

Attachment B

LOS Definitions

The following is an excerpt from the 2000 Highway Capacity Manual (HCM).

Level of Service for Signalized Intersections

Level of service for a signalized intersection is defined in terms of control delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions: in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group. Levels of service are defined to represent reasonable ranges in control delay.

LOS A describes operations with low control delay, up to 10 s/veh. This LOS occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay.

LOS B describes operations with control delay greater than 10 and up to 20 s/veh. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

LOS C describes operations with control delay greater than 20 and up to 35 s/veh. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles, and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

LOS D describes operations with control delay greater than 35 and up to 55 s/veh. At LOS D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, and high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

LOS E describes operations with control delay greater than 55 and up to 80 s/veh. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

LOS F describes operations with control delay in excess of 80 s/veh. This level, considered unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity of lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	KLB	Intersection	NY Route 28/Peaceful Valley Rd
Agency/Co.	CME, 28PEACexfri	Jurisdiction	Town of Johnsbury
Date Performed	3/9/2007	Analysis Year	2007 Existing
Analysis Time Period	Friday PM Peak Hour		

Project Description 05-116d, Ski Bowl Village

East/West Street: Peaceful Valley Road

North/South Street: NY Route 28

Intersection Orientation: North-South

Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	33	119			127	52
Peak-Hour Factor, PHF	0.83	0.83	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	39	143	0	0	133	54
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	112		140			
Peak-Hour Factor, PHF	0.74	1.00	0.74	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	151	0	189	0	0	0
Percent Heavy Vehicles	3	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	39						340	
C (m) (veh/h)	1399						734	
v/c	0.03						0.46	
95% queue length	0.09						2.47	
Control Delay (s/veh)	7.6						14.1	
LOS	A						B	
Approach Delay (s/veh)	--	--					14.1	
Approach LOS	--	--					B	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	KLB	Intersection	NY Route 28/Peaceful Valley Rd
Agency/Co.	CME, 28PEACexsun	Jurisdiction	Town of Johnsbury
Date Performed	3/9/2007	Analysis Year	2007 Existing
Analysis Time Period	Sunday Peak Hour		

Project Description 05-116d, Ski Bowl Village	
East/West Street: Peaceful Valley Road	North/South Street: NY Route 28
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments						
Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	37	62			137	42
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.68	0.68
Hourly Flow Rate, HFR (veh/h)	46	77	0	0	201	61
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	139		459			
Peak-Hour Factor, PHF	0.90	1.00	0.90	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	154	0	510	0	0	0
Percent Heavy Vehicles	4	0	1	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	46						664	
C (m) (veh/h)	1296						742	
v/c	0.04						0.89	
95% queue length	0.11						11.64	
Control Delay (s/veh)	7.9						36.3	
LOS	A						E	
Approach Delay (s/veh)	--	--					36.3	
Approach LOS	--	--					E	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	KLB	Intersection	NY Route 28/Peaceful Valley Rd
Agency/Co.	CME, 28PEACnbfri	Jurisdiction	Town of Johnsborg
Date Performed	3/9/2007	Analysis Year	2011 No-Build
Analysis Time Period	Friday PM Peak Hour		
Project Description 05-116d, Ski Bowl Village			
East/West Street: Peaceful Valley Road		North/South Street: NY Route 28	
Intersection Orientation: North-South		Study Period (hrs): 0.25	

Vehicle Volumes and Adjustments						
Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	34	121			130	53
Peak-Hour Factor, PHF	0.83	0.83	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	40	145	0	0	136	55
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	
Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	114		143			
Peak-Hour Factor, PHF	0.74	1.00	0.74	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	154	0	193	0	0	0
Percent Heavy Vehicles	3	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	40						347	
C (m) (veh/h)	1395						728	
v/c	0.03						0.48	
95% queue length	0.09						2.59	
Control Delay (s/veh)	7.7						14.4	
LOS	A						B	
Approach Delay (s/veh)	--	--					14.4	
Approach LOS	--	--					B	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	<i>KLB</i>	Intersection	<i>NY Route 28/Peaceful Valley Rd</i>
Agency/Co.	<i>CME, 28PEACnbsun</i>	Jurisdiction	<i>Town of Johnsborg</i>
Date Performed	<i>3/9/2007</i>	Analysis Year	<i>2011 No-Build</i>
Analysis Time Period	<i>Sunday Peak Hour</i>		
Project Description <i>05-116d, Ski Bowl Village</i>			
East/West Street: <i>Peaceful Valley Road</i>		North/South Street: <i>NY Route 28</i>	
Intersection Orientation: <i>North-South</i>		Study Period (hrs): <i>0.25</i>	

Vehicle Volumes and Adjustments						
Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	38	63			140	43
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.68	0.68
Hourly Flow Rate, HFR (veh/h)	47	78	0	0	205	63
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	<i>Undivided</i>					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	<i>LT</i>					<i>TR</i>
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	142		468			
Peak-Hour Factor, PHF	0.90	1.00	0.90	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	157	0	520	0	0	0
Percent Heavy Vehicles	4	0	1	0	0	0
Percent Grade (%)		0			0	
Flared Approach		<i>N</i>			<i>N</i>	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		<i>LR</i>				

