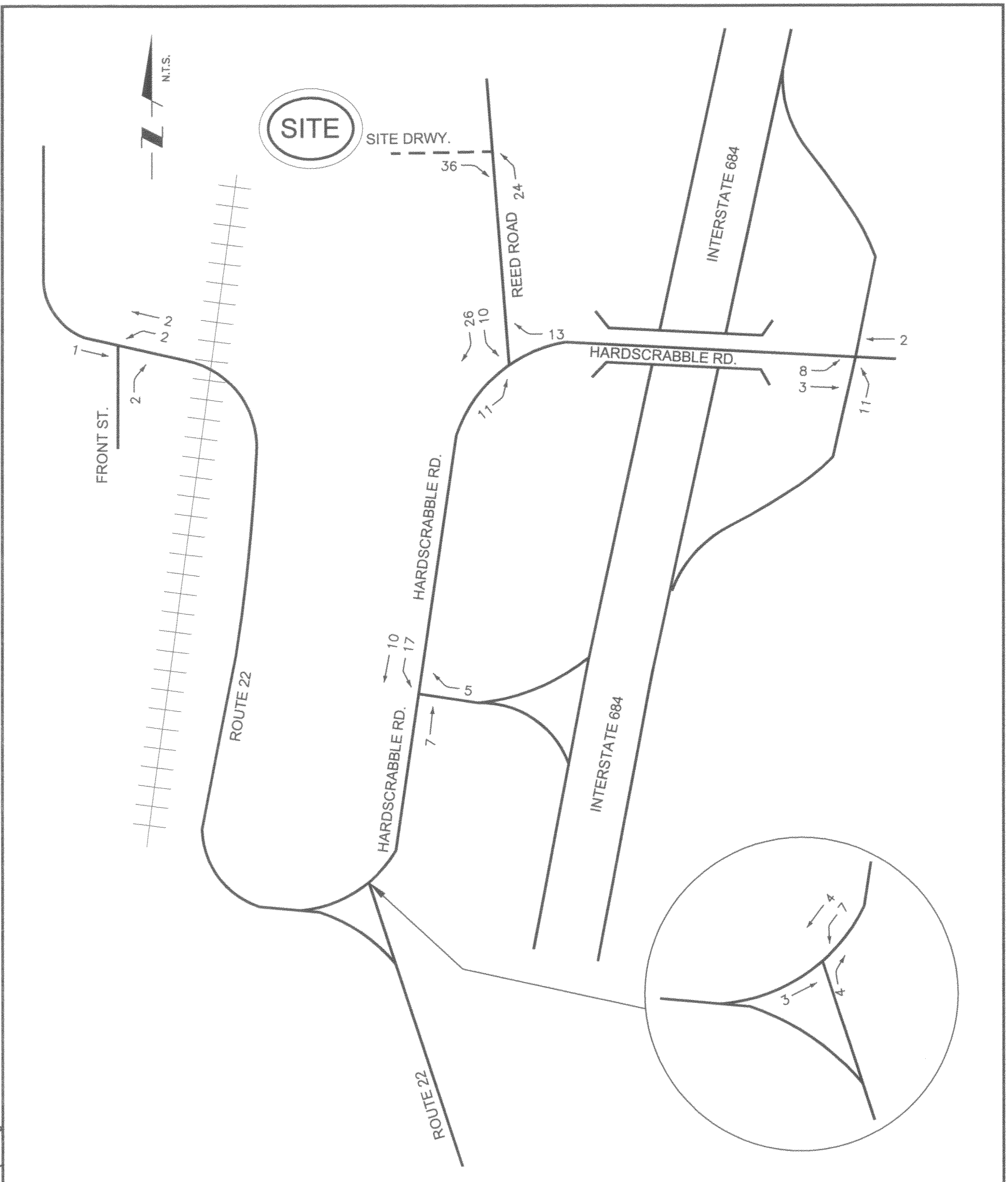

EXHIBIT NO. 10

PEAK PM HIGHWAY HOUR
2007 SITE GENERATED TRAFFIC VOLUMES

Woodlands Development
Town of North Salem, New York

Project No. 04-841

April, 2005

MICHAEL MARIS ASSOCIATES, INC.

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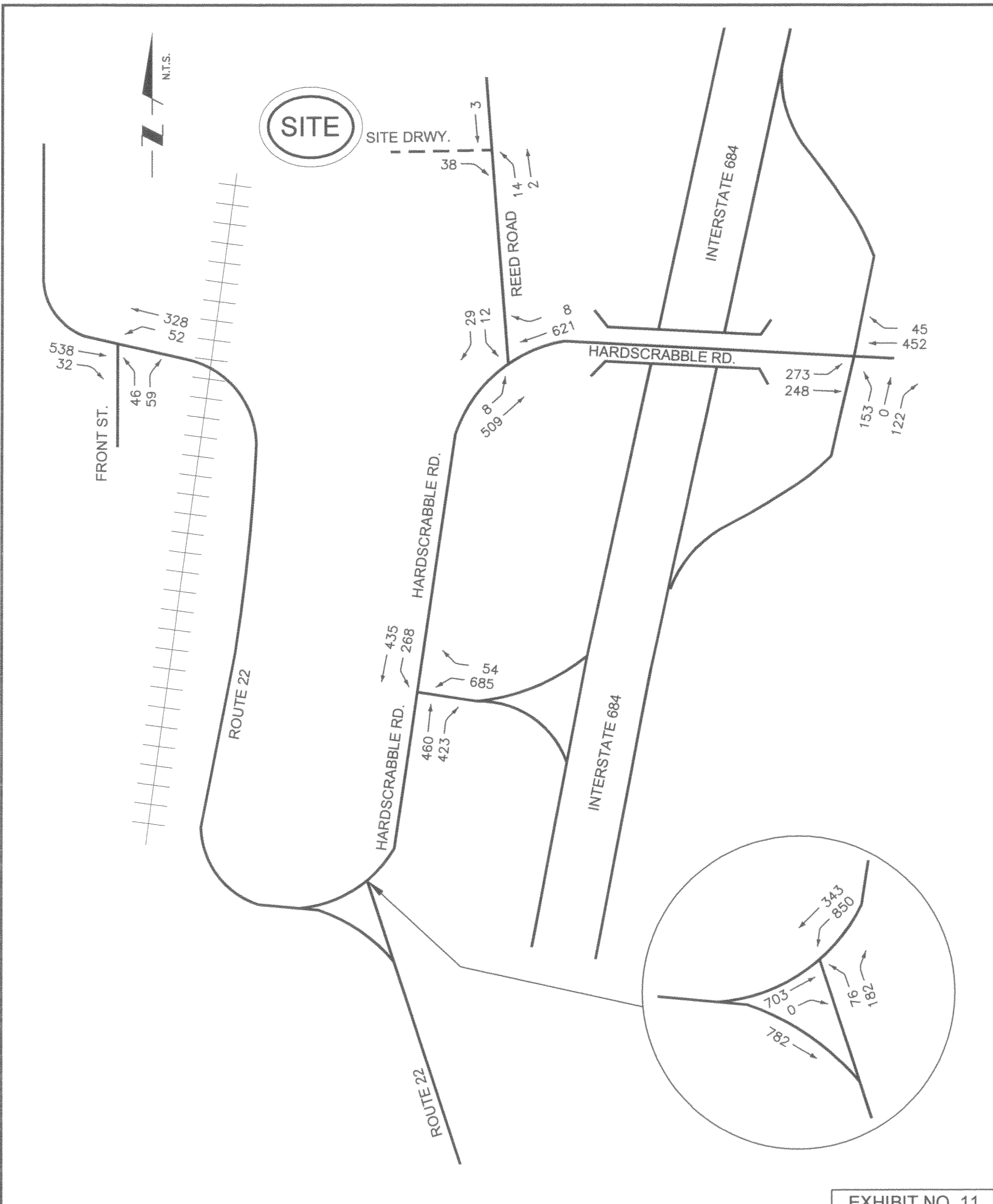

EXHIBIT NO. 11

MICHAEL MARIS ASSOCIATES, INC.

PEAK AM HIGHWAY HOUR
2010 BUILD TRAFFIC VOLUMES

Woodlands Development
Town of North Salem, New York

Project No. 04-841 April, 2005

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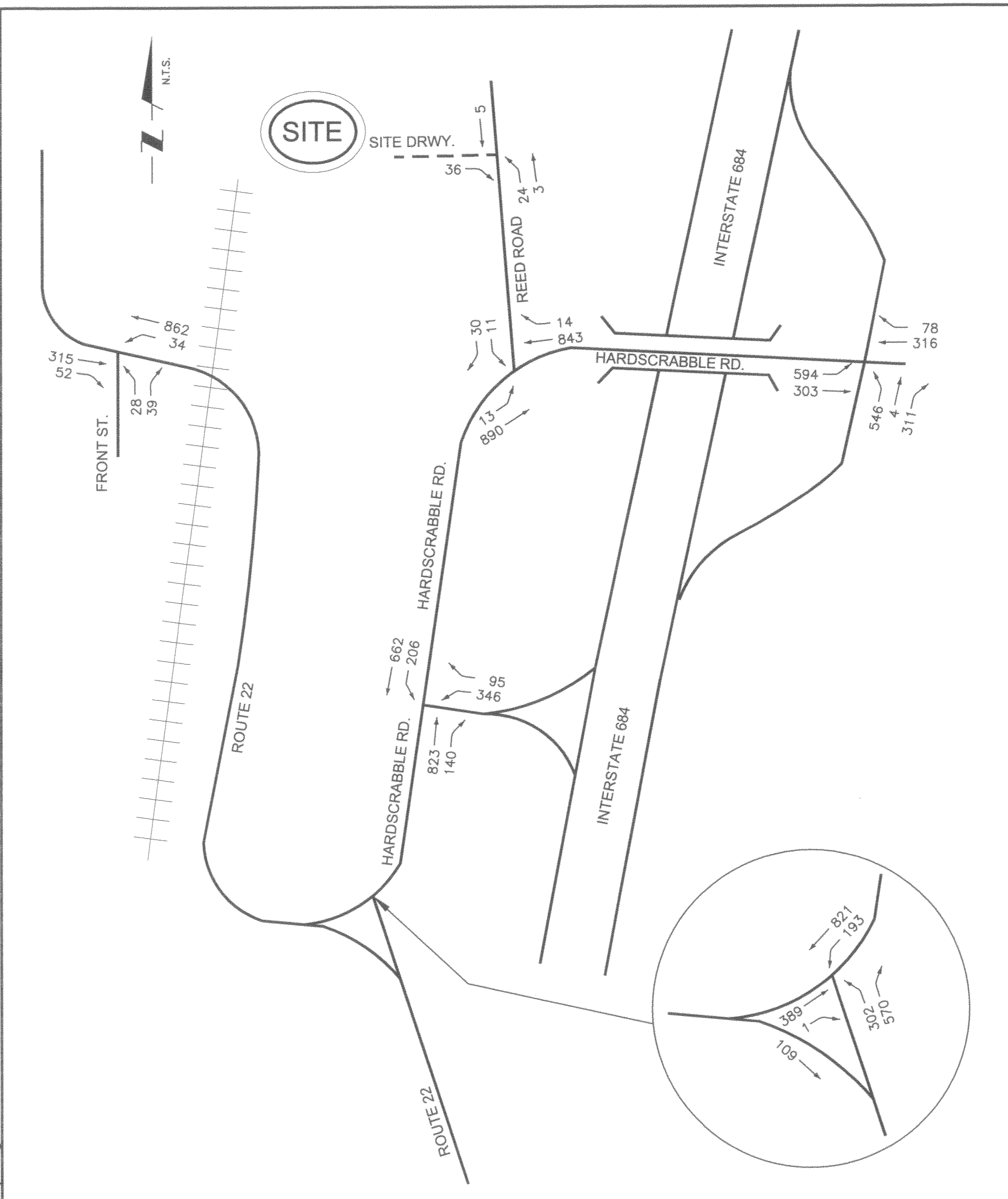

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EXHIBIT NO. 12

MICHAEL MARIS ASSOCIATES, INC.

PEAK PM HIGHWAY HOUR
2010 BUILD TRAFFIC VOLUMES
Woodlands Development
Town of North Salem, New York

Project No. 04-841 April, 2005

APPENDIX B

CAPACITY ANALYSES

2007 BASE TRAFFIC CONDITIONS

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	mm - 1AMbase
Agency/Co.	mma
Date Performed	4/5/2005
Analysis Time Period	Peak AM Hour

Site Information

Intersection	Hardscrabble & 684 NB Ramps
Jurisdiction	North Salem, NY
Analysis Year	2007 Base Condition

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road*

North/South Street: *I-684 Northbound Ramps*

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)	250	231	0	0	425	42
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	277	256	0	0	472	46
Proportion of heavy vehicles, P_{HV}	2	--	--	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)	139	0	115	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	154	0	127	0	0	0
Proportion of heavy vehicles, P_{HV}	2	2	2	0	0	0
Percent grade (%)		0			0	
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	1	1	0	0	0	0
Configuration	L		TR			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT		L		TR			
Volume, v (vph)	277		154		127			
Capacity, c_m (vph)	1048		130		783			
v/c ratio	0.26		1.18		0.16			
Queue length (95%)	1.07		9.25		0.58			

Control Delay (s/veh)	9.7		202.6		10.5			
LOS	A		F		B			
Approach delay (s/veh)	--	--	115.8					
Approach LOS	--	--	F					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 1AMbase
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	250	231			425	42
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	277	256			472	46
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	139	0	115			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Hourly Flow Rate, HFR	154	0	127			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	1	1	0			
Configuration	L		TR			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	277		154		127			
C(m) (vph)	1048		130		783			
v/c	0.26		1.18		0.16			
95% queue length	1.07		9.25		0.58			
Control Delay	9.7		202.6		10.5			
LOS	A		F		B			
Approach Delay				115.8				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 1AMbase
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	250	231			425	42
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	69	64			118	12
Hourly Flow Rate, HFR	277	256			472	46
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	139	0	115			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Peak-15 Minute Volume	39	0	32			
Hourly Flow Rate, HFR	154	0	127			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	1	1	0			
Configuration	L	TR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	256	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1		7.1	6.5	6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2		2	2	2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00		0.70	0.00	0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1		6.4	6.5	6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2		2	2	2			
t(f)	2.2		3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	518		1305	1328	256			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	256	
Potential Capacity	783	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	783	
Probability of Queue free St.	0.84	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		518
Potential Capacity		1048
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1048
Probability of Queue free St.	1.00	0.74
Maj L-Shared Prob Q free St.		0.69

Step 3: TH from Minor St.	8	11
Conflicting Flows	1328	
Potential Capacity	155	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.69	0.69
Movement Capacity	107	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1305	
Potential Capacity	177	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.69
Maj. L, Min T Adj. Imp Factor.		0.76
Cap. Adj. factor due to Impeding mvmnt	0.74	0.64
Movement Capacity	130	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1328	
Potential Capacity	155	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.69	0.69
Movement Capacity	107	

Result for 2 stage process:		
a		
y		
C t	107	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1305	
Potential Capacity	177	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.69
Maj. L, Min T Adj. Imp Factor.		0.76
Cap. Adj. factor due to Impeding mvmnt	0.74	0.64
Movement Capacity	130	

Results for Two-stage process:		
a		
y		
C t	130	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	154	0	127			
Movement Capacity (vph)	130	107	783			
Shared Lane Capacity (vph)			783			

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	130	107	783			
Volume	154	0	127			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh			783			
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	277		154		127			
C(m) (vph)	1048		130		783			
v/c	0.26		1.18		0.16			
95% queue length	1.07		9.25		0.58			
Control Delay	9.7		202.6		10.5			
LOS	A		F		B			
Approach Delay				115.8				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.74	1.00
v(il), Volume for stream 2 or 5	256	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.69	
d(M,LT), Delay for stream 1 or 4	9.7	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	3.0	

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*mm - 1PMbase*
Agency/Co.	*mma*
Date Performed	*4/5/2005*
Analysis Time Period	*Peak PM Hour*

Site Information

Intersection	*Hardscrabble & 684 NB Ramps*
Jurisdiction	*North Salem, NY*
Analysis Year	*2007 Base Condition*

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road*

North/South Street: *I-684 Northbound Ramps*

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)	553	283	0	0	296	74
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	614	314	0	0	328	82
Proportion of heavy vehicles, P_{HV}	2	--	--	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)	505	3	293	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	561	3	325	0	0	0
Proportion of heavy vehicles, P_{HV}	2	2	2	0	0	0
Percent grade (%)		0			0	
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	1	1	0	0	0	0
Configuration	L		TR			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT		L		TR			
Volume, v (vph)	614		561		328			
Capacity, c_m (vph)	1149		35		562			
v/c ratio	0.53		16.03		0.58			
Queue length (95%)	3.28		68.81		3.73			

Control Delay (s/veh)	11.7		6979		20.0			
LOS	B		F		C			
Approach delay (s/veh)	--	--	4411					
Approach LOS	--	--	F					

HCS2000TM Version 4.1d

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 1PMbase
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	553	283			296	74
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	614	314			328	82
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	505	3	293			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Hourly Flow Rate, HFR	561	3	325			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	1	1	0			
Configuration	L	TR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	614		561		328			
C(m) (vph)	1149		35		562			
v/c	0.53		16.03		0.58			
95% queue length	3.28		68.81		3.73			
Control Delay	11.7		6979		20.0			
LOS	B		F		C			
Approach Delay				4411				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst:	mm - 1PMbase
Agency/Co.:	mma
Date Performed:	4/5/2005
Analysis Time Period:	Peak PM Hour
Intersection:	Hardscrabble & 684 NB Ramps
Jurisdiction:	North Salem, NY
Units: U. S. Customary	
Analysis Year:	2007 Base Condition
Project ID:	Woodlands Development
East/West Street:	Hardscrabble Road
North/South Street:	I-684 Northbound Ramps
Intersection Orientation: EW	Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	553	283			296	74
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	154	79			82	21
Hourly Flow Rate, HFR	614	314			328	82
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	505	3	293			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Peak-15 Minute Volume	140	1	81			
Hourly Flow Rate, HFR	561	3	325			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	1	1	0			
Configuration	L		TR			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	314	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1		7.1	6.5	6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2		2	2	2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00		0.70	0.00	0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1		6.4	6.5	6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2		2	2	2			
t(f)	2.2		3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	410		1911	1952	314			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	314	
Potential Capacity	726	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	726	
Probability of Queue free St.	0.55	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		410
Potential Capacity		1149
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1149
Probability of Queue free St.	1.00	0.47
Maj L-Shared Prob Q free St.		0.34

Step 3: TH from Minor St.	8	11
Conflicting Flows	1952	
Potential Capacity	64	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.34	0.34
Movement Capacity	22	
Probability of Queue free St.	0.86	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1911	
Potential Capacity	75	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.30
Maj. L, Min T Adj. Imp Factor.		0.43
Cap. Adj. factor due to Impeding mvmnt	0.47	0.24
Movement Capacity	35	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1952	
Potential Capacity	64	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.34	0.34
Movement Capacity	22	

Result for 2 stage process:		
a		
y		
C t	22	
Probability of Queue free St.	0.86	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1911	
Potential Capacity	75	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.30
Maj. L, Min T Adj. Imp Factor.		0.43
Cap. Adj. factor due to Impeding mvmnt	0.47	0.24
Movement Capacity	35	

Results for Two-stage process:		
a		
y		
C t	35	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	561	3	325			
Movement Capacity (vph)	35	22	726			
Shared Lane Capacity (vph)			562			

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	35	22	726			
Volume	561	3	325			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh			562			
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	614		561		328			
C(m) (vph)	1149		35		562			
v/c	0.53		16.03		0.58			
95% queue length	3.28		68.81		3.73			
Control Delay	11.7		6979		20.0			
LOS	B		F		C			
Approach Delay				4411				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.47	1.00
v(il), Volume for stream 2 or 5	314	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.34	
d(M,LT), Delay for stream 1 or 4	11.7	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	7.6	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*mm - 2AMbase*	Intersection	*Hardscrabble & Reed*
Agency/Co.	*MMA*	Jurisdiction	*North Salem, NY*
Date Performed	*4/5/2005*	Analysis Year	*2007 Base Condition*
Analysis Time Period	*Peak AM Hour*		

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road*	North/South Street: *Reed Road*
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)	0	480	0	0	586	1
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	0	533	0	0	651	1
Proportion of heavy vehicles, P_{HV}	2	--	--	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	0	0	0	0	2
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	0	0	0	0	0	2
Proportion of heavy vehicles, P_{HV}	0	0	0	2	0	2
Percent grade (%)	0			0		
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
Volume, v (vph)	0						2	
Capacity, c_m (vph)	935						468	
v/c ratio	0.00						0.00	
Queue length (95%)	0.00						0.01	
Control Delay (s/veh)	8.9						12.7	

LOS	*A*						*B*	
Approach delay (s/veh)	--	--				*12.7*		
Approach LOS	--	--				*B*		

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 2AMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach	Eastbound			Westbound		
	Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		0	480			586	1
Peak-Hour Factor, PHF		0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR		0	533			651	1
Percent Heavy Vehicles		2	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	1			1	0
Configuration		LT				TR	
Upstream Signal?			No			No	

Minor Street:	Approach	Northbound			Southbound		
	Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume					0		2
Peak Hour Factor, PHF					0.90		0.90
Hourly Flow Rate, HFR					0		2
Percent Heavy Vehicles					2		2
Percent Grade (%)			0			0	
Flared Approach:	Exists?/Storage			/			No /
Lanes					0		0
Configuration						LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	0						2	
C(m) (vph)	935						468	
v/c	0.00						0.00	
95% queue length	0.00						0.01	
Control Delay	8.9						12.7	
LOS	A						B	
Approach Delay							12.7	
Approach LOS							B	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 2AMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	0	480			586	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	0	133			163	0
Hourly Flow Rate, HFR	0	533			651	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume				0		2
Peak Hour Factor, PHF				0.90		0.90
Peak-15 Minute Volume				0		1
Hourly Flow Rate, HFR				0		2
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
RT Channelized?						
Lanes				0		0
Configuration					LR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	533	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.1		6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1					6.4		6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	652					1185		652
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		652
Potential Capacity		468
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		468
Probability of Queue free St.	1.00	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		652
Potential Capacity		935
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		935
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		1185
Potential Capacity		209
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		209

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		1185
Potential Capacity		209
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		209
Results for Two-stage process:		
a		
y		
C t		209

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				0		2
Movement Capacity (vph)				209		468
Shared Lane Capacity (vph)					468	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				209		468
Volume				0		2
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					468	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	0						2	
C(m) (vph)	935						468	
v/c	0.00						0.00	
95% queue length	0.00						0.01	
Control Delay	8.9						12.7	
LOS	A						B	
Approach Delay							12.7	
Approach LOS							B	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5	533	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	1.00	
d(M,LT), Delay for stream 1 or 4	8.9	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.0	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	mm - 2PMbase	Intersection	Hardscrabble & Reed
Agency/Co.	MMA	Jurisdiction	North Salem, NY
Date Performed	4/5/2005	Analysis Year	2007 Base Condition
Analysis Time Period	Peak PM Hour		

Project Description: Woodlands Development	
East/West Street: Hardscrabble Road	North/South Street: Reed Road
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)	2	840	0	0	795	1
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	2	933	0	0	883	1
Proportion of heavy vehicles, P_{HV}	2	--	--	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	0	0	1	0	3
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	0	0	0	1	0	3
Proportion of heavy vehicles, P_{HV}	0	0	0	2	0	2
Percent grade (%)	0			0		
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
Volume, v (vph)	2						4	
Capacity, c_m (vph)	765						195	
v/c ratio	0.00						0.02	
Queue length (95%)	0.01						0.06	
Control Delay (s/veh)	9.7						23.8	

LOS	A						C	
Approach delay (s/veh)	--	--					23.8	
Approach LOS	--	--					C	

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 2PMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	2	840			795	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	2	933			883	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				1		3
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				1		3
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	2						4	
C(m) (vph)	765						195	
v/c	0.00						0.02	
95% queue length	0.01						0.06	
Control Delay	9.7						23.8	
LOS	A						C	
Approach Delay							23.8	
Approach LOS							C	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 2PMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	2	840			795	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	1	233			221	0
Hourly Flow Rate, HFR	2	933			883	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				1		3
Peak Hour Factor, PHF				0.90		0.90
Peak-15 Minute Volume				0		1
Hourly Flow Rate, HFR				1		3
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		No /
RT Channelized?						
Lanes				0		0
Configuration					LR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	933	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.1		6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1					6.4		6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	884					1821		884
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		884
Potential Capacity		344
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		344
Probability of Queue free St.	1.00	0.99

Step 2: LT from Major St.	4	1
Conflicting Flows		884
Potential Capacity		765
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		765
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		0.99

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		1821
Potential Capacity		85
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.99	1.00
Movement Capacity		85

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		1821
Potential Capacity		85
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.99	1.00
Movement Capacity		85

Results for Two-stage process:		
a		
y		
C t		85

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				1		3
Movement Capacity (vph)				85		344
Shared Lane Capacity (vph)					195	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				85		344
Volume				1		3
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					195	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	2						4	
C(m) (vph)	765						195	
v/c	0.00						0.02	
95% queue length	0.01						0.06	
Control Delay	9.7						23.8	
LOS	A						C	
Approach Delay							23.8	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5	933	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.99	
d(M,LT), Delay for stream 1 or 4	9.7	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.1	

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 3AMbase*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*2007 Base Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				646		48		430	399	236	401	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				2		2		2	2	2	2	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 10.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 65.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				718		53		478	443	262	446	
Lane group cap.				513		822		597	508	384	967	
v/c ratio				1.40		0.06		0.80	0.87	0.68	0.46	
Green ratio				0.29		0.52		0.32	0.32	0.52	0.52	
Unif. delay d1				23.0		7.7		20.1	20.7	11.4	9.7	
Delay factor k				0.50		0.11		0.50	0.50	0.25	0.11	
Increm. delay d2				191.4		0.0		10.8	18.3	4.9	0.4	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				214.4		7.7		30.9	39.1	16.3	10.1	
Lane group LOS				F		A		C	D	B	B	
Apprch. delay				200.2			34.8			12.4		
Approach LOS				F			C			B		
Intersec. delay	81.3			Intersection LOS						F		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3AMbase
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2007 Base Condition

N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				646		48		430	399	236	401	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left				
Thru						Thru		P		
Right						Right		P		
Peds						Peds				
WB Left	A				SB	Left	A	P		
Thru						Thru	A	P		
Right	A					Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right	A			
Green	19.0						10.0	21.0		
Yellow	3.0						3.0	4.0		
All Red	2.0						0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	513	1755	1.40	0.29	214.4	F		
							200.2	F
R	822	1571	0.06	0.52	7.7	A		
Northbound								
T	597	1848	0.80	0.32	30.9	C	34.8	C
R	508	1571	0.87	0.32	39.1	D		
Southbound								
L	384	1755	0.68	0.52	16.3	B		
T	967	1848	0.46	0.52	10.1	B	12.4	B

Intersection Delay = 81.3 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3AMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2007 Base Condition
Project ID: Woodlands

East/West Street: I-684 Southbound Ramps
North/South Street: Hardscrabble Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume				646		48		430	399	236	401	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				179		13		119	111	66	111	
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				718		53		478	443	262	446	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				2		2		2	2	2	2	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

Ped Min g	3.2	3.2	3.2	

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left				
	Thru						Thru		P		
	Right						Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru						Thru	A	P		
	Right	A					Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right	A			
Green		19.0						10.0	21.0		
Yellow		3.0						3.0	4.0		
All Red		2.0						0.0	3.0		

Cycle Length: 65.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V				646		48		430	399	236	401	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Adj flow				718		53		478	443	262	446	
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Adj flow				718		53		478	443	262	446	
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG				L		R		T	R	L	T	
So				1900		1900		1900	1900	1900	1900	
Lanes	0	0	0	1	0	1	0	1	1	1	1	0
fW				1.000		1.000		1.000	1.000	1.000	1.000	
fHV				0.980		0.980		0.980	0.980	0.980	0.980	
fG				1.000		1.000		1.000	1.000	1.000	1.000	
fP				1.000		1.000		1.000	1.000	1.000	1.000	
fBB				0.992		0.992		0.992	0.992	0.992	0.992	
fA				1.000		1.000		1.000	1.000	1.000	1.000	
fLU				1.000		1.000		1.000	1.000	1.000	1.000	
fRT						0.850		1.000	0.850		1.000	
fLT				0.950				1.000		0.950	1.000	
Sec.										0.167		
fLpb				1.000				1.000		1.000	1.000	
fRpb						1.000		1.000	1.000		1.000	
S				1755		1571		1848	1571	1755	1848	
Sec.										308		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	718	1755	# 0.41	0.29	513	1.40
Prot							
Perm							
Thru							
Right	R	53	1571	0.03	0.52	822	0.06
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	478	1848	0.26	0.32	597	0.80
Right	R	443	1571	# 0.28	0.32	508	0.87
Southbound							
Prot		262	1755	# 0.15	0.154	270	0.97
Perm		0	308	0.00	0.369	114	0.00
Left	L	262			0.52	384	0.68
Prot							
Perm							
Thru	T	446	1848	0.24	0.52	967	0.46
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.84
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.19

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
Westbound												
L	1.40	0.29	23.0	1.000	513	0.50	191.4	0.0	214.4	F	200.2	F
R	0.06	0.52	7.7	1.000	822	0.11	0.0	0.0	7.7	A		
Northbound												
T	0.80	0.32	20.1	1.000	597	0.50	10.8	0.0	30.9	C	34.8	C
R	0.87	0.32	20.7	1.000	508	0.50	18.3	0.0	39.1	D		
Southbound												
L	0.68	0.52	11.4	1.000	384	0.25	4.9	0.0	16.3	B		

```
T    0.46  0.52  9.7   1.000 967   0.11   0.4   0.0   10.1   B    12.4   B

_______________________________________________________________________________
         Intersection delay = 81.3  (sec/veh)   Intersection LOS = F


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET_______________________
                              for exclusive lefts
Input
                                                       EB     WB     NB     SB
Opposed by Single(S) or Multiple(M) lane approach                           M
Cycle length, C                               65.0    sec
Total actual green time for LT lane group, G (s)                            34.0
Effective permitted green time for LT lane group, g(s)                      24.0
Opposing effective green time, go (s)                                       21.0
Number of lanes in LT lane group, N                                         1
Number of lanes in opposing approach, No                                    1
Adjusted LT flow rate, VLT (veh/h)                                          262
Proportion of LT in LT lane group, PLT                                      1.000
Proportion of LT in opposing flow, PLTo                                     0.00
Adjusted opposing flow rate, Vo (veh/h)                                     478
Lost time for LT lane group, tL                                             7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                          4.73
Opposing lane util. factor, fLUo                                    1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                         8.63
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                       0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                           1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                                0.68
gq, (see Exhibit C16-4,5,6,7,8)                                             15.91
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                       8.09
n=Max(gq-gf)/2,0)                                                           7.95
PTHo=1-PLTo                                                                 1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                          1.00
EL1 (refer to Exhibit C16-3)                                                2.04
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                          0.17
gdiff=max(gq-gf,0)                                                          0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                         0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                   0.167

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET_______________________
                               for shared lefts
Input
                                                       EB     WB     NB     SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                               65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                            0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                                  1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET________________
Permitted Left Turns
                                                          EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v						262
v/c ratio from Capacity Worksheet, X						0.68
Protected phase effective green interval, g (s)						10.0
Opposing queue effective green interval, gq						15.91
Unopposed green interval, gu						8.09
Red time r=(C-g-gq-gu)						31.0
Arrival rate, qa=v/(3600(max[X,1.0]))						0.07
Protected ph. departure rate, Sp=s/3600						0.488
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)						0.25
XPerm						0.85
XProt						0.61
Case						1
Queue at beginning of green arrow, Qa						2.26
Queue at beginning of unsaturated green, Qu						1.16
Residual queue, Qr						0.00
Uniform Delay, d1						11.4

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 81.3 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				718		53		478	443	262	446	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	1	0	1	0	1	1	1	1	0
SL				1755		1571		1848	1571	734	1848	
LnCapacity				513		822		597	508	384	967	
Flow Ratio				0.41		0.03		0.26	0.28	0.36	0.24	
v/c Ratio				1.40		0.06		0.80	0.87	0.68	0.46	
Grn Ratio				0.29		0.52		0.32	0.32	0.52	0.52	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				13.0		0.5		7.9	7.5	2.5	5.1	
kB				0.4		0.5		0.6	0.6	0.3	0.6	
Q2				26.9		0.0		2.2	2.9	0.7	0.5	
Q Average				39.9		0.5		10.1	10.4	3.2	5.5	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.1		1.2		1.2	1.2	1.2	1.2	
BOQ				45.3		0.6		12.3	12.6	3.8	6.6	
QSRatio												
85th Percentile Output:												
fB%				1.4		1.6		1.4	1.4	1.6	1.5	
BOQ				55.0		0.8		14.5	14.9	5.0	8.6	
QSRatio												
90th Percentile Output:												
fB%				1.5		1.8		1.6	1.6	1.7	1.7	
BOQ				58.0		0.9		15.8	16.2	5.5	9.4	
QSRatio												
95th Percentile Output:												
fB%				1.6		2.1		1.7	1.7	2.0	1.9	
BOQ				62.4		1.1		17.5	17.9	6.4	10.7	
QSRatio												
98th Percentile Output:												
fB%				1.7		2.7		1.9	1.9	2.5	2.4	
BOQ				69.6		1.3		19.2	19.6	7.9	13.0	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 3PMbase*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak PM Hour*	Analysis Year	*2007 Base Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				326		85		770	132	178	615	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 10.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 65.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				362		94		856	147	198	683	
Lane group cap.				517		828		602	511	386	974	
v/c ratio				0.70		0.11		1.42	0.29	0.51	0.70	
Green ratio				0.29		0.52		0.32	0.32	0.52	0.52	
Unif. delay d1				20.5		7.9		22.0	16.4	11.8	11.7	
Delay factor k				0.27		0.11		0.50	0.50	0.12	0.27	
Increm. delay d2				4.2		0.1		199.5	1.4	1.2	2.3	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				24.7		7.9		221.5	17.8	12.9	14.0	
Lane group LOS				C		A		F	B	B	B	
Apprch. delay				21.2			191.6			13.7		
Approach LOS				C			F			B		
Intersec. delay	91.4			Intersection LOS						F		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3PMbase
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2007 Base Condition
N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				326		85		770	132	178	615	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left				
Thru						Thru		P		
Right						Right		P		
Peds						Peds				
WB Left	A				SB	Left	A	P		
Thru						Thru	A	P		
Right	A					Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right	A			
Green	19.0						10.0	21.0		
Yellow	3.0						3.0	4.0		
All Red	2.0						0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	517	1770	0.70	0.29	24.7	C		
							21.2	C
R	828	1583	0.11	0.52	7.9	A		
Northbound								
T	602	1863	1.42	0.32	221.5	F	191.6	F
R	511	1583	0.29	0.32	17.8	B		
Southbound								
L	386	1770	0.51	0.52	12.9	B		
T	974	1863	0.70	0.52	14.0	B	13.7	B

Intersection Delay = 91.4 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3PMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2007 Base Condition
Project ID: Woodlands

East/West Street	North/South Street
I-684 Southbound Ramps	Hardscrabble Road

VOLUME DATA

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Volume				326		85		770	132	178	615	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				91		24		214	37	49	171	
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				362		94		856	147	198	683	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

