

## **APPENDIX O**

### **2017 Build Kendrick Intersection Analysis**

Route 128 Add-A-Lane  
2: Kendrick St & Hunting Rd

AM 2017 Build  
8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔		↖	↗			↖	↗	↖	↗	
Volume (vph)	34	508	2	165	197	71	2	369	560	144	43	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	230		0	0		430	140		0
Storage Lanes	0		0	1		0	0		1	1		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.960				0.850		0.994	
Flt Protected		0.997		0.950						0.950		
Satd. Flow (prot)	0	3525	0	1770	1788	0	0	1863	1583	1770	1852	0
Flt Permitted		0.917		0.328				0.999		0.229		
Satd. Flow (perm)	0	3242	0	611	1788	0	0	1861	1583	427	1852	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					21				609			2
Link Speed (mph)		30			30			30				30
Link Distance (ft)		212			425			438				316
Travel Time (s)		4.8			9.7			10.0				7.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	552	2	179	214	77	2	401	609	157	47	2
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	591	0	179	291	0	0	403	609	157	49	0
Turn Type	Perm			pm+pt			Perm		custom		pm+pt	
Protected Phases		6		5	2			8		7	4	
Permitted Phases	6			2			8		8 2	4		
Detector Phase	6	6		5	2		8	8	8 2	7	4	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	10.0		10.0	10.0		7.0	10.0	
Minimum Split (s)	12.0	12.0		12.0	15.0		15.0	15.0		12.0	15.0	
Total Split (s)	22.0	22.0	0.0	11.0	33.0	0.0	28.0	28.0	61.0	11.0	39.0	0.0
Total Split (%)	24.4%	24.4%	0.0%	12.2%	36.7%	0.0%	31.1%	31.1%	67.8%	12.2%	43.3%	0.0%
Maximum Green (s)	17.0	17.0		6.0	28.0		23.0	23.0		6.0	34.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	0.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead		Lag			Lead	Lead		Lag		
Lead-Lag Optimize?	Yes	Yes		Yes			Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effect Green (s)		32.9		43.9	43.9			23.1	71.0	34.5	34.5	
Actuated g/C Ratio		0.37		0.49	0.49			0.26	0.79	0.38	0.38	
v/c Ratio		0.50		0.46	0.33			0.84	0.44	0.57	0.07	
Control Delay		26.4		33.4	23.5			49.1	1.6	36.6	17.1	
Queue Delay		0.0		0.0	0.0			0.0	0.2	4.0	0.0	
Total Delay		26.4		33.4	23.5			49.1	1.7	40.6	17.1	
LOS		C		C	C			D	A	D	B	

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	18.0
Total Split (s)	18.0
Total Split (%)	20%
Maximum Green (s)	16.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	6.0
Flash Dont Walk (s)	12.0
Pedestrian Calls (#/hr)	1
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	

Route 128 Add-A-Lane  
2: Kendrick St & Hunting Rd

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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		26.4			27.3			20.6				35.0
Approach LOS		C			C			C				C
Queue Length 50th (ft)		126		80	132			215	0	59		16
Queue Length 95th (ft)		#274		m169	m243			#362	36	103		39
Internal Link Dist (ft)		132			345			358				236
Turn Bay Length (ft)				230					430	140		
Base Capacity (vph)		1184		388	882			496	1387	275		721
Starvation Cap Reductn		0		0	0			0	0	0		0
Spillback Cap Reductn		0		0	0			0	204	61		0
Storage Cap Reductn		0		0	0			0	0	0		0
Reduced v/c Ratio		0.50		0.46	0.33			0.81	0.51	0.73		0.07

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.84  
 Intersection Signal Delay: 24.8 Intersection LOS: C  
 Intersection Capacity Utilization 71.0% ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Kendrick St & Hunting Rd