Delay, Queue Length, and Level of Service								
Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	<i>LT</i>						<i>LR</i>	
v (veh/h)	47						677	
C (m) (veh/h)	1290						736	
v/c	0.04						0.92	
95% queue length	0.11						12.67	
Control Delay (s/veh)	7.9						40.3	
LOS	<i>A</i>						<i>E</i>	
Approach Delay (s/veh)	--	--					40.3	
Approach LOS	--	--					<i>E</i>	

TWO-WAY STOP CONTROL SUMMARY

General Information	Site Information
Analyst: <i>KLB</i>	Intersection: <i>NY Route 28/Peaceful Valley Rd</i>
Agency/Co.: <i>CME, 28PEACbufri</i>	Jurisdiction: <i>Town of Johnsborg</i>
Date Performed: <i>3/8/2007</i>	Analysis Year: <i>2011 Build</i>
Analysis Time Period: <i>Friday PM Peak Hour</i>	

Project Description: <i>05-116d, Ski Bowl Village</i>	
East/West Street: <i>Peaceful Valley Road</i>	North/South Street: <i>NY Route 28</i>
Intersection Orientation: <i>North-South</i>	Study Period (hrs): <i>0.25</i>

Vehicle Volumes and Adjustments

Major Street Movement	Northbound			Southbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume (veh/h)	34	186			237	96
Peak-Hour Factor, PHF	0.83	0.83	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	40	224	0	0	249	101
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	<i>Undivided</i>					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street Movement	Eastbound			Westbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume (veh/h)	139		143			
Peak-Hour Factor, PHF	0.74	1.00	0.74	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	187	0	193	0	0	0
Percent Heavy Vehicles	3	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
	1	4	7	8	9	10	11	12
Movement								
Lane Configuration	LT						LR	
v (veh/h)	40						380	
C (m) (veh/h)	1220						559	
v/c	0.03						0.68	
95% queue length	0.10						5.17	
Control Delay (s/veh)	8.1						24.0	
LOS	A						C	
Approach Delay (s/veh)	--	--					24.0	
Approach LOS	--	--					C	

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	KLB	Intersection	NY Route 28/Peaceful Valley Rd
Agency/Co.	CME, 28PEACbusun	Jurisdiction	Town of Johnsbury
Date Performed	3/8/2007	Analysis Year	2011 Build
Analysis Time Period	Sunday Peak Hour		

Project Description 05-116d, Ski Bowl Village	
East/West Street: Peaceful Valley Road	North/South Street: NY Route 28
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	38	138			244	85
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	47	172	0	0	325	113
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	172		468			
Peak-Hour Factor, PHF	0.90	1.00	0.90	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	191	0	520	0	0	0
Percent Heavy Vehicles	4	0	1	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	0	0
Configuration		LR				

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT						LR	
v (veh/h)	47						711	
C (m) (veh/h)	1117						573	
v/c	0.04						1.24	
95% queue length	0.13						27.09	
Control Delay (s/veh)	8.4						145.7	
LOS	A						F	
Approach Delay (s/veh)	--	--					145.7	
Approach LOS	--	--					F	

TWO-WAY STOP CONTROL SUMMARY

General Information	Site Information
Analyst	Intersection NY Route 28/Peaceful Valley Rd
Agency/Co. CME, 28PEACbufrii	Jurisdiction Town of Johnsburg
Date Performed 3/8/2007	Analysis Year 2011 Build w/ Improvements
Analysis Time Period Friday PM Peak Hour	

Project Description 05-116d, Ski Bowl Village	
East/West Street: Peaceful Valley Road	North/South Street: NY Route 28
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	34	186			237	96
Peak-Hour Factor, PHF	0.83	0.83	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	40	224	0	0	249	101
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	139		143			
Peak-Hour Factor, PHF	0.74	1.00	0.74	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	187	0	193	0	0	0
Percent Heavy Vehicles	3	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (veh/h)	40					187		193
C (m) (veh/h)	1220					445		744
v/c	0.03					0.42		0.26
95% queue length	0.10					2.04		1.04
Control Delay (s/veh)	8.1					18.8		11.5
LOS	A					C		B
Approach Delay (s/veh)	--	--				15.1		
Approach LOS	--	--				C		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	KLB	Intersection	NY Route 28/Peaceful Valley Rd
Agency/Co.	CME, 28PEACbusuni	Jurisdiction	Town of Johnsburg
Date Performed	3/9/2007	Analysis Year	2011 Build w/ Improvements
Analysis Time Period	Sunday Peak Hour		

Project Description 05-116d, Ski Bowl Village	
East/West Street: Peaceful Valley Road	North/South Street: NY Route 28
Intersection Orientation: North-South	Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	38	138			244	85
Peak-Hour Factor, PHF	0.80	0.80	1.00	1.00	0.75	0.75
Hourly Flow Rate, HFR (veh/h)	47	172	0	0	325	113
Percent Heavy Vehicles	3	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	172		468			
Peak-Hour Factor, PHF	0.90	1.00	0.90	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	191	0	520	0	0	0
Percent Heavy Vehicles	4	0	1	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	1	0	1	0	0	0
Configuration	L		R			

Delay, Queue Length, and Level of Service

Approach	Northbound	Southbound	Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	LT					L		R
v (veh/h)	47					191		520
C (m) (veh/h)	1117					414		667
v/c	0.04					0.46		0.78
95% queue length	0.13					2.37		7.53
Control Delay (s/veh)	8.4					20.9		26.8
LOS	A					C		D
Approach Delay (s/veh)	--	--				25.2		
Approach LOS	--	--				D		