```
Ped Min g  |      3.2        |      3.2        |      3.2        |                |

________________________________PHASE DATA__________________________________

Phase Combination 1     2     3     4 |            5     6     7     8

EB   Left                             | NB  Left
     Thru                             |     Thru             P
     Right                            |     Right            P
     Peds                             |     Peds

WB   Left          A                  | SB  Left   A         P
     Thru                             |     Thru   A         P
     Right         A                  |     Right
     Peds                             |     Peds

NB   Right                            | EB  Right
                                      |
SB   Right                            | WB  Right  A
                                      |
                                      |
Green             19.0                           10.0  21.0
Yellow            3.0                            3.0   4.0
All Red           2.0                            0.0   3.0

                                                   Cycle Length: 65.0    secs

________________VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET_______________
Volume Adjustment
              |  Eastbound      |  Westbound      |  Northbound     |  Southbound     |
              | L    T    R     | L    T    R     | L    T    R     | L    T    R     |
              |                 |                 |                 |                 |
Volume, V     |                 |326        85    |      770  132   |178  615         |
PHF           |                 |0.90       0.90  |      0.90 0.90  |0.90 0.90        |
Adj flow      |                 |362        94    |      856  147   |198  683         |
No. Lanes     |  0    0    0    |  1    0    1    |  0    1    1    |  1    1    0    |
Lane group    |                 | L          R    |       T    R    | L    T          |
Adj flow      |                 |362        94    |      856  147   |198  683         |
Prop LTs      |                 |                 |      0.000      |1.000 0.000      |
Prop RTs      |                 |          1.000  |  0.000 1.000    |   0.000         |

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)____
         Eastbound          Westbound         Northbound       Southbound
LG                        L          R           T     R     L     T
So                        1900       1900        1900  1900  1900  1900
Lanes 0     0     0       1     0    1     0     1     1     1     1     0
fW                        1.000      1.000       1.000 1.000 1.000 1.000
fHV                       0.980      0.980       0.980 0.980 0.980 0.980
fG                        1.000      1.000       1.000 1.000 1.000 1.000
fP                        1.000      1.000       1.000 1.000 1.000 1.000
fBB                       1.000      1.000       1.000 1.000 1.000 1.000
fA                        1.000      1.000       1.000 1.000 1.000 1.000
fLU                       1.000      1.000       1.000 1.000 1.000 1.000
fRT                                  0.850       1.000 0.850       1.000
fLT                       0.950                  1.000       0.950 1.000
Sec.                                                         0.167
fLpb                      1.000                  1.000       1.000 1.000
fRpb                                 1.000       1.000 1.000       1.000
S                         1770       1583        1863  1583  1770  1863
Sec.                                                         310
________________________CAPACITY AND LOS WORKSHEET___________________________
```

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	362	1770	# 0.20	0.29	517	0.70
Prot							
Perm							
Thru							
Right	R	94	1583	0.06	0.52	828	0.11
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	856	1863	# 0.46	0.32	602	1.42
Right	R	147	1583	0.09	0.32	511	0.29
Southbound							
Prot		198	1770	# 0.11	0.154	272	0.73
Perm		0	310	0.00	0.369	114	0.00
Left	L	198			0.52	386	0.51
Prot							
Perm							
Thru	T	683	1863	0.37	0.52	974	0.70
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.78
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.10

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
Westbound												
L	0.70	0.29	20.5	1.000	517	0.27	4.2	0.0	24.7	C	21.2	C
R	0.11	0.52	7.9	1.000	828	0.11	0.1	0.0	7.9	A		
Northbound												
T	1.42	0.32	22.0	1.000	602	0.50	199.5	0.0	221.5	F	191.6	F
R	0.29	0.32	16.4	1.000	511	0.50	1.4	0.0	17.8	B		
Southbound												
L	0.51	0.52	11.8	1.000	386	0.12	1.2	0.0	12.9	B		

```
T    0.70  0.52  11.7  1.000 974   0.27   2.3   0.0   14.0   B    13.7   B

________________________________________________________________________________
        Intersection delay = 91.4  (sec/veh)   Intersection LOS = F


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET_______________________
                              for exclusive lefts
Input
                                                          EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach                           M
Cycle length, C                               65.0    sec
Total actual green time for LT lane group, G (s)                            34.0
Effective permitted green time for LT lane group, g(s)                      24.0
Opposing effective green time, go (s)                                       21.0
Number of lanes in LT lane group, N                                         1
Number of lanes in opposing approach, No                                    1
Adjusted LT flow rate, VLT (veh/h)                                          198
Proportion of LT in LT lane group, PLT                                      1.000
Proportion of LT in opposing flow, PLTo                                     0.00
Adjusted opposing flow rate, Vo (veh/h)                                     856
Lost time for LT lane group, tL                                             7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                          3.58
Opposing lane util. factor, fLUo                                      1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                         15.46
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                       0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                           1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                                0.68
gq, (see Exhibit C16-4,5,6,7,8)                                             20.00
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                       4.00
n=Max(gq-gf)/2,0)                                                           10.00
PTHo=1-PLTo                                                                 1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                          1.00
EL1 (refer to Exhibit C16-3)                                                2.90
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                          0.17
gdiff=max(gq-gf,0)                                                          0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                         0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                   0.167

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET_______________________
                                for shared lefts
Input
                                                          EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                               65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                          0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                                1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                        EB     WB     NB     SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v					198
v/c ratio from Capacity Worksheet, X					0.51
Protected phase effective green interval, g (s)					10.0
Opposing queue effective green interval, gq					20.00
Unopposed green interval, gu					4.00
Red time r=(C-g-gq-gu)					31.0
Arrival rate, qa=v/(3600(max[X,1.0]))					0.05
Protected ph. departure rate, Sp=s/3600					0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)					0.52
XPerm					0.64
XProt					0.46
Case					1
Queue at beginning of green arrow, Qa					1.71
Queue at beginning of unsaturated green, Qu					1.10
Residual queue, Qr					0.00
Uniform Delay, d1					11.8

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 91.4 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				362		94		856	147	198	683	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	1	0	1	0	1	1	1	1	0
SL				1770		1583		1863	1583	739	1863	
LnCapacity				517		828		602	511	386	974	
Flow Ratio				0.20		0.06		0.46	0.09	0.27	0.37	
v/c Ratio				0.70		0.11		1.42	0.29	0.51	0.70	
Grn Ratio				0.29		0.52		0.32	0.32	0.52	0.52	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				5.8		0.9		15.5	2.0	1.9	9.3	
kB				0.4		0.5		0.6	0.6	0.3	0.6	
Q2				0.9		0.1		33.8	0.2	0.3	1.3	
Q Average				6.7		0.9		49.2	2.2	2.2	10.6	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.2		1.2		1.2	1.3	1.2	1.2	
BOQ				7.9		1.1		59.1	2.8	2.6	12.4	
QSRatio												
85th Percentile Output:												
fB%				1.5		1.6		1.4	1.6	1.6	1.5	
BOQ				10.3		1.5		68.9	3.5	3.4	15.9	
QSRatio												
90th Percentile Output:												
fB%				1.7		1.8		1.5	1.8	1.8	1.6	
BOQ				11.3		1.6		73.8	4.0	3.8	17.3	
QSRatio												
95th Percentile Output:												
fB%				1.9		2.1		1.6	2.2	2.0	1.8	
BOQ				12.8		1.9		78.8	5.0	4.4	19.4	
QSRatio												
98th Percentile Output:												
fB%				2.3		2.6		1.7	2.7	2.5	2.1	
BOQ				15.3		2.4		83.7	5.9	5.6	22.6	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 4AMbase*	Intersection	*Hardscrabble & Route 22*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*2007 Base Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		661	0	795	320		72		169			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 9.0	G = 21.0	G =	G =	G = 15.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 60.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		734		883	356		80		188			
Lane group cap.		652		301	1025		443		765			
v/c ratio		1.13		2.93	0.35		0.18		0.25			
Green ratio		0.35		0.55	0.55		0.25		0.48			
Unif. delay d1		19.5		13.4	7.5		17.7		9.1			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		75.2		879.1	0.9		0.9		0.8			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		94.7		892.5	8.4		18.6		9.9			
Lane group LOS		F		F	A		B		A			
Apprch. delay	94.7			638.5			12.5					
Approach LOS	F			F			B					
Intersec. delay	385.5			Intersection LOS						F		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4AMbase
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2007 Base Condition

N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		661	0	795	320		72		169			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	P			
Thru		P			Thru				
Right		P			Right	P			
Peds					Peds				
WB Left	P	P			SB Left				
Thru	P	P			Thru				
Right					Right				
Peds					Peds				
NB Right	P				EB Right				
SB Right					WB Right				
Green	9.0	21.0				15.0			
Yellow	3.0	4.0				3.0			
All Red		3.0				2.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	652	1863	1.13	0.35	94.7	F	94.7	F
Westbound								
L	301	1770	2.93	0.55	892.5	F		
T	1025	1863	0.35	0.55	8.4	A	638.5	F
Northbound								
L	443	1770	0.18	0.25	18.6	B	12.5	B
R	765	1583	0.25	0.48	9.9	A		
Southbound								

Intersection Delay = 385.5 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 4AMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Route 22
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2007 Base Condition
Project ID: Woodlands

East/West Street: Hardscrabble Road
North/South Street: Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		661	0	795	320		72		169			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		184	0	221	89		20		47			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		734		883	356		80		188			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.000			0.000				1.000			
Peds Bikes	0							0		0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

Ped Min g	3.2		3.2	3.2

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left	P			
	Thru		P				Thru				
	Right		P				Right	P			
	Peds						Peds				
WB	Left	P	P			SB	Left				
	Thru	P	P				Thru				
	Right						Right				
	Peds						Peds				
NB	Right	P				EB	Right				
SB	Right					WB	Right				
Green		9.0	21.0					15.0			
Yellow		3.0	4.0					3.0			
All Red			3.0					2.0			

Cycle Length: 60.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V		661	0	795	320		72		169			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		734	0	883	356		80		188			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		734		883	356		80		188			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.000			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG		TR		L	T		L		R			
So		1900		1900	1900		1900		1900			
Lanes	0	1	0	1	1	0	1	0	1	0	0	0
fW		1.000		1.000	1.000		1.000		1.000			
fHV		0.980		0.980	0.980		0.980		0.980			
fG		1.000		1.000	1.000		1.000		1.000			
fP		1.000		1.000	1.000		1.000		1.000			
fBB		1.000		1.000	1.000		1.000		1.000			
fA		1.000		1.000	1.000		1.000		1.000			
fLU		1.000		1.000	1.000		1.000		1.000			
fRT		1.000			1.000				0.850			
fLT		1.000		0.950	1.000		0.950					
Sec.				0.148								
fLpb		1.000		1.000	1.000		1.000					
fRpb		1.000			1.000				1.000			
S		1863		1770	1863		1770		1583			
Sec.				276								

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	734	1863	0.39	0.35	652	1.13
Right							
Westbound							
Prot		177	1770	# 0.10	0.100	177	1.00
Perm		706	276	# 2.56	0.450	124	5.69
Left	L	883			0.55	301	2.93
Prot							
Perm							
Thru	T	356	1863	0.19	0.55	1025	0.35
Right							
Northbound							
Prot							
Perm							
Left	L	80	1770	# 0.05	0.25	443	0.18
Prot							
Perm							
Thru							
Right	R	188	1583	0.12	0.48	765	0.25
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 2.70
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 3.38

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
TR	1.13	0.35	19.5	1.000	652	0.50	75.2	0.0	94.7	F	94.7	F
Westbound												
L	2.93	0.55	13.4	1.000	301	0.50	879.1	0.0	892.5	F		
T	0.35	0.55	7.5	1.000	1025	0.50	0.9	0.0	8.4	A	638.5	F
Northbound												
L	0.18	0.25	17.7	1.000	443	0.50	0.9	0.0	18.6	B	12.5	B
R	0.25	0.48	9.1	1.000	765	0.50	0.8	0.0	9.9	A		
Southbound												

```
__________________________________________________________________________________
         Intersection delay = 385.5 (sec/veh)   Intersection LOS = F


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                                for exclusive lefts
Input
                                                         EB     WB     NB     SB
Opposed by Single(S) or Multiple(M) lane approach              S
Cycle length, C                               60.0    sec
Total actual green time for LT lane group, G (s)               33.0
Effective permitted green time for LT lane group, g(s)         27.0
Opposing effective green time, go (s)                          21.0
Number of lanes in LT lane group, N                            1
Number of lanes in opposing approach, No                       1
Adjusted LT flow rate, VLT (veh/h)                             883
Proportion of LT in LT lane group, PLT                         1.000
Proportion of LT in opposing flow, PLTo                        0.00
Adjusted opposing flow rate, Vo (veh/h)                        734
Lost time for LT lane group, tL                                7.00
Computation
LT volume per cycle, LTC=VLTC/3600                             14.72
Opposing lane util. factor, fLUo                         1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)            12.23
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                          0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)              1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                   0.65
gq, (see Exhibit C16-4,5,6,7,8)                                21.10
gu=g-gq if gq>=gf, or = g-gf if gq<gf                          5.90
n=Max(gq-gf)/2,0)                                              10.55
PTHo=1-PLTo                                                    1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                             1.00
EL1 (refer to Exhibit C16-3)                                   2.59
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                             0.15
gdiff=max(gq-gf,0)                                             0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)            0.15
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                      0.148

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                                for shared lefts
Input
                                                         EB     WB     NB     SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                               60.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                        0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                              1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET________________
Permitted Left Turns
                                                            EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	60.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v				883		
v/c ratio from Capacity Worksheet, X				2.93		
Protected phase effective green interval, g (s)				6.0		
Opposing queue effective green interval, gq				21.10		
Unopposed green interval, gu				5.90		
Red time r=(C-g-gq-gu)				27.0		
Arrival rate, qa=v/(3600(max[X,1.0]))				0.08		
Protected ph. departure rate, Sp=s/3600				0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)				0.35		
XPerm				1.09		
XProt				0.94		
Case				3		
Queue at beginning of green arrow, Qa				2.44		
Queue at beginning of unsaturated green, Qu				1.76		
Residual queue, Qr				0.19		
Uniform Delay, d1				13.4		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 385.5 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		734		883	356		80		188			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1863		548	1863		1770		1583			
LnCapacity		652		301	1025		443		765			
Flow Ratio		0.39		1.61	0.19		0.05		0.12			
v/c Ratio		1.13		2.93	0.35		0.18		0.25			
Grn Ratio		0.35		0.55	0.55		0.25		0.48			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		12.2		7.4	3.3		1.0		1.8			
kB		0.6		0.4	0.9		0.5		0.7			
Q2		14.3		73.3	0.5		0.1		0.2			
Q Average		26.6		80.7	3.8		1.2		2.1			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.2	1.2		1.3		1.3			
BOQ		31.9		96.8	4.7		1.5		2.6			
QSRatio												
85th Percentile Output:												
fB%		1.4		1.4	1.5		1.6		1.6			
BOQ		37.2		113	5.8		1.9		3.3			
QSRatio												
90th Percentile Output:												
fB%		1.5		1.5	1.7		1.9		1.8			
BOQ		39.9		121	6.5		2.2		3.8			
QSRatio												
95th Percentile Output:												
fB%		1.6		1.6	2.1		2.4		2.3			
BOQ		42.6		129	7.8		2.8		4.7			
QSRatio												
98th Percentile Output:												
fB%		1.7		1.7	2.4		2.9		2.7			
BOQ		45.4		137	9.1		3.3		5.6			
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 4PMbase	Intersection	Hardscrabble & Route 22
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2007 Base Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		364	1	175	771		285		534			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 9.0	G = 21.0	G =	G =	G = 15.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		405		194	857		317		593			
Lane group cap.		652		398	1025		443		765			
v/c ratio		0.62		0.49	0.84		0.72		0.78			
Green ratio		0.35		0.55	0.55		0.25		0.48			
Unif. delay d1		16.2		8.7	11.2		20.6		12.8			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		4.4		4.2	8.1		9.5		7.5			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		20.6		12.9	19.3		30.1		20.4			
Lane group LOS		C		B	B		C		C			
Apprch. delay	20.6			18.1			23.7					
Approach LOS	C			B			C					
Intersec. delay	20.7			Intersection LOS						C		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4PMbase
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2007 Base Condition

N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		364	1	175	771		285		534			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	9.0	21.0					15.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	652	1862	0.62	0.35	20.6	C	20.6	C
Westbound								
L	398	1770	0.49	0.55	12.9	B		
T	1025	1863	0.84	0.55	19.3	B	18.1	B
Northbound								
L	443	1770	0.72	0.25	30.1	C	23.7	C
R	765	1583	0.78	0.48	20.4	C		
Southbound								

Intersection Delay = 20.7 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 4PMbase
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Route 22
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2007 Base Condition
Project ID: Woodlands

East/West Street	North/South Street
Hardscrabble Road	Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		364	1	175	771		285		534			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		101	1	49	214		79		148			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		405		194	857		317		593			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			
Peds Bikes	0						0			0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

Ped Min g	3.2		3.2	3.2

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left	P			
	Thru		P				Thru				
	Right		P				Right	P			
	Peds						Peds				
WB	Left	P	P			SB	Left				
	Thru	P	P				Thru				
	Right						Right				
	Peds						Peds				
NB	Right	P				EB	Right				
SB	Right					WB	Right				
Green		9.0	21.0					15.0			
Yellow		3.0	4.0					3.0			
All Red			3.0					2.0			

Cycle Length: 60.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V		364	1	175	771		285		534			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		404	1	194	857		317		593			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		405		194	857		317		593			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound	Westbound		Northbound		Southbound
LG	TR	L	T	L	R	
So	1900	1900	1900	1900	1900	
Lanes	0 1 0	1	1 0	1 0	1	0 0 0
fW	1.000	1.000	1.000	1.000	1.000	
fHV	0.980	0.980	0.980	0.980	0.980	
fG	1.000	1.000	1.000	1.000	1.000	
fP	1.000	1.000	1.000	1.000	1.000	
fBB	1.000	1.000	1.000	1.000	1.000	
fA	1.000	1.000	1.000	1.000	1.000	
fLU	1.000	1.000	1.000	1.000	1.000	
fRT	1.000		1.000		0.850	
fLT	1.000	0.950	1.000	0.950		
Sec.		0.264				
fLpb	1.000	1.000	1.000	1.000		
fRpb	1.000		1.000		1.000	
S	1862	1770	1863	1770	1583	
Sec.		491				

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	405	1862	0.22	0.35	652	0.62
Right							
Westbound							
Prot		177	1770	0.10	0.100	177	1.00
Perm		17	491	0.03	0.450	221	0.08
Left	L	194			0.55	398	0.49
Prot							
Perm							
Thru	T	857	1863	# 0.46	0.55	1025	0.84
Right							
Northbound							
Prot							
Perm							
Left	L	317	1770	# 0.18	0.25	443	0.72
Prot							
Perm							
Thru							
Right	R	593	1583	0.37	0.48	765	0.78
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.64
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.80

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
TR	0.62	0.35	16.2	1.000	652	0.50	4.4	0.0	20.6	C	20.6	C
Westbound												
L	0.49	0.55	8.7	1.000	398	0.50	4.2	0.0	12.9	B		
T	0.84	0.55	11.2	1.000	1025	0.50	8.1	0.0	19.3	B	18.1	B
Northbound												
L	0.72	0.25	20.6	1.000	443	0.50	9.5	0.0	30.1	C	23.7	C
R	0.78	0.48	12.8	1.000	765	0.50	7.5	0.0	20.4	C		
Southbound												

```
________________________________________________________________________________
         Intersection delay = 20.7  (sec/veh)   Intersection LOS = C


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                              for exclusive lefts
Input
                                                          EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach             S
Cycle length, C                               60.0   sec
Total actual green time for LT lane group, G (s)              33.0
Effective permitted green time for LT lane group, g(s)        27.0
Opposing effective green time, go (s)                         21.0
Number of lanes in LT lane group, N                           1
Number of lanes in opposing approach, No                      1
Adjusted LT flow rate, VLT (veh/h)                            194
Proportion of LT in LT lane group, PLT                        1.000
Proportion of LT in opposing flow, PLTo                       0.00
Adjusted opposing flow rate, Vo (veh/h)                       405
Lost time for LT lane group, tL                               7.00
Computation
LT volume per cycle, LTC=VLTC/3600                            3.23
Opposing lane util. factor, fLUo                          1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)           6.75
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                         0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)             1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                  0.65
gq, (see Exhibit C16-4,5,6,7,8)                               13.41
gu=g-gq if gq>=gf, or = g-gf if gq<gf                         13.59
n=Max(gq-gf)/2,0)                                             6.70
PTHo=1-PLTo                                                   1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                            1.00
EL1 (refer to Exhibit C16-3)                                  1.91
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                            0.15
gdiff=max(gq-gf,0)                                            0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)           0.26
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                     0.264

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                               for shared lefts
Input
                                                          EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                               60.0   sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                        0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                              1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET________________
Permitted Left Turns
                                                              EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	60.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v			194		
v/c ratio from Capacity Worksheet, X			0.49		
Protected phase effective green interval, g (s)			6.0		
Opposing queue effective green interval, gq			13.41		
Unopposed green interval, gu			13.59		
Red time r=(C-g-gq-gu)			27.0		
Arrival rate, qa=v/(3600(max[X,1.0]))			0.05		
Protected ph. departure rate, Sp=s/3600			0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)			0.27		
XPerm			0.40		
XProt			0.60		
Case			1		
Queue at beginning of green arrow, Qa			1.45		
Queue at beginning of unsaturated green, Qu			0.72		
Residual queue, Qr			0.00		
Uniform Delay, d1			8.7		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 20.7 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		405		194	857		317		593			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1862		724	1863		1770		1583			
LnCapacity		652		398	1025		443		765			
Flow Ratio		0.22		0.27	0.46		0.18		0.37			
v/c Ratio		0.62		0.49	0.84		0.72		0.78			
Grn Ratio		0.35		0.55	0.55		0.25		0.48			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		5.6		1.5	11.9		4.8		8.2			
kB		0.6		0.5	0.9		0.5		0.7			
Q2		1.0		0.4	3.8		1.1		2.2			
Q Average		6.6		2.0	15.7		6.0		10.4			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.3	1.2		1.2		1.2			
BOQ		8.1		2.5	18.9		7.3		12.6			
QSRatio												
85th Percentile Output:												
fB%		1.5		1.6	1.4		1.5		1.4			
BOQ		9.8		3.1	22.2		8.9		14.9			
QSRatio												
90th Percentile Output:												
fB%		1.6		1.8	1.5		1.7		1.6			
BOQ		10.8		3.6	23.9		9.9		16.2			
QSRatio												
95th Percentile Output:												
fB%		1.9		2.3	1.6		1.9		1.7			
BOQ		12.4		4.4	25.8		11.4		17.9			
QSRatio												
98th Percentile Output:												
fB%		2.1		2.7	1.8		2.2		1.9			
BOQ		13.9		5.3	27.7		12.9		19.6			
QSRatio												

ERROR MESSAGES

No errors to report.

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*mm - 5AMbase*	Intersection	*Route 22 & Front St*
Agency/Co.	*MMA*	Jurisdiction	*North Salem, NY*
Date Performed	*4/6/2005*	Analysis Year	*2007 Base Condition*
Analysis Time Period	*Peak AM Hour*		

Project Description *Woodlands Development*

East/West Street: *Croton Falls Road* | North/South Street: *Front Street*

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)	0	507	30	47	308	1
Peak-hour factor, PHF	0.90	0.87	0.87	0.75	0.75	0.90
Hourly Flow Rate (veh/h)	0	582	34	62	410	0
Proportion of heavy vehicles, P_{HV}	0	--	--	2	--	--
Median type	Undivided					
RT Channelized?			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	43	0	55	0	0	2
Peak-hour factor, PHF	0.81	0.90	0.81	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	53	0	67	0	0	0
Proportion of heavy vehicles, P_{HV}	2	0	2	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			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
Volume, v (vph)		62	53		67			
Capacity, c_m (vph)		964	210		502			
v/c ratio		0.06	0.25		0.13			
Queue length (95%)		0.21	0.97		0.46			
Control Delay (s/veh)		9.0	27.8		13.3			

LOS		*A*	*D*		*B*			
Approach delay (s/veh)	--	--	*19.7*					
Approach LOS	--	--	*C*					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 5AMbase
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak AM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		507	30	47	308	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Hourly Flow Rate, HFR		582	34	62	410	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	43		55			
Peak Hour Factor, PHF	0.81		0.81			
Hourly Flow Rate, HFR	53		67			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes		1	1			
Configuration		L	R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		62	53		67			
C(m) (vph)		964	210		502			
v/c		0.06	0.25		0.13			
95% queue length		0.21	0.97		0.46			
Control Delay		9.0	27.8		13.3			
LOS		A	D		B			
Approach Delay				19.7				
Approach LOS				C				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 5AMbase
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak AM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		507	30	47	308	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Peak-15 Minute Volume		146	9	16	103	
Hourly Flow Rate, HFR		582	34	62	410	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration		TR		LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	43		55			
Peak Hour Factor, PHF	0.81		0.81			
Peak-15 Minute Volume	13		17			
Hourly Flow Rate, HFR	53		67			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?			No			
Lanes	1		1			
Configuration	L		R			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		410
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			4.1	7.1		6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			2	2		2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.00	0.70		0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage		4.1	6.4		6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2		2			
t(f)		2.2	3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		616	1133		599			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	599	
Potential Capacity	502	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	502	
Probability of Queue free St.	0.87	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	616	
Potential Capacity	964	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	964	
Probability of Queue free St.	0.94	1.00
Maj L-Shared Prob Q free St.	0.92	

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.92	0.92
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1133	
Potential Capacity	224	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.92
Maj. L, Min T Adj. Imp Factor.		0.94
Cap. Adj. factor due to Impeding mvmnt	0.94	0.81
Movement Capacity	210	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.92	0.92
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1133	
Potential Capacity	224	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.92
Maj. L, Min T Adj. Imp Factor.		0.94
Cap. Adj. factor due to Impeding mvmnt	0.94	0.81
Movement Capacity	210	

Results for Two-stage process:		
a		
y		
C t	210	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	53		67			
Movement Capacity (vph)	210		502			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	210		502			
Volume	53		67			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		62	53		67			
C(m) (vph)		964	210		502			
v/c		0.06	0.25		0.13			
95% queue length		0.21	0.97		0.46			
Control Delay		9.0	27.8		13.3			
LOS		A	D		B			
Approach Delay				19.7				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.94
v(il), Volume for stream 2 or 5		410
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.92
d(M,LT), Delay for stream 1 or 4		9.0
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.8

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	mm - 5PMbase	Intersection	Route 22 & Front St
Agency/Co.	MMA	Jurisdiction	North Salem, NY
Date Performed	4/6/2005	Analysis Year	2007 Base Condition
Analysis Time Period	Peak PM Hour		

Project Description *Woodlands Development*

East/West Street: *Croton Falls Road* | North/South Street: *Front Street*

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)	0	296	49	30	811	1
Peak-hour factor, PHF	0.90	0.87	0.87	0.75	0.75	0.90
Hourly Flow Rate (veh/h)	0	340	56	40	1081	0
Proportion of heavy vehicles, P_{HV}	0	--	--	2	--	--
Median type	Undivided					
RT Channelized?			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	26	0	35	0	0	2
Peak-hour factor, PHF	0.81	0.90	0.81	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	32	0	43	0	0	0
Proportion of heavy vehicles, P_{HV}	2	0	2	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			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
Volume, v (vph)		40	32		43			
Capacity, c_m (vph)		1163	125		677			
v/c ratio		0.03	0.26		0.06			
Queue length (95%)		0.11	0.95		0.20			
Control Delay (s/veh)		8.2	43.4		10.7			

LOS		A	E		B			
Approach delay (s/veh)	--	--	24.7					
Approach LOS	--	--	C					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 5PMbase
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak PM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		296	49	30	811	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Hourly Flow Rate, HFR		340	56	40	1081	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume	26		35			
Peak Hour Factor, PHF	0.81		0.81			
Hourly Flow Rate, HFR	32		43			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1	1				
Configuration	L	R				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		40	32		43			
C(m) (vph)		1163	125		677			
v/c		0.03	0.26		0.06			
95% queue length		0.11	0.95		0.20			
Control Delay		8.2	43.4		10.7			
LOS		A	E		B			
Approach Delay				24.7				
Approach LOS				C				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 5PMbase
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak PM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2007 Base Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		296	49	30	811	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Peak-15 Minute Volume		85	14	10	270	
Hourly Flow Rate, HFR		340	56	40	1081	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	26		35			
Peak Hour Factor, PHF	0.81		0.81			
Peak-15 Minute Volume	8		11			
Hourly Flow Rate, HFR	32		43			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?			No			
Lanes	1		1			
Configuration	L		R			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		1081
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			4.1	7.1		6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			2	2		2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.00	0.70		0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage		4.1	6.4		6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2		2			
t(f)		2.2	3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		396	1529		368			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	368	
Potential Capacity	677	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	677	
Probability of Queue free St.	0.94	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	396	
Potential Capacity	1163	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1163	
Probability of Queue free St.	0.97	1.00
Maj L-Shared Prob Q free St.	0.91	

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.91	0.91
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1529	
Potential Capacity	129	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.91
Maj. L, Min T Adj. Imp Factor.		0.93
Cap. Adj. factor due to Impeding mvmnt	0.97	0.87
Movement Capacity	125	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.91	0.91
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1529	
Potential Capacity	129	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.91
Maj. L, Min T Adj. Imp Factor.		0.93
Cap. Adj. factor due to Impeding mvmnt	0.97	0.87
Movement Capacity	125	

Results for Two-stage process:		
a		
y		
C t	125	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	32		43			
Movement Capacity (vph)	125		677			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	125		677			
Volume	32		43			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		40	32		43			
C(m) (vph)		1163	125		677			
v/c		0.03	0.26		0.06			
95% queue length		0.11	0.95		0.20			
Control Delay		8.2	43.4		10.7			
LOS		A	E		B			
Approach Delay				24.7				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.97
v(il), Volume for stream 2 or 5		1081
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.91
d(M,LT), Delay for stream 1 or 4		8.2
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.8

2010 NO-BUILD TRAFFIC CONDITIONS

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	mm - 1AMno-build	Intersection	Hardscrabble & 684 NB Ramps
Agency/Co.	mma	Jurisdiction	North Salem, NY
Date Performed	4/5/2005	Analysis Year	2010 No-build Condition
Analysis Time Period	Peak AM Hour		

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road* | North/South Street: *I-684 Northbound Ramps*

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)	265	245	0	0	451	45
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	294	272	0	0	501	50
Proportion of heavy vehicles, P_{HV}	2	--	--	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)	147	0	122	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	163	0	135	0	0	0
Proportion of heavy vehicles, P_{HV}	2	2	2	0	0	0
Percent grade (%)		0			0	
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	1	1	0	0	0	0
Configuration	L		TR			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT		L		TR			
Volume, v (vph)	294		163		135			
Capacity, c_m (vph)	1019		112		767			
v/c ratio	0.29		1.46		0.18			
Queue length (95%)	1.20		11.63		0.64			