Route 128 Add-A-Lane  
3: Kendrick St & 3rd Ave

AM 2017 Build  
8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	683	1813	400	132	580	48	28	5	10	59	41	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	12	12	12	12	12	12
Storage Length (ft)	0		360	150		0	0		0	0		0
Storage Lanes	1		1	1		0	1		0	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.989			0.925				0.850
Flt Protected	0.950			0.950			0.950	0.987			0.971	
Satd. Flow (prot)	1652	3421	1531	1652	3384	0	1681	1616	0	0	1809	1583
Flt Permitted	0.950			0.950			0.950	0.987			0.971	
Satd. Flow (perm)	1652	3421	1531	1652	3384	0	1681	1616	0	0	1809	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			435		8			11				45
Link Speed (mph)		30			30			30				30
Link Distance (ft)		1055			1027			274				474
Travel Time (s)		24.0			23.3			6.2				10.8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	742	1971	435	143	630	52	30	5	11	64	45	45
Shared Lane Traffic (%)							21%					
Lane Group Flow (vph)	742	1971	435	143	682	0	24	22	0	0	109	45
Turn Type	Prot		custom	Prot			Split			Split		Free
Protected Phases	1	6		5	2		8	8		4	4	
Permitted Phases			6 8		2							Free
Detector Phase	1	6	6 8	5	2		8	8		4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		3.0	10.0		3.0	3.0		3.0	3.0	
Minimum Split (s)	12.0	15.0		8.0	21.0		8.0	8.0		8.0	8.0	
Total Split (s)	40.0	57.0	65.0	9.0	26.0	0.0	8.0	8.0	0.0	8.0	8.0	0.0
Total Split (%)	40.0%	57.0%	65.0%	9.0%	26.0%	0.0%	8.0%	8.0%	0.0%	8.0%	8.0%	0.0%
Maximum Green (s)	35.0	52.0		4.0	21.0		3.0	3.0		3.0	3.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	0.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	C-Min		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effect Green (s)	38.6	53.0	62.2	7.6	22.0		6.0	6.0			13.8	100.0
Actuated g/C Ratio	0.39	0.53	0.62	0.08	0.22		0.06	0.06			0.14	1.00
v/c Ratio	1.16	1.09	0.39	1.13	0.91		0.24	0.21			0.44	0.03
Control Delay	119.6	73.7	1.6	163.8	55.2		51.2	35.2			49.6	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	119.6	73.7	1.6	163.8	55.2		51.2	35.2			49.6	0.0

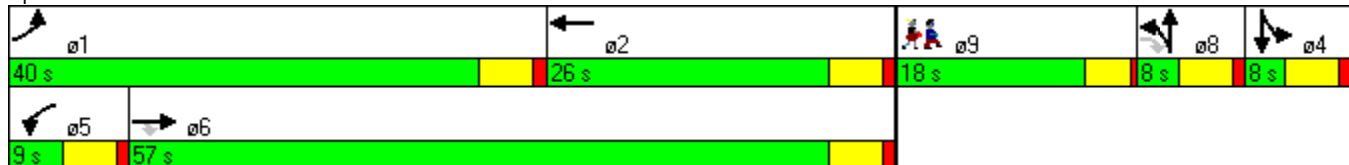


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	F	E	A	F	E		D	D			D	A
Approach Delay		74.5			74.0			43.5			35.1	
Approach LOS		E			E			D			D	
Queue Length 50th (ft)	~545	~747	0	92	222		15	7			64	0
Queue Length 95th (ft)	#817	#885	17	#258	#329		44	33			#207	0
Internal Link Dist (ft)		975			947			194			394	
Turn Bay Length (ft)			360	150								
Base Capacity (vph)	638	1813	1117	126	751		101	107			249	1583
Starvation Cap Reductn	0	0	0	0	0		0	0			0	0
Spillback Cap Reductn	0	0	0	0	0		0	0			0	0
Storage Cap Reductn	0	0	0	0	0		0	0			0	0
Reduced v/c Ratio	1.16	1.09	0.39	1.13	0.91		0.24	0.21			0.44	0.03

**Intersection Summary**

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 0 (0%), Referenced to phase 2:WBT, Start of Green  
 Natural Cycle: 130  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.16  
 Intersection Signal Delay: 72.6  
 Intersection LOS: E  
 Intersection Capacity Utilization 79.5%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Kendrick St & 3rd Ave



Route 128 Add-A-Lane  
4: Kendrick St & 4th Ave

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8/12/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	↕
Volume (veh/h)	456	1417	5	5	557	407	5	5	5	185	5	167
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	496	1540	5	5	605	442	5	5	5	201	5	182
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		1027										
pX, platoon unblocked				0.53			0.53	0.53	0.53	0.53	0.53	
vC, conflicting volume	1048			1546			3032	3593	773	2607	3374	524
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1048			258			3060	4118	0	2259	3706	524
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	25			99			0	0	99	0	0	64
cM capacity (veh/h)	660			691			0	0	575	0	1	498

