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Mr. David R. Consigli
Chairman
Milford Zoning Board of Appeals
Town of Milford
52 Main Street
Milford, MA 01757

May 9, 2018

Ref. T0718.01

Re: The Residences at Stone Ridge
Response to Traffic Comments

Dear Mr. Consigli:

TEC offers this letter as a formal response to technical transportation related comments provided by the Milford Town staff, questions heard at the Zoning Board of Appeals (ZBA) public hearing on April 18, 2018 and comments from the Town's peer reviewer, BSC Group. The following documents were reviewed as part of this effort:

- Transportation Peer Review letter to the ZBA, dated May 1, 2018
- Milford Town Engineer letter to the ZBA, dated April 18, 2018
- Milford Town Planner memorandum to the Milford Planning Board, dated April 17, 2018
- Planning Board letter to the ZBA, dated April 18, 2018
- Milford Upper Charles Trail Committee letter to the ZBA, undated, provided at the April 18, 2018 ZBA meeting

These recently issued documents highlight comments regarding emergency vehicle access and design treatments, on-site circulation and pedestrian accommodations. The following is a summary of our responses to the traffic comments listed within each memorandum.

Transportation Peer Review, BSC Comments (May 1, 2018)

Existing Conditions

1. *The Traffic Impact Memorandum (Traffic Memo) evaluated two intersections under existing and future conditions: Cedar Street (Route 85) / I-495 NB Ramps and Cedar Street / Deer Street. A review of site generated trips shows that more than half of the site generated traffic would travel south through the Cedar Street / I-495 NB Ramps towards Cedar Street / I-495 SB Ramps. BSC recommends that the Proponent should evaluate the impacts of the project trips on traffic operations at the Cedar Street / I-495 SB Ramps.*

[Plan](#) | [Permit](#) | [Design](#) | [Construct](#)

TEC Response: While not specifically required in the MEPA Section 61 finding for Phase I, TEC has evaluated the operation of the intersection Cedar Street (Route 85) / Route I-495 Southbound Ramps during the weekday morning and evening peak hours for the 2024 No Build and Build conditions. Counts at this intersection were conducted in January 2018 and projected to the year 2024 No Build condition using the methodology detailed within TEC's Traffic Impact Memorandum (March 12, 2018). The traffic projected to be generated by the residential development was then added to provide the Build condition.

This unsignalized intersection operates with some delays on the eastbound Route I-495 ramp left turn and right turn movements during both peak hours in the No Build condition. With the addition of the traffic associated with the project, the delays remain virtually unchanged. During the morning and evening peak hours, the 95% queue length is projected to increase by only one vehicle on the eastbound ramp approach with the addition of project related traffic. The operation of the through movements on Cedar Street and the southbound left turn movement are unaffected. Operations of the intersection are not anticipated to be noticeably impacted by the project and no mitigation of the intersection is recommended as part of Phase I. The analyses are attached.

Traffic Volumes

2. *Turning movement counts were collected in May 2017 during the weekday morning (7-9 AM and afternoon (4-6 PM) commuter peak hours. These times are consistent with standard procedures. No seasonal adjustments were made to the traffic counts; BSC concurs with the Proponent's explanation.*

TEC Response: Agreed.

Crash History Analysis

3. *The Traffic Memo provides crash information for study area intersections and notes that the I-495 Interchange is a Highway Safety Improvement Program (HSIP) location. TEC stated that through phone conversations with MassDOT District 3 Traffic section, no additional review was necessary since the Section 61 Findings for the Stone Ridge Project only required traffic signal timing modification. BSC recommends that detailed crash analysis should be performed under future phases of the project.*

TEC Response: Agreed, detailed crash analyses will be performed at the Route 495 / Cedar Street (Route 85) Interchange in future phases as required by MassDOT for Section 61 improvements.

Future Conditions

4. *The future conditions were projected under a seven-year planning horizon. BSC concurs with this timeline, which is consistent with current MassDOT standards.*

TEC Response: Agreed.

5. *Future No Build conditions were estimated by applying a one-percent annual growth rate and adding vehicle trips from specific known developments in the area. BSC concurs with this methodology.*

TEC Response: Agreed.

Trip Generation

6. *Table 2 summarizes the estimated number of vehicle trips for the proposed development. Trips for the proposed development were estimated using rates from the Institute of Transportation (ITE) Trip Generation and empirical data for the Restaurant Depot.*

TEC Response: Agreed.

7. *The Traffic Memo notes that the daily trips generated by the current project will be approximately 12% higher than the originally permitted Phase 1 daily trips. The current project will however have less peak hour trips than the original project. BSC agrees with this assertion, but notes that residential uses have different trip characteristics than office uses. For example, during the morning peak hour, more vehicles would leave the site under the proposed residential/Restaurant Depot development (146 trips exiting) compared to 31 trips under the office development. This pattern of travel is reversed during the evening peak hour. BSC recommends that the Proponent should evaluate how the change in the peak direction of the project trips affect traffic signal timings at Cedar Street / I-495 NB Ramps. The Proponent should also evaluate the impacts to the roadway network especially at Cedar Street / I-495 SB Ramps.*

TEC Response: TEC acknowledges that the peak hour trip distribution characteristics of the previously approved office building and the proposed residential development are different. However, the overall peak hour trip generation for the residential development is lower than the office building projected in Phase I. Further, the residential distribution of traffic allows for a better balance of traffic flow to and from Deer Street with the other commercial uses. TEC's Traffic Impact Memo outlines the impact of the residential development on the study area through a comparison between the No Build condition and the Build condition. The results are summarized as follows:

- Cedar Street / Deer Street
The intersection continues to operate with acceptable levels of service in the unsignalized condition during the weekday morning and weekday evening peak periods with the residential development traffic.
- Cedar Street / Route 495 NB Ramps
The intersection continues to operate with acceptable levels of service during the weekday morning and weekday evening peak periods with the residential traffic.
- Cedar Street / Route 495 SB Ramps
As stated above, the intersection operates with delays on the eastbound Route I-495 Ramp approach movements during both peak hours in the No Build and Build conditions. The residential project has no significant impact on the operation of the intersection and no intersection mitigation is recommended with this Phase.