Control Delay (s/veh)	10.0		317.2		10.7			
LOS	A		F		B			
Approach delay (s/veh)	--	--	178.4					
Approach LOS	--	--	F					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 1AMno-build
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	265	245			451	45
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	294	272			501	50
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	147	0	122			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Hourly Flow Rate, HFR	163	0	135			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
Lanes	1	1	0			
Configuration	L		TR			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	294		163		135			
C(m) (vph)	1019		112		767			
v/c	0.29		1.46		0.18			
95% queue length	1.20		11.63		0.64			
Control Delay	10.0-		317.2		10.7			
LOS	A		F		B			
Approach Delay				178.4				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 1AMno-build
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	265	245			451	45
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	74	68			125	12
Hourly Flow Rate, HFR	294	272			501	50
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	147	0	122			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Peak-15 Minute Volume	41	0	34			
Hourly Flow Rate, HFR	163	0	135			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	1	1	0			
Configuration	L		TR			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	272	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1		7.1	6.5	6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2		2	2	2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00		0.70	0.00	0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1		6.4	6.5	6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2		2	2	2			
t(f)	2.2		3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	551		1386	1411	272			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	272	
Potential Capacity	767	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	767	
Probability of Queue free St.	0.82	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		551
Potential Capacity		1019
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1019
Probability of Queue free St.	1.00	0.71
Maj L-Shared Prob Q free St.		0.66

Step 3: TH from Minor St.	8	11
Conflicting Flows	1411	
Potential Capacity	138	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.66	0.66
Movement Capacity	91	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1386	
Potential Capacity	158	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.66
Maj. L, Min T Adj. Imp Factor.		0.73
Cap. Adj. factor due to Impeding mvmnt	0.71	0.60
Movement Capacity	112	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1411	
Potential Capacity	138	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.66	0.66
Movement Capacity	91	

Result for 2 stage process:		
a		
y		
C t	91	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1386	
Potential Capacity	158	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.66
Maj. L, Min T Adj. Imp Factor.		0.73
Cap. Adj. factor due to Impeding mvmnt	0.71	0.60
Movement Capacity	112	

Results for Two-stage process:		
a		
y		
C t	112	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	163	0	135			
Movement Capacity (vph)	112	91	767			
Shared Lane Capacity (vph)			767			

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	112	91	767			
Volume	163	0	135			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh			767			
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	294		163		135			
C(m) (vph)	1019		112		767			
v/c	0.29		1.46		0.18			
95% queue length	1.20		11.63		0.64			
Control Delay	10.0-		317.2		10.7			
LOS	A		F		B			
Approach Delay				178.4				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.71	1.00
v(il), Volume for stream 2 or 5	272	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.66	
d(M,LT), Delay for stream 1 or 4	10.0-	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	3.4	

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*mm - 1PMno-build*
Agency/Co.	*mma*
Date Performed	*4/5/2005*
Analysis Time Period	*Peak PM Hour*

Site Information

Intersection	*Hardscrabble & 684 NB Ramps*
Jurisdiction	*North Salem, NY*
Analysis Year	*2010 No-build Condition*

Project Description *Woodlands Development*
East/West Street: *Hardscrabble Road*
North/South Street: *I-684 Northbound Ramps*
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)	586	300	0	0	314	78
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	651	333	0	0	348	86
Proportion of heavy vehicles, P_{HV}	2	--	--	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)	535	4	311	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	594	4	345	0	0	0
Proportion of heavy vehicles, P_{HV}	2	2	2	0	0	0
Percent grade (%)		0			0	
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	1	1	0	0	0	0
Configuration	L		TR			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT		L		TR			
Volume, v (vph)	651		594		349			
Capacity, c_m (vph)	1126		27		463			
v/c ratio	0.58		22.00		0.75			
Queue length (95%)	3.86		73.89		6.35			

Control Delay (s/veh)	12.5		9726		32.9			
LOS	B		F		D			
Approach delay (s/veh)	--	--	6139					
Approach LOS	--	--	F					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 1PMno-build
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach	Eastbound			Westbound		
	Movement	1	2	3	4	5	6
		L	T	R	L	T	R
Volume		586	300			314	78
Peak-Hour Factor, PHF		0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR		651	333			348	86
Percent Heavy Vehicles		2	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	1			1	0
Configuration		LT					TR
Upstream Signal?			No			No	

Minor Street:	Approach	Northbound			Southbound		
	Movement	7	8	9	10	11	12
		L	T	R	L	T	R
Volume		535	4	311			
Peak Hour Factor, PHF		0.90	0.90	0.90			
Hourly Flow Rate, HFR		594	4	345			
Percent Heavy Vehicles		2	2	2			
Percent Grade (%)			0			0	
Flared Approach:	Exists?/Storage			No	/		/
Lanes		1	1	0			
Configuration		L		TR			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	651		594		349			
C(m) (vph)	1126		27		463			
v/c	0.58		22.00		0.75			
95% queue length	3.86		73.89		6.35			
Control Delay	12.5		9726		32.9			
LOS	B		F		D			
Approach Delay				6139				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 1PMno-build
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	586	300			314	78
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	163	83			87	22
Hourly Flow Rate, HFR	651	333			348	86
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	535	4	311			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Peak-15 Minute Volume	149	1	86			
Hourly Flow Rate, HFR	594	4	345			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	1	1	0			
Configuration	L		TR			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	333	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1		7.1	6.5	6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2		2	2	2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00		0.70	0.00	0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1		6.4	6.5	6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2		2	2	2			
t(f)	2.2		3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x	434		2026	2069	333			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	333	
Potential Capacity	709	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	709	
Probability of Queue free St.	0.51	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		434
Potential Capacity		1126
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1126
Probability of Queue free St.	1.00	0.42
Maj L-Shared Prob Q free St.		0.28

Step 3: TH from Minor St.	8	11
Conflicting Flows	2069	
Potential Capacity	54	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.28	0.28
Movement Capacity	15	
Probability of Queue free St.	0.73	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	2026	
Potential Capacity	63	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.21
Maj. L, Min T Adj. Imp Factor.		0.34
Cap. Adj. factor due to Impeding mvmnt	0.42	0.18
Movement Capacity	27	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	2069	
Potential Capacity	54	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.28	0.28
Movement Capacity	15	
Result for 2 stage process:		
a		
y		
C t	15	
Probability of Queue free St.	0.73	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	2026	
Potential Capacity	63	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.21
Maj. L, Min T Adj. Imp Factor.		0.34
Cap. Adj. factor due to Impeding mvmnt	0.42	0.18
Movement Capacity	27	
Results for Two-stage process:		
a		
y		
C t	27	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	594	4	345			
Movement Capacity (vph)	27	15	709			
Shared Lane Capacity (vph)			463			

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	27	15	709			
Volume	594	4	345			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh			463			
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	651		594		349			
C(m) (vph)	1126		27		463			
v/c	0.58		22.00		0.75			
95% queue length	3.86		73.89		6.35			
Control Delay	12.5		9726		32.9			
LOS	B		F		D			
Approach Delay				6139				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.42	1.00
v(il), Volume for stream 2 or 5	333	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.28	
d(M,LT), Delay for stream 1 or 4	12.5	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	9.0	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*mm - 2AMno-build*	Intersection	*Hardscrabble & Reed*
Agency/Co.	*MMA*	Jurisdiction	*North Salem, NY*
Date Performed	*4/5/2005*	Analysis Year	*2010 No-build Condition*
Analysis Time Period	*Peak AM Hour*		

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road*	North/South Street: *Reed Road*
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)	*1*	*509*	*0*	*0*	*621*	*1*
Peak-hour factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate (veh/h)	*1*	*565*	*0*	*0*	*690*	*1*
Proportion of heavy vehicles, P_{HV}	*2*	*--*	*--*	*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*	*0*	*0*	*1*	*0*	*2*
Peak-hour factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate (veh/h)	*0*	*0*	*0*	*1*	*0*	*2*
Proportion of heavy vehicles, P_{HV}	*0*	*0*	*0*	*2*	*0*	*2*
Percent grade (%)	*0*			*0*		
Flared approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized?			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
Volume, v (vph)	*1*						*3*	
Capacity, c_m (vph)	*904*						*307*	
v/c ratio	*0.00*						*0.01*	
Queue length (95%)	*0.00*						*0.03*	
Control Delay (s/veh)	*9.0*						*16.8*	

LOS	A						C	
Approach delay (s/veh)	--	--				16.8		
Approach LOS	--	--				C		

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 2AMno-build
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	1	509			621	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	1	565			690	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1		2
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				1		2
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	1						3	
C(m) (vph)	904						307	
v/c	0.00						0.01	
95% queue length	0.00						0.03	
Control Delay	9.0						16.8	
LOS	A						C	
Approach Delay							16.8	
Approach LOS							C	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 2AMno-build
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	1	509			621	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	0	141			172	0
Hourly Flow Rate, HFR	1	565			690	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				1		2
Peak Hour Factor, PHF				0.90		0.90
Peak-15 Minute Volume				0		1
Hourly Flow Rate, HFR				1		2
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		No /
RT Channelized?						
Lanes				0		0
Configuration					LR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	565	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.1		6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1					6.4		6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	691					1257		690
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		690
Potential Capacity		445
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		445
Probability of Queue free St.	1.00	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		691
Potential Capacity		904
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		904
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		1.00

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		1257
Potential Capacity		189
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.99	1.00
Movement Capacity		189

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	1.00	1.00
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		1257
Potential Capacity		189
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	1.00	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.99	1.00
Movement Capacity		189
Results for Two-stage process:		
a		
y		
C t		189

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				1		2
Movement Capacity (vph)				189		445
Shared Lane Capacity (vph)					307	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep				189		445
Volume				1		2
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					307	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	1						3	
C(m) (vph)	904						307	
v/c	0.00						0.01	
95% queue length	0.00						0.03	
Control Delay	9.0						16.8	
LOS	A						C	
Approach Delay							16.8	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5	565	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	1.00	
d(M,LT), Delay for stream 1 or 4	9.0	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.0	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	mm - 2PMno-build	Intersection	Hardscrabble & Reed
Agency/Co.	MMA	Jurisdiction	North Salem, NY
Date Performed	4/5/2005	Analysis Year	2010 No-build Condition
Analysis Time Period	Peak PM Hour		

Project Description Woodlands Development

East/West Street: Hardscrabble Road | North/South Street: Reed Road

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)	2	890	0	0	843	1
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	2	988	0	0	936	1
Proportion of heavy vehicles, P_{HV}	2	--	--	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	0	0	1	0	4
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	0	0	0	1	0	4
Proportion of heavy vehicles, P_{HV}	0	0	0	2	0	2
Percent grade (%)		0			0	
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
Volume, v (vph)	2						5	
Capacity, c_m (vph)	731						191	
v/c ratio	0.00						0.03	
Queue length (95%)	0.01						0.08	
Control Delay (s/veh)	9.9						24.4	

LOS	A						C	
Approach delay (s/veh)	--	--					24.4	
Approach LOS	--	--					C	

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 2PMno-build
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	2	890			843	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	2	988			936	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume				1		4
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				1		4
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	2						5	
C(m) (vph)	731						191	
v/c	0.00						0.03	
95% queue length	0.01						0.08	
Control Delay	9.9						24.4	
LOS	A						C	
Approach Delay							24.4	
Approach LOS							C	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 2PMno-build
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	2	890			843	1
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	1	247			234	0
Hourly Flow Rate, HFR	2	988			936	1
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				1		4
Peak Hour Factor, PHF				0.90		0.90
Peak-15 Minute Volume				0		1
Hourly Flow Rate, HFR				1		4
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
RT Channelized?						
Lanes				0		0
Configuration					LR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	988	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.1		6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1					6.4		6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	937					1928		936
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		936
Potential Capacity		321
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		321
Probability of Queue free St.	1.00	0.99

Step 2: LT from Major St.	4	1
Conflicting Flows		937
Potential Capacity		731
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		731
Probability of Queue free St.	1.00	1.00
Maj L-Shared Prob Q free St.		0.99

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		1928
Potential Capacity		73
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.98	1.00
Movement Capacity		73

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		1928
Potential Capacity		73
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	1.00	
Cap. Adj. factor due to Impeding mvmnt	0.98	1.00
Movement Capacity		73
Results for Two-stage process:		
a		
y		
C t		73

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				1		4
Movement Capacity (vph)				73		321
Shared Lane Capacity (vph)					191	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				73		321
Volume				1		4
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					191	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	2						5	
C(m) (vph)	731						191	
v/c	0.00						0.03	
95% queue length	0.01						0.08	
Control Delay	9.9						24.4	
LOS	A						C	
Approach Delay							24.4	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	1.00
v(il), Volume for stream 2 or 5	988	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.99	
d(M,LT), Delay for stream 1 or 4	9.9	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.1	

SHORT REPORT

General Information		Site Information	
Analyst	mm - 3AMno-build	Intersection	Hardscrabble & I-684 SB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak AM Hour	Analysis Year	2010 No-build Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				685		51		456	423	251	425	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 10.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 65.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				761		57		507	470	279	472	
Lane group cap.				517		828		602	511	386	974	
v/c ratio				1.47		0.07		0.84	0.92	0.72	0.48	
Green ratio				0.29		0.52		0.32	0.32	0.52	0.52	
Unif. delay d1				23.0		7.7		20.5	21.2	11.8	9.9	
Delay factor k				0.50		0.11		0.50	0.50	0.28	0.11	
Increm. delay d2				222.7		0.0		13.4	24.2	6.6	0.4	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				245.7		7.7		33.9	45.4	18.4	10.3	
Lane group LOS				F		A		C	D	B	B	
Apprch. delay				229.1			39.4			13.3		
Approach LOS				F			D			B		
Intersec. delay	92.7			Intersection LOS						F		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3AMno-build
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 No-build Condition

N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				685		51		456	423	251	425	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left				
Thru						Thru		P		
Right						Right		P		
Peds						Peds				
WB Left	A				SB	Left	A	P		
Thru						Thru	A	P		
Right	A					Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right	A			
Green	19.0						10.0	21.0		
Yellow	3.0						3.0	4.0		
All Red	2.0						0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	g/C	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound								
Westbound								
L	517	1770	1.47	0.29	245.7	F		
							229.1	F
R	828	1583	0.07	0.52	7.7	A		
Northbound								
T	602	1863	0.84	0.32	33.9	C	39.4	D
R	511	1583	0.92	0.32	45.4	D		
Southbound								
L	386	1770	0.72	0.52	18.4	B		
T	974	1863	0.48	0.52	10.3	B	13.3	B

Intersection Delay = 92.7 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3AMno-build
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 No-build Condition
Project ID: Woodlands

East/West Street: I-684 Southbound Ramps
North/South Street: Hardscrabble Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume				685		51		456	423	251	425	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				190		14		127	118	70	118	
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				761		57		507	470	279	472	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

```
Ped Min g  |      3.2         |      3.2         |      3.2         |                  |

_______________________________________PHASE DATA__________________________________________

Phase Combination 1       2       3       4 |                5       6       7       8

EB   Left                                   | NB   Left
     Thru                                   |      Thru               P
     Right                                  |      Right              P
     Peds                                   |      Peds

WB   Left          A                        | SB   Left   A           P
     Thru                                   |      Thru   A           P
     Right         A                        |      Right
     Peds                                   |      Peds

NB   Right                                  | EB   Right
                                            |
SB   Right                                  | WB   Right  A
                                            |
                                            |
Green              19.0                                  10.0  21.0
Yellow             3.0                                   3.0   4.0
All Red            2.0                                   0.0   3.0

                                                        Cycle Length: 65.0    secs

____________________VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET____________________
Volume Adjustment
             |   Eastbound      |   Westbound      |   Northbound     |   Southbound     |
             | L     T     R    | L     T     R    | L     T     R    | L     T     R    |
             |__________________|__________________|__________________|__________________|
Volume, V    |                  |685         51    |      456   423   |251   425         |
PHF          |                  |0.90        0.90  |      0.90  0.90  |0.90  0.90        |
Adj flow     |                  |761         57    |      507   470   |279   472         |
No. Lanes    |   0    0    0    |   1    0    1    |  0    1    1    |   1    1    0    |
Lane group   |                  | L            R   |       T     R    | L     T          |
Adj flow     |                  |761         57    |      507   470   |279   472         |
Prop LTs     |                  |                  |       0.000      |1.000 0.000       |
Prop RTs     |                  |            1.000 |  0.000 1.000     |   0.000          |

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)____
          Eastbound          Westbound          Northbound          Southbound
LG                           L           R           T     R     L     T
So                           1900        1900        1900  1900  1900  1900
Lanes 0      0      0        1     0     1     0     1     1     1     1      0
fW                           1.000       1.000       1.000 1.000 1.000 1.000
fHV                          0.980       0.980       0.980 0.980 0.980 0.980
fG                           1.000       1.000       1.000 1.000 1.000 1.000
fP                           1.000       1.000       1.000 1.000 1.000 1.000
fBB                          1.000       1.000       1.000 1.000 1.000 1.000
fA                           1.000       1.000       1.000 1.000 1.000 1.000
fLU                          1.000       1.000       1.000 1.000 1.000 1.000
fRT                                      0.850       1.000 0.850       1.000
fLT                          0.950                   1.000       0.950 1.000
Sec.                                                             0.167
fLpb                         1.000                   1.000       1.000 1.000
fRpb                                     1.000       1.000 1.000       1.000
S                            1770        1583        1863  1583  1770  1863
Sec.                                                             310
_________________________CAPACITY AND LOS WORKSHEET____________________________
```

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	761	1770	# 0.43	0.29	517	1.47
Prot							
Perm							
Thru							
Right	R	57	1583	0.04	0.52	828	0.07
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	507	1863	0.27	0.32	602	0.84
Right	R	470	1583	# 0.30	0.32	511	0.92
Southbound							
Prot		272	1770	# 0.15	0.154	272	1.00
Perm		7	310	0.02	0.369	114	0.06
Left	L	279			0.52	386	0.72
Prot							
Perm							
Thru	T	472	1863	0.25	0.52	974	0.48
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.88
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.24

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
Westbound												
L	1.47	0.29	23.0	1.000	517	0.50	222.7	0.0	245.7	F	229.1	F
R	0.07	0.52	7.7	1.000	828	0.11	0.0	0.0	7.7	A		
Northbound												
T	0.84	0.32	20.5	1.000	602	0.50	13.4	0.0	33.9	C	39.4	D
R	0.92	0.32	21.2	1.000	511	0.50	24.2	0.0	45.4	D		
Southbound												
L	0.72	0.52	11.8	1.000	386	0.28	6.6	0.0	18.4	B		

```
T    0.48  0.52  9.9   1.000 974   0.11   0.4   0.0   10.3   B    13.3   B

_______________________________________________________________________________
         Intersection delay = 92.7  (sec/veh)   Intersection LOS = F



______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                              for exclusive lefts
Input
                                                         EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach                          M
Cycle length, C                             65.0    sec
Total actual green time for LT lane group, G (s)                           34.0
Effective permitted green time for LT lane group, g(s)                     24.0
Opposing effective green time, go (s)                                      21.0
Number of lanes in LT lane group, N                                        1
Number of lanes in opposing approach, No                                   1
Adjusted LT flow rate, VLT (veh/h)                                         279
Proportion of LT in LT lane group, PLT                                     1.000
Proportion of LT in opposing flow, PLTo                                    0.00
Adjusted opposing flow rate, Vo (veh/h)                                    507
Lost time for LT lane group, tL                                            7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                         5.04
Opposing lane util. factor, fLUo                                     1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                        9.15
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                      0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                          1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                               0.68
gq, (see Exhibit C16-4,5,6,7,8)                                            17.25
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                      6.75
n=Max(gq-gf)/2,0)                                                          8.63
PTHo=1-PLTo                                                                1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                         1.00
EL1 (refer to Exhibit C16-3)                                               2.10
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                         0.17
gdiff=max(gq-gf,0)                                                         0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                        0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                  0.167

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                              for shared lefts
Input
                                                         EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                             65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT 0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo 1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach, see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

	EB	WB	NB	SB
Effective pedestrian green time, gp (s)				
Conflicting pedestrian volume, Vped (p/h)				
Pedestrian flow rate, Vpedg (p/h)				
OCCpedg				
Opposing queue clearing green, gq (s)				
Eff. ped. green consumed by opp. veh. queue, gq/gp				
OCCpedu				
Opposing flow rate, Vo (veh/h)				
OCCr				
Number of cross-street receiving lanes, Nrec				
Number of turning lanes, Nturn				
ApbT				
Proportion of left turns, PLT				
Proportion of left turns using protected phase, PLTA				
Left-turn adjustment, fLpb				
Permitted Right Turns				
Effective pedestrian green time, gp (s)				
Conflicting pedestrian volume, Vped (p/h)				
Conflicting bicycle volume, Vbic (bicycles/h)				
Vpedg				
OCCpedg				
Effective green, g (s)				

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v						279
v/c ratio from Capacity Worksheet, X						0.72
Protected phase effective green interval, g (s)						10.0
Opposing queue effective green interval, gq						17.25
Unopposed green interval, gu						6.75
Red time r=(C-g-gq-gu)						31.0
Arrival rate, qa=v/(3600(max[X,1.0]))						0.08
Protected ph. departure rate, Sp=s/3600						0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)						0.31
XPerm						0.90
XProt						0.65
Case						1
Queue at beginning of green arrow, Qa						2.40
Queue at beginning of unsaturated green, Qu						1.34
Residual queue, Qr						0.00
Uniform Delay, d1						11.8

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 92.7 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				761		57		507	470	279	472	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	1	0	1	0	1	1	1	1	0
SL				1770		1583		1863	1583	739	1863	
LnCapacity				517		828		602	511	386	974	
Flow Ratio				0.43		0.04		0.27	0.30	0.38	0.25	
v/c Ratio				1.47		0.07		0.84	0.92	0.72	0.48	
Grn Ratio				0.29		0.52		0.32	0.32	0.52	0.52	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				13.7		0.5		8.5	8.2	2.7	5.4	
kB				0.4		0.5		0.6	0.6	0.3	0.6	
Q2				31.6		0.0		2.8	3.8	0.8	0.5	
Q Average				45.4		0.5		11.3	11.9	3.5	6.0	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.1		1.2		1.2	1.2	1.2	1.2	
BOQ				51.4		0.7		13.6	14.4	4.2	7.1	
QSRatio												
85th Percentile Output:												
fB%				1.4		1.6		1.4	1.4	1.6	1.5	
BOQ				62.0		0.9		16.1	17.0	5.5	9.2	
QSRatio												
90th Percentile Output:												
fB%				1.4		1.8		1.6	1.5	1.7	1.7	
BOQ				65.4		1.0		17.5	18.4	6.1	10.1	
QSRatio												
95th Percentile Output:												
fB%				1.5		2.1		1.7	1.7	2.0	1.9	
BOQ				70.3		1.1		19.2	20.2	7.0	11.5	
QSRatio												
98th Percentile Output:												
fB%				1.7		2.7		1.9	1.8	2.5	2.3	
BOQ				78.5		1.5		20.9	21.9	8.6	13.9	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 3PMno-build	Intersection	Hardscrabble & I-684 SB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2010 No-build Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				346		90		816	140	189	652	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 10.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 65.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				384		100		907	156	210	724	
Lane group cap.				517		828		602	511	386	974	
v/c ratio				0.74		0.12		1.51	0.31	0.54	0.74	
Green ratio				0.29		0.52		0.32	0.32	0.52	0.52	
Unif. delay d1				20.8		7.9		22.0	16.5	11.9	12.1	
Delay factor k				0.30		0.11		0.50	0.50	0.14	0.30	
Increm. delay d2				5.7		0.1		236.6	1.5	1.6	3.1	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				26.5		8.0		258.6	18.1	13.4	15.2	
Lane group LOS				C		A		F	B	B	B	
Apprch. delay				22.7			223.3			14.8		
Approach LOS				C			F			B		
Intersec. delay	105.7			Intersection LOS						F		

HCS2000™

Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3PMno-build
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 No-build Condition
N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				346		90		816	140	189	652	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left				
Thru						Thru		P		
Right						Right		P		
Peds						Peds				
WB Left	A				SB	Left	A	P		
Thru						Thru	A	P		
Right	A					Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right	A			
Green	19.0						10.0	21.0		
Yellow	3.0						3.0	4.0		
All Red	2.0						0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	517	1770	0.74	0.29	26.5	C		
							22.7	C
R	828	1583	0.12	0.52	8.0	A		
Northbound								
T	602	1863	1.51	0.32	258.6	F	223.3	F
R	511	1583	0.31	0.32	18.1	B		
Southbound								
L	386	1770	0.54	0.52	13.4	B		
T	974	1863	0.74	0.52	15.2	B	14.8	B

Intersection Delay = 105.7 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst:	mm - 3PMno-build
Agency/Co.:	MMA
Date Performed:	4/5/2005
Analysis Time Period:	Peak PM Hour
Intersection:	Hardscrabble & I-684 SB Ramps
Area Type:	All other areas
Jurisdiction:	North Salem, NY
Analysis Year:	2010 No-build Condition
Project ID: Woodlands	

East/West Street	North/South Street
I-684 Southbound Ramps	Hardscrabble Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume				346		90		816	140	189	652	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				96		25		227	39	53	181	
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				384		100		907	156	210	724	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

Ped Min g	3.2	3.2	3.2	

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left				
	Thru						Thru		P		
	Right						Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru						Thru	A	P		
	Right	A					Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right	A			
Green		19.0						10.0	21.0		
Yellow		3.0						3.0	4.0		
All Red		2.0						0.0	3.0		

Cycle Length: 65.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V				346		90		816	140	189	652	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Adj flow				384		100		907	156	210	724	
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Adj flow				384		100		907	156	210	724	
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG				L		R		T	R	L	T	
So				1900		1900		1900	1900	1900	1900	
Lanes	0	0	0	1	0	1	0	1	1	1	1	0
fW				1.000		1.000		1.000	1.000	1.000	1.000	
fHV				0.980		0.980		0.980	0.980	0.980	0.980	
fG				1.000		1.000		1.000	1.000	1.000	1.000	
fP				1.000		1.000		1.000	1.000	1.000	1.000	
fBB				1.000		1.000		1.000	1.000	1.000	1.000	
fA				1.000		1.000		1.000	1.000	1.000	1.000	
fLU				1.000		1.000		1.000	1.000	1.000	1.000	
fRT						0.850		1.000	0.850		1.000	
fLT				0.950				1.000		0.950	1.000	
Sec.										0.167		
fLpb				1.000				1.000		1.000	1.000	
fRpb						1.000		1.000	1.000		1.000	
S				1770		1583		1863	1583	1770	1863	
Sec.										310		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	384	1770	# 0.22	0.29	517	0.74
Prot							
Perm							
Thru							
Right	R	100	1583	0.06	0.52	828	0.12
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	907	1863	# 0.49	0.32	602	1.51
Right	R	156	1583	0.10	0.32	511	0.31
Southbound							
Prot		210	1770	# 0.12	0.154	272	0.77
Perm		0	310	0.00	0.369	114	0.00
Left	L	210			0.52	386	0.54
Prot							
Perm							
Thru	T	724	1863	0.39	0.52	974	0.74
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.82
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.16

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
Westbound												
L	0.74	0.29	20.8	1.000	517	0.30	5.7	0.0	26.5	C	22.7	C
R	0.12	0.52	7.9	1.000	828	0.11	0.1	0.0	8.0	A		
Northbound												
T	1.51	0.32	22.0	1.000	602	0.50	236.6	0.0	258.6	F	223.3	F
R	0.31	0.32	16.5	1.000	511	0.50	1.5	0.0	18.1	B		
Southbound												
L	0.54	0.52	11.9	1.000	386	0.14	1.6	0.0	13.4	B		

```
T    0.74  0.52  12.1  1.000 974   0.30   3.1   0.0   15.2   B    14.8   B

__________________________________________________________________________
          Intersection delay = 105.7 (sec/veh)   Intersection LOS = F


____________________SUPPLEMENTAL PERMITTED LT WORKSHEET___________________
                           for exclusive lefts
Input
                                                        EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach                         M
Cycle length, C                              65.0    sec
Total actual green time for LT lane group, G (s)                          34.0
Effective permitted green time for LT lane group, g(s)                    24.0
Opposing effective green time, go (s)                                     21.0
Number of lanes in LT lane group, N                                       1
Number of lanes in opposing approach, No                                  1
Adjusted LT flow rate, VLT (veh/h)                                        210
Proportion of LT in LT lane group, PLT                                    1.000
Proportion of LT in opposing flow, PLTo                                   0.00
Adjusted opposing flow rate, Vo (veh/h)                                   907
Lost time for LT lane group, tL                                           7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                        3.79
Opposing lane util. factor, fLUo                                    1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                       16.38
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                     0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                         1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                              0.68
gq, (see Exhibit C16-4,5,6,7,8)                                           20.00
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                     4.00
n=Max(gq-gf)/2,0)                                                         10.00
PTHo=1-PLTo                                                               1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                        1.00
EL1 (refer to Exhibit C16-3)                                              3.04
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                        0.17
gdiff=max(gq-gf,0)                                                        0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                       0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                 0.167

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

____________________SUPPLEMENTAL PERMITTED LT WORKSHEET___________________
                             for shared lefts
Input
                                                        EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                              65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                          0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                                1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                        EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v					210
v/c ratio from Capacity Worksheet, X					0.54
Protected phase effective green interval, g (s)					10.0
Opposing queue effective green interval, gq					20.00
Unopposed green interval, gu					4.00
Red time r=(C-g-gq-gu)					31.0
Arrival rate, qa=v/(3600(max[X,1.0]))					0.06
Protected ph. departure rate, Sp=s/3600					0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)					0.52
XPerm					0.68
XProt					0.49
Case					1
Queue at beginning of green arrow, Qa					1.81
Queue at beginning of unsaturated green, Qu					1.17
Residual queue, Qr					0.00
Uniform Delay, d1					11.9

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 105.7 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				384		100		907	156	210	724	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	1	0	1	0	1	1	1	1	0
SL				1770		1583		1863	1583	739	1863	
LnCapacity				517		828		602	511	386	974	
Flow Ratio				0.22		0.06		0.49	0.10	0.28	0.39	
v/c Ratio				0.74		0.12		1.51	0.31	0.54	0.74	
Grn Ratio				0.29		0.52		0.32	0.32	0.52	0.52	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				6.3		0.9		16.4	2.1	2.0	10.2	
kB				0.4		0.5		0.6	0.6	0.3	0.6	
Q2				1.0		0.1		39.9	0.2	0.4	1.5	
Q Average				7.3		1.0		56.3	2.4	2.3	11.7	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.2		1.2		1.2	1.3	1.2	1.2	
BOQ				8.6		1.2		67.6	3.0	2.8	13.8	
QSRatio												
85th Percentile Output:												
fB%				1.5		1.6		1.4	1.6	1.6	1.5	
BOQ				11.2		1.6		78.8	3.8	3.7	17.6	
QSRatio												
90th Percentile Output:												
fB%				1.7		1.8		1.5	1.8	1.8	1.6	
BOQ				12.3		1.8		84.5	4.3	4.1	19.1	
QSRatio												
95th Percentile Output:												
fB%				1.9		2.1		1.6	2.2	2.0	1.8	
BOQ				13.9		2.0		90.1	5.3	4.8	21.3	
QSRatio												
98th Percentile Output:												
fB%				2.3		2.6		1.7	2.6	2.5	2.1	
BOQ				16.6		2.6		95.7	6.2	6.0	24.7	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 4AMno-build*	Intersection	*Hardscrabble & Route 22*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*2010 No-build Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		701	0	843	339		76		179			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 9.0	G = 21.0	G =	G =	G = 15.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		779		937	377		84		199			
Lane group cap.		652		301	1025		443		765			
v/c ratio		1.19		3.11	0.37		0.19		0.26			
Green ratio		0.35		0.55	0.55		0.25		0.48			
Unif. delay d1		19.5		13.6	7.6		17.7		9.2			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		102.2		959.6	1.0		0.9		0.8			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		121.7		973.2	8.6		18.7		10.0			
Lane group LOS		F		F	A		B		A			
Apprch. delay	121.7			696.4			12.6					
Approach LOS	F			F			B					
Intersec. delay	426.5			Intersection LOS						F		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4AMno-build
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 No-build Condition

N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		701	0	843	339		76		179			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	9.0	21.0					15.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	652	1863	1.19	0.35	121.7	F	121.7	F
Westbound								
L	301	1770	3.11	0.55	973.2	F		
T	1025	1863	0.37	0.55	8.6	A	696.4	F
Northbound								
L	443	1770	0.19	0.25	18.7	B	12.6	B
R	765	1583	0.26	0.48	10.0-	A		
Southbound								

Intersection Delay = 426.5 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst:	mm - 4AMno-build
Agency/Co.:	MMA
Date Performed:	4/5/2005
Analysis Time Period:	Peak AM Hour
Intersection:	Hardscrabble & Route 22
Area Type:	All other areas
Jurisdiction:	North Salem, NY
Analysis Year:	2010 No-build Condition
Project ID:	Woodlands

East/West Street	North/South Street
Hardscrabble Road	Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		701	0	843	339		76		179			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		195	0	234	94		21		50			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		779		937	377		84		199			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.000			0.000				1.000			
Peds Bikes	0						0			0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