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	1266	776	308	745	16	207	182
Volume Left	496	0	5	0	5	201	0
Volume Right	0	5	0	442	5	0	182
cSH	660	1700	691	1700	0	0	498
Volume to Capacity	0.75	0.46	0.01	0.44	Err	Err	0.36
Queue Length 95th (ft)	170	0	1	0	Err	Err	41
Control Delay (s)	25.0	0.0	0.3	0.0	Err	Err	16.3
Lane LOS	D		A		F	F	C
Approach Delay (s)	15.5		0.1		Err	Err	
Approach LOS					F	F	

Intersection Summary

Average Delay		Err					
Intersection Capacity Utilization		108.3%		ICU Level of Service		G	
Analysis Period (min)		15					

Route 128 Add-A-Lane  
12: Kendrick St & Route 128 SB off-ramp

AM 2017 Build  
8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑↑	↑					↑	↑↓	
Volume (vph)	0	1215	0	178	436	0	0	0	0	992	0	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt												0.992
Flt Protected				0.950						0.950	0.955	
Satd. Flow (prot)	0	3539	0	3433	1863	0	0	0	0	1681	1676	0
Flt Permitted				0.950						0.950	0.955	
Satd. Flow (perm)	0	3539	0	3433	1863	0	0	0	0	1681	1676	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												3
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		425			350			476			472	
Travel Time (s)		9.7			8.0			10.8			10.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1321	0	193	474	0	0	0	0	1078	0	28
Shared Lane Traffic (%)										49%		
Lane Group Flow (vph)	0	1321	0	193	474	0	0	0	0	550	556	0
Turn Type				Prot						custom		
Protected Phases		4		3	8					6	6	
Permitted Phases										6		
Detector Phase		4		3	8					6	6	
Switch Phase												
Minimum Initial (s)		4.0		4.0	4.0					4.0	4.0	
Minimum Split (s)		20.0		8.0	20.0					20.0	20.0	
Total Split (s)	0.0	45.0	0.0	12.0	57.0	0.0	0.0	0.0	0.0	33.0	33.0	0.0
Total Split (%)	0.0%	50.0%	0.0%	13.3%	63.3%	0.0%	0.0%	0.0%	0.0%	36.7%	36.7%	0.0%
Maximum Green (s)		41.0		8.0	53.0					29.0	29.0	
Yellow Time (s)		3.0		3.0	3.0					3.0	3.0	
All-Red Time (s)		1.0		1.0	1.0					1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag		Lag		Lead								
Lead-Lag Optimize?		Yes		Yes								
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Recall Mode		None		None	None					C-Max	C-Max	
Walk Time (s)		5.0			5.0					5.0	5.0	
Flash Dont Walk (s)		11.0			11.0					11.0	11.0	
Pedestrian Calls (#/hr)		0			0					0	0	
Act Effct Green (s)		39.7		7.9	51.6					30.4	30.4	
Actuated g/C Ratio		0.44		0.09	0.57					0.34	0.34	
v/c Ratio		0.85		0.64	0.44					0.97	0.98	
Control Delay		35.0		50.0	12.3					62.5	64.7	
Queue Delay		9.8		0.0	0.0					0.0	0.0	
Total Delay		44.8		50.0	12.3					62.5	64.7	
LOS		D		D	B					E	E	
Approach Delay		44.8			23.2						63.6	
Approach LOS		D			C						E	
Queue Length 50th (ft)		320		55	137					-336	-357	



Route 128 Add-A-Lane  
 12: Kendrick St & Route 128 SB off-ramp

AM 2017 Build  
 8/12/2010

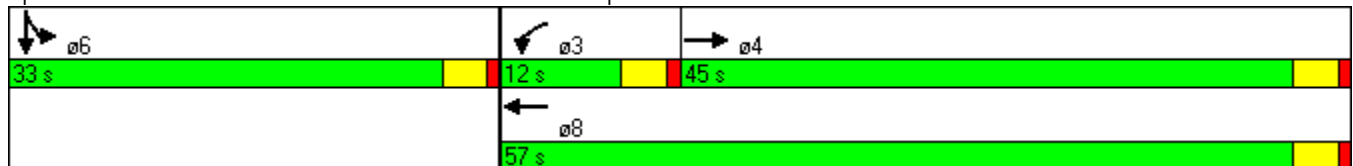


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		478		90	206					#558	#569	
Internal Link Dist (ft)		345			270			396			392	
Turn Bay Length (ft)												
Base Capacity (vph)		1612		305	1097					568	568	
Starvation Cap Reductn		277		0	0					0	0	
Spillback Cap Reductn		0		0	0					0	0	
Storage Cap Reductn		0		0	0					0	0	
Reduced v/c Ratio		0.99		0.63	0.43					0.97	0.98	