Ped Min g	3.2		3.2	3.2

PHASE DATA

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	9.0	21.0					15.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 60.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound L	T	R	Westbound L	T	R	Northbound L	T	R	Southbound L	T	R
Volume, V		701	0	843	339		76		179			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		779	0	937	377		84		199			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		779		937	377		84		199			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.000			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound	Westbound		Northbound		Southbound
LG	TR	L	T	L	R	
So	1900	1900	1900	1900	1900	
Lanes	0 1 0	1	1 0	1 0	1	0 0 0
fW	1.000	1.000	1.000	1.000	1.000	
fHV	0.980	0.980	0.980	0.980	0.980	
fG	1.000	1.000	1.000	1.000	1.000	
fP	1.000	1.000	1.000	1.000	1.000	
fBB	1.000	1.000	1.000	1.000	1.000	
fA	1.000	1.000	1.000	1.000	1.000	
fLU	1.000	1.000	1.000	1.000	1.000	
fRT	1.000		1.000		0.850	
fLT	1.000	0.950	1.000	0.950		
Sec.		0.148				
fLpb	1.000	1.000	1.000	1.000		
fRpb	1.000		1.000		1.000	
S	1863	1770	1863	1770	1583	
Sec.		276				

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	779	1863	0.42	0.35	652	1.19
Right							
Westbound							
Prot		177	1770	# 0.10	0.100	177	1.00
Perm		760	276	# 2.75	0.450	124	6.13
Left	L	937			0.55	301	3.11
Prot							
Perm							
Thru	T	377	1863	0.20	0.55	1025	0.37
Right							
Northbound							
Prot							
Perm							
Left	L	84	1770	# 0.05	0.25	443	0.19
Prot							
Perm							
Thru							
Right	R	199	1583	0.13	0.48	765	0.26
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 2.90
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 3.63

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
TR	1.19	0.35	19.5	1.000	652	0.50	102.2	0.0	121.7	F	121.7	F
Westbound												
L	3.11	0.55	13.6	1.000	301	0.50	959.6	0.0	973.2	F		
T	0.37	0.55	7.6	1.000	1025	0.50	1.0	0.0	8.6	A	696.4	F
Northbound												
L	0.19	0.25	17.7	1.000	443	0.50	0.9	0.0	18.7	B		
											12.6	B
R	0.26	0.48	9.2	1.000	765	0.50	0.8	0.0	10.0-	A		
Southbound												

Intersection delay = 426.5 (sec/veh)   Intersection LOS = F

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach		S		
Cycle length, C 60.0 sec				
Total actual green time for LT lane group, G (s)		33.0		
Effective permitted green time for LT lane group, g(s)		27.0		
Opposing effective green time, go (s)		21.0		
Number of lanes in LT lane group, N		1		
Number of lanes in opposing approach, No		1		
Adjusted LT flow rate, VLT (veh/h)		937		
Proportion of LT in LT lane group, PLT		1.000		
Proportion of LT in opposing flow, PLTo		0.00		
Adjusted opposing flow rate, Vo (veh/h)		779		
Lost time for LT lane group, tL		7.00		
Computation				
LT volume per cycle, LTC=VLTC/3600		15.62		
Opposing lane util. factor, fLUo	1.000	1.000		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		12.98		
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0		
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.00		
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.65		
gq, (see Exhibit C16-4,5,6,7,8)		22.07		
gu=g-gq if gq>=gf, or = g-gf if gq<gf		4.93		
n=Max(gq-gf)/2,0)		11.04		
PTHo=1-PLTo		1.00		
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00		
EL1 (refer to Exhibit C16-3)		2.70		
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.15		
gdiff=max(gq-gf,0)		0.00		
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.15		
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT		0.148		

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 60.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                      0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                            1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                             EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	60.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v			937		
v/c ratio from Capacity Worksheet, X			3.11		
Protected phase effective green interval, g (s)			6.0		
Opposing queue effective green interval, gq			22.07		
Unopposed green interval, gu			4.93		
Red time r=(C-g-gq-gu)			27.0		
Arrival rate, qa=v/(3600(max[X,1.0]))			0.08		
Protected ph. departure rate, Sp=s/3600			0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)			0.42		
XPerm			1.09		
XProt			0.94		
Case			3		
Queue at beginning of green arrow, Qa			2.45		
Queue at beginning of unsaturated green, Qu			1.85		
Residual queue, Qr			0.19		
Uniform Delay, d1			13.6		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 426.5 sec/veh   Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		779		937	377		84		199			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1863		548	1863		1770		1583			
LnCapacity		652		301	1025		443		765			
Flow Ratio		0.42		1.71	0.20		0.05		0.13			
v/c Ratio		1.19		3.11	0.37		0.19		0.26			
Grn Ratio		0.35		0.55	0.55		0.25		0.48			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		13.0		7.8	3.5		1.1		2.0			
kB		0.6		0.4	0.9		0.5		0.7			
Q2		19.1		80.0	0.5		0.1		0.2			
Q Average		32.1		87.9	4.1		1.2		2.2			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.2	1.2		1.3		1.3			
BOQ		38.5		105	5.0		1.6		2.8			
QSRatio												
85th Percentile Output:												
fB%		1.4		1.4	1.5		1.6		1.6			
BOQ		45.0		123	6.2		2.0		3.5			
QSRatio												
90th Percentile Output:												
fB%		1.5		1.5	1.7		1.9		1.8			
BOQ		48.2		132	7.0		2.3		4.0			
QSRatio												
95th Percentile Output:												
fB%		1.6		1.6	2.0		2.4		2.2			
BOQ		51.4		141	8.3		2.9		5.0			
QSRatio												
98th Percentile Output:												
fB%		1.7		1.7	2.4		2.9		2.7			
BOQ		54.7		149	9.6		3.5		5.9			
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 4PMno-build	Intersection	Hardscrabble & Route 22
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2010 No-build Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		386	1	186	817		302		566			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 9.0	G = 21.0	G =	G =	G = 15.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		430		207	908		336		629			
Lane group cap.		652		383	1025		443		765			
v/c ratio		0.66		0.54	0.89		0.76		0.82			
Green ratio		0.35		0.55	0.55		0.25		0.48			
Unif. delay d1		16.5		9.0	11.8		20.8		13.3			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		5.2		5.4	11.2		11.5		9.7			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		21.7		14.4	23.0		32.4		23.0			
Lane group LOS		C		B	C		C		C			
Apprch. delay	21.7			21.4			26.3					
Approach LOS	C			C			C					
Intersec. delay	23.3			Intersection LOS						C		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4PMno-build	Inter.: Hardscrabble & Route 22
Agency: MMA	Area Type: All other areas
Date: 4/5/2005	Jurisd: North Salem, NY
Period: Peak PM Hour	Year : 2010 No-build Condition
Project ID: Woodlands	
E/W St: Hardscrabble Road	N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		386	1	186	817		302		566			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	P			
Thru		P			Thru				
Right		P			Right	P			
Peds					Peds				
WB Left	P	P			SB Left				
Thru	P	P			Thru				
Right					Right				
Peds					Peds				
NB Right	P				EB Right				
SB Right					WB Right				
Green	9.0	21.0				15.0			
Yellow	3.0	4.0				3.0			
All Red		3.0				2.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	652	1862	0.66	0.35	21.7	C	21.7	C
Westbound								
L	383	1770	0.54	0.55	14.4	B		
T	1025	1863	0.89	0.55	23.0	C	21.4	C
Northbound								
L	443	1770	0.76	0.25	32.4	C		
							26.3	C
R	765	1583	0.82	0.48	23.0	C		
Southbound								

Intersection Delay = 23.3 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst:	mm - 4PMno-build
Agency/Co.:	MMA
Date Performed:	4/5/2005
Analysis Time Period:	Peak PM Hour
Intersection:	Hardscrabble & Route 22
Area Type:	All other areas
Jurisdiction:	North Salem, NY
Analysis Year:	2010 No-build Condition
Project ID:	Woodlands

East/West Street	North/South Street
Hardscrabble Road	Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		386	1	186	817		302		566			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		107	1	52	227		84		157			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		430		207	908		336		629			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			
Peds Bikes	0							0		0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

Ped Min g	3.2		3.2	3.2

PHASE DATA

Phase Combination		1	2	3	4
EB	Left				
	Thru		P		
	Right		P		
	Peds				
WB	Left	P	P		
	Thru	P	P		
	Right				
	Peds				
NB	Right	P			
SB	Right				

Phase Combination		5	6	7	8
NB	Left	P			
	Thru				
	Right	P			
	Peds				
SB	Left				
	Thru				
	Right				
	Peds				
EB	Right				
WB	Right				

	1	2	3	4	5	6	7	8
Green	9.0	21.0			15.0			
Yellow	3.0	4.0			3.0			
All Red		3.0			2.0			

Cycle Length: 60.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V		386	1	186	817		302		566			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		429	1	207	908		336		629			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		430		207	908		336		629			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG		TR		L	T		L		R			
So		1900		1900	1900		1900		1900			
Lanes	0	1	0	1	1	0	1	0	1	0	0	0
fW		1.000		1.000	1.000		1.000		1.000			
fHV		0.980		0.980	0.980		0.980		0.980			
fG		1.000		1.000	1.000		1.000		1.000			
fP		1.000		1.000	1.000		1.000		1.000			
fBB		1.000		1.000	1.000		1.000		1.000			
fA		1.000		1.000	1.000		1.000		1.000			
fLU		1.000		1.000	1.000		1.000		1.000			
fRT		1.000			1.000				0.850			
fLT		1.000		0.950	1.000		0.950					
Sec.				0.246								
fLpb		1.000		1.000	1.000		1.000					
fRpb		1.000			1.000				1.000			
S		1862		1770	1863		1770		1583			
Sec.				458								

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	430	1862	0.23	0.35	652	0.66
Right							
Westbound							
Prot		177	1770	0.10	0.100	177	1.00
Perm		30	458	0.07	0.450	206	0.15
Left	L	207			0.55	383	0.54
Prot							
Perm							
Thru	T	908	1863	# 0.49	0.55	1025	0.89
Right							
Northbound							
Prot							
Perm							
Left	L	336	1770	# 0.19	0.25	443	0.76
Prot							
Perm							
Thru							
Right	R	629	1583	0.40	0.48	765	0.82
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.68
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.85

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
TR	0.66	0.35	16.5	1.000	652	0.50	5.2	0.0	21.7	C	21.7	C
Westbound												
L	0.54	0.55	9.0	1.000	383	0.50	5.4	0.0	14.4	B		
T	0.89	0.55	11.8	1.000	1025	0.50	11.2	0.0	23.0	C	21.4	C
Northbound												
L	0.76	0.25	20.8	1.000	443	0.50	11.5	0.0	32.4	C	26.3	C
R	0.82	0.48	13.3	1.000	765	0.50	9.7	0.0	23.0	C		
Southbound												

Intersection delay = 23.3 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach		S		
Cycle length, C 60.0 sec				
Total actual green time for LT lane group, G (s)		33.0		
Effective permitted green time for LT lane group, g(s)		27.0		
Opposing effective green time, go (s)		21.0		
Number of lanes in LT lane group, N		1		
Number of lanes in opposing approach, No		1		
Adjusted LT flow rate, VLT (veh/h)		207		
Proportion of LT in LT lane group, PLT		1.000		
Proportion of LT in opposing flow, PLTo		0.00		
Adjusted opposing flow rate, Vo (veh/h)		430		
Lost time for LT lane group, tL		7.00		
Computation				
LT volume per cycle, LTC=VLTC/3600		3.45		
Opposing lane util. factor, fLUo	1.000	1.000		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		7.17		
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0		
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.00		
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.65		
gq, (see Exhibit C16-4,5,6,7,8)		14.04		
gu=g-gq if gq>=gf, or = g-gf if gq<gf		12.96		
n=Max(gq-gf)/2,0)		7.02		
PTHo=1-PLTo		1.00		
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00		
EL1 (refer to Exhibit C16-3)		1.95		
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.15		
gdiff=max(gq-gf,0)		0.00		
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.25		
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT		0.246		

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input

	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 60.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                  0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                        1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_________________
Permitted Left Turns
                                                        EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	60.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v			207		
v/c ratio from Capacity Worksheet, X			0.54		
Protected phase effective green interval, g (s)			6.0		
Opposing queue effective green interval, gq			14.04		
Unopposed green interval, gu			12.96		
Red time r=(C-g-gq-gu)			27.0		
Arrival rate, qa=v/(3600(max[X,1.0]))			0.06		
Protected ph. departure rate, Sp=s/3600			0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)			0.26		
XPerm			0.45		
XProt			0.64		
Case			1		
Queue at beginning of green arrow, Qa			1.55		
Queue at beginning of unsaturated green, Qu			0.81		
Residual queue, Qr			0.00		
Uniform Delay, d1			9.0		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 23.3 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		430		207	908		336		629			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1862		697	1863		1770		1583			
LnCapacity		652		383	1025		443		765			
Flow Ratio		0.23		0.30	0.49		0.19		0.40			
v/c Ratio		0.66		0.54	0.89		0.76		0.82			
Grn Ratio		0.35		0.55	0.55		0.25		0.48			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		6.1		1.6	13.3		5.2		9.0			
kB		0.6		0.4	0.9		0.5		0.7			
Q2		1.2		0.5	5.0		1.4		2.8			
Q Average		7.2		2.1	18.3		6.6		11.8			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.3	1.2		1.2		1.2			
BOQ		8.9		2.7	22.0		8.1		14.3			
QSRatio												
85th Percentile Output:												
fB%		1.5		1.6	1.4		1.5		1.4			
BOQ		10.6		3.4	25.8		9.7		16.9			
QSRatio												
90th Percentile Output:												
fB%		1.6		1.8	1.5		1.6		1.5			
BOQ		11.7		3.9	27.7		10.7		18.3			
QSRatio												
95th Percentile Output:												
fB%		1.8		2.3	1.6		1.9		1.7			
BOQ		13.3		4.8	29.8		12.3		20.0			
QSRatio												
98th Percentile Output:												
fB%		2.1		2.7	1.7		2.1		1.8			
BOQ		14.9		5.7	31.9		13.8		21.8			
QSRatio												

ERROR MESSAGES

No errors to report.

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*mm - 5AMno-build*
Agency/Co.	*MMA*
Date Performed	*4/6/2005*
Analysis Time Period	*Peak AM Hour*

Site Information

Intersection	*Route 22 & Front St*
Jurisdiction	*North Salem, NY*
Analysis Year	*2010 No-build Condition*

Project Description *Woodlands Development*

East/West Street: *Croton Falls Road*

North/South Street: *Front Street*

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)	0	537	32	50	326	1
Peak-hour factor, PHF	0.90	0.87	0.87	0.75	0.75	0.90
Hourly Flow Rate (veh/h)	0	617	36	66	434	0
Proportion of heavy vehicles, P_{HV}	0	--	--	2	--	--
Median type	Undivided					
RT Channelized?			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	46	0	58	0	0	2
Peak-hour factor, PHF	0.81	0.90	0.81	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	56	0	71	0	0	0
Proportion of heavy vehicles, P_{HV}	2	0	2	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			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
Volume, v (vph)		66	56		71			
Capacity, c_m (vph)		934	190		478			
v/c ratio		0.07	0.29		0.15			
Queue length (95%)		0.23	1.17		0.52			
Control Delay (s/veh)		9.1	31.7		13.8			

LOS		A	D		B			
Approach delay (s/veh)	--	--	21.7					
Approach LOS	--	--	C					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 5AMno-build
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak AM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		537	32	50	326	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Hourly Flow Rate, HFR		617	36	66	434	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	46		58			
Peak Hour Factor, PHF	0.81		0.81			
Hourly Flow Rate, HFR	56		71			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		66	56		71			
C(m) (vph)		934	190		478			
v/c		0.07	0.29		0.15			
95% queue length		0.23	1.17		0.52			
Control Delay		9.1	31.7		13.8			
LOS		A	D		B			
Approach Delay				21.7				
Approach LOS				C				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 5AMno-build
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak AM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		537	32	50	326	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Peak-15 Minute Volume		154	9	17	109	
Hourly Flow Rate, HFR		617	36	66	434	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration		TR		LT		
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	46		58			
Peak Hour Factor, PHF	0.81		0.81			
Peak-15 Minute Volume	14		18			
Hourly Flow Rate, HFR	56		71			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?			No			
Lanes	1	1				
Configuration	L	R				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		434
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			4.1	7.1		6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			2	2		2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.00	0.70		0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage		4.1	6.4		6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2		2			
t(f)		2.2	3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		653	1201		635			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	635	
Potential Capacity	478	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	478	
Probability of Queue free St.	0.85	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	653	
Potential Capacity	934	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	934	
Probability of Queue free St.	0.93	1.00
Maj L-Shared Prob Q free St.	0.91	

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.91	0.91
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1201	
Potential Capacity	204	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.91
Maj. L, Min T Adj. Imp Factor.		0.93
Cap. Adj. factor due to Impeding mvmnt	0.93	0.79
Movement Capacity	190	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.91	0.91
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1201	
Potential Capacity	204	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.91
Maj. L, Min T Adj. Imp Factor.		0.93
Cap. Adj. factor due to Impeding mvmnt	0.93	0.79
Movement Capacity	190	

Results for Two-stage process:		
a		
y		
C t	190	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	56		71			
Movement Capacity (vph)	190		478			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	190		478			
Volume	56		71			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		66	56		71			
C(m) (vph)		934	190		478			
v/c		0.07	0.29		0.15			
95% queue length		0.23	1.17		0.52			
Control Delay		9.1	31.7		13.8			
LOS		A	D		B			
Approach Delay				21.7				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.93
v(il), Volume for stream 2 or 5		434
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.91
d(M,LT), Delay for stream 1 or 4		9.1
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.9

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	mm - 5PMno-build
Agency/Co.	MMA
Date Performed	4/6/2005
Analysis Time Period	Peak PM Hour

Site Information

Intersection	Route 22 & Front St
Jurisdiction	North Salem, NY
Analysis Year	2010 No-build Condition

Project Description *Woodlands Development*

East/West Street: *Croton Falls Road*

North/South Street: *Front Street*

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)	0	314	52	32	860	1
Peak-hour factor, PHF	0.90	0.87	0.87	0.75	0.75	0.90
Hourly Flow Rate (veh/h)	0	360	59	42	1146	0
Proportion of heavy vehicles, P_{HV}	0	--	--	2	--	--
Median type	Undivided					
RT Channelized?			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	28	0	37	0	0	2
Peak-hour factor, PHF	0.81	0.90	0.81	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	34	0	45	0	0	0
Proportion of heavy vehicles, P_{HV}	2	0	2	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			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
Volume, v (vph)		42	34		45			
Capacity, c_m (vph)		1140	109		658			
v/c ratio		0.04	0.31		0.07			
Queue length (95%)		0.11	1.21		0.22			
Control Delay (s/veh)		8.3	52.3		10.9			

LOS		*A*	*F*		*B*			
Approach delay (s/veh)	--	--	*28.7*					
Approach LOS	--	--	*D*					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 5PMno-build
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak PM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 No-build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		314	52	32	860	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Hourly Flow Rate, HFR		360	59	42	1146	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	28		37			
Peak Hour Factor, PHF	0.81		0.81			
Hourly Flow Rate, HFR	34		45			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes		1	1			
Configuration		L	R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		42	34		45			
C(m) (vph)		1140	109		658			
v/c		0.04	0.31		0.07			
95% queue length		0.11	1.21		0.22			
Control Delay		8.3	52.3		10.9			
LOS		A	F		B			
Approach Delay				28.7				
Approach LOS				D				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst:	mm - 5PMno-build
Agency/Co.:	MMA
Date Performed:	4/6/2005
Analysis Time Period:	Peak PM Hour
Intersection:	Route 22 & Front St
Jurisdiction:	North Salem, NY
Units: U. S. Customary	
Analysis Year:	2010 No-build Condition
Project ID: Woodlands Development	
East/West Street:	Croton Falls Road
North/South Street:	Front Street
Intersection Orientation: EW	Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		314	52	32	860	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Peak-15 Minute Volume		90	15	11	287	
Hourly Flow Rate, HFR		360	59	42	1146	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	28		37			
Peak Hour Factor, PHF	0.81		0.81			
Peak-15 Minute Volume	9		11			
Hourly Flow Rate, HFR	34		45			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?			No			
Lanes	1	1				
Configuration	L	R				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		1146
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			4.1	7.1		6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			2	2		2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.00	0.70		0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage		4.1	6.4		6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2		2			
t(f)		2.2	3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x		419	1620		390			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	390	
Potential Capacity	658	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	658	
Probability of Queue free St.	0.93	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	419	
Potential Capacity	1140	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1140	
Probability of Queue free St.	0.96	1.00
Maj L-Shared Prob Q free St.	0.89	

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.89	0.89
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1620	
Potential Capacity	113	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.89
Maj. L, Min T Adj. Imp Factor.		0.91
Cap. Adj. factor due to Impeding mvmnt	0.96	0.85
Movement Capacity	109	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.89	0.89
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1620	
Potential Capacity	113	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.89
Maj. L, Min T Adj. Imp Factor.		0.91
Cap. Adj. factor due to Impeding mvmnt	0.96	0.85
Movement Capacity	109	

Results for Two-stage process:		
a		
y		
C t	109	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	34		45			
Movement Capacity (vph)	109		658			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	109		658			
Volume	34		45			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		42	34		45			
C(m) (vph)		1140	109		658			
v/c		0.04	0.31		0.07			
95% queue length		0.11	1.21		0.22			
Control Delay		8.3	52.3		10.9			
LOS		A	F		B			
Approach Delay				28.7				
Approach LOS				D				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.96
v(il), Volume for stream 2 or 5		1146
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.89
d(M,LT), Delay for stream 1 or 4		8.3
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.9

2010 BUILD TRAFFIC CONDITIONS

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	mm - 1AMbuild
Agency/Co.	mma
Date Performed	4/5/2005
Analysis Time Period	Peak AM Hour

Site Information

Intersection	Hardscrabble & 684 NB Ramps
Jurisdiction	North Salem, NY
Analysis Year	2010 Build Condition

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road* | North/South Street: *I-684 Northbound Ramps*

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)	273	248	0	0	452	45
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	303	275	0	0	502	50
Proportion of heavy vehicles, P_{HV}	2	--	--	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)	153	0	122	0	0	0
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	170	0	135	0	0	0
Proportion of heavy vehicles, P_{HV}	2	2	2	0	0	0
Percent grade (%)		0			0	
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	1	1	0	0	0	0
Configuration	L		TR			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT		L		TR			
Volume, v (vph)	303		170		135			
Capacity, c_m (vph)	1018		107		764			
v/c ratio	0.30		1.59		0.18			
Queue length (95%)	1.25		12.84		0.64			

Control Delay (s/veh)	*10.0*		*375.1*		*10.7*			
LOS	*B*		*F*		*B*			
Approach delay (s/veh)	--	--		*213.8*				
Approach LOS	--	--		*F*				

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 1AMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	273	248			452	45
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	303	275			502	50
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	153	0	122			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Hourly Flow Rate, HFR	170	0	135			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	1	1	0			
Configuration	L		TR			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	303		170		135			
C(m) (vph)	1018		107		764			
v/c	0.30		1.59		0.18			
95% queue length	1.25		12.84		0.64			
Control Delay	10.0+		375.1		10.7			
LOS	B		F		B			
Approach Delay				213.8				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 1AMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	273	248			452	45
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	76	69			126	12
Hourly Flow Rate, HFR	303	275			502	50
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	153	0	122			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Peak-15 Minute Volume	42	0	34			
Hourly Flow Rate, HFR	170	0	135			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	1	1	0			
Configuration	L		TR			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	275	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1		7.1	6.5	6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2		2	2	2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00		0.70	0.00	0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1		6.4	6.5	6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2		2	2	2			
t(f)	2.2		3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	552		1408	1433	275			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	275	
Potential Capacity	764	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	764	
Probability of Queue free St.	0.82	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		552
Potential Capacity		1018
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1018
Probability of Queue free St.	1.00	0.70
Maj L-Shared Prob Q free St.		0.64

Step 3: TH from Minor St.	8	11
Conflicting Flows	1433	
Potential Capacity	134	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.64	0.64
Movement Capacity	86	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1408	
Potential Capacity	153	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.64
Maj. L, Min T Adj. Imp Factor.		0.72
Cap. Adj. factor due to Impeding mvmnt	0.70	0.60
Movement Capacity	107	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	1433	
Potential Capacity	134	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.64	0.64
Movement Capacity	86	
Result for 2 stage process:		
a		
y		
C t	86	
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows	1408	
Potential Capacity	153	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.64
Maj. L, Min T Adj. Imp Factor.		0.72
Cap. Adj. factor due to Impeding mvmnt	0.70	0.60
Movement Capacity	107	
Results for Two-stage process:		
a		
y		
C t	107	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	170	0	135			
Movement Capacity (vph)	107	86	764			
Shared Lane Capacity (vph)			764			

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	107	86	764			
Volume	170	0	135			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh			764			
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	303		170		135			
C(m) (vph)	1018		107		764			
v/c	0.30		1.59		0.18			
95% queue length	1.25		12.84		0.64			
Control Delay	10.0+		375.1		10.7			
LOS	B		F		B			
Approach Delay				213.8				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.70	1.00
v(il), Volume for stream 2 or 5	275	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.64	
d(M,LT), Delay for stream 1 or 4	10.0+	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	3.6	

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*mm - 1PMbuild*
Agency/Co.	*mma*
Date Performed	*4/5/2005*
Analysis Time Period	*Peak PM Hour*

Site Information

Intersection	*Hardscrabble & 684 NB Ramps*
Jurisdiction	*North Salem, NY*
Analysis Year	*2010 Build Condition*

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road*

North/South Street: *I-684 Northbound Ramps*

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)	*594*	*303*	*0*	*0*	*316*	*78*
Peak-hour factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate (veh/h)	*660*	*336*	*0*	*0*	*351*	*86*
Proportion of heavy vehicles, P_{HV}	*2*	--	--	*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)	*546*	*4*	*311*	*0*	*0*	*0*
Peak-hour factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate (veh/h)	*606*	*4*	*345*	*0*	*0*	*0*
Proportion of heavy vehicles, P_{HV}	*2*	*2*	*2*	*0*	*0*	*0*
Percent grade (%)		*0*			*0*	
Flared approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized?			*0*			*0*
Lanes	*1*	*1*	*0*	*0*	*0*	*0*
Configuration	*L*		*TR*			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*		*L*		*TR*			
Volume, v (vph)	*660*		*606*		*349*			
Capacity, c_m (vph)	*1123*		*25*		*451*			
v/c ratio	*0.59*		*24.24*		*0.77*			
Queue length (95%)	*4.00*		*75.63*		*6.72*			

Control Delay (s/veh)	12.7		10755		35.4			
LOS	B		F		E			
Approach delay (s/veh)	--	--	6838					
Approach LOS	--	--	F					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 1PMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	594	303			316	78
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	660	336			351	86
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume	546	4	311			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Hourly Flow Rate, HFR	606	4	345			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No /			/
Lanes	1	1	0			
Configuration	L	TR				

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	660		606		349			
C(m) (vph)	1123		25		451			
v/c	0.59		24.24		0.77			
95% queue length	4.00		75.63		6.72			
Control Delay	12.7		10755		35.4			
LOS	B		F		E			
Approach Delay				6838				
Approach LOS				F				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 1PMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & 684 NB Ramps
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	594	303			316	78
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	165	84			88	22
Hourly Flow Rate, HFR	660	336			351	86
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	546	4	311			
Peak Hour Factor, PHF	0.90	0.90	0.90			
Peak-15 Minute Volume	152	1	86			
Hourly Flow Rate, HFR	606	4	345			
Percent Heavy Vehicles	2	2	2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			No	/		/
RT Channelized?						
Lanes	1	1	0			
Configuration	L	TR				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	336	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1		7.1	6.5	6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2		2	2	2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00		0.70	0.00	0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1		6.4	6.5	6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20		3.50	4.00	3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2		2	2	2			
t(f)	2.2		3.5	4.0	3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	437		2050	2093	336			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500		1500				
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	336	
Potential Capacity	706	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	706	
Probability of Queue free St.	0.51	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows		437
Potential Capacity		1123
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1123
Probability of Queue free St.	1.00	0.41
Maj L-Shared Prob Q free St.		0.27

Step 3: TH from Minor St.	8	11
Conflicting Flows	2093	
Potential Capacity	52	
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.27	0.27
Movement Capacity	14	
Probability of Queue free St.	0.71	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	2050	
Potential Capacity	61	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.19
Maj. L, Min T Adj. Imp Factor.		0.33
Cap. Adj. factor due to Impeding mvmnt	0.41	0.17
Movement Capacity	25	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

```
Part 2 - Second Stage
Conflicting Flows
Potential Capacity
Pedestrian Impedance Factor
Cap. Adj. factor due to Impeding mvmnt
Movement Capacity
```

```
Part 3 - Single Stage
Conflicting Flows                             2093
Potential Capacity                            52
Pedestrian Impedance Factor                   1.00             1.00
Cap. Adj. factor due to Impeding mvmnt        0.27             0.27
Movement Capacity                             14
```

```
Result for 2 stage process:
a
y
C t                                           14
Probability of Queue free St.                 0.71             1.00
```

```
Step 4: LT from Minor St.                       7                10
```

```
Part 1 - First Stage
Conflicting Flows
Potential Capacity
Pedestrian Impedance Factor
Cap. Adj. factor due to Impeding mvmnt
Movement Capacity
```

```
Part 2 - Second Stage
Conflicting Flows
Potential Capacity
Pedestrian Impedance Factor
Cap. Adj. factor due to Impeding mvmnt
Movement Capacity
```

```
Part 3 - Single Stage
Conflicting Flows                             2050
Potential Capacity                            61
Pedestrian Impedance Factor                   1.00             1.00
Maj. L, Min T Impedance factor                                 0.19
Maj. L, Min T Adj. Imp Factor.                                 0.33
Cap. Adj. factor due to Impeding mvmnt        0.41             0.17
Movement Capacity                             25
```

```
Results for Two-stage process:
a
y
C t                                           25
```

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	606	4	345			
Movement Capacity (vph)	25	14	706			
Shared Lane Capacity (vph)			451			

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7	8	9	10	11	12
	L	T	R	L	T	R
C sep	25	14	706			
Volume	606	4	345			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh			451			
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT		L		TR			
v (vph)	660		606		349			
C(m) (vph)	1123		25		451			
v/c	0.59		24.24		0.77			
95% queue length	4.00		75.63		6.72			
Control Delay	12.7		10755		35.4			
LOS	B		F		E			
Approach Delay				6838				
Approach LOS				F				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.41	1.00
v(il), Volume for stream 2 or 5	336	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.27	
d(M,LT), Delay for stream 1 or 4	12.7	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	9.3	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*mm - 2AMbuild*	Intersection	*Hardscrabble & Reed*
Agency/Co.	*MMA*	Jurisdiction	*North Salem, NY*
Date Performed	*4/5/2005*	Analysis Year	*2010 Build Condition*
Analysis Time Period	*Peak AM Hour*		

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road* North/South Street: *Reed Road*

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)	*8*	*509*	*0*	*0*	*621*	*8*
Peak-hour factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate (veh/h)	*8*	*565*	*0*	*0*	*690*	*8*
Proportion of heavy vehicles, P_{HV}	*2*	--	--	*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*	*0*	*0*	*12*	*0*	*29*
Peak-hour factor, PHF	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*	*0.90*
Hourly Flow Rate (veh/h)	*0*	*0*	*0*	*13*	*0*	*32*
Proportion of heavy vehicles, P_{HV}	*0*	*0*	*0*	*2*	*0*	*2*
Percent grade (%)		*0*			*0*	
Flared approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized?			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
Volume, v (vph)	*8*						*45*	
Capacity, c_m (vph)	*898*						*313*	
v/c ratio	*0.01*						*0.14*	
Queue length (95%)	*0.03*						*0.50*	
Control Delay (s/veh)	*9.0*						*18.4*	

LOS	*A*						*C*	
Approach delay (s/veh)	--	--				*18.4*		
Approach LOS	--	--				*C*		

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 2AMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	8	509			621	8
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR	8	565			690	8
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT				TR	
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume				12		29
Peak Hour Factor, PHF				0.90		0.90
Hourly Flow Rate, HFR				13		32
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/		No	/
Lanes				0		0
Configuration					LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	8						45	
C(m) (vph)	898						313	
v/c	0.01						0.14	
95% queue length	0.03						0.50	
Control Delay	9.0						18.4	
LOS	A						C	
Approach Delay							18.4	
Approach LOS							C	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 2AMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	8	509			621	8
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	2	141			172	2
Hourly Flow Rate, HFR	8	565			690	8
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7	8	9	10	11	12
	L	T	R	L	T	R
Volume				12		29
Peak Hour Factor, PHF				0.90		0.90
Peak-15 Minute Volume				3		8
Hourly Flow Rate, HFR				13		32
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
RT Channelized?						
Lanes				0		0
Configuration					LR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	565	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.1		6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1					6.4		6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	698					1275		694
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		694
Potential Capacity		443
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		443
Probability of Queue free St.	1.00	0.93

Step 2: LT from Major St.	4	1
Conflicting Flows		698
Potential Capacity		898
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		898
Probability of Queue free St.	1.00	0.99
Maj L-Shared Prob Q free St.		0.99

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		1275
Potential Capacity		184
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.92	0.99
Movement Capacity		182

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		1275
Potential Capacity		184
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.92	0.99
Movement Capacity		182

Results for Two-stage process:		
a		
y		
C t		182

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				13		32
Movement Capacity (vph)				182		443
Shared Lane Capacity (vph)					313	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				182		443
Volume				13		32
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					313	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	8						45	
C(m) (vph)	898						313	
v/c	0.01						0.14	
95% queue length	0.03						0.50	
Control Delay	9.0						18.4	
LOS	A						C	
Approach Delay							18.4	
Approach LOS							C	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.99	1.00
v(il), Volume for stream 2 or 5	565	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.99	
d(M,LT), Delay for stream 1 or 4	9.0	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.1	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*mm - 2PMbuild*	Intersection	*Hardscrabble & Reed*
Agency/Co.	*MMA*	Jurisdiction	*North Salem, NY*
Date Performed	*4/5/2005*	Analysis Year	*2010 Build Condition*
Analysis Time Period	*Peak PM Hour*		

Project Description *Woodlands Development*

East/West Street: *Hardscrabble Road* North/South Street: *Reed Road*

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)	13	890	0	0	843	14
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	14	988	0	0	936	15
Proportion of heavy vehicles, P_{HV}	2	--	--	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	0	0	11	0	30
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	0	0	0	12	0	33
Proportion of heavy vehicles, P_{HV}	0	0	0	2	0	2
Percent grade (%)	0			0		
Flared approach		N			N	
Storage		0			0	
RT Channelized?			0			0
Lanes	0	0	0	0	0	0
Configuration					LR	

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
Volume, v (vph)	14						45	
Capacity, c_m (vph)	722						162	
v/c ratio	0.02						0.28	
Queue length (95%)	0.06						1.07	
Control Delay (s/veh)	10.1						35.6	

LOS	B						E	
Approach delay (s/veh)	--	--					35.6	
Approach LOS	--	--					E	

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 2PMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach	Eastbound			Westbound		
	Movement	1	2	3	4	5	6
		L	T	R	L	T	R
Volume		13	890			843	14
Peak-Hour Factor, PHF		0.90	0.90			0.90	0.90
Hourly Flow Rate, HFR		14	988			936	15
Percent Heavy Vehicles		2	--	--		--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	1			1	0
Configuration		LT					TR
Upstream Signal?			No			No	

Minor Street:	Approach	Northbound			Southbound		
	Movement	7	8	9	10	11	12
		L	T	R	L	T	R
Volume					11		30
Peak Hour Factor, PHF					0.90		0.90
Hourly Flow Rate, HFR					12		33
Percent Heavy Vehicles					2		2
Percent Grade (%)			0			0	
Flared Approach:	Exists?/Storage			/			No /
Lanes					0		0
Configuration						LR	

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	14						45	
C(m) (vph)	722						162	
v/c	0.02						0.28	
95% queue length	0.06						1.07	
Control Delay	10.1						35.6	
LOS	B						E	
Approach Delay							35.6	
Approach LOS							E	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 2PMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Reed
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Hardscrabble Road
North/South Street: Reed Road
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	13	890			843	14
Peak-Hour Factor, PHF	0.90	0.90			0.90	0.90
Peak-15 Minute Volume	4	247			234	4
Hourly Flow Rate, HFR	14	988			936	15
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	0
Configuration	LT					TR
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume				11		30
Peak Hour Factor, PHF				0.90		0.90
Peak-15 Minute Volume				3		8
Hourly Flow Rate, HFR				12		33
Percent Heavy Vehicles				2		2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			No /
RT Channelized?						
Lanes				0		0
Configuration					LR	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	988	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1					7.1		6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2					2		2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00					0.70		0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1					6.4		6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20					3.50		3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2					2		2
t(f)	2.2					3.5		3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)								
Arrival Type								
Effective Green, g (sec)								
Cycle Length, C (sec)								
Rp (from Exhibit 16-11)								
Proportion vehicles arriving on green P								
g(q1)								
g(q2)								
g(q)								

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	951					1960		944
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s						1500		
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		944
Potential Capacity		318
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		318
Probability of Queue free St.	1.00	0.90

Step 2: LT from Major St.	4	1
Conflicting Flows		951
Potential Capacity		722
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		722
Probability of Queue free St.	1.00	0.98
Maj L-Shared Prob Q free St.		0.95

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.95	0.95
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		1960
Potential Capacity		70
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.95	
Maj. L, Min T Adj. Imp Factor.	0.96	
Cap. Adj. factor due to Impeding mvmnt	0.86	0.98
Movement Capacity		69

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.95	0.95
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Part 3 - Single Stage		
Conflicting Flows		1960
Potential Capacity		70
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.95	
Maj. L, Min T Adj. Imp Factor.	0.96	
Cap. Adj. factor due to Impeding mvmnt	0.86	0.98
Movement Capacity		69
Results for Two-stage process:		
a		
y		
C t		69

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)				12		33
Movement Capacity (vph)				69		318
Shared Lane Capacity (vph)					162	

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep				69		318
Volume				12		33
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh					162	
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT						LR	
v (vph)	14						45	
C(m) (vph)	722						162	
v/c	0.02						0.28	
95% queue length	0.06						1.07	
Control Delay	10.1						35.6	
LOS	B						E	
Approach Delay							35.6	
Approach LOS							E	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.98	1.00
v(il), Volume for stream 2 or 5	988	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.95	
d(M,LT), Delay for stream 1 or 4	10.1	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.5	

SHORT REPORT

General Information		Site Information	
Analyst	mm - 3AMbuild	Intersection	Hardscrabble & I-684 SB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak AM Hour	Analysis Year	2010 Build Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				685		54		460	423	268	435	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 10.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 65.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				761		60		511	470	298	483	
Lane group cap.				517		828		602	511	386	974	
v/c ratio				1.47		0.07		0.85	0.92	0.77	0.50	
Green ratio				0.29		0.52		0.32	0.32	0.52	0.52	
Unif. delay d1				23.0		7.7		20.5	21.2	12.1	10.0	
Delay factor k				0.50		0.11		0.50	0.50	0.32	0.11	
Increm. delay d2				222.7		0.0		13.9	24.2	9.3	0.4	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				245.7		7.7		34.5	45.4	21.4	10.4	
Lane group LOS				F		A		C	D	C	B	
Apprch. delay				228.3			39.7			14.6		
Approach LOS				F			D			B		
Intersec. delay	92.1			Intersection LOS						F		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3AMbuild
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build Condition
N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				685		54		460	423	268	435	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru					Thru		P		
Right					Right		P		
Peds					Peds				
WB Left	A				SB Left	A	P		
Thru					Thru	A	P		
Right	A				Right				
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right	A			
Green	19.0					10.0	21.0		
Yellow	3.0					3.0	4.0		
All Red	2.0					0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	517	1770	1.47	0.29	245.7	F		
							228.3	F
R	828	1583	0.07	0.52	7.7	A		
Northbound								
T	602	1863	0.85	0.32	34.5	C	39.7	D
R	511	1583	0.92	0.32	45.4	D		
Southbound								
L	386	1770	0.77	0.52	21.4	C		
T	974	1863	0.50	0.52	10.4	B	14.6	B

Intersection Delay = 92.1 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3AMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build Condition
Project ID: Woodlands

East/West Street: I-684 Southbound Ramps
North/South Street: Hardscrabble Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume				685		54		460	423	268	435	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				190		15		128	118	74	121	
Hi Ln Vol												
% Grade					0		0				0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				761		60		511	470	298	483	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

Ped Min g	3.2	3.2	3.2	

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left				
	Thru						Thru		P		
	Right						Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru						Thru	A	P		
	Right	A					Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right	A			
Green		19.0						10.0	21.0		
Yellow		3.0						3.0	4.0		
All Red		2.0						0.0	3.0		

Cycle Length: 65.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V				685		54		460	423	268	435	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Adj flow				761		60		511	470	298	483	
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Adj flow				761		60		511	470	298	483	
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG				L		R		T	R	L	T	
So				1900		1900		1900	1900	1900	1900	
Lanes	0	0	0	1	0	1	0	1	1	1	1	0
fW				1.000		1.000		1.000	1.000	1.000	1.000	
fHV				0.980		0.980		0.980	0.980	0.980	0.980	
fG				1.000		1.000		1.000	1.000	1.000	1.000	
fP				1.000		1.000		1.000	1.000	1.000	1.000	
fBB				1.000		1.000		1.000	1.000	1.000	1.000	
fA				1.000		1.000		1.000	1.000	1.000	1.000	
fLU				1.000		1.000		1.000	1.000	1.000	1.000	
fRT						0.850		1.000	0.850		1.000	
fLT				0.950				1.000		0.950	1.000	
Sec.										0.167		
fLpb				1.000				1.000		1.000	1.000	
fRpb						1.000		1.000	1.000		1.000	
S				1770		1583		1863	1583	1770	1863	
Sec.										310		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	761	1770	# 0.43	0.29	517	1.47
Prot							
Perm							
Thru							
Right	R	60	1583	0.04	0.52	828	0.07
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	511	1863	0.27	0.32	602	0.85
Right	R	470	1583	# 0.30	0.32	511	0.92
Southbound							
Prot		272	1770	# 0.15	0.154	272	1.00
Perm		26	310	0.08	0.369	114	0.23
Left	L	298			0.52	386	0.77
Prot							
Perm							
Thru	T	483	1863	0.26	0.52	974	0.50
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.88
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.24

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
Westbound												
L	1.47	0.29	23.0	1.000	517	0.50	222.7	0.0	245.7	F	228.3	F
R	0.07	0.52	7.7	1.000	828	0.11	0.0	0.0	7.7	A		
Northbound												
T	0.85	0.32	20.5	1.000	602	0.50	13.9	0.0	34.5	C	39.7	D
R	0.92	0.32	21.2	1.000	511	0.50	24.2	0.0	45.4	D		
Southbound												
L	0.77	0.52	12.1	1.000	386	0.32	9.3	0.0	21.4	C		

```
T    0.50  0.52  10.0  1.000 974   0.11   0.4   0.0   10.4   B    14.6   B

_____________________________________________________________________________
         Intersection delay = 92.1  (sec/veh)   Intersection LOS = F


_____________________SUPPLEMENTAL PERMITTED LT WORKSHEET_____________________
                             for exclusive lefts
Input
                                                       EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach                        M
Cycle length, C                             65.0    sec
Total actual green time for LT lane group, G (s)                         34.0
Effective permitted green time for LT lane group, g(s)                   24.0
Opposing effective green time, go (s)                                    21.0
Number of lanes in LT lane group, N                                      1
Number of lanes in opposing approach, No                                 1
Adjusted LT flow rate, VLT (veh/h)                                       298
Proportion of LT in LT lane group, PLT                                   1.000
Proportion of LT in opposing flow, PLTo                                  0.00
Adjusted opposing flow rate, Vo (veh/h)                                  511
Lost time for LT lane group, tL                                          7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                       5.38
Opposing lane util. factor, fLUo                                   1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                      9.23
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                    0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                        1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                             0.68
gq, (see Exhibit C16-4,5,6,7,8)                                          17.44
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                    6.56
n=Max(gq-gf)/2,0)                                                        8.72
PTHo=1-PLTo                                                              1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                       1.00
EL1 (refer to Exhibit C16-3)                                             2.10
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                       0.17
gdiff=max(gq-gf,0)                                                       0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                      0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                0.167

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_____________________SUPPLEMENTAL PERMITTED LT WORKSHEET_____________________
                              for shared lefts
Input
                                                       EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                             65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                              0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                                    1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                        EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v						298
v/c ratio from Capacity Worksheet, X						0.77
Protected phase effective green interval, g (s)						10.0
Opposing queue effective green interval, gq						17.44
Unopposed green interval, gu						6.56
Red time r=(C-g-gq-gu)						31.0
Arrival rate, qa=v/(3600(max[X,1.0]))						0.08
Protected ph. departure rate, Sp=s/3600						0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)						0.32
XPerm						0.96
XProt						0.69
Case						1
Queue at beginning of green arrow, Qa						2.57
Queue at beginning of unsaturated green, Qu						1.44
Residual queue, Qr						0.00
Uniform Delay, d1						12.1

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 92.1 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				761		60		511	470	298	483	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	1	0	1	0	1	1	1	1	0
SL				1770		1583		1863	1583	739	1863	
LnCapacity				517		828		602	511	386	974	
Flow Ratio				0.43		0.04		0.27	0.30	0.40	0.26	
v/c Ratio				1.47		0.07		0.85	0.92	0.77	0.50	
Grn Ratio				0.29		0.52		0.32	0.32	0.52	0.52	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				13.7		0.5		8.6	8.2	2.9	5.6	
kB				0.4		0.5		0.6	0.6	0.3	0.6	
Q2				31.6		0.0		2.9	3.8	1.0	0.5	
Q Average				45.4		0.6		11.5	11.9	3.9	6.2	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.1		1.2		1.2	1.2	1.2	1.2	
BOQ				51.4		0.7		13.9	14.4	4.7	7.3	
QSRatio												
85th Percentile Output:												
fB%				1.4		1.6		1.4	1.4	1.6	1.5	
BOQ				62.0		0.9		16.4	17.0	6.1	9.5	
QSRatio												
90th Percentile Output:												
fB%				1.4		1.8		1.6	1.5	1.7	1.7	
BOQ				65.4		1.0		17.8	18.4	6.8	10.4	
QSRatio												
95th Percentile Output:												
fB%				1.5		2.1		1.7	1.7	2.0	1.9	
BOQ				70.3		1.2		19.5	20.2	7.7	11.9	
QSRatio												
98th Percentile Output:												
fB%				1.7		2.7		1.9	1.8	2.4	2.3	
BOQ				78.5		1.5		21.2	21.9	9.5	14.3	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 3PMbuild*	Intersection	*Hardscrabble & I-684 SB Ramps*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak PM Hour*	Analysis Year	*2010 Build Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				346		95		823	140	206	662	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 19.0	G =	G =	G =	G = 10.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 65.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				384		106		914	156	229	736	
Lane group cap.				517		463		602	1145	386	974	
v/c ratio				0.74		0.23		1.52	0.14	0.59	0.76	
Green ratio				0.29		0.29		0.32	0.72	0.52	0.52	
Unif. delay d1				20.8		17.4		22.0	2.8	12.0	12.2	
Delay factor k				0.30		0.11		0.50	0.11	0.18	0.31	
Increm. delay d2				5.7		0.3		241.7	0.1	2.5	3.4	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				26.5		17.7		263.7	2.8	14.5	15.7	
Lane group LOS				C		B		F	A	B	B	
Apprch. delay				24.6			225.6			15.4		
Approach LOS				C			F			B		
Intersec. delay	106.3			Intersection LOS						F		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3PMbuild
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build Condition
N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				346		95		823	140	206	662	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru					Thru		P		
Right					Right		P		
Peds					Peds				
WB Left	A				SB Left	A	P		
Thru					Thru	A	P		
Right	A				Right				
Peds					Peds				
NB Right	A				EB Right				
SB Right					WB Right				
Green	19.0					10.0	21.0		
Yellow	3.0					3.0	4.0		
All Red	2.0					0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	517	1770	0.74	0.29	26.5	C	24.6	C
R	463	1583	0.23	0.29	17.7	B		
Northbound								
T	602	1863	1.52	0.32	263.7	F	225.6	F
R	1145	1583	0.14	0.72	2.8	A		
Southbound								
L	386	1770	0.59	0.52	14.5	B		
T	974	1863	0.76	0.52	15.7	B	15.4	B

Intersection Delay = 106.3 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3PMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build Condition
Project ID: Woodlands

East/West Street: I-684 Southbound Ramps
North/South Street: Hardscrabble Road

VOLUME DATA

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Volume				346		95		823	140	206	662	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				96		26		229	39	57	184	
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				384		106		914	156	229	736	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0				0		0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

Ped Min g	3.2	3.2	3.2		

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left				
	Thru						Thru		P		
	Right						Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru						Thru	A	P		
	Right	A					Right				
	Peds						Peds				
NB	Right	A				EB	Right				
SB	Right					WB	Right				
Green		19.0						10.0	21.0		
Yellow		3.0						3.0	4.0		
All Red		2.0						0.0	3.0		

Cycle Length: 65.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V				346		95		823	140	206	662	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Adj flow				384		106		914	156	229	736	
No. Lanes	0	0	0	1	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Adj flow				384		106		914	156	229	736	
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG				L		R		T	R	L	T	
So				1900		1900		1900	1900	1900	1900	
Lanes	0	0	0	1	0	1	0	1	1	1	1	0
fW				1.000		1.000		1.000	1.000	1.000	1.000	
fHV				0.980		0.980		0.980	0.980	0.980	0.980	
fG				1.000		1.000		1.000	1.000	1.000	1.000	
fP				1.000		1.000		1.000	1.000	1.000	1.000	
fBB				1.000		1.000		1.000	1.000	1.000	1.000	
fA				1.000		1.000		1.000	1.000	1.000	1.000	
fLU				1.000		1.000		1.000	1.000	1.000	1.000	
fRT						0.850		1.000	0.850		1.000	
fLT				0.950				1.000		0.950	1.000	
Sec.										0.167		
fLpb				1.000				1.000		1.000	1.000	
fRpb						1.000		1.000	1.000		1.000	
S				1770		1583		1863	1583	1770	1863	
Sec.										310		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	384	1770	# 0.22	0.29	517	0.74
Prot							
Perm							
Thru							
Right	R	106	1583	0.07	0.29	463	0.23
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	914	1863	# 0.49	0.32	602	1.52
Right	R	156	1583	0.10	0.72	1145	0.14
Southbound							
Prot		229	1770	# 0.13	0.154	272	0.84
Perm		0	310	0.00	0.369	114	0.00
Left	L	229			0.52	386	0.59
Prot							
Perm							
Thru	T	736	1863	0.40	0.52	974	0.76
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.84
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.18

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
Westbound												
L	0.74	0.29	20.8	1.000	517	0.30	5.7	0.0	26.5	C	24.6	C
R	0.23	0.29	17.4	1.000	463	0.11	0.3	0.0	17.7	B		
Northbound												
T	1.52	0.32	22.0	1.000	602	0.50	241.7	0.0	263.7	F	225.6	F
R	0.14	0.72	2.8	1.000	1145	0.11	0.1	0.0	2.8	A		
Southbound												
L	0.59	0.52	12.0	1.000	386	0.18	2.5	0.0	14.5	B		

```
T    0.76  0.52  12.2  1.000 974   0.31   3.4   0.0   15.7   B    15.4   B

_____________________________________________________________________________
         Intersection delay = 106.3 (sec/veh)   Intersection LOS = F


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                             for exclusive lefts
Input
                                                         EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach                          M
Cycle length, C                              65.0    sec
Total actual green time for LT lane group, G (s)                           34.0
Effective permitted green time for LT lane group, g(s)                     24.0
Opposing effective green time, go (s)                                      21.0
Number of lanes in LT lane group, N                                        1
Number of lanes in opposing approach, No                                   1
Adjusted LT flow rate, VLT (veh/h)                                         229
Proportion of LT in LT lane group, PLT                                     1.000
Proportion of LT in opposing flow, PLTo                                    0.00
Adjusted opposing flow rate, Vo (veh/h)                                    914
Lost time for LT lane group, tL                                            7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                         4.13
Opposing lane util. factor, fLUo                                     1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                        16.50
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                      0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                          1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                               0.68
gq, (see Exhibit C16-4,5,6,7,8)                                            20.00
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                      4.00
n=Max(gq-gf)/2,0)                                                          10.00
PTHo=1-PLTo                                                                1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                         1.00
EL1 (refer to Exhibit C16-3)                                               3.06
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                         0.17
gdiff=max(gq-gf,0)                                                         0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                        0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                  0.167

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                             for shared lefts
Input
                                                         EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                              65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                              0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                                    1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                       EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v						229
v/c ratio from Capacity Worksheet, X						0.59
Protected phase effective green interval, g (s)						10.0
Opposing queue effective green interval, gq						20.00
Unopposed green interval, gu						4.00
Red time r=(C-g-gq-gu)						31.0
Arrival rate, qa=v/(3600(max[X,1.0]))						0.06
Protected ph. departure rate, Sp=s/3600						0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)						0.52
XPerm						0.74
XProt						0.53
Case						1
Queue at beginning of green arrow, Qa						1.97
Queue at beginning of unsaturated green, Qu						1.27
Residual queue, Qr						0.00
Uniform Delay, d1						12.0

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 106.3 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound	Westbound		Northbound		Southbound	
LaneGroup		L	R	T	R	L	T
Init Queue		0.0	0.0	0.0	0.0	0.0	0.0
Flow Rate		384	106	914	156	229	736
So		1900	1900	1900	1900	1900	1900
No.Lanes	0 0 0	1 0	1	0 1	1	1	1 0
SL		1770	1583	1863	1583	739	1863
LnCapacity		517	463	602	1145	386	974
Flow Ratio		0.22	0.07	0.49	0.10	0.31	0.40
v/c Ratio		0.74	0.23	1.52	0.14	0.59	0.76
Grn Ratio		0.29	0.29	0.32	0.72	0.52	0.52
I Factor		1.000		1.000			1.000
AT or PVG		3	3	3	3	3	3
Pltn Ratio		1.00	1.00	1.00	1.00	1.00	1.00
PF2		1.00	1.00	1.00	1.00	1.00	1.00
Q1		6.3	1.5	16.5	0.9	2.2	10.5
kB		0.4	0.4	0.6	0.6	0.3	0.6
Q2		1.0	0.1	40.8	0.1	0.5	1.6
Q Average		7.3	1.6	57.3	1.0	2.6	12.1
Q Spacing		25.0	25.0	25.0	25.0	25.0	25.0
Q Storage		0	0	0	0	0	0
Q S Ratio							
70th Percentile Output:							
fB%		1.2	1.2	1.2	1.2	1.2	1.2
BOQ		8.6	1.9	68.7	1.2	3.1	14.2
QSRatio							
85th Percentile Output:							
fB%		1.5	1.6	1.4	1.6	1.6	1.5
BOQ		11.2	2.5	80.2	1.5	4.1	18.2
QSRatio							
90th Percentile Output:							
fB%		1.7	1.8	1.5	1.8	1.8	1.6
BOQ		12.3	2.8	85.9	1.7	4.6	19.6
QSRatio							
95th Percentile Output:							
fB%		1.9	2.1	1.6	2.1	2.0	1.8
BOQ		13.9	3.2	91.7	2.0	5.3	21.9
QSRatio							
98th Percentile Output:							
fB%		2.3	2.6	1.7	2.6	2.5	2.1
BOQ		16.6	4.0	97.4	2.5	6.6	25.4
QSRatio							

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 4AMbuild*	Intersection	*Hardscrabble & Route 22*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*2010 Build Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		703	0	850	343		76		182			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 9.0	G = 21.0	G =	G =	G = 15.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		781		944	381		84		202			
Lane group cap.		652		301	1025		443		765			
v/c ratio		1.20		3.14	0.37		0.19		0.26			
Green ratio		0.35		0.55	0.55		0.25		0.48			
Unif. delay d1		19.5		13.6	7.6		17.7		9.2			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		103.4		970.0	1.0		0.9		0.8			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		122.9		983.6	8.7		18.7		10.0			
Lane group LOS		F		F	A		B		B			
Apprch. delay	122.9			703.3			12.6					
Approach LOS	F			F			B					
Intersec. delay	431.2			Intersection LOS						F		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4AMbuild
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build Condition

N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		703	0	850	343		76		182			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	9.0	21.0					15.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	652	1863	1.20	0.35	122.9	F	122.9	F
Westbound								
L	301	1770	3.14	0.55	983.6	F		
T	1025	1863	0.37	0.55	8.7	A	703.3	F
Northbound								
L	443	1770	0.19	0.25	18.7	B	12.6	B
R	765	1583	0.26	0.48	10.0+	B		
Southbound								

Intersection Delay = 431.2 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 4AMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Route 22
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build Condition
Project ID: Woodlands

East/West Street: Hardscrabble Road
North/South Street: Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		703	0	850	343		76		182			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		195	0	236	95		21		51			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		781		944	381		84		202			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs	0.000				0.000				1.000			
Peds Bikes	0						0			0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

Ped Min g	3.2		3.2	3.2

PHASE DATA

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	9.0	21.0					15.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 60.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Volume, V		703	0	850	343		76		182			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		781	0	944	381		84		202			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		781		944	381		84		202			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.000			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG		TR		L	T		L		R			
So		1900		1900	1900		1900		1900			
Lanes	0	1	0	1	1	0	1	0	1	0	0	0
fW		1.000		1.000	1.000		1.000		1.000			
fHV		0.980		0.980	0.980		0.980		0.980			
fG		1.000		1.000	1.000		1.000		1.000			
fP		1.000		1.000	1.000		1.000		1.000			
fBB		1.000		1.000	1.000		1.000		1.000			
fA		1.000		1.000	1.000		1.000		1.000			
fLU		1.000		1.000	1.000		1.000		1.000			
fRT		1.000			1.000				0.850			
fLT		1.000		0.950	1.000		0.950					
Sec.				0.148								
fLpb		1.000		1.000	1.000		1.000					
fRpb		1.000			1.000				1.000			
S		1863		1770	1863		1770		1583			
Sec.				276								

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	781	1863	0.42	0.35	652	1.20
Right							
Westbound							
Prot		177	1770	# 0.10	0.100	177	1.00
Perm		767	276	# 2.78	0.450	124	6.19
Left	L	944			0.55	301	3.14
Prot							
Perm							
Thru	T	381	1863	0.20	0.55	1025	0.37
Right							
Northbound							
Prot							
Perm							
Left	L	84	1770	# 0.05	0.25	443	0.19
Prot							
Perm							
Thru							
Right	R	202	1583	0.13	0.48	765	0.26
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 2.93
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 3.66

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
TR	1.20	0.35	19.5	1.000	652	0.50	103.4	0.0	122.9	F	122.9	F
Westbound												
L	3.14	0.55	13.6	1.000	301	0.50	970.0	0.0	983.6	F		
T	0.37	0.55	7.6	1.000	1025	0.50	1.0	0.0	8.7	A	703.3	F
Northbound												
L	0.19	0.25	17.7	1.000	443	0.50	0.9	0.0	18.7	B	12.6	B
R	0.26	0.48	9.2	1.000	765	0.50	0.8	0.0	10.0+	B		
Southbound												

Intersection delay = 431.2 (sec/veh)   Intersection LOS = F

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input

	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach		S		
Cycle length, C 60.0 sec				
Total actual green time for LT lane group, G (s)		33.0		
Effective permitted green time for LT lane group, g(s)		27.0		
Opposing effective green time, go (s)		21.0		
Number of lanes in LT lane group, N		1		
Number of lanes in opposing approach, No		1		
Adjusted LT flow rate, VLT (veh/h)		944		
Proportion of LT in LT lane group, PLT		1.000		
Proportion of LT in opposing flow, PLTo		0.00		
Adjusted opposing flow rate, Vo (veh/h)		781		
Lost time for LT lane group, tL		7.00		
Computation				
LT volume per cycle, LTC=VLTC/3600		15.73		
Opposing lane util. factor, fLUo	1.000	1.000		
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)		13.02		
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g		0.0		
Opposing platoon ratio, Rpo (refer Exhibit 16-11)		1.00		
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]		0.65		
gq, (see Exhibit C16-4,5,6,7,8)		22.12		
gu=g-gq if gq>=gf, or = g-gf if gq<gf		4.88		
n=Max(gq-gf)/2,0)		11.06		
PTHo=1-PLTo		1.00		
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]		1.00		
EL1 (refer to Exhibit C16-3)		2.70		
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g		0.15		
gdiff=max(gq-gf,0)		0.00		
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)		0.15		
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT		0.148		

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input

	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 60.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                       0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                             1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET________________
Permitted Left Turns
                                                            EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	60.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v				944		
v/c ratio from Capacity Worksheet, X				3.14		
Protected phase effective green interval, g (s)				6.0		
Opposing queue effective green interval, gq				22.12		
Unopposed green interval, gu				4.88		
Red time r=(C-g-gq-gu)				27.0		
Arrival rate, qa=v/(3600(max[X,1.0]))				0.08		
Protected ph. departure rate, Sp=s/3600				0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)				0.42		
XPerm				1.09		
XProt				0.94		
Case				3		
Queue at beginning of green arrow, Qa				2.45		
Queue at beginning of unsaturated green, Qu				1.85		
Residual queue, Qr				0.19		
Uniform Delay, d1				13.6		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 431.2 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		781		944	381		84		202			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1863		548	1863		1770		1583			
LnCapacity		652		301	1025		443		765			
Flow Ratio		0.42		1.72	0.20		0.05		0.13			
v/c Ratio		1.20		3.14	0.37		0.19		0.26			
Grn Ratio		0.35		0.55	0.55		0.25		0.48			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		13.0		7.9	3.6		1.1		2.0			
kB		0.6		0.4	0.9		0.5		0.7			
Q2		19.3		80.9	0.5		0.1		0.3			
Q Average		32.4		88.8	4.1		1.2		2.2			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.2	1.2		1.3		1.3			
BOQ		38.8		107	5.1		1.6		2.8			
QSRatio												
85th Percentile Output:												
fB%		1.4		1.4	1.5		1.6		1.6			
BOQ		45.3		124	6.3		2.0		3.6			
QSRatio												
90th Percentile Output:												
fB%		1.5		1.5	1.7		1.9		1.8			
BOQ		48.6		133	7.1		2.3		4.1			
QSRatio												
95th Percentile Output:												
fB%		1.6		1.6	2.0		2.4		2.2			
BOQ		51.8		142	8.4		2.9		5.0			
QSRatio												
98th Percentile Output:												
fB%		1.7		1.7	2.4		2.9		2.7			
BOQ		55.1		151	9.7		3.5		6.0			
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 4PMbuild	Intersection	Hardscrabble & Route 22
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2010 Build Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		389	1	193	821		302		570			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 9.0	G = 21.0	G =	G =	G = 15.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 60.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		433		214	912		336		633			
Lane group cap.		652		381	1025		443		765			
v/c ratio		0.66		0.56	0.89		0.76		0.83			
Green ratio		0.35		0.55	0.55		0.25		0.48			
Unif. delay d1		16.5		9.1	11.9		20.8		13.3			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		5.3		5.9	11.5		11.5		10.0			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		21.8		14.9	23.4		32.4		23.3			
Lane group LOS		C		B	C		C		C			
Apprch. delay	21.8			21.8			26.5					
Approach LOS	C			C			C					
Intersec. delay	23.6			Intersection LOS						C		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4PMbuild
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build Condition

N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		389	1	193	821		302		570			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	9.0	21.0					15.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 60.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	652	1862	0.66	0.35	21.8	C	21.8	C
Westbound								
L	381	1770	0.56	0.55	14.9	B		
T	1025	1863	0.89	0.55	23.4	C	21.8	C
Northbound								
L	443	1770	0.76	0.25	32.4	C		
							26.5	C
R	765	1583	0.83	0.48	23.3	C		
Southbound								

Intersection Delay = 23.6 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 4PMbuild
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & Route 22
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build Condition
Project ID: Woodlands

East/West Street: Hardscrabble Road
North/South Street: Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		389	1	193	821		302		570			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		108	1	54	228		84		158			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		433		214	912		336		633			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			
Peds Bikes	0						0			0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

Ped Min g	3.2		3.2	3.2	

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left	P			
	Thru		P				Thru				
	Right		P				Right	P			
	Peds						Peds				
WB	Left	P	P			SB	Left				
	Thru	P	P				Thru				
	Right						Right				
	Peds						Peds				
NB	Right	P				EB	Right				
SB	Right					WB	Right				
Green		9.0	21.0					15.0			
Yellow		3.0	4.0					3.0			
All Red			3.0					2.0			

Cycle Length: 60.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V		389	1	193	821		302		570			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		432	1	214	912		336		633			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		433		214	912		336		633			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG		TR		L	T		L		R			
So		1900		1900	1900		1900		1900			
Lanes	0	1	0	1	1	0	1	0	1	0	0	0
fW		1.000		1.000	1.000		1.000		1.000			
fHV		0.980		0.980	0.980		0.980		0.980			
fG		1.000		1.000	1.000		1.000		1.000			
fP		1.000		1.000	1.000		1.000		1.000			
fBB		1.000		1.000	1.000		1.000		1.000			
fA		1.000		1.000	1.000		1.000		1.000			
fLU		1.000		1.000	1.000		1.000		1.000			
fRT		1.000			1.000				0.850			
fLT		1.000		0.950	1.000		0.950					
Sec.				0.244								
fLpb		1.000		1.000	1.000		1.000					
fRpb		1.000			1.000				1.000			
S		1862		1770	1863		1770		1583			
Sec.				454								

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	433	1862	0.23	0.35	652	0.66
Right							
Westbound							
Prot		177	1770	0.10	0.100	177	1.00
Perm		37	454	0.08	0.450	204	0.18
Left	L	214			0.55	381	0.56
Prot							
Perm							
Thru	T	912	1863	# 0.49	0.55	1025	0.89
Right							
Northbound							
Prot							
Perm							
Left	L	336	1770	# 0.19	0.25	443	0.76
Prot							
Perm							
Thru							
Right	R	633	1583	0.40	0.48	765	0.83
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.68
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.85