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green  
 Natural Cycle: 75  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.98  
 Intersection Signal Delay: 46.9  
 Intersection LOS: D  
 Intersection Capacity Utilization 88.9%  
 ICU Level of Service E  
 Analysis Period (min) 15  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 12: Kendrick St & Route 128 SB off-ramp



Route 128 Add-A-Lane  
 15: Kendrick St & Route 128 NB on-ramp

AM 2017 Build  
 8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑	↗			↗			
Volume (vph)	0	2207	0	0	615	100	0	0	687	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		235	0		0	0		0
Storage Lanes	0		0	0		1	0		1	0		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850			0.865			
Flt Protected												
Satd. Flow (prot)	0	3539	0	0	3539	1583	0	0	1611	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	3539	0	0	3539	1583	0	0	1611	0	0	0
Link Speed (mph)		30			30			30				30
Link Distance (ft)		350			1055			454				439
Travel Time (s)		8.0			24.0			10.3				10.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2399	0	0	668	109	0	0	747	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	2399	0	0	668	109	0	0	747	0	0	0
Sign Control		Free			Free			Free				Stop

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	88.9%
Analysis Period (min)	15
	ICU Level of Service E

Route 128 Add-A-Lane  
2: Kendrick St & Hunting Rd

PM 2017 Build  
8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	2	100	5	191	573	139	2	87	89	50	411	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	230		0	0		430	140		0
Storage Lanes	0		0	1		0	0		1	1		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.994			0.971				0.850			0.992
Flt Protected		0.999		0.950				0.999		0.950		
Satd. Flow (prot)	0	3514	0	1770	1809	0	0	1861	1583	1770	1848	0
Flt Permitted		0.948		0.679				0.567		0.686		
Satd. Flow (perm)	0	3335	0	1265	1809	0	0	1056	1583	1278	1848	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			17				97			3
Link Speed (mph)		30			30			30				30
Link Distance (ft)		212			425			438				316
Travel Time (s)		4.8			9.7			10.0				7.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2	109	5	208	623	151	2	95	97	54	447	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	116	0	208	774	0	0	97	97	54	471	0
Turn Type	Perm			pm+pt			Perm		custom		pm+pt	
Protected Phases		6		5	2			8		7	4	
Permitted Phases	6			2			8		8 2	4		
Detector Phase	6	6		5	2		8	8	8 2	7	4	
Switch Phase												
Minimum Initial (s)	7.0	7.0		5.0	10.0		10.0	10.0		5.0	10.0	
Minimum Split (s)	12.0	12.0		10.0	15.0		15.0	15.0		10.0	15.0	
Total Split (s)	32.0	32.0	0.0	12.0	44.0	0.0	18.0	18.0	62.0	10.0	28.0	0.0
Total Split (%)	35.6%	35.6%	0.0%	13.3%	48.9%	0.0%	20.0%	20.0%	68.9%	11.1%	31.1%	0.0%
Maximum Green (s)	27.0	27.0		7.0	39.0		13.0	13.0		5.0	23.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	0.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead		Lag			Lead	Lead		Lag		
Lead-Lag Optimize?	Yes	Yes		Yes			Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effect Green (s)		42.4		54.4	54.4			15.7	74.9	24.0	24.0	
Actuated g/C Ratio		0.47		0.60	0.60			0.17	0.83	0.27	0.27	
v/c Ratio		0.07		0.26	0.70			0.52	0.07	0.14	0.95	
Control Delay		14.7		16.5	24.8			47.1	1.2	26.7	64.1	
Queue Delay		0.0		0.0	15.6			0.0	0.0	0.0	0.0	
Total Delay		14.7		16.5	40.5			47.1	1.2	26.7	64.1	
LOS		B		B	D			D	A	C	E	