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
TR	0.66	0.35	16.5	1.000	652	0.50	5.3	0.0	21.8	C	21.8	C
Westbound												
L	0.56	0.55	9.1	1.000	381	0.50	5.9	0.0	14.9	B		
T	0.89	0.55	11.9	1.000	1025	0.50	11.5	0.0	23.4	C	21.8	C
Northbound												
L	0.76	0.25	20.8	1.000	443	0.50	11.5	0.0	32.4	C	26.5	C
R	0.83	0.48	13.3	1.000	765	0.50	10.0	0.0	23.3	C		
Southbound												

```
         Intersection delay = 23.6  (sec/veh)   Intersection LOS = C


                          SUPPLEMENTAL PERMITTED LT WORKSHEET
                                 for exclusive lefts
Input
                                                         EB     WB     NB     SB
Opposed by Single(S) or Multiple(M) lane approach               S
Cycle length, C                              60.0    sec
Total actual green time for LT lane group, G (s)                33.0
Effective permitted green time for LT lane group, g(s)          27.0
Opposing effective green time, go (s)                           21.0
Number of lanes in LT lane group, N                             1
Number of lanes in opposing approach, No                        1
Adjusted LT flow rate, VLT (veh/h)                              214
Proportion of LT in LT lane group, PLT                          1.000
Proportion of LT in opposing flow, PLTo                         0.00
Adjusted opposing flow rate, Vo (veh/h)                         433
Lost time for LT lane group, tL                                 7.00
Computation
LT volume per cycle, LTC=VLTC/3600                              3.57
Opposing lane util. factor, fLUo                         1.000  1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)             7.22
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                           0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)               1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                    0.65
gq, (see Exhibit C16-4,5,6,7,8)                                 14.11
gu=g-gq if gq>=gf, or = g-gf if gq<gf                           12.89
n=Max(gq-gf)/2,0)                                               7.06
PTHo=1-PLTo                                                     1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                              1.00
EL1 (refer to Exhibit C16-3)                                    1.96
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                              0.15
gdiff=max(gq-gf,0)                                              0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)             0.24
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                       0.244

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

                          SUPPLEMENTAL PERMITTED LT WORKSHEET
                                   for shared lefts
Input
                                                         EB     WB     NB     SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                              60.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                    0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                          1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET________________
Permitted Left Turns
                                                          EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

	EBLT	WBLT	NBLT	SBLT
Cycle length, C 60.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v		214		
v/c ratio from Capacity Worksheet, X		0.56		
Protected phase effective green interval, g (s)		6.0		
Opposing queue effective green interval, gq		14.11		
Unopposed green interval, gu		12.89		
Red time r=(C-g-gq-gu)		27.0		
Arrival rate, qa=v/(3600(max[X,1.0]))		0.06		
Protected ph. departure rate, Sp=s/3600		0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)		0.26		
XPerm		0.47		
XProt		0.66		
Case		1		
Queue at beginning of green arrow, Qa		1.61		
Queue at beginning of unsaturated green, Qu		0.84		
Residual queue, Qr		0.00		
Uniform Delay, d1		9.1		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 23.6 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		433		214	912		336		633			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1862		693	1863		1770		1583			
LnCapacity		652		381	1025		443		765			
Flow Ratio		0.23		0.31	0.49		0.19		0.40			
v/c Ratio		0.66		0.56	0.89		0.76		0.83			
Grn Ratio		0.35		0.55	0.55		0.25		0.48			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		6.1		1.7	13.4		5.2		9.1			
kB		0.6		0.4	0.9		0.5		0.7			
Q2		1.2		0.5	5.2		1.4		2.9			
Q Average		7.3		2.2	18.6		6.6		12.0			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.3	1.2		1.2		1.2			
BOQ		9.0		2.8	22.3		8.1		14.5			
QSRatio												
85th Percentile Output:												
fB%		1.5		1.6	1.4		1.5		1.4			
BOQ		10.8		3.6	26.1		9.7		17.1			
QSRatio												
90th Percentile Output:												
fB%		1.6		1.8	1.5		1.6		1.5			
BOQ		11.8		4.1	28.1		10.7		18.5			
QSRatio												
95th Percentile Output:												
fB%		1.8		2.2	1.6		1.9		1.7			
BOQ		13.4		5.0	30.2		12.3		20.3			
QSRatio												
98th Percentile Output:												
fB%		2.0		2.7	1.7		2.1		1.8			
BOQ		15.0		6.0	32.2		13.8		22.0			
QSRatio												

ERROR MESSAGES

No errors to report.

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	mm - 5AMbuild
Agency/Co.	MMA
Date Performed	4/6/2005
Analysis Time Period	Peak AM Hour

Site Information

Intersection	Route 22 & Front St
Jurisdiction	North Salem, NY
Analysis Year	2010 Build Condition

Project Description *Woodlands Development*

East/West Street: *Croton Falls Road* North/South Street: *Front Street*

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)	0	538	32	52	328	1
Peak-hour factor, PHF	0.90	0.87	0.87	0.75	0.75	0.90
Hourly Flow Rate (veh/h)	0	618	36	69	437	0
Proportion of heavy vehicles, P_{HV}	0	--	--	2	--	--
Median type	Undivided					
RT Channelized?			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	46	0	59	0	0	2
Peak-hour factor, PHF	0.81	0.90	0.81	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	56	0	72	0	0	0
Proportion of heavy vehicles, P_{HV}	2	0	2	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			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
Volume, v (vph)		69	56		72			
Capacity, c_m (vph)		933	186		478			
v/c ratio		0.07	0.30		0.15			
Queue length (95%)		0.24	1.20		0.53			
Control Delay (s/veh)		9.2	32.5		13.9			

LOS		A	D		B			
Approach delay (s/veh)	--	--	22.0					
Approach LOS	--	--	C					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 5AMbuild
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak AM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		538	32	52	328	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Hourly Flow Rate, HFR		618	36	69	437	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration		TR		LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume	46		59			
Peak Hour Factor, PHF	0.81		0.81			
Hourly Flow Rate, HFR	56		72			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		69	56		72			
C(m) (vph)		933	186		478			
v/c		0.07	0.30		0.15			
95% queue length		0.24	1.20		0.53			
Control Delay		9.2	32.5		13.9			
LOS		A	D		B			
Approach Delay				22.0				
Approach LOS				C				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 5AMbuild
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak AM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		538	32	52	328	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Peak-15 Minute Volume		155	9	17	109	
Hourly Flow Rate, HFR		618	36	69	437	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration		TR		LT		
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	46		59			
Peak Hour Factor, PHF	0.81		0.81			
Peak-15 Minute Volume	14		18			
Hourly Flow Rate, HFR	56		72			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?			No			
Lanes	1	1				
Configuration	L	R				

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		437
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			4.1	7.1		6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			2	2		2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.00	0.70		0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage		4.1	6.4		6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2		2			
t(f)		2.2	3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		654	1211		636			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	636	
Potential Capacity	478	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	478	
Probability of Queue free St.	0.85	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	654	
Potential Capacity	933	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	933	
Probability of Queue free St.	0.93	1.00
Maj L-Shared Prob Q free St.	0.90	

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.90	0.90
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1211	
Potential Capacity	201	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.90
Maj. L, Min T Adj. Imp Factor.		0.92
Cap. Adj. factor due to Impeding mvmnt	0.93	0.78
Movement Capacity	186	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.90	0.90
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1211	
Potential Capacity	201	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.90
Maj. L, Min T Adj. Imp Factor.		0.92
Cap. Adj. factor due to Impeding mvmnt	0.93	0.78
Movement Capacity	186	

Results for Two-stage process:		
a		
y		
C t	186	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	56		72			
Movement Capacity (vph)	186		478			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	186		478			
Volume	56		72			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		69	56		72			
C(m) (vph)		933	186		478			
v/c		0.07	0.30		0.15			
95% queue length		0.24	1.20		0.53			
Control Delay		9.2	32.5		13.9			
LOS		A	D		B			
Approach Delay				22.0				
Approach LOS				C				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.93
v(il), Volume for stream 2 or 5		437
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.90
d(M,LT), Delay for stream 1 or 4		9.2
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		0.9

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*mm - 5PMbuild*
Agency/Co.	*MMA*
Date Performed	*4/6/2005*
Analysis Time Period	*Peak PM Hour*

Site Information

Intersection	*Route 22 & Front St*
Jurisdiction	*North Salem, NY*
Analysis Year	*2010 Build Condition*

Project Description *Woodlands Development*

East/West Street: *Croton Falls Road* North/South Street: *Front Street*

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)	0	315	52	34	860	1
Peak-hour factor, PHF	0.90	0.87	0.87	0.75	0.75	0.90
Hourly Flow Rate (veh/h)	0	362	59	45	1146	0
Proportion of heavy vehicles, P_{HV}	0	--	--	2	--	--
Median type	Undivided					
RT Channelized?			0			0
Lanes	0	1	0	0	1	0
Configuration			TR	LT		
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	28	0	39	0	0	2
Peak-hour factor, PHF	0.81	0.90	0.81	0.90	0.90	0.90
Hourly Flow Rate (veh/h)	34	0	48	0	0	0
Proportion of heavy vehicles, P_{HV}	2	0	2	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			

Control Delay, Queue Length, Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration		LT	L		R			
Volume, v (vph)		45	34		48			
Capacity, c_m (vph)		1138	108		657			
v/c ratio		0.04	0.31		0.07			
Queue length (95%)		0.12	1.22		0.24			
Control Delay (s/veh)		8.3	53.0		10.9			

LOS		A	F		B			
Approach delay (s/veh)	--	--	28.3					
Approach LOS	--	--	D					

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 5PMbuild
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak PM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume		315	52	34	860	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Hourly Flow Rate, HFR		362	59	45	1146	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration		TR		LT		
Upstream Signal?		No			No	

Minor Street: Approach	Northbound			Southbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume	28		39			
Peak Hour Factor, PHF	0.81		0.81			
Hourly Flow Rate, HFR	34		48			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes	1		1			
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		45	34		48			
C(m) (vph)		1138	108		657			
v/c		0.04	0.31		0.07			
95% queue length		0.12	1.22		0.24			
Control Delay		8.3	53.0		10.9			
LOS		A	F		B			
Approach Delay				28.3				
Approach LOS				D				

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 5PMbuild
Agency/Co.: MMA
Date Performed: 4/6/2005
Analysis Time Period: Peak PM Hour
Intersection: Route 22 & Front St
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Croton Falls Road
North/South Street: Front Street
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume		315	52	34	860	
Peak-Hour Factor, PHF		0.87	0.87	0.75	0.75	
Peak-15 Minute Volume		91	15	11	287	
Hourly Flow Rate, HFR		362	59	45	1146	
Percent Heavy Vehicles		--	--	2	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes		1	0	0	1	
Configuration			TR	LT		
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume	28		39			
Peak Hour Factor, PHF	0.81		0.81			
Peak-15 Minute Volume	9		12			
Hourly Flow Rate, HFR	34		48			
Percent Heavy Vehicles	2		2			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage				/		/
RT Channelized?			No			
Lanes	1		1			
Configuration	L		R			

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:		1146
Shared ln volume, major rt vehicles:		0
Sat flow rate, major th vehicles:		1700
Sat flow rate, major rt vehicles:		1700
Number of major street through lanes:		1

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)			4.1	7.1		6.2			
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)			2	2		2			
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)			0.00	0.70		0.00			
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage		4.1	6.4		6.2			
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)		2.20	3.50		3.30			
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)		2	2		2			
t(f)		2.2	3.5		3.3			

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p	0.000		0.000	

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x		421	1628		392			
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s		1500						
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows	392	
Potential Capacity	657	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	657	
Probability of Queue free St.	0.93	1.00

Step 2: LT from Major St.	4	1
Conflicting Flows	421	
Potential Capacity	1138	
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity	1138	
Probability of Queue free St.	0.96	1.00
Maj L-Shared Prob Q free St.	0.88	

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.88	0.88
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows	1628	
Potential Capacity	112	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.88
Maj. L, Min T Adj. Imp Factor.		0.91
Cap. Adj. factor due to Impeding mvmnt	0.96	0.84
Movement Capacity	108	

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.88	0.88
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows	1628	
Potential Capacity	112	
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor		0.88
Maj. L, Min T Adj. Imp Factor.		0.91
Cap. Adj. factor due to Impeding mvmnt	0.96	0.84
Movement Capacity	108	

Results for Two-stage process:		
a		
y		
C t	108	

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)	34		48			
Movement Capacity (vph)	108		657			
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep	108		657			
Volume	34		48			
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config		LT	L		R			
v (vph)		45	34		48			
C(m) (vph)		1138	108		657			
v/c		0.04	0.31		0.07			
95% queue length		0.12	1.22		0.24			
Control Delay		8.3	53.0		10.9			
LOS		A	F		B			
Approach Delay				28.3				
Approach LOS				D				

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	1.00	0.96
v(il), Volume for stream 2 or 5		1146
v(i2), Volume for stream 3 or 6		0
s(il), Saturation flow rate for stream 2 or 5		1700
s(i2), Saturation flow rate for stream 3 or 6		1700
P*(oj)		0.88
d(M,LT), Delay for stream 1 or 4		8.3
N, Number of major street through lanes		1
d(rank,1) Delay for stream 2 or 5		1.0

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	mm - 6AMbuild	Intersection	Reed Road & Site Driveway
Agency/Co.	mma	Jurisdiction	North Salem, NY
Date Performed	4/5/2005	Analysis Year	2010 Build Condition
Analysis Time Period	Peak AM Hour		

Project Description	Woodlands Development		
East/West Street:	Site Driveway	North/South Street:	Reed Road
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	14	2	122	0	3	0
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	17	2	0	0	3	0
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT				T	
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	452	45	0	248	38
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	0	0	0	0	0	47
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	1
Configuration						R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							R
v (vph)	17							47
C (m) (vph)	1619							1081
v/c	0.01							0.04
95% queue length	0.03							0.14
Control Delay	7.2							8.5
LOS	A							A
Approach Delay	--	--				8.5		
Approach LOS	--	--				A		

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 6AMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Reed Road & Site Driveway
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Site Driveway
North/South Street: Reed Road
Intersection Orientation: NS   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume	14	2			3	
Peak-Hour Factor, PHF	0.90	0.90			0.90	
Hourly Flow Rate, HFR	15	2			3	
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes	0	1			1	
Configuration	LT				T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume						38
Peak Hour Factor, PHF						0.90
Hourly Flow Rate, HFR						42
Percent Heavy Vehicles						0
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes					1	
Configuration					R	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT							R
v (vph)	15							42
C(m) (vph)	1619							1087
v/c	0.01							0.04
95% queue length	0.03							0.12
Control Delay	7.2							8.4
LOS	A							A
Approach Delay							8.4	
Approach LOS							A	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 6AMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Reed Road & Site Driveway
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Site Driveway
North/South Street: Reed Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	14	2			3	
Peak-Hour Factor, PHF	0.90	0.90			0.90	
Peak-15 Minute Volume	4	1			1	
Hourly Flow Rate, HFR	15	2			3	
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	
Configuration	LT				T	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume						38
Peak Hour Factor, PHF						0.90
Peak-15 Minute Volume						11
Hourly Flow Rate, HFR						42
Percent Heavy Vehicles						0
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
RT Channelized?						No
Lanes					1	
Configuration					R	

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

		Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2	Left-Turn							
	Through							
S5	Left-Turn							
	Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	2	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1							6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2							0
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00							0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1							6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20							3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2							0
t(f)	2.2							3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)
Arrival Type
Effective Green, g (sec)
Cycle Length, C (sec)
Rp (from Exhibit 16-11)
Proportion vehicles arriving on green P
g(q1)
g(q2)
g(q)

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1	4	7	8	9	10	11	12
	L	L	L	T	R	L	T	R
V c,x	3							3
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s								
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		3
Potential Capacity		1087
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1087
Probability of Queue free St.	1.00	0.96

Step 2: LT from Major St.	4	1
Conflicting Flows		3
Potential Capacity		1619
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1619
Probability of Queue free St.	1.00	0.99
Maj L-Shared Prob Q free St.		0.99

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.95	0.99
Movement Capacity		

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.99	0.99
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.99	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.95	0.99
Movement Capacity		

Results for Two-stage process:		
a		
y		
C t		

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)						42
Movement Capacity (vph)						1087
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep						1087
Volume						42
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT							R
v (vph)	15							42
C(m) (vph)	1619							1087
v/c	0.01							0.04
95% queue length	0.03							0.12
Control Delay	7.2							8.4
LOS	A							A
Approach Delay							8.4	
Approach LOS							A	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.99	1.00
v(il), Volume for stream 2 or 5	2	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.99	
d(M,LT), Delay for stream 1 or 4	7.2	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.1	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	*mm - 6PMbuild*	Intersection	*Reed Road & Site Driveway*
Agency/Co.	*mma*	Jurisdiction	*North Salem, NY*
Date Performed	*4/5/2005*	Analysis Year	*2010 Build Condition*
Analysis Time Period	*Peak PM Hour*		

Project Description *Woodlands Development*	
East/West Street: *Site Driveway*	North/South Street: *Reed Road*
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	24	3	1	0	5	0
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	29	3	0	0	6	0
Percent Heavy Vehicles	2	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT				T	
Upstream Signal		0			0	

Minor Street	Westbound			Eastbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume	0	1	45	0	1	36
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	0	0	0	0	0	44
Percent Heavy Vehicles	0	0	0	2	0	2
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	1
Configuration						R

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT							R
v (vph)	29							44
C (m) (vph)	1615							1077
v/c	0.02							0.04
95% queue length	0.05							0.13
Control Delay	7.3							8.5
LOS	A							A
Approach Delay	--	--				8.5		
Approach LOS	--	--				A		

HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: mm - 6PMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Reed Road & Site Driveway
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Site Driveway
North/South Street: Reed Road
Intersection Orientation: NS   Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Northbound			Southbound		
Movement	1 L	2 T	3 R	4 L	5 T	6 R
Volume	24	3			5	
Peak-Hour Factor, PHF	0.80	0.80			0.80	
Hourly Flow Rate, HFR	29	3			6	
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	
Configuration	LT				T	
Upstream Signal?		No			No	

Minor Street: Approach	Westbound			Eastbound		
Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume						36
Peak Hour Factor, PHF						0.80
Hourly Flow Rate, HFR						44
Percent Heavy Vehicles						2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes					1	
Configuration					R	

Delay, Queue Length, and Level of Service

Approach	NB	SB	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Config	LT							R
v (vph)	29							44
C(m) (vph)	1615							1077
v/c	0.02							0.04
95% queue length	0.05							0.13
Control Delay	7.3							8.5
LOS	A							A
Approach Delay							8.5	
Approach LOS							A	

HCS2000: Unsignalized Intersections Release 4.1d

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TWO-WAY STOP CONTROL(TWSC) ANALYSIS

Analyst: mm - 6PMbuild
Agency/Co.: mma
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Reed Road & Site Driveway
Jurisdiction: North Salem, NY
Units: U. S. Customary
Analysis Year: 2010 Build Condition
Project ID: Woodlands Development
East/West Street: Site Driveway
North/South Street: Reed Road
Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street Movements	1 L	2 T	3 R	4 L	5 T	6 R
Volume	24	3			5	
Peak-Hour Factor, PHF	0.80	0.80			0.80	
Peak-15 Minute Volume	8	1			2	
Hourly Flow Rate, HFR	29	3			6	
Percent Heavy Vehicles	2	--	--		--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1			1	
Configuration	LT				T	
Upstream Signal?		No			No	

Minor Street Movements	7 L	8 T	9 R	10 L	11 T	12 R
Volume						36
Peak Hour Factor, PHF						0.80
Peak-15 Minute Volume						11
Hourly Flow Rate, HFR						44
Percent Heavy Vehicles						2
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
RT Channelized?						No
Lanes						1
Configuration						R

Pedestrian Volumes and Adjustments

Movements	13	14	15	16
Flow (ped/hr)	0	0	0	0

Lane Width (ft)	12.0	12.0	12.0	12.0
Walking Speed (ft/sec)	4.0	4.0	4.0	4.0
Percent Blockage	0	0	0	0

Upstream Signal Data

	Prog. Flow vph	Sat Flow vph	Arrival Type	Green Time sec	Cycle Length sec	Prog. Speed mph	Distance to Signal feet
S2 Left-Turn							
Through							
S5 Left-Turn							
Through							

Worksheet 3-Data for Computing Effect of Delay to Major Street Vehicles

	Movement 2	Movement 5
Shared ln volume, major th vehicles:	3	
Shared ln volume, major rt vehicles:	0	
Sat flow rate, major th vehicles:	1700	
Sat flow rate, major rt vehicles:	1700	
Number of major street through lanes:	1	

Worksheet 4-Critical Gap and Follow-up Time Calculation

Critical Gap Calculation

Movement		1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(c,base)		4.1							6.2
t(c,hv)		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
P(hv)		2							2
t(c,g)				0.20	0.20	0.10	0.20	0.20	0.10
Grade/100				0.00	0.00	0.00	0.00	0.00	0.00
t(3,lt)		0.00							0.00
t(c,T):	1-stage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2-stage	0.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00
t(c)	1-stage	4.1							6.2
	2-stage								

Follow-Up Time Calculations

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
t(f,base)	2.20							3.30
t(f,HV)	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
P(HV)	2							2
t(f)	2.2							3.3

Worksheet 5-Effect of Upstream Signals

Computation 1-Queue Clearance Time at Upstream Signal

	Movement 2 V(t)	Movement 2 V(l,prot)	Movement 5 V(t)	Movement 5 V(l,prot)
V prog				

Total Saturation Flow Rate, s (vph)	
Arrival Type	
Effective Green, g (sec)	
Cycle Length, C (sec)	
Rp (from Exhibit 16-11)	
Proportion vehicles arriving on green P	
g(q1)	
g(q2)	
g(q)	

Computation 2-Proportion of TWSC Intersection Time blocked	Movement 2		Movement 5	
	V(t)	V(l,prot)	V(t)	V(l,prot)
alpha				
beta				
Travel time, t(a) (sec)				
Smoothing Factor, F				
Proportion of conflicting flow, f				
Max platooned flow, V(c,max)				
Min platooned flow, V(c,min)				
Duration of blocked period, t(p)				
Proportion time blocked, p		0.000		0.000

Computation 3-Platoon Event Periods	Result
p(2)	0.000
p(5)	0.000
p(dom)	
p(subo)	
Constrained or unconstrained?	

Proportion unblocked for minor movements, p(x)	(1) Single-stage Process	(2) Two-Stage Process Stage I	(3) Two-Stage Process Stage II
p(1)			
p(4)			
p(7)			
p(8)			
p(9)			
p(10)			
p(11)			
p(12)			

Computation 4 and 5
Single-Stage Process

Movement	1 L	4 L	7 L	8 T	9 R	10 L	11 T	12 R
V c,x	6							6
s								
Px								
V c,u,x								
C r,x								
C plat,x								

Two-Stage Process

	7	8	10	11

	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2	Stage1	Stage2
V(c,x)								
s								
P(x)								
V(c,u,x)								
C(r,x)								
C(plat,x)								

Worksheet 6-Impedance and Capacity Equations

Step 1: RT from Minor St.	9	12
Conflicting Flows		6
Potential Capacity		1077
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1077
Probability of Queue free St.	1.00	0.96

Step 2: LT from Major St.	4	1
Conflicting Flows		6
Potential Capacity		1615
Pedestrian Impedance Factor	1.00	1.00
Movement Capacity		1615
Probability of Queue free St.	1.00	0.98
Maj L-Shared Prob Q free St.		0.98

Step 3: TH from Minor St.	8	11
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.98	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.95	0.98
Movement Capacity		

Worksheet 7-Computation of the Effect of Two-stage Gap Acceptance

Step 3: TH from Minor St.	8	11
Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		
Probability of Queue free St.		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Cap. Adj. factor due to Impeding mvmnt	0.98	0.98
Movement Capacity		

Result for 2 stage process:		
a		
y		
C t		
Probability of Queue free St.	1.00	1.00

Step 4: LT from Minor St.	7	10

Part 1 - First Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 2 - Second Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor		
Cap. Adj. factor due to Impeding mvmnt		
Movement Capacity		

Part 3 - Single Stage		
Conflicting Flows		
Potential Capacity		
Pedestrian Impedance Factor	1.00	1.00
Maj. L, Min T Impedance factor	0.98	
Maj. L, Min T Adj. Imp Factor.	0.99	
Cap. Adj. factor due to Impeding mvmnt	0.95	0.98
Movement Capacity		

Results for Two-stage process:		
a		
y		
C t		

Worksheet 8-Shared Lane Calculations

Movement	7 L	8 T	9 R	10 L	11 T	12 R
Volume (vph)						44
Movement Capacity (vph)						1077
Shared Lane Capacity (vph)						

Worksheet 9-Computation of Effect of Flared Minor Street Approaches

Movement	7 L	8 T	9 R	10 L	11 T	12 R
C sep						1077
Volume						44
Delay						
Q sep						
Q sep +1						
round (Qsep +1)						
n max						
C sh						
SUM C sep						
n						
C act						

Worksheet 10-Delay, Queue Length, and Level of Service

Movement	1	4	7	8	9	10	11	12
Lane Config	LT							R
v (vph)	29							44
C(m) (vph)	1615							1077
v/c	0.02							0.04
95% queue length	0.05							0.13
Control Delay	7.3							8.5
LOS	A							A
Approach Delay							8.5	
Approach LOS							A	

Worksheet 11-Shared Major LT Impedance and Delay

	Movement 2	Movement 5
p(oj)	0.98	1.00
v(il), Volume for stream 2 or 5	3	
v(i2), Volume for stream 3 or 6	0	
s(il), Saturation flow rate for stream 2 or 5	1700	
s(i2), Saturation flow rate for stream 3 or 6	1700	
P*(oj)	0.98	
d(M,LT), Delay for stream 1 or 4	7.3	
N, Number of major street through lanes	1	
d(rank,1) Delay for stream 2 or 5	0.1	

2010 BUILD WITH IMPROVEMENTS TRAFFIC CONDITIONS

SHORT REPORT

General Information		Site Information	
Analyst	mm - 1AMbuild/imps	Intersection	Hardscrabble & 684 NB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak AM Hour	Analysis Year	2010 Build w/Imps. Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	0	0	1	1	1	1	0	0	0	0
Lane group	L	T			T	R	L	TR				
Volume (vph)	273	248			452	45	153	0	122			
% Heavy veh	2	2			2	2	2	2	2			
PHF	0.90	0.90			0.90	0.90	0.90	0.90	0.90			
Actuated (P/A)	P	P			P	P	P	P	P			
Startup lost time	2.0	2.0			2.0	2.0	2.0	2.0				
Ext. eff. green	2.0	2.0			2.0	2.0	2.0	2.0				
Arrival type	3	3			3	3	3	3				
Unit Extension	3.0	3.0			3.0	3.0	3.0	3.0				
Ped/Bike/RTOR Volume				0		0	0		0	0		
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0				
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr	0	0			0	0	0	0				
Unit Extension	3.0	3.0			3.0	3.0	3.0	3.0				

Phasing	EB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 20.0	G = 32.0	G =	G =	G = 25.0	G =	G =	G =
	Y = 3	Y = 5	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25					Cycle Length C = 90.0			

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	303	276			502	50	170	136				
Lane group cap.	518	1138			662	563	492	440				
v/c ratio	0.58	0.24			0.76	0.09	0.35	0.31				
Green ratio	0.61	0.61			0.36	0.36	0.28	0.28				
Unif. delay d1	12.4	8.0			25.6	19.3	26.0	25.7				
Delay factor k	0.50	0.50			0.50	0.50	0.50	0.50				
Increm. delay d2	4.8	0.5			7.9	0.3	1.9	1.8				
PF factor	1.000	1.000			1.000	1.000	1.000	1.000				
Control delay	17.2	8.5			33.5	19.6	27.9	27.5				
Lane group LOS	B	A			C	B	C	C				
Apprch. delay	13.1			32.3			27.7					
Approach LOS	B			C			C					
Intersec. delay	23.6			Intersection LOS						C		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 1AMbuild/imps
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & 684 NB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build w/Imps. Condition

N/S St: I-684 Northbound Ramps

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	0	0	1	1	1	1	0	0	0	0
LGConfig	L	T			T	R	L	TR				
Volume	273	248			452	45	153	0	122			
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0				
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	P	P			NB	Left	P			
Thru	P	P				Thru	P			
Right						Right	P			
Peds						Peds				
WB Left					SB	Left				
Thru		P				Thru				
Right		P				Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	20.0	32.0					25.0			
Yellow	3.0	3.0					3.0			
All Red	0.0	2.0					2.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	518	1770	0.58	0.61	17.2	B		
T	1138	1863	0.24	0.61	8.5	A	13.1	B
Westbound								
T	662	1863	0.76	0.36	33.5	C	32.3	C
R	563	1583	0.09	0.36	19.6	B		
Northbound								
L	492	1770	0.35	0.28	27.9	C		
TR	440	1583	0.31	0.28	27.5	C	27.7	C
Southbound								

Intersection Delay = 23.6 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 1AMbuild/imps
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & 684 NB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build w/Imps. Condition
Project ID: Woodlands

East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	273	248			452	45	153	0	122			
% Heavy Veh	2	2			2	2	2	2	2			
PHF	0.90	0.90			0.90	0.90	0.90	0.90	0.90			
PK 15 Vol	76	69			126	13	43	0	34			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat	1900	1900			1900	1900	1900	1900				
ParkExist												
NumPark												
No. Lanes	1	1	0	0	1	1	1	1	0	0	0	0
LGConfig	L	T			T	R	L	TR				
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0				
RTOR Vol						0			0			
Adj Flow	303	276			502	50	170	136				
%InSharedLn												
Prop LTs	1.000	0.000			0.000			0.000				
Prop RTs		0.000			0.000	1.000		1.000				
Peds Bikes				0			0			0		
Buses	0	0			0	0	0	0				
%InProtPhase	0.0											

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0			0.0	0.0	0.0	0.0				
Arriv. Type	3	3			3	3	3	3				
Unit Ext.	3.0	3.0			3.0	3.0	3.0	3.0				
I Factor		1.000			1.000			1.000				
Lost Time	2.0	2.0			2.0	2.0	2.0	2.0				
Ext of g	2.0	2.0			2.0	2.0	2.0	2.0				

```
Ped Min g  |                   |      3.2        |      3.2        |      3.2        |

________________________________PHASE DATA__________________________________

Phase Combination 1      2      3      4 |            5      6      7      8

EB   Left             P      P           | NB  Left    P
     Thru             P      P           |     Thru    P
     Right                               |     Right   P
     Peds                                |     Peds

WB   Left                                | SB  Left
     Thru                    P           |     Thru
     Right                   P           |     Right
     Peds                                |     Peds

NB   Right                               | EB  Right
                                         |
SB   Right                               | WB  Right
                                         |
                                         |
Green               20.0   32.0                     25.0
Yellow              3.0    3.0                      3.0
All Red             0.0    2.0                      2.0

                                                   Cycle Length: 90.0    secs

________________VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET_______________
Volume Adjustment
              |  Eastbound      |  Westbound      |  Northbound     |  Southbound     |
              | L     T     R   | L     T     R   | L     T     R   | L     T     R   |
              |_________________|_________________|_________________|_________________|
Volume, V     |273   248        |       452   45  |153   0     122  |                 |
PHF           |0.90  0.90       |       0.90  0.90|0.90  0.90  0.90 |                 |
Adj flow      |303   276        |       502   50  |170   0     136  |                 |
No. Lanes     |   1     1     0 |   0     1     1 |   1     1     0 |   0     0     0 |
Lane group    | L       T       |       T      R  | L        TR     |                 |
Adj flow      |303   276        |       502   50  |170   136        |                 |
Prop LTs      |1.000 0.000      |        0.000    |         0.000   |                 |
Prop RTs      |   0.000         |     0.000 1.000 |    1.000        |                 |

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)____
           Eastbound              Westbound         Northbound         Southbound
LG       L      T                      T      R      L      TR
So     1900   1900                   1900   1900   1900   1900
Lanes  1        1      0      0      1      1      1      1      0      0      0      0
fW     1.000  1.000                  1.000  1.000  1.000  1.000
fHV    0.980  0.980                  0.980  0.980  0.980  0.980
fG     1.000  1.000                  1.000  1.000  1.000  1.000
fP     1.000  1.000                  1.000  1.000  1.000  1.000
fBB    1.000  1.000                  1.000  1.000  1.000  1.000
fA     1.000  1.000                  1.000  1.000  1.000  1.000
fLU    1.000  1.000                  1.000  1.000  1.000  1.000
fRT           1.000                  1.000  0.850         0.850
fLT    0.950  1.000                  1.000         0.950  1.000
Sec.   0.172
fLpb   1.000  1.000                  1.000         1.000  1.000
fRpb          1.000                  1.000  1.000         1.000
S      1770   1863                   1863   1583   1770   1583
Sec.   321
_________________________CAPACITY AND LOS WORKSHEET___________________________
```

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot		303	1770	# 0.17	0.222	393	0.77
Perm		0	321	0.00	0.389	125	0.00
Left	L	303			0.61	518	0.58
Prot							
Perm							
Thru	T	276	1863	0.15	0.61	1138	0.24
Right							
Westbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	502	1863	# 0.27	0.36	662	0.76
Right	R	50	1583	0.03	0.36	563	0.09
Northbound							
Prot							
Perm							
Left	L	170	1770	# 0.10	0.28	492	0.35
Prot							
Perm							
Thru	TR	136	1583	0.09	0.28	440	0.31
Right							
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.54
Total lost time per cycle, L = 15.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.64

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Incremental Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
L	0.58	0.61	12.4	1.000	518	0.50	4.8	0.0	17.2	B		
T	0.24	0.61	8.0	1.000	1138	0.50	0.5	0.0	8.5	A	13.1	B
Westbound												
T	0.76	0.36	25.6	1.000	662	0.50	7.9	0.0	33.5	C	32.3	C
R	0.09	0.36	19.3	1.000	563	0.50	0.3	0.0	19.6	B		
Northbound												
L	0.35	0.28	26.0	1.000	492	0.50	1.9	0.0	27.9	C		
TR	0.31	0.28	25.7	1.000	440	0.50	1.8	0.0	27.5	C	27.7	C
Southbound												