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Peak Hour Factor	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	18.0
Total Split (s)	18.0
Total Split (%)	20%
Maximum Green (s)	16.0
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Vehicle Extension (s)	3.0
Recall Mode	None
Walk Time (s)	6.0
Flash Dont Walk (s)	12.0
Pedestrian Calls (#/hr)	1
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	

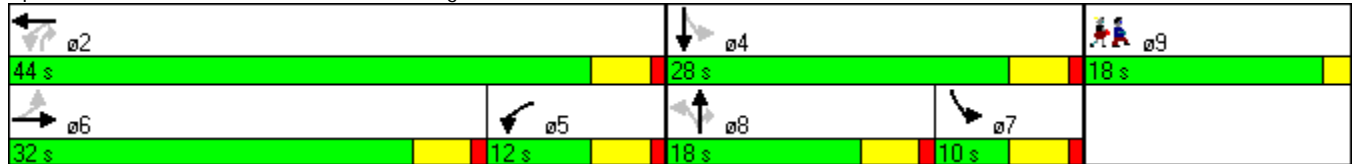


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		14.7			35.4			24.1				60.3
Approach LOS		B			D			C				E
Queue Length 50th (ft)		15		66	338			52	0	23		262
Queue Length 95th (ft)		43		m136	#646			#116	16	52		#456
Internal Link Dist (ft)		132			345			358				236
Turn Bay Length (ft)				230					430	140		
Base Capacity (vph)		1574		809	1100			188	1339	376		495
Starvation Cap Reductn		0		0	323			0	0	0		0
Spillback Cap Reductn		0		0	0			0	0	0		0
Storage Cap Reductn		0		0	0			0	0	0		0
Reduced v/c Ratio		0.07		0.26	1.00			0.52	0.07	0.14		0.95

**Intersection Summary**

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.95  
 Intersection Signal Delay: 40.1  
 Intersection LOS: D  
 Intersection Capacity Utilization 68.2%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

**Splits and Phases: 2: Kendrick St & Hunting Rd**



Route 128 Add-A-Lane  
3: Kendrick St & 3rd Ave

PM 2017 Build  
8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	346	575	43	35	1395	48	289	34	45	178	5	653
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	10	11	11	10	11	11	12	12	12	12	12	12
Storage Length (ft)	0		360	150		0	0		0	0		0
Storage Lanes	1		1	1		0	1		0	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	0.95	0.95	0.95	1.00	1.00	1.00	1.00
Frt			0.850		0.995			0.963				0.850
Flt Protected	0.950			0.950			0.950	0.972			0.954	
Satd. Flow (prot)	1652	3421	1531	1652	3404	0	1681	1656	0	0	1777	1583
Flt Permitted	0.950			0.950			0.950	0.972			0.954	
Satd. Flow (perm)	1652	3421	1531	1652	3404	0	1681	1656	0	0	1777	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			47		3			11				435
Link Speed (mph)		30			30			30				30
Link Distance (ft)		1077			1027			274				474
Travel Time (s)		24.5			23.3			6.2				10.8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	376	625	47	38	1516	52	314	37	49	193	5	710
Shared Lane Traffic (%)							36%					
Lane Group Flow (vph)	376	625	47	38	1568	0	201	199	0	0	198	710
Turn Type	Prot		custom	Prot			Split			Split		Free
Protected Phases	1	6		5	2		8	8		4	4	
Permitted Phases		6	6 8		2							Free
Detector Phase	1	6	6 8	5	2		8	8		4	4	
Switch Phase												
Minimum Initial (s)	7.0	10.0		7.0	10.0		3.0	3.0		6.0	6.0	
Minimum Split (s)	12.0	15.0		12.0	21.0		8.0	8.0		11.0	11.0	
Total Split (s)	23.0	62.0	76.0	12.0	51.0	0.0	14.0	14.0	0.0	14.0	14.0	0.0
Total Split (%)	19.2%	51.7%	63.3%	10.0%	42.5%	0.0%	11.7%	11.7%	0.0%	11.7%	11.7%	0.0%
Maximum Green (s)	18.0	57.0		7.0	46.0		9.0	9.0		9.0	9.0	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	0.0	-1.0	-1.0	0.0	-1.0	-1.0	-1.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Recall Mode	None	Min		None	Min		None	None		None	None	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effect Green (s)	19.0	62.8	76.8	8.0	47.0		10.0	10.0			10.0	102.0
Actuated g/C Ratio	0.19	0.62	0.75	0.08	0.46		0.10	0.10			0.10	1.00
v/c Ratio	1.22	0.30	0.04	0.29	1.00		1.22	1.16			1.14	0.45
Control Delay	162.2	10.5	1.4	50.6	50.6		181.2	157.3			153.1	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	162.2	10.5	1.4	50.6	50.6		181.2	157.3			153.1	0.9