```
        Intersection delay = 23.6  (sec/veh)   Intersection LOS = C


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                              for exclusive lefts
Input
                                                          EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach         M
Cycle length, C                                 90.0    sec
Total actual green time for LT lane group, G (s)          55.0
Effective permitted green time for LT lane group, g(s)    35.0
Opposing effective green time, go (s)                     32.0
Number of lanes in LT lane group, N                       1
Number of lanes in opposing approach, No                  1
Adjusted LT flow rate, VLT (veh/h)                        303
Proportion of LT in LT lane group, PLT                    1.000
Proportion of LT in opposing flow, PLTo                   0.00
Adjusted opposing flow rate, Vo (veh/h)                   502
Lost time for LT lane group, tL                           5.00
Computation
LT volume per cycle, LTC=VLTC/3600                        7.58
Opposing lane util. factor, fLUo                          1.000 1.000       1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)       12.55
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                     0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)         1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]              0.64
gq, (see Exhibit C16-4,5,6,7,8)                           22.43
gu=g-gq if gq>=gf, or = g-gf if gq<gf                     12.57
n=Max(gq-gf)/2,0)                                         11.22
PTHo=1-PLTo                                               1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                        1.00
EL1 (refer to Exhibit C16-3)                              2.09
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                        0.11
gdiff=max(gq-gf,0)                                        0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)       0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                 0.172

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                              for shared lefts
Input
                                                          EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                                 90.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                     0.000 0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                           1.000 1.000       1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_________________
Permitted Left Turns
                                                           EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	90.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v			303			
v/c ratio from Capacity Worksheet, X			0.58			
Protected phase effective green interval, g (s)			20.0			
Opposing queue effective green interval, gq			22.43			
Unopposed green interval, gu			12.57			
Red time r=(C-g-gq-gu)			35.0			
Arrival rate, qa=v/(3600(max[X,1.0]))			0.08			
Protected ph. departure rate, Sp=s/3600			0.492			
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)			0.25			
XPerm			0.94			
XProt			0.47			
Case			1			
Queue at beginning of green arrow, Qa			2.95			
Queue at beginning of unsaturated green, Qu			1.89			
Residual queue, Qr			0.00			
Uniform Delay, d1			12.4			

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 23.6 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup	L	T			T	R	L	TR				
Init Queue	0.0	0.0			0.0	0.0	0.0	0.0				
Flow Rate	303	276			502	50	170	136				
So	1900	1900			1900	1900	1900	1900				
No.Lanes	1	1	0	0	1	1	1	1	0	0	0	0
SL	848	1863			1863	1583	1770	1583				
LnCapacity	518	1138			662	563	492	440				
Flow Ratio	0.36	0.15			0.27	0.03	0.10	0.09				
v/c Ratio	0.58	0.24			0.76	0.09	0.35	0.31				
Grn Ratio	0.61	0.61			0.36	0.36	0.28	0.28				
I Factor		1.000			1.000			1.000				
AT or PVG	3	3			3	3	3	3				
Pltn Ratio	1.00	1.00			1.00	1.00	1.00	1.00				
PF2	1.00	1.00			1.00	1.00	1.00	1.00				
Q1	3.4	3.2			11.1	0.8	3.4	2.7				
kB	0.7	1.3			0.9	0.8	0.7	0.6				
Q2	1.0	0.4			2.4	0.1	0.4	0.3				
Q Average	4.4	3.5			13.5	0.9	3.8	3.0				
Q Spacing	25.0	25.0			25.0	25.0	25.0	25.0				
Q Storage	0	0			0	0	0	0				
Q S Ratio												
70th Percentile Output:												
fB%	1.2	1.2			1.2	1.3	1.2	1.3				
BOQ	5.4	4.4			16.3	1.2	4.7	3.7				
QSRatio												
85th Percentile Output:												
fB%	1.5	1.5			1.4	1.7	1.5	1.6				
BOQ	6.7	5.5			19.1	1.5	5.8	4.7				
QSRatio												
90th Percentile Output:												
fB%	1.7	1.7			1.5	1.9	1.7	1.8				
BOQ	7.5	6.2			20.7	1.7	6.5	5.3				
QSRatio												
95th Percentile Output:												
fB%	2.0	2.1			1.7	2.4	2.1	2.2				
BOQ	8.8	7.4			22.5	2.2	7.8	6.4				
QSRatio												
98th Percentile Output:												
fB%	2.3	2.4			1.8	3.0	2.4	2.5				
BOQ	10.2	8.7			24.3	2.7	9.0	7.5				
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	yem - 1PMbuild/imps	Intersection	Hardscrabble & 684 NB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2010 Build w/Imps. Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	1	1	0	0	1	1	1	1	0	0	0	0
Lane group	L	T			T	R	L	TR				
Volume (vph)	594	303			316	78	546	4	311			
% Heavy veh	2	2			2	2	2	2	2			
PHF	0.90	0.90			0.90	0.90	0.90	0.90	0.90			
Actuated (P/A)	P	P			P	P	P	P	P			
Startup lost time	2.0	2.0			2.0	2.0	2.0	2.0				
Ext. eff. green	2.0	2.0			2.0	2.0	2.0	2.0				
Arrival type	3	3			3	3	3	3				
Unit Extension	3.0	3.0			3.0	3.0	3.0	3.0				
Ped/Bike/RTOR Volume				0		0	0		0	0		
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0				
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr	0	0			0	0	0	0				
Unit Extension	3.0	3.0			3.0	3.0	3.0	3.0				

Phasing	EB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 29.0	G = 18.0	G =	G =	G = 30.0	G =	G =	G =
	Y = 3	Y = 5	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate	660	337			351	87	607	350				
Lane group cap.	653	1035			373	317	590	529				
v/c ratio	1.01	0.33			0.94	0.27	1.03	0.66				
Green ratio	0.56	0.56			0.20	0.20	0.33	0.33				
Unif. delay d1	23.3	10.9			35.5	30.5	30.0	25.7				
Delay factor k	0.50	0.50			0.50	0.50	0.50	0.50				
Increm. delay d2	37.9	0.8			33.8	2.1	44.6	6.4				
PF factor	1.000	1.000			1.000	1.000	1.000	1.000				
Control delay	61.2	11.7			69.3	32.6	74.6	32.0				
Lane group LOS	E	B			E	C	E	C				
Apprch. delay	44.5			62.0			59.0					
Approach LOS	D			E			E					
Intersec. delay	53.5			Intersection LOS						D		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: yem - 1PMbuild/imps
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & 684 NB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build w/Imps. Condition

N/S St: I-684 Northbound Ramps

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	1	1	0	0	1	1	1	1	0	0	0	0
LGConfig	L	T			T	R	L	TR				
Volume	594	303			316	78	546	4	311			
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0				
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left	P	P			NB	Left	P			
Thru	P	P				Thru	P			
Right						Right	P			
Peds						Peds				
WB Left					SB	Left				
Thru		P				Thru				
Right		P				Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right				
Green	29.0	18.0					30.0			
Yellow	3.0	3.0					3.0			
All Red	0.0	2.0					2.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
L	653	1770	1.01	0.56	61.2	E		
T	1035	1863	0.33	0.56	11.7	B	44.5	D
Westbound								
T	373	1863	0.94	0.20	69.3	E	62.0	E
R	317	1583	0.27	0.20	32.6	C		
Northbound								
L	590	1770	1.03	0.33	74.6	E		
TR	529	1587	0.66	0.33	32.0	C	59.0	E
Southbound								

Intersection Delay = 53.5 (sec/veh) Intersection LOS = D

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: yem - 1PMbuild/imps
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & 684 NB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build w/Imps. Condition
Project ID: Woodlands

East/West Street: Hardscrabble Road
North/South Street: I-684 Northbound Ramps

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	594	303			316	78	546	4	311			
% Heavy Veh	2	2			2	2	2	2	2			
PHF	0.90	0.90			0.90	0.90	0.90	0.90	0.90			
PK 15 Vol	165	84			88	22	152	1	86			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat	1900	1900			1900	1900	1900	1900				
ParkExist												
NumPark												
No. Lanes	1	1	0	0	1	1	1	1	0	0	0	0
LGConfig	L	T			T	R	L	TR				
Lane Width	12.0	12.0			12.0	12.0	12.0	12.0				
RTOR Vol						0			0			
Adj Flow	660	337			351	87	607	350				
%InSharedLn												
Prop LTs	1.000	0.000			0.000			0.000				
Prop RTs		0.000			0.000	1.000		0.989				
Peds Bikes				0			0			0		
Buses	0	0			0	0	0	0				
%InProtPhase 0.0												

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet	0.0	0.0			0.0	0.0	0.0	0.0				
Arriv. Type	3	3			3	3	3	3				
Unit Ext.	3.0	3.0			3.0	3.0	3.0	3.0				
I Factor		1.000			1.000			1.000				
Lost Time	2.0	2.0			2.0	2.0	2.0	2.0				
Ext of g	2.0	2.0			2.0	2.0	2.0	2.0				

```
Ped Min g  |                   |       3.2         |       3.2         |       3.2         |

________________________________PHASE DATA____________________________________

Phase Combination 1     2     3     4 |            5     6     7     8

EB   Left           P     P           | NB   Left     P
     Thru           P     P           |      Thru     P
     Right                            |      Right    P
     Peds                             |      Peds

WB   Left                             | SB   Left
     Thru                 P           |      Thru
     Right                P           |      Right
     Peds                             |      Peds

NB   Right                            | EB   Right
                                      |
SB   Right                            | WB   Right
                                      |
                                      |
Green              29.0  18.0                     30.0
Yellow             3.0   3.0                      3.0
All Red            0.0   2.0                      2.0

                                                    Cycle Length: 90.0    secs

_________________VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET_________________
Volume Adjustment
              |  Eastbound      |  Westbound      |  Northbound     |  Southbound     |
              | L    T    R     | L    T    R     | L    T    R     | L    T    R     |
              |_________________|_________________|_________________|_________________|
Volume, V     |594  303         |     316  78     |546  4    311    |                 |
PHF           |0.90 0.90        |     0.90 0.90   |0.90 0.90 0.90   |                 |
Adj flow      |660  337         |     351  87     |607  4    346    |                 |
No. Lanes     |  1    1    0    |  0    1    1    |  1    1    0    |  0    0    0    |
Lane group    | L     T         |       T    R    | L      TR       |                 |
Adj flow      |660  337         |     351  87     |607  350         |                 |
Prop LTs      |1.000 0.000      |     0.000       |      0.000      |                 |
Prop RTs      |   0.000         |  0.000 1.000    |   0.989         |                 |

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)____
            Eastbound          Westbound          Northbound          Southbound
LG      L     T                  T     R      L     TR
So     1900  1900               1900  1900  1900  1900
Lanes  1     1     0     0      1     1     1     1     0     0     0     0
fW     1.000 1.000              1.000 1.000 1.000 1.000
fHV    0.980 0.980              0.980 0.980 0.980 0.980
fG     1.000 1.000              1.000 1.000 1.000 1.000
fP     1.000 1.000              1.000 1.000 1.000 1.000
fBB    1.000 1.000              1.000 1.000 1.000 1.000
fA     1.000 1.000              1.000 1.000 1.000 1.000
fLU    1.000 1.000              1.000 1.000 1.000 1.000
fRT          1.000              1.000 0.850       0.852
fLT    0.950 1.000              1.000       0.950 1.000
Sec.   0.190
fLpb   1.000 1.000              1.000       1.000 1.000
fRpb         1.000              1.000 1.000       1.000
S      1770  1863               1863  1583  1770  1587
Sec.   355
_________________________CAPACITY AND LOS WORKSHEET____________________________
```

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot		570	1770	# 0.32	0.322	570	1.00
Perm		90	355	# 0.25	0.233	83	1.08
Left	L	660			0.56	653	1.01
Prot							
Perm							
Thru	T	337	1863	0.18	0.56	1035	0.33
Right							
Westbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	351	1863	0.19	0.20	373	0.94
Right	R	87	1583	0.05	0.20	317	0.27
Northbound							
Prot							
Perm							
Left	L	607	1770	# 0.34	0.33	590	1.03
Prot							
Perm							
Thru	TR	350	1587	0.22	0.33	529	0.66
Right							
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.92
Total lost time per cycle, L = 10.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.03

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
L	1.01	0.56	23.3	1.000	653	0.50	37.9	0.0	61.2	E		
T	0.33	0.56	10.9	1.000	1035	0.50	0.8	0.0	11.7	B	44.5	D
Westbound												
T	0.94	0.20	35.5	1.000	373	0.50	33.8	0.0	69.3	E	62.0	E
R	0.27	0.20	30.5	1.000	317	0.50	2.1	0.0	32.6	C		
Northbound												
L	1.03	0.33	30.0	1.000	590	0.50	44.6	0.0	74.6	E		
TR	0.66	0.33	25.7	1.000	529	0.50	6.4	0.0	32.0	C	59.0	E
Southbound												

Intersection delay = 53.5 (sec/veh) Intersection LOS = D

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach	M			
Cycle length, C 90.0 sec				
Total actual green time for LT lane group, G (s)	50.0			
Effective permitted green time for LT lane group, g(s)	21.0			
Opposing effective green time, go (s)	18.0			
Number of lanes in LT lane group, N	1			
Number of lanes in opposing approach, No	1			
Adjusted LT flow rate, VLT (veh/h)	660			
Proportion of LT in LT lane group, PLT	1.000			
Proportion of LT in opposing flow, PLTo	0.00			
Adjusted opposing flow rate, Vo (veh/h)	351			
Lost time for LT lane group, tL	5.00			
Computation				
LT volume per cycle, LTC=VLTC/3600	16.50			
Opposing lane util. factor, fLUo	1.000	1.000		1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)	8.77			
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g	0.0			
Opposing platoon ratio, Rpo (refer Exhibit 16-11)	1.00			
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]	0.80			
gq, (see Exhibit C16-4,5,6,7,8)	17.00			
gu=g-gq if gq>=gf, or = g-gf if gq<gf	4.00			
n=Max(gq-gf)/2,0)	8.50			
PTHo=1-PLTo	1.00			
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]	1.00			
EL1 (refer to Exhibit C16-3)	1.82			
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g	0.19			
gdiff=max(gq-gf,0)	0.00			
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)	0.19			
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00) or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT	0.190			

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 90.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                  0.000 0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                        1.000 1.000       1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET________________
Permitted Left Turns
                                                        EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

```
Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb
```

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	90.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v			660			
v/c ratio from Capacity Worksheet, X			1.01			
Protected phase effective green interval, g (s)			29.0			
Opposing queue effective green interval, gq			17.00			
Unopposed green interval, gu			4.00			
Red time r=(C-g-gq-gu)			40.0			
Arrival rate, qa=v/(3600(max[X,1.0]))			0.18			
Protected ph. departure rate, Sp=s/3600			0.492			
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)			0.52			
XPerm			1.84			
XProt			0.88			
Case			3			
Queue at beginning of green arrow, Qa			8.99			
Queue at beginning of unsaturated green, Qu			3.08			
Residual queue, Qr			1.74			
Uniform Delay, d1			23.3			

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 53.5 sec/veh Intersection LOS D

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup	L	T			T	R	L	TR				
Init Queue	0.0	0.0			0.0	0.0	0.0	0.0				
Flow Rate	660	337			351	87	607	350				
So	1900	1900			1900	1900	1900	1900				
No.Lanes	1	1	0	0	1	1	1	1	0	0	0	0
SL	1176	1863			1863	1583	1770	1587				
LnCapacity	653	1035			373	317	590	529				
Flow Ratio	0.56	0.18			0.19	0.05	0.34	0.22				
v/c Ratio	1.01	0.33			0.94	0.27	1.03	0.66				
Grn Ratio	0.56	0.56			0.20	0.20	0.33	0.33				
I Factor		1.000			1.000			1.000				
AT or PVG	3	3			3	3	3	3				
Pltn Ratio	1.00	1.00			1.00	1.00	1.00	1.00				
PF2	1.00	1.00			1.00	1.00	1.00	1.00				
Q1	10.8	4.6			8.6	1.8	15.2	7.5				
kB	0.8	1.2			0.6	0.5	0.8	0.7				
Q2	8.8	0.6			3.8	0.2	8.9	1.3				
Q Average	19.6	5.1			12.5	2.0	24.0	8.8				
Q Spacing	25.0	25.0			25.0	25.0	25.0	25.0				
Q Storage	0	0			0	0	0	0				
Q S Ratio												
70th Percentile Output:												
fB%	1.2	1.2			1.2	1.3	1.2	1.2				
BOQ	23.6	6.3			15.1	2.6	28.9	10.8				
QSRatio												
85th Percentile Output:												
fB%	1.4	1.5			1.4	1.6	1.4	1.5				
BOQ	27.6	7.7			17.8	3.3	33.7	12.8				
QSRatio												
90th Percentile Output:												
fB%	1.5	1.7			1.5	1.8	1.5	1.6				
BOQ	29.6	8.6			19.2	3.7	36.2	14.0				
QSRatio												
95th Percentile Output:												
fB%	1.6	2.0			1.7	2.3	1.6	1.8				
BOQ	31.8	10.1			21.0	4.6	38.7	15.6				
QSRatio												
98th Percentile Output:												
fB%	1.7	2.2			1.8	2.7	1.7	2.0				
BOQ	34.0	11.5			22.7	5.5	41.2	17.3				
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 3AMbuild/imps	Intersection	Hardscrabble & I-684 SB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak AM Hour	Analysis Year	2010 Build w/Imps. Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	2	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				685		54		460	423	268	435	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 17.0	G =	G =	G =	G = 12.0	G = 21.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 65.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				761		60		511	470	298	483	
Lane group cap.				899		828		602	511	441	1032	
v/c ratio				0.85		0.07		0.85	0.92	0.68	0.47	
Green ratio				0.26		0.52		0.32	0.32	0.55	0.55	
Unif. delay d1				22.8		7.7		20.5	21.2	11.0	8.7	
Delay factor k				0.38		0.11		0.50	0.50	0.25	0.11	
Increm. delay d2				7.6		0.0		13.9	24.2	4.1	0.3	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				30.3		7.7		34.5	45.4	15.0	9.1	
Lane group LOS				C		A		C	D	B	A	
Apprch. delay				28.7			39.7			11.3		
Approach LOS				C			D			B		
Intersec. delay	27.6			Intersection LOS						C		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3AMbuild/imps
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build w/Imps. Condition
N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes	0	0	0	2	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				685		54		460	423	268	435	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left				
Thru						Thru		P		
Right						Right		P		
Peds						Peds				
WB Left	A				SB	Left	A	P		
Thru						Thru	A	P		
Right	A					Right				
Peds						Peds				
NB Right					EB	Right				
SB Right					WB	Right	A			
Green	17.0						12.0	21.0		
Yellow	3.0						3.0	4.0		
All Red	2.0						0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	899	3437	0.85	0.26	30.3	C		
							28.7	C
R	828	1583	0.07	0.52	7.7	A		
Northbound								
T	602	1863	0.85	0.32	34.5	C	39.7	D
R	511	1583	0.92	0.32	45.4	D		
Southbound								
L	441	1770	0.68	0.55	15.0	B		
T	1032	1863	0.47	0.55	9.1	A	11.3	B

Intersection Delay = 27.6 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3AMbuild/imps
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build w/Imps. Condition
Project ID: Woodlands

East/West Street: I-684 Southbound Ramps
North/South Street: Hardscrabble Road

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume				685		54		460	423	268	435	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				190		15		128	118	74	121	
Hi Ln Vol												
% Grade					0			0			0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	2	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				761		60		511	470	298	483	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

Ped Min g	3.2	3.2	3.2	

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left				
	Thru						Thru		P		
	Right						Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru						Thru	A	P		
	Right	A					Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right	A			
Green		17.0						12.0	21.0		
Yellow		3.0						3.0	4.0		
All Red		2.0						0.0	3.0		

Cycle Length: 65.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V				685		54		460	423	268	435	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Adj flow				761		60		511	470	298	483	
No. Lanes	0	0	0	2	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Adj flow				761		60		511	470	298	483	
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG				L		R		T	R	L	T	
So				1900		1900		1900	1900	1900	1900	
Lanes	0	0	0	2	0	1	0	1	1	1	1	0
fW				1.000		1.000		1.000	1.000	1.000	1.000	
fHV				0.980		0.980		0.980	0.980	0.980	0.980	
fG				1.000		1.000		1.000	1.000	1.000	1.000	
fP				1.000		1.000		1.000	1.000	1.000	1.000	
fBB				1.000		1.000		1.000	1.000	1.000	1.000	
fA				1.000		1.000		1.000	1.000	1.000	1.000	
fLU				0.971		1.000		1.000	1.000	1.000	1.000	
fRT						0.850		1.000	0.850		1.000	
fLT				0.950				1.000		0.950	1.000	
Sec.										0.167		
fLpb				1.000				1.000		1.000	1.000	
fRpb						1.000		1.000	1.000		1.000	
S				3437		1583		1863	1583	1770	1863	
Sec.										310		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	761	3437	# 0.22	0.26	899	0.85
Prot							
Perm							
Thru							
Right	R	60	1583	0.04	0.52	828	0.07
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	511	1863	0.27	0.32	602	0.85
Right	R	470	1583	# 0.30	0.32	511	0.92
Southbound							
Prot		298	1770	# 0.17	0.185	327	0.91
Perm		0	310	0.00	0.369	114	0.00
Left	L	298			0.55	441	0.68
Prot							
Perm							
Thru	T	483	1863	0.26	0.55	1032	0.47
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.69
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.97

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
Westbound												
L	0.85	0.26	22.8	1.000	899	0.38	7.6	0.0	30.3	C	28.7	C
R	0.07	0.52	7.7	1.000	828	0.11	0.0	0.0	7.7	A		
Northbound												
T	0.85	0.32	20.5	1.000	602	0.50	13.9	0.0	34.5	C	39.7	D
R	0.92	0.32	21.2	1.000	511	0.50	24.2	0.0	45.4	D		
Southbound												
L	0.68	0.55	11.0	1.000	441	0.25	4.1	0.0	15.0	B		

T	0.47	0.55	8.7	1.000	1032	0.11	0.3	0.0	9.1	A	11.3	B

Intersection delay = 27.6 (sec/veh) Intersection LOS = C

SUPPLEMENTAL PERMITTED LT WORKSHEET
for exclusive lefts

Input	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				M
Cycle length, C 65.0 sec				
Total actual green time for LT lane group, G (s)				36.0
Effective permitted green time for LT lane group, g(s)				24.0
Opposing effective green time, go (s)				21.0
Number of lanes in LT lane group, N				1
Number of lanes in opposing approach, No				1
Adjusted LT flow rate, VLT (veh/h)				298
Proportion of LT in LT lane group, PLT				1.000
Proportion of LT in opposing flow, PLTo				0.00
Adjusted opposing flow rate, Vo (veh/h)				511
Lost time for LT lane group, tL				7.00
Computation				
LT volume per cycle, LTC=VLTC/3600				5.38
Opposing lane util. factor, fLUo			1.000	1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)				9.23
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g				0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)				1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]				0.68
gq, (see Exhibit C16-4,5,6,7,8)				17.44
gu=g-gq if gq>=gf, or = g-gf if gq<gf				6.56
n=Max(gq-gf)/2,0)				8.72
PTHo=1-PLTo				1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]				1.00
EL1 (refer to Exhibit C16-3)				2.10
EL2=Max((1-Ptho**n)/Plto, 1.0)				
fmin=2(1+PL)/g or fmin=2(1+Pl)/g				0.17
gdiff=max(gq-gf,0)				0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)				0.17
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)				
or flt=[fm+0.91(N-1)]/N**				
Left-turn adjustment, fLT				0.167

For special case of single-lane approach opposed by multilane approach, see text.

* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.

** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm. For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PERMITTED LT WORKSHEET
for shared lefts

Input	EB	WB	NB	SB
Opposed by Single(S) or Multiple(M) lane approach				
Cycle length, C 65.0 sec				
Total actual green time for LT lane group, G (s)				
Effective permitted green time for LT lane group, g(s)				
Opposing effective green time, go (s)				

Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT 0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo 1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g or fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach, see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach or when gf>gq, see text.

SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET

Permitted Left Turns

EB WB NB SB

Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v					298
v/c ratio from Capacity Worksheet, X					0.68
Protected phase effective green interval, g (s)					12.0
Opposing queue effective green interval, gq					17.44
Unopposed green interval, gu					6.56
Red time r=(C-g-gq-gu)					29.0
Arrival rate, qa=v/(3600(max[X,1.0]))					0.08
Protected ph. departure rate, Sp=s/3600					0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)					0.32
XPerm					0.96
XProt					0.58
Case					1
Queue at beginning of green arrow, Qa					2.40
Queue at beginning of unsaturated green, Qu					1.44
Residual queue, Qr					0.00
Uniform Delay, d1					11.0

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 27.6 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				391		60		511	470	298	483	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	2	0	1	0	1	1	1	1	0
SL				1770		1583		1863	1583	797	1863	
LnCapacity				462		828		602	511	441	1032	
Flow Ratio				0.22		0.04		0.27	0.30	0.37	0.26	
v/c Ratio				0.85		0.07		0.85	0.92	0.68	0.47	
Grn Ratio				0.26		0.52		0.32	0.32	0.55	0.55	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				6.7		0.5		8.6	8.2	2.7	5.3	
kB				0.4		0.5		0.6	0.6	0.3	0.6	
Q2				1.7		0.0		2.9	3.8	0.7	0.5	
Q Average				8.4		0.6		11.5	11.9	3.4	5.8	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.2		1.2		1.2	1.2	1.2	1.2	
BOQ				9.9		0.7		13.9	14.4	4.1	6.8	
QSRatio												
85th Percentile Output:												
fB%				1.5		1.6		1.4	1.4	1.6	1.5	
BOQ				12.8		0.9		16.4	17.0	5.4	8.9	
QSRatio												
90th Percentile Output:												
fB%				1.7		1.8		1.6	1.5	1.7	1.7	
BOQ				13.9		1.0		17.8	18.4	6.0	9.8	
QSRatio												
95th Percentile Output:												
fB%				1.9		2.1		1.7	1.7	2.0	1.9	
BOQ				15.7		1.2		19.5	20.2	6.9	11.1	
QSRatio												
98th Percentile Output:												
fB%				2.2		2.7		1.9	1.8	2.5	2.3	
BOQ				18.6		1.5		21.2	21.9	8.5	13.5	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 3PMbuild/imps	Intersection	Hardscrabble & I-684 SB Ramps
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2010 Build w/Imps. Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	0	0	2	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Volume (vph)				346		95		823	140	206	662	
% Heavy veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Actuated (P/A)				A		A		P	P	A	A	
Startup lost time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext. eff. green				2.0		2.0		2.0	2.0	2.0	2.0	
Arrival type				3		3		3	3	3	3	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	
Ped/Bike/RTOR Volume	0			0		0	0		0			
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
Parking/Grade/Parking	N		N	N	0	N	N	0	N	N	0	N
Parking/hr												
Bus stops/hr				0		0		0	0	0	0	
Unit Extension				3.0		3.0		3.0	3.0	3.0	3.0	

Phasing	WB Only	02	03	04	SB Only	NS Perm	07	08
Timing	G = 12.0	G =	G =	G =	G = 7.0	G = 31.0	G =	G =
	Y = 5	Y =	Y =	Y =	Y = 3	Y = 7	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 65.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate				384		106		914	156	229	736	
Lane group cap.				635		584		889	755	306	1175	
v/c ratio				0.60		0.18		1.03	0.21	0.75	0.63	
Green ratio				0.18		0.37		0.48	0.48	0.63	0.63	
Unif. delay d1				24.3		13.9		17.0	9.9	13.6	7.3	
Delay factor k				0.19		0.11		0.50	0.50	0.30	0.21	
Increm. delay d2				1.6		0.2		37.6	0.6	9.8	1.1	
PF factor				1.000		1.000		1.000	1.000	1.000	1.000	
Control delay				26.0		14.0		54.6	10.5	23.4	8.4	
Lane group LOS				C		B		D	B	C	A	
Apprch. delay				23.4			48.2			12.0		
Approach LOS				C			D			B		
Intersec. delay	29.5			Intersection LOS						C		

HCS2000™ Version 4.1e

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 3PMbuild/imps
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: I-684 Southbound Ramps

Inter.: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build w/Imps. Condition
N/S St: Hardscrabble Road

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	0	0	2	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Volume				346		95		823	140	206	662	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru					Thru		P		
Right					Right		P		
Peds					Peds				
WB Left	A				SB Left	A	P		
Thru					Thru	A	P		
Right	A				Right				
Peds					Peds				
NB Right					EB Right				
SB Right					WB Right	A			
Green	12.0					7.0	31.0		
Yellow	3.0					3.0	4.0		
All Red	2.0					0.0	3.0		

Cycle Length: 65.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
Westbound								
L	635	3437	0.60	0.18	26.0	C		
							23.4	C
R	584	1583	0.18	0.37	14.0	B		
Northbound								
T	889	1863	1.03	0.48	54.6	D	48.2	D
R	755	1583	0.21	0.48	10.5	B		
Southbound								
L	306	1770	0.75	0.63	23.4	C		
T	1175	1863	0.63	0.63	8.4	A	12.0	B

Intersection Delay = 29.5 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 3PMbuild/imps
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak PM Hour
Intersection: Hardscrabble & I-684 SB Ramps
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build w/Imps. Condition
Project ID: Woodlands

East/West Street: I-684 Southbound Ramps
North/South Street: Hardscrabble Road

VOLUME DATA

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Volume				346		95		823	140	206	662	
% Heavy Veh				2		2		2	2	2	2	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
PK 15 Vol				96		26		229	39	57	184	
Hi Ln Vol												
% Grade					0		0				0	
Ideal Sat				1900		1900		1900	1900	1900	1900	
ParkExist												
NumPark												
No. Lanes	0	0	0	2	0	1	0	1	1	1	1	0
LGConfig				L		R		T	R	L	T	
Lane Width				12.0		12.0		12.0	12.0	12.0	12.0	
RTOR Vol						0			0			
Adj Flow				384		106		914	156	229	736	
%InSharedLn												
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	
Peds Bikes	0			0			0					
Buses				0		0		0	0	0	0	
%InProtPhase										0.0		

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
Init Unmet				0.0		0.0		0.0	0.0	0.0	0.0	
Arriv. Type				3		3		3	3	3	3	
Unit Ext.				3.0		3.0		3.0	3.0	3.0	3.0	
I Factor					1.000			1.000			1.000	
Lost Time				2.0		2.0		2.0	2.0	2.0	2.0	
Ext of g				2.0		2.0		2.0	2.0	2.0	2.0	

Ped Min g	3.2	3.2	3.2		

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left				
	Thru						Thru		P		
	Right						Right		P		
	Peds						Peds				
WB	Left	A				SB	Left	A	P		
	Thru						Thru	A	P		
	Right	A					Right				
	Peds						Peds				
NB	Right					EB	Right				
SB	Right					WB	Right	A			
Green		12.0						7.0	31.0		
Yellow		3.0						3.0	4.0		
All Red		2.0						0.0	3.0		

Cycle Length: 65.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V				346		95		823	140	206	662	
PHF				0.90		0.90		0.90	0.90	0.90	0.90	
Adj flow				384		106		914	156	229	736	
No. Lanes	0	0	0	2	0	1	0	1	1	1	1	0
Lane group				L		R		T	R	L	T	
Adj flow				384		106		914	156	229	736	
Prop LTs								0.000		1.000	0.000	
Prop RTs						1.000		0.000	1.000		0.000	

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG				L		R		T	R	L	T	
So				1900		1900		1900	1900	1900	1900	
Lanes	0	0	0	2	0	1	0	1	1	1	1	0
fW				1.000		1.000		1.000	1.000	1.000	1.000	
fHV				0.980		0.980		0.980	0.980	0.980	0.980	
fG				1.000		1.000		1.000	1.000	1.000	1.000	
fP				1.000		1.000		1.000	1.000	1.000	1.000	
fBB				1.000		1.000		1.000	1.000	1.000	1.000	
fA				1.000		1.000		1.000	1.000	1.000	1.000	
fLU				0.971		1.000		1.000	1.000	1.000	1.000	
fRT						0.850		1.000	0.850		1.000	
fLT				0.950				1.000		0.950	1.000	
Sec.										0.118		
fLpb				1.000				1.000		1.000	1.000	
fRpb						1.000		1.000	1.000		1.000	
S				3437		1583		1863	1583	1770	1863	
Sec.										219		

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							
Westbound							
Prot							
Perm							
Left	L	384	3437	# 0.11	0.18	635	0.60
Prot							
Perm							
Thru							
Right	R	106	1583	0.07	0.37	584	0.18
Northbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	T	914	1863	# 0.49	0.48	889	1.03
Right	R	156	1583	0.10	0.48	755	0.21
Southbound							
Prot		191	1770	# 0.11	0.108	191	1.00
Perm		38	219	0.17	0.523	115	0.33
Left	L	229			0.63	306	0.75
Prot							
Perm							
Thru	T	736	1863	0.40	0.63	1175	0.63
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.71
Total lost time per cycle, L = 19.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 1.00

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	LOS	Approach Delay	LOS
Eastbound												
Westbound												
L	0.60	0.18	24.3	1.000	635	0.19	1.6	0.0	26.0	C	23.4	C
R	0.18	0.37	13.9	1.000	584	0.11	0.2	0.0	14.0	B		
Northbound												
T	1.03	0.48	17.0	1.000	889	0.50	37.6	0.0	54.6	D	48.2	D
R	0.21	0.48	9.9	1.000	755	0.50	0.6	0.0	10.5	B		
Southbound												
L	0.75	0.63	13.6	1.000	306	0.30	9.8	0.0	23.4	C		

```
T    0.63  0.63  7.3   1.000 1175  0.21   1.1   0.0   8.4    A    12.0   B

_______________________________________________________________________________
         Intersection delay = 29.5  (sec/veh)   Intersection LOS = C


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                              for exclusive lefts
Input
                                                        EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach                         M
Cycle length, C                             65.0    sec
Total actual green time for LT lane group, G (s)                          41.0
Effective permitted green time for LT lane group, g(s)                    34.0
Opposing effective green time, go (s)                                     31.0
Number of lanes in LT lane group, N                                       1
Number of lanes in opposing approach, No                                  1
Adjusted LT flow rate, VLT (veh/h)                                        229
Proportion of LT in LT lane group, PLT                                    1.000
Proportion of LT in opposing flow, PLTo                                   0.00
Adjusted opposing flow rate, Vo (veh/h)                                   914
Lost time for LT lane group, tL                                           7.00
Computation
LT volume per cycle, LTC=VLTC/3600                                        4.13
Opposing lane util. factor, fLUo                                    1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)                       16.50
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                                     0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)                         1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                              0.52
gq, (see Exhibit C16-4,5,6,7,8)                                           30.00
gu=g-gq if gq>=gf, or = g-gf if gq<gf                                     4.00
n=Max(gq-gf)/2,0)                                                         15.00
PTHo=1-PLTo                                                               1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                                        1.00
EL1 (refer to Exhibit C16-3)                                              3.06
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                                        0.12
gdiff=max(gq-gf,0)                                                        0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)                       0.12
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                                 0.118

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                               for shared lefts
Input
                                                        EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                             65.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                              0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                                    1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET______________
Permitted Left Turns
                                                     EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	65.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v					229
v/c ratio from Capacity Worksheet, X					0.75
Protected phase effective green interval, g (s)					7.0
Opposing queue effective green interval, gq					30.00
Unopposed green interval, gu					4.00
Red time r=(C-g-gq-gu)					24.0
Arrival rate, qa=v/(3600(max[X,1.0]))					0.06
Protected ph. departure rate, Sp=s/3600					0.492
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)					0.52
XPerm					1.05
XProt					0.57
Case					3
Queue at beginning of green arrow, Qa					1.62
Queue at beginning of unsaturated green, Qu					1.91
Residual queue, Qr					0.09
Uniform Delay, d1					13.6

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 29.5 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup				L		R		T	R	L	T	
Init Queue				0.0		0.0		0.0	0.0	0.0	0.0	
Flow Rate				197		106		914	156	229	736	
So				1900		1900		1900	1900	1900	1900	
No.Lanes	0	0	0	2	0	1	0	1	1	1	1	0
SL				1770		1583		1863	1583	484	1863	
LnCapacity				326		584		889	755	306	1175	
Flow Ratio				0.11		0.07		0.49	0.10	0.47	0.40	
v/c Ratio				0.60		0.18		1.03	0.21	0.75	0.63	
Grn Ratio				0.18		0.37		0.48	0.48	0.63	0.63	
I Factor					1.000			1.000			1.000	
AT or PVG				3		3		3	3	3	3	
Pltn Ratio				1.00		1.00		1.00	1.00	1.00	1.00	
PF2				1.00		1.00		1.00	1.00	1.00	1.00	
Q1				3.3		1.3		16.5	1.6	1.7	8.1	
kB				0.3		0.4		0.8	0.7	0.3	0.6	
Q2				0.4		0.1		11.5	0.2	0.8	1.0	
Q Average				3.7		1.4		28.0	1.8	2.4	9.1	
Q Spacing				25.0		25.0		25.0	25.0	25.0	25.0	
Q Storage				0		0		0	0	0	0	
Q S Ratio												
70th Percentile Output:												
fB%				1.2		1.2		1.2	1.3	1.2	1.2	
BOQ				4.4		1.7		33.6	2.3	2.9	10.8	
QSRatio												
85th Percentile Output:												
fB%				1.6		1.6		1.4	1.6	1.6	1.5	
BOQ				5.8		2.2		39.2	2.9	3.8	13.9	
QSRatio												
90th Percentile Output:												
fB%				1.7		1.8		1.5	1.8	1.8	1.7	
BOQ				6.4		2.5		42.0	3.4	4.3	15.1	
QSRatio												
95th Percentile Output:												
fB%				2.0		2.1		1.6	2.3	2.0	1.9	
BOQ				7.3		2.8		44.9	4.2	4.9	17.0	
QSRatio												
98th Percentile Output:												
fB%				2.5		2.6		1.7	2.7	2.5	2.2	
BOQ				9.1		3.6		47.7	5.0	6.1	20.1	
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	*mm - 4AMbuild/imps*	Intersection	*Hardscrabble & Route 22*
Agency or Co.	*MMA*	Area Type	*All other areas*
Date Performed	*4/5/2005*	Jurisdiction	*North Salem, NY*
Time Period	*Peak AM Hour*	Analysis Year	*2010 Build w/Imps. Condition*

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		703	0	850	343		76		182			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 33.0	G = 31.0	G =	G =	G = 11.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		781		944	381		84		202			
Lane group cap.		642		673	1387		216		862			
v/c ratio		1.22		1.40	0.27		0.39		0.23			
Green ratio		0.34		0.74	0.74		0.12		0.54			
Unif. delay d1		29.5		24.9	3.7		36.4		10.7			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		111.2		190.1	0.5		5.2		0.6			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		140.7		215.0	4.2		41.6		11.3			
Lane group LOS		F		F	A		D		B			
Apprch. delay	140.7			154.4			20.2					
Approach LOS	F			F			C					
Intersec. delay	133.9			Intersection LOS						F		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4AMbuild/imps
Agency: MMA
Date: 4/5/2005
Period: Peak AM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build w/Imps. Condition
N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		703	0	850	343		76		182			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left	P			
Thru		P				Thru				
Right		P				Right	P			
Peds						Peds				
WB Left	P	P			SB	Left				
Thru	P	P				Thru				
Right						Right				
Peds						Peds				
NB Right	P				EB	Right				
SB Right					WB	Right				
Green	33.0	31.0					11.0			
Yellow	3.0	4.0					3.0			
All Red		3.0					2.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	642	1863	1.22	0.34	140.7	F	140.7	F
Westbound								
L	673	1770	1.40	0.74	215.0	F		
T	1387	1863	0.27	0.74	4.2	A	154.4	F
Northbound								
L	216	1770	0.39	0.12	41.6	D	20.2	C
R	862	1583	0.23	0.54	11.3	B		
Southbound								

Intersection Delay = 133.9 (sec/veh) Intersection LOS = F

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst: mm - 4AMbuild/imps
Agency/Co.: MMA
Date Performed: 4/5/2005
Analysis Time Period: Peak AM Hour
Intersection: Hardscrabble & Route 22
Area Type: All other areas
Jurisdiction: North Salem, NY
Analysis Year: 2010 Build w/Imps. Condition
Project ID: Woodlands

East/West Street: Hardscrabble Road
North/South Street: Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		703	0	850	343		76		182			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		195	0	236	95		21		51			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		781		944	381		84		202			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.000			0.000				1.000			
Peds Bikes	0						0			0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

```
Ped Min g  |      3.2         |                   |      3.2         |      3.2         |

___________________________________PHASE DATA______________________________________

Phase Combination 1      2      3      4 |            5      6      7      8

EB   Left                                 | NB   Left    P
     Thru               P                 |      Thru
     Right              P                 |      Right   P
     Peds                                 |      Peds

WB   Left          P    P                 | SB   Left
     Thru          P    P                 |      Thru
     Right                                |      Right
     Peds                                 |      Peds

NB   Right         P                      | EB   Right
                                          |
SB   Right                                | WB   Right
                                          |
                                          |
Green             33.0  31.0                         11.0
Yellow            3.0   4.0                          3.0
All Red                 3.0                          2.0

                                                 Cycle Length: 90.0    secs

_________________VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET_________________
Volume Adjustment
           |  Eastbound      |  Westbound      |  Northbound     |  Southbound     |
           | L     T     R   | L     T     R   | L     T     R   | L     T     R   |
           |_________________|_________________|_________________|_________________|
Volume, V  |      703   0    |850   343        |76          182  |                 |
PHF        |      0.90 0.90  |0.90  0.90       |0.90        0.90 |                 |
Adj flow   |      781   0    |944   381        |84          202  |                 |
No. Lanes  |   0    1    0   |   1    1    0   |   1    0    1   |   0    0    0   |
Lane group |       TR        | L      T        | L           R   |                 |
Adj flow   |      781        |944   381        |84          202  |                 |
Prop LTs   |       0.000     |1.000 0.000      |                 |                 |
Prop RTs   |   0.000         |    0.000        |           1.000 |                 |

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)____
            Eastbound          Westbound          Northbound         Southbound
LG              TR           L      T            L           R
So          1900         1900   1900        1900        1900
Lanes 0     1     0      1      1     0     1     0     1     0     0     0
fW          1.000        1.000  1.000       1.000       1.000
fHV         0.980        0.980  0.980       0.980       0.980
fG          1.000        1.000  1.000       1.000       1.000
fP          1.000        1.000  1.000       1.000       1.000
fBB         1.000        1.000  1.000       1.000       1.000
fA          1.000        1.000  1.000       1.000       1.000
fLU         1.000        1.000  1.000       1.000       1.000
fRT         1.000               1.000                   0.850
fLT         1.000        0.950  1.000       0.950
Sec.                     0.108
fLpb        1.000        1.000  1.000       1.000
fRpb        1.000               1.000                   1.000
S           1863         1770   1863        1770        1583
Sec.                     201
_______________________________CAPACITY AND LOS WORKSHEET____________________________
```

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	781	1863	0.42	0.34	642	1.22
Right							
Westbound							
Prot		590	1770	# 0.33	0.333	590	1.00
Perm		354	201	# 1.76	0.411	83	4.27
Left	L	944			0.74	673	1.40
Prot							
Perm							
Thru	T	381	1863	0.20	0.74	1387	0.27
Right							
Northbound							
Prot							
Perm							
Left	L	84	1770	# 0.05	0.12	216	0.39
Prot							
Perm							
Thru							
Right	R	202	1583	0.13	0.54	862	0.23
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 2.14
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 2.47

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
TR	1.22	0.34	29.5	1.000	642	0.50	111.2	0.0	140.7	F	140.7	F
Westbound												
L	1.40	0.74	24.9	1.000	673	0.50	190.1	0.0	215.0	F		
T	0.27	0.74	3.7	1.000	1387	0.50	0.5	0.0	4.2	A	154.4	F
Northbound												
L	0.39	0.12	36.4	1.000	216	0.50	5.2	0.0	41.6	D	20.2	C
R	0.23	0.54	10.7	1.000	862	0.50	0.6	0.0	11.3	B		
Southbound												

```
        Intersection delay = 133.9 (sec/veh)   Intersection LOS = F


______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                           for exclusive lefts
Input
                                                        EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach           S
Cycle length, C                              90.0    sec
Total actual green time for LT lane group, G (s)            67.0
Effective permitted green time for LT lane group, g(s)      37.0
Opposing effective green time, go (s)                       31.0
Number of lanes in LT lane group, N                         1
Number of lanes in opposing approach, No                    1
Adjusted LT flow rate, VLT (veh/h)                          944
Proportion of LT in LT lane group, PLT                      1.000
Proportion of LT in opposing flow, PLTo                     0.00
Adjusted opposing flow rate, Vo (veh/h)                     781
Lost time for LT lane group, tL                             7.00
Computation
LT volume per cycle, LTC=VLTC/3600                          23.60
Opposing lane util. factor, fLUo                      1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)         19.52
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                       0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)           1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                0.66
gq, (see Exhibit C16-4,5,6,7,8)                             30.40
gu=g-gq if gq>=gf, or = g-gf if gq<gf                       6.60
n=Max(gq-gf)/2,0)                                           15.20
PTHo=1-PLTo                                                 1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                          1.00
EL1 (refer to Exhibit C16-3)                                2.70
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                          0.11
gdiff=max(gq-gf,0)                                          0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)         0.11
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                   0.108

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

______________________SUPPLEMENTAL PERMITTED LT WORKSHEET______________________
                            for shared lefts
Input
                                                        EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                              90.0    sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                   0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                         1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                         EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg
OCCbicg
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion right-turns, PRT
Proportion right-turns using protected phase, PRTA
Right turn adjustment, fRpb

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

			EBLT	WBLT	NBLT	SBLT
Cycle length, C	90.0	sec				
Adj. LT vol from Vol Adjustment Worksheet, v				944		
v/c ratio from Capacity Worksheet, X				1.40		
Protected phase effective green interval, g (s)				30.0		
Opposing queue effective green interval, gq				30.40		
Unopposed green interval, gu				6.60		
Red time r=(C-g-gq-gu)				23.0		
Arrival rate, qa=v/(3600(max[X,1.0]))				0.19		
Protected ph. departure rate, Sp=s/3600				0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)				0.31		
XPerm				3.35		
XProt				0.67		
Case				3		
Queue at beginning of green arrow, Qa				9.15		
Queue at beginning of unsaturated green, Qu				5.68		
Residual queue, Qr				4.85		
Uniform Delay, d1				24.9		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 133.9 sec/veh Intersection LOS F

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		781		944	381		84		202			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1863		904	1863		1770		1583			
LnCapacity		642		673	1387		216		862			
Flow Ratio		0.42		1.04	0.20		0.05		0.13			
v/c Ratio		1.22		1.40	0.27		0.39		0.23			
Grn Ratio		0.34		0.74	0.74		0.12		0.54			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		19.5		9.0	3.1		1.9		2.6			
kB		0.8		0.9	1.4		0.4		1.0			
Q2		21.2		36.7	0.5		0.2		0.3			
Q Average		40.8		45.7	3.6		2.2		3.0			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.2	1.2		1.3		1.3			
BOQ		48.9		54.8	4.5		2.8		3.7			
QSRatio												
85th Percentile Output:												
fB%		1.4		1.4	1.5		1.6		1.6			
BOQ		57.1		64.0	5.6		3.5		4.6			
QSRatio												
90th Percentile Output:												
fB%		1.5		1.5	1.7		1.8		1.8			
BOQ		61.1		68.6	6.3		4.0		5.2			
QSRatio												
95th Percentile Output:												
fB%		1.6		1.6	2.1		2.2		2.2			
BOQ		65.2		73.1	7.5		4.9		6.4			
QSRatio												
98th Percentile Output:												
fB%		1.7		1.7	2.4		2.7		2.5			
BOQ		69.3		77.7	8.8		5.8		7.5			
QSRatio												

ERROR MESSAGES

No errors to report.

SHORT REPORT

General Information		Site Information	
Analyst	mm - 4PMbuild/imps	Intersection	Hardscrabble & Route 22
Agency or Co.	MMA	Area Type	All other areas
Date Performed	4/5/2005	Jurisdiction	North Salem, NY
Time Period	Peak PM Hour	Analysis Year	2010 Build w/Imps. Condition

Volume and Timing Input

	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Num. of Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Volume (vph)		389	1	193	821		302		570			
% Heavy veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Actuated (P/A)		P	P	P	P		P		P			
Startup lost time		2.0		2.0	2.0		2.0		2.0			
Ext. eff. green		2.0		2.0	2.0		2.0		2.0			
Arrival type		3		3	3		3		3			
Unit Extension		3.0		3.0	3.0		3.0		3.0			
Ped/Bike/RTOR Volume	0		0				0		0	0		
Lane Width		12.0		12.0	12.0		12.0		12.0			
Parking/Grade/Parking	N	0	N	N	0	N	N	0	N	N		N
Parking/hr												
Bus stops/hr		0		0	0		0		0			
Unit Extension		3.0		3.0	3.0		3.0		3.0			

Phasing	WB Only	EW Perm	03	04	NB Only	06	07	08
Timing	G = 15.0	G = 35.0	G =	G =	G = 25.0	G =	G =	G =
	Y =	Y = 7	Y =	Y =	Y = 5	Y =	Y =	Y =
Duration of Analysis (hrs) = 0.25						Cycle Length C = 90.0		

Lane Group Capacity, Control Delay, and LOS Determination

	EB			WB			NB			SB		
Adj. flow rate		433		214	912		336		633			
Lane group cap.		724		479	1097		492		792			
v/c ratio		0.60		0.45	0.83		0.68		0.80			
Green ratio		0.39		0.59	0.59		0.28		0.50			
Unif. delay d1		21.9		11.0	14.9		29.0		18.7			
Delay factor k		0.50		0.50	0.50		0.50		0.50			
Increm. delay d2		3.6		3.0	7.4		7.5		8.3			
PF factor		1.000		1.000	1.000		1.000		1.000			
Control delay		25.5		14.0	22.3		36.5		27.0			
Lane group LOS		C		B	C		D		C			
Apprch. delay	25.5			20.7			30.3					
Approach LOS	C			C			C					
Intersec. delay	25.2			Intersection LOS						C		

HCS2000: Signalized Intersections Release 4.1e

Analyst: mm - 4PMbuild/imps
Agency: MMA
Date: 4/5/2005
Period: Peak PM Hour
Project ID: Woodlands
E/W St: Hardscrabble Road

Inter.: Hardscrabble & Route 22
Area Type: All other areas
Jurisd: North Salem, NY
Year : 2010 Build w/Imps. Condition

N/S St: Route 22

SIGNALIZED INTERSECTION SUMMARY

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Volume		389	1	193	821		302		570			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			

Duration 0.25 Area Type: All other areas

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left	P			
Thru		P			Thru				
Right		P			Right	P			
Peds					Peds				
WB Left	P	P			SB Left				
Thru	P	P			Thru				
Right					Right				
Peds					Peds				
NB Right	P				EB Right				
SB Right					WB Right				
Green	15.0	35.0				25.0			
Yellow	3.0	4.0				3.0			
All Red		3.0				2.0			

Cycle Length: 90.0 secs

Intersection Performance Summary

Appr/ Lane Grp	Lane Group Capacity	Adj Sat Flow Rate (s)	Ratios v/c	Ratios g/C	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound								
TR	724	1862	0.60	0.39	25.5	C	25.5	C
Westbound								
L	479	1770	0.45	0.59	14.0	B		
T	1097	1863	0.83	0.59	22.3	C	20.7	C
Northbound								
L	492	1770	0.68	0.28	36.5	D	30.3	C
R	792	1583	0.80	0.50	27.0	C		
Southbound								

Intersection Delay = 25.2 (sec/veh) Intersection LOS = C

HCS2000: Signalized Intersections Release 4.1e

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OPERATIONAL ANALYSIS

Analyst:	mm - 4PMbuild/imps
Agency/Co.:	MMA
Date Performed:	4/5/2005
Analysis Time Period:	Peak PM Hour
Intersection:	Hardscrabble & Route 22
Area Type:	All other areas
Jurisdiction:	North Salem, NY
Analysis Year:	2010 Build w/Imps. Condition
Project ID:	Woodlands

East/West Street: Hardscrabble Road
North/South Street: Route 22

VOLUME DATA

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume		389	1	193	821		302		570			
% Heavy Veh		2	2	2	2		2		2			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
PK 15 Vol		108	1	54	228		84		158			
Hi Ln Vol												
% Grade		0			0			0				
Ideal Sat		1900		1900	1900		1900		1900			
ParkExist												
NumPark												
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
LGConfig		TR		L	T		L		R			
Lane Width		12.0		12.0	12.0		12.0		12.0			
RTOR Vol			0						0			
Adj Flow		433		214	912		336		633			
%InSharedLn												
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			
Peds Bikes	0						0			0		
Buses		0		0	0		0		0			
%InProtPhase				0.0								

Duration 0.25 Area Type: All other areas

OPERATING PARAMETERS

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Init Unmet		0.0		0.0	0.0		0.0		0.0			
Arriv. Type		3		3	3		3		3			
Unit Ext.		3.0		3.0	3.0		3.0		3.0			
I Factor		1.000			1.000			1.000				
Lost Time		2.0		2.0	2.0		2.0		2.0			
Ext of g		2.0		2.0	2.0		2.0		2.0			

	Eastbound	Westbound	Northbound	Southbound
Ped Min g	3.2		3.2	3.2

PHASE DATA

Phase Combination		1	2	3	4			5	6	7	8
EB	Left					NB	Left	P			
	Thru		P				Thru				
	Right		P				Right	P			
	Peds						Peds				
WB	Left	P	P			SB	Left				
	Thru	P	P				Thru				
	Right						Right				
	Peds						Peds				
NB	Right	P				EB	Right				
SB	Right					WB	Right				
Green		15.0	35.0					25.0			
Yellow		3.0	4.0					3.0			
All Red			3.0					2.0			

Cycle Length: 90.0 secs

VOLUME ADJUSTMENT AND SATURATION FLOW WORKSHEET

Volume Adjustment

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume, V		389	1	193	821		302		570			
PHF		0.90	0.90	0.90	0.90		0.90		0.90			
Adj flow		432	1	214	912		336		633			
No. Lanes	0	1	0	1	1	0	1	0	1	0	0	0
Lane group		TR		L	T		L		R			
Adj flow		433		214	912		336		633			
Prop LTs		0.000		1.000	0.000							
Prop RTs		0.002			0.000				1.000			

Saturation Flow Rate (see Exhibit 16-7 to determine the adjustment factors)

	Eastbound			Westbound			Northbound			Southbound		
LG		TR		L	T		L		R			
So		1900		1900	1900		1900		1900			
Lanes	0	1	0	1	1	0	1	0	1	0	0	0
fW		1.000		1.000	1.000		1.000		1.000			
fHV		0.980		0.980	0.980		0.980		0.980			
fG		1.000		1.000	1.000		1.000		1.000			
fP		1.000		1.000	1.000		1.000		1.000			
fBB		1.000		1.000	1.000		1.000		1.000			
fA		1.000		1.000	1.000		1.000		1.000			
fLU		1.000		1.000	1.000		1.000		1.000			
fRT		1.000			1.000				0.850			
fLT		1.000		0.950	1.000		0.950					
Sec.				0.287								
fLpb		1.000		1.000	1.000		1.000					
fRpb		1.000			1.000				1.000			
S		1862		1770	1863		1770		1583			
Sec.				534								

CAPACITY AND LOS WORKSHEET

Capacity Analysis and Lane Group Capacity

Appr/ Mvmt	Lane Group	Adj Flow Rate (v)	Adj Sat Flow Rate (s)	Flow Ratio (v/s)	Green Ratio (g/C)	--Lane Group-- Capacity (c)	v/c Ratio
Eastbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru	TR	433	1862	0.23	0.39	724	0.60
Right							
Westbound							
Prot		214	1770	0.12	0.133	236	0.91
Perm		0	534	0.00	0.456	243	0.00
Left	L	214			0.59	479	0.45
Prot							
Perm							
Thru	T	912	1863	# 0.49	0.59	1097	0.83
Right							
Northbound							
Prot							
Perm							
Left	L	336	1770	# 0.19	0.28	492	0.68
Prot							
Perm							
Thru							
Right	R	633	1583	0.40	0.50	792	0.80
Southbound							
Prot							
Perm							
Left							
Prot							
Perm							
Thru							
Right							

Sum of flow ratios for critical lane groups, Yc = Sum (v/s) = 0.68
Total lost time per cycle, L = 12.00 sec
Critical flow rate to capacity ratio, Xc = (Yc)(C)/(C-L) = 0.78

Control Delay and LOS Determination

Appr/ Lane Grp	Ratios v/c	Ratios g/C	Unf Del d1	Prog Adj Fact	Lane Grp Cap	Incremental Factor k	Del d2	Res Del d3	Lane Group Delay	Lane Group LOS	Approach Delay	Approach LOS
Eastbound												
TR	0.60	0.39	21.9	1.000	724	0.50	3.6	0.0	25.5	C	25.5	C
Westbound												
L	0.45	0.59	11.0	1.000	479	0.50	3.0	0.0	14.0	B		
T	0.83	0.59	14.9	1.000	1097	0.50	7.4	0.0	22.3	C	20.7	C
Northbound												
L	0.68	0.28	29.0	1.000	492	0.50	7.5	0.0	36.5	D	30.3	C
R	0.80	0.50	18.7	1.000	792	0.50	8.3	0.0	27.0	C		
Southbound												

```
        Intersection delay = 25.2  (sec/veh)   Intersection LOS = C


_____________________SUPPLEMENTAL PERMITTED LT WORKSHEET____________________
                            for exclusive lefts
Input
                                                       EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach            S
Cycle length, C                                  90.0   sec
Total actual green time for LT lane group, G (s)             53.0
Effective permitted green time for LT lane group, g(s)       41.0
Opposing effective green time, go (s)                        35.0
Number of lanes in LT lane group, N                          1
Number of lanes in opposing approach, No                     1
Adjusted LT flow rate, VLT (veh/h)                           214
Proportion of LT in LT lane group, PLT                       1.000
Proportion of LT in opposing flow, PLTo                      0.00
Adjusted opposing flow rate, Vo (veh/h)                      433
Lost time for LT lane group, tL                              7.00
Computation
LT volume per cycle, LTC=VLTC/3600                           5.35
Opposing lane util. factor, fLUo                       1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)          10.82
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g                        0.0
Opposing platoon ratio, Rpo (refer Exhibit 16-11)            1.00
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]                 0.61
gq, (see Exhibit C16-4,5,6,7,8)                              18.00
gu=g-gq if gq>=gf, or = g-gf if gq<gf                        23.00
n=Max(gq-gf)/2,0)                                            9.00
PTHo=1-PLTo                                                  1.00
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]                           1.00
EL1 (refer to Exhibit C16-3)                                 1.96
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g                           0.10
gdiff=max(gq-gf,0)                                           0.00
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)          0.29
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT                                    0.287

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_____________________SUPPLEMENTAL PERMITTED LT WORKSHEET____________________
                              for shared lefts
Input
                                                       EB    WB    NB    SB
Opposed by Single(S) or Multiple(M) lane approach
Cycle length, C                                  90.0   sec
Total actual green time for LT lane group, G (s)
Effective permitted green time for LT lane group, g(s)
Opposing effective green time, go (s)
```

```
Number of lanes in LT lane group, N
Number of lanes in opposing approach, No
Adjusted LT flow rate, VLT (veh/h)
Proportion of LT in LT lane group, PLT                    0.000 0.000
Proportion of LT in opposing flow, PLTo
Adjusted opposing flow rate, Vo (veh/h)
Lost time for LT lane group, tL
Computation
LT volume per cycle, LTC=VLTC/3600
Opposing lane util. factor, fLUo                          1.000 1.000
Opposing flow, Volc=VoC/[3600(No)fLUo] (veh/ln/cyc)
gf=G[exp(- a * (LTC ** b))]-tl, gf<=g
Opposing platoon ratio, Rpo (refer Exhibit 16-11)
Opposing Queue Ratio, qro=Max[1-Rpo(go/C),0]
gq, (see Exhibit C16-4,5,6,7,8)
gu=g-gq if gq>=gf, or = g-gf if gq<gf
n=Max(gq-gf)/2,0)
PTHo=1-PLTo
PL*=PLT[1+(N-1)g/(gf+gu/EL1+4.24)]
EL1 (refer to Exhibit C16-3)
EL2=Max((1-Ptho**n)/Plto, 1.0)
fmin=2(1+PL)/g  or  fmin=2(1+Pl)/g
gdiff=max(gq-gf,0)
fm=[gf/g]+[gu/g]/[1+PL(EL1-1)], (min=fmin;max=1.00)
flt=fm=[gf/g]+[gu/g]/[1+PL(EL1-1)]+[gdiff/g]/[1+PL(EL2-1)],(fmin<=fm<=1.00)
or flt=[fm+0.91(N-1)]/N**
Left-turn adjustment, fLT

For special case of single-lane approach opposed by multilane approach,
see text.
* If Pl>=1 for shared left-turn lanes with N>1, then assume de-facto
  left-turn lane and redo calculations.
** For permitted left-turns with multiple exclusive left-turn lanes, flt=fm.
For special case of multilane approach opposed by single-lane approach
or when gf>gq, see text.

_______________SUPPLEMENTAL PEDESTRIAN-BICYCLE EFFECTS WORKSHEET_______________
Permitted Left Turns
                                                         EB    WB    NB    SB
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Pedestrian flow rate, Vpedg (p/h)
OCCpedg
Opposing queue clearing green, gq (s)
Eff. ped. green consumed by opp. veh. queue, gq/gp
OCCpedu
Opposing flow rate, Vo (veh/h)
OCCr
Number of cross-street receiving lanes, Nrec
Number of turning lanes, Nturn
ApbT
Proportion of left turns, PLT
Proportion of left turns using protected phase, PLTA
Left-turn adjustment, fLpb
Permitted Right Turns
Effective pedestrian green time, gp (s)
Conflicting pedestrian volume, Vped (p/h)
Conflicting bicycle volume, Vbic (bicycles/h)
Vpedg
OCCpedg
Effective green, g (s)
```

Vbicg	
OCCbicg	
OCCr	
Number of cross-street receiving lanes, Nrec	
Number of turning lanes, Nturn	
ApbT	
Proportion right-turns, PRT	
Proportion right-turns using protected phase, PRTA	
Right turn adjustment, fRpb	

SUPPLEMENTAL UNIFORM DELAY WORKSHEET

		EBLT	WBLT	NBLT	SBLT
Cycle length, C	90.0 sec				
Adj. LT vol from Vol Adjustment Worksheet, v			214		
v/c ratio from Capacity Worksheet, X			0.45		
Protected phase effective green interval, g (s)			12.0		
Opposing queue effective green interval, gq			18.00		
Unopposed green interval, gu			23.00		
Red time r=(C-g-gq-gu)			37.0		
Arrival rate, qa=v/(3600(max[X,1.0]))			0.06		
Protected ph. departure rate, Sp=s/3600			0.492		
Permitted ph. departure rate, Ss=s(gq+gu)/(gu*3600)			0.26		
XPerm			0.40		
XProt			0.49		
Case			1		
Queue at beginning of green arrow, Qa			2.20		
Queue at beginning of unsaturated green, Qu			1.07		
Residual queue, Qr			0.00		
Uniform Delay, d1			11.0		

DELAY/LOS WORKSHEET WITH INITIAL QUEUE

Appr/ Lane Group	Initial Unmet Demand Q veh	Dur. Unmet Demand t hrs.	Uniform Delay Unadj. ds	Uniform Delay Adj. d1 sec	Initial Queue Param. u	Final Unmet Demand Q veh	Initial Queue Delay d3 sec	Lane Group Delay d sec
Eastbound								
Westbound								
Northbound								
Southbound								

Intersection Delay 25.2 sec/veh Intersection LOS C

BACK OF QUEUE WORKSHEET

	Eastbound			Westbound			Northbound			Southbound		
LaneGroup		TR		L	T		L		R			
Init Queue		0.0		0.0	0.0		0.0		0.0			
Flow Rate		433		214	912		336		633			
So		1900		1900	1900		1900		1900			
No.Lanes	0	1	0	1	1	0	1	0	1	0	0	0
SL		1862		814	1863		1770		1583			
LnCapacity		724		479	1097		492		792			
Flow Ratio		0.23		0.26	0.49		0.19		0.40			
v/c Ratio		0.60		0.45	0.83		0.68		0.80			
Grn Ratio		0.39		0.59	0.59		0.28		0.50			
I Factor		1.000			1.000			1.000				
AT or PVG		3		3	3		3		3			
Pltn Ratio		1.00		1.00	1.00		1.00		1.00			
PF2		1.00		1.00	1.00		1.00		1.00			
Q1		8.6		2.3	18.4		7.5		13.2			
kB		0.9		0.7	1.2		0.7		1.0			
Q2		1.3		0.5	4.9		1.4		3.3			
Q Average		9.9		2.9	23.3		8.9		16.5			
Q Spacing		25.0		25.0	25.0		25.0		25.0			
Q Storage		0		0	0		0		0			
Q S Ratio												
70th Percentile Output:												
fB%		1.2		1.3	1.2		1.2		1.2			
BOQ		12.1		3.6	28.0		10.8		19.8			
QSRatio												
85th Percentile Output:												
fB%		1.4		1.6	1.4		1.5		1.4			
BOQ		14.3		4.5	32.7		12.9		23.3			
QSRatio												
90th Percentile Output:												
fB%		1.6		1.8	1.5		1.6		1.5			
BOQ		15.6		5.1	35.1		14.1		25.0			
QSRatio												
95th Percentile Output:												
fB%		1.7		2.2	1.6		1.8		1.6			
BOQ		17.2		6.2	37.5		15.7		27.0			
QSRatio												
98th Percentile Output:												
fB%		1.9		2.5	1.7		2.0		1.8			
BOQ		18.9		7.3	40.0		17.4		28.9			
QSRatio												

ERROR MESSAGES

No errors to report.