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	F	B	A	D	D		F	F			F	A
Approach Delay		64.5			50.6			169.3			34.1	
Approach LOS		E			D			F			C	
Queue Length 50th (ft)	~303	106	0	24	520		~170	~154			~151	0
Queue Length 95th (ft)	#484	141	10	57	#701		#321	#307			#293	0
Internal Link Dist (ft)		997			947			194			394	
Turn Bay Length (ft)			360	150								
Base Capacity (vph)	308	2106	1165	130	1570		165	172			174	1583
Starvation Cap Reductn	0	0	0	0	0		0	0			0	0
Spillback Cap Reductn	0	0	0	0	0		0	0			0	0
Storage Cap Reductn	0	0	0	0	0		0	0			0	0
Reduced v/c Ratio	1.22	0.30	0.04	0.29	1.00		1.22	1.16			1.14	0.45

**Intersection Summary**

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 102  
 Natural Cycle: 150  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.22  
 Intersection Signal Delay: 62.5  
 Intersection LOS: E  
 Intersection Capacity Utilization 86.2%  
 ICU Level of Service E  
 Analysis Period (min) 15  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Kendrick St & 3rd Ave



Route 128 Add-A-Lane  
4: Kendrick St & 4th Ave

PM 2017 Build  
8/12/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕			↕			↕	↕
Volume (veh/h)	149	647	5	5	942	263	5	5	5	259	5	490
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	162	703	5	5	1024	286	5	5	5	282	5	533
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)		1027										
pX, platoon unblocked				0.97			0.97	0.97	0.97	0.97	0.97	0.97
vC, conflicting volume	1310			709			2088	2351	354	1861	2210	655
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1310			627			2055	2327	260	1821	2182	655
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	69			99			0	78	99	0	82	0
cM capacity (veh/h)	524			918			0	24	713	29	30	409

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	514	357	517	798	16	287	533
Volume Left	162	0	5	0	5	282	0
Volume Right	0	5	0	286	5	0	533
cSH	524	1700	918	1700	0	29	409
Volume to Capacity	0.31	0.21	0.01	0.47	Err	9.77	1.30
Queue Length 95th (ft)	33	0	0	0	Err	Err	596
Control Delay (s)	8.7	0.0	0.2	0.0	Err	Err	181.1
Lane LOS	A		A		F	F	F
Approach Delay (s)	5.1		0.1		Err	3618.6	
Approach LOS					F	F	

Intersection Summary

Average Delay		Err					
Intersection Capacity Utilization		88.2%		ICU Level of Service		E	
Analysis Period (min)		15					



Route 128 Add-A-Lane  
12: Kendrick St & Route 128 SB off-ramp

PM 2017 Build  
8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑↑	↑					↑	↑	
Volume (vph)	0	239	0	800	850	0	0	0	0	539	0	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	0.95	0.95	0.97	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt												0.935
Flt Protected				0.950						0.950	0.972	
Satd. Flow (prot)	0	3539	0	3433	1863	0	0	0	0	1681	1608	0
Flt Permitted				0.950						0.950	0.972	
Satd. Flow (perm)	0	3539	0	3433	1863	0	0	0	0	1681	1608	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)												38
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		425			350			476			472	
Travel Time (s)		9.7			8.0			10.8			10.7	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	260	0	870	924	0	0	0	0	586	0	155
Shared Lane Traffic (%)										35%		
Lane Group Flow (vph)	0	260	0	870	924	0	0	0	0	381	360	0
Turn Type				Prot						Split		
Protected Phases		4		3	8					6	6	
Permitted Phases												
Detector Phase		4		3	8					6	6	
Switch Phase												
Minimum Initial (s)		4.0		4.0	4.0					4.0	4.0	
Minimum Split (s)		20.0		8.0	20.0					20.0	20.0	
Total Split (s)	0.0	30.0	0.0	38.0	68.0	0.0	0.0	0.0	0.0	22.0	22.0	0.0
Total Split (%)	0.0%	33.3%	0.0%	42.2%	75.6%	0.0%	0.0%	0.0%	0.0%	24.4%	24.4%	0.0%
Maximum Green (s)		26.0		34.0	64.0					18.0	18.0	
Yellow Time (s)		3.5		3.5	3.5					3.5	3.5	
All-Red Time (s)		0.5		0.5	0.5					0.5	0.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag		Lag		Lead								
Lead-Lag Optimize?		Yes		Yes								
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	
Recall Mode		None		None	None					C-Max	C-Max	
Walk Time (s)		5.0			5.0					5.0	5.0	
Flash Dont Walk (s)		11.0			11.0					11.0	11.0	
Pedestrian Calls (#/hr)		0			0					0	0	
Act Effct Green (s)		24.1		28.5	56.7					25.3	25.3	
Actuated g/C Ratio		0.27		0.32	0.63					0.28	0.28	
v/c Ratio		0.27		0.80	0.79					0.81	0.75	
Control Delay		29.0		33.9	17.1					48.9	41.5	
Queue Delay		0.0		0.0	1.8					0.0	27.2	
Total Delay		29.0		33.9	18.9					48.9	68.7	
LOS		C		C	B					D	E	
Approach Delay		29.0			26.2						58.5	
Approach LOS		C			C						E	
Queue Length 50th (ft)		52		229	305					223	186	

Route 128 Add-A-Lane  
 12: Kendrick St & Route 128 SB off-ramp

PM 2017 Build  
 8/12/2010

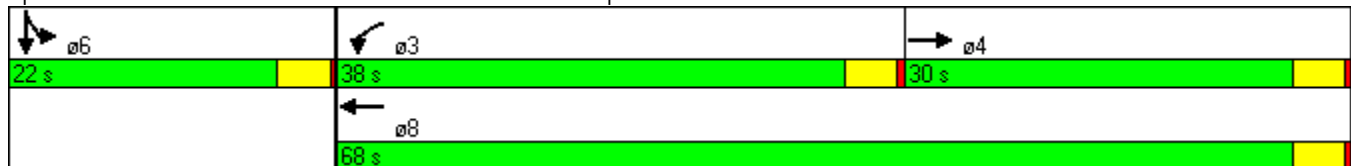


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		114		274	387					#450	#393	
Internal Link Dist (ft)		345			270			396			392	
Turn Bay Length (ft)												
Base Capacity (vph)		1054		1297	1325					473	480	
Starvation Cap Reductn		0		0	0					0	0	
Spillback Cap Reductn		0		0	237					0	126	
Storage Cap Reductn		0		0	0					0	0	
Reduced v/c Ratio		0.25		0.67	0.85					0.81	1.02	

Intersection Summary

Area Type: Other  
 Cycle Length: 90  
 Actuated Cycle Length: 90  
 Offset: 0 (0%), Referenced to phase 6:SBTL, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.81  
 Intersection Signal Delay: 35.0  
 Intersection LOS: D  
 Intersection Capacity Utilization 86.8%  
 ICU Level of Service E  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 12: Kendrick St & Route 128 SB off-ramp



Route 128 Add-A-Lane  
 15: Kendrick St & Route 128 NB on-ramp

PM 2017 Build  
 8/12/2010



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑			↑↑	↗			↗			
Volume (vph)	0	1189	0	0	1650	764	0	0	220	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		235	0		0	0		0
Storage Lanes	0		0	0		1	0		1	0		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt						0.850			0.865			
Flt Protected												
Satd. Flow (prot)	0	3539	0	0	3539	1583	0	0	1611	0	0	0
Flt Permitted												
Satd. Flow (perm)	0	3539	0	0	3539	1583	0	0	1611	0	0	0
Link Speed (mph)		30			30			30				30
Link Distance (ft)		350			1077			454				439
Travel Time (s)		8.0			24.5			10.3				10.0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1292	0	0	1793	830	0	0	239	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1292	0	0	1793	830	0	0	239	0	0	0
Sign Control		Free			Free			Free				Free

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	86.8%
Analysis Period (min)	15
	ICU Level of Service E