Trip Distribution

8. *BSC Group generally concurs with the methodology used to estimate the trip distribution patterns.*

TEC Response: Agreed.

Site Access

9. *Access to the project site is via Deer Street off of Cedar Street. The provision of a singular access/egress to the proposed residential development is a concern. The Proponent should explore additional access options for emergency purposes.*

TEC Response: TEC acknowledges that access to the site is via Deer Street from Cedar Street. The access roadway has been reviewed by the Milford Fire Department and the Department has expressed that their concerns have been addressed by exhibits provided by SMMA regarding fire truck circulation and ladder truck access.

10. *BSC recommends the installation of devices such as the Rectangular Rapid Flash Beacon to warn drivers of the presence of non-motorized trail users.*

TEC Response: Agreed, a Rectangular Rapid Flash Beacon (RRFB) is proposed to be located at Upper Charles Trail crossing of Deer Street. A detail of the crossing location is attached.

Sight Distance Analysis

11. *The proposed driveway is currently under construction and BSC did not perform any independent sight distance measurements in the field.*

TEC Response: TEC's highway design group prepared the design plans for the improvements under construction along Cedar Street at Deer Street. The design of the intersection complies with all MassDOT criteria including sight distance requirements. The signing and striping plans from the approved plan set are attached.

Traffic Operations Analysis

12. *Tables 5 and 6 indicate that the overall delay at the study area intersections operated at acceptable levels of service. The detailed analyses show that Peak Hour Factor (PHF) inputs applied in the analysis were based on the overall intersection, instead of each intersection approach, as stated in the MassDOT Traffic Impact Analysis Guidelines. Traffic analysis outcomes are sensitive to peak hour factors; therefore, we recommend that the Proponent revise the analysis and use the appropriate PHF for each approach.*

TEC Response: The capacity analyses performed in the Traffic Impact Memo used the procedures described within the *Highway Capacity Manual (HCM) 2010*, a MassDOT approved methodology for analyzing signalized and unsignalized intersections. Within the *HCM 2010*, Peak Hour Factors are recommended to be applied for the entire intersection (Chapter 18, Exhibit 18-4 and Chapter 19, page 19-9). However, TEC revised the analyses for the study area intersections to include the PHF by approach. The revised analyses indicate very minor variations and no significant differences with the results detailed within our initial Memo and as outlined in Comment #7 above. The revised capacity analyses for the study area intersections are attached.

Pedestrian Safety

13. *Deer Street crosses the Upper Charles Trail. It was not clear from the plans reviewed what treatments were proposed at this crossing to alert drivers to the presence of non-motorized trail users. If warranted, the Proponent should install signs and Rectangular Rapid Flash Beacons (RRFB) to enhance pedestrian and bicycle safety at this trail crossing with deer Street.*

TEC Response: Agreed. A Rectangular Rapid Flash Beacon (RRFB) is proposed to be located at Upper Charles Trail crossing of Deer Street to alert drivers to crossing bicyclists and pedestrians. A detail of the crossing location is attached. The RRFB will be hard-wired into the roadway lighting system to provide constant power.

Milford Town Engineer letter to the ZBA (April 18, 2018)

Traffic related comments:

3. The site was originally designed and approved for a business park use, not a residential use. The site is at the end of an 1,800-foot-long dead end which includes a bridge (over the Charles River). This long dead end with residential units pose some safety concerns.... The dead-end road does not have a typical cul-de-sac for emergency vehicles to safely turn around. In place of a typical cul-de-sac turnaround there was a dedicated travel lane / looped driveway system, separate from the parking areas, that provided safe building access to the Building "sites" from the end of Deer Street. This long dead end with the current design does not compliment a residential development...

TEC Response: TEC acknowledges that access to the site is via Deer Street from Cedar Street. However, TEC does not agree with the characterization of Deer Street as a "dead end" roadway. As depicted on the plans, the circulation drive aisle within the residential area contains a loop at the entrance to the residential site that allows vehicles, including trucks and emergency vehicles, adequate turn around access without having to make a 3-point turn and without having to navigate through the residential site. It is anticipated that the overall site design will continue to have a looped roadway system, separate from the parking areas, to provide access to the remaining building lots. The residential site as shown is accessed from the main circulation road and the buildings are surrounded by surface parking, similarly to the previously approved office building lot layouts. Therefore, the difference is only in the change in use, not the change in the overall approved subdivision design.

The Milford Fire Department expressed that their concerns have been alleviated by exhibits provided by SMMA regarding fire truck circulation and ladder truck access in an email from Chief Touhey dated April 18, 2018.

"We met with representatives from the Gutierrez Company and Mr. Park from SMMA on 3/29/18 as an introduction to the project. We expressed two concerns after reviewing the drawings. First was ensuring emergency vehicle access, in particular, the ability of our ladder truck to reach buildings where access was restricted and secondly, the ability to have sufficient water flow to supply the sprinkler system as well as hose lines. At this meeting, we provided Mr. Park with the dimensions of our new ladder truck.

In a follow-up email from Mr. Park on 4/13/18, a drawing was provided that depicts the reach of the ladder truck in various locations where we had concerns. At this time, it appears that we have sufficient reach to access the buildings."

There are areas of environmental concern throughout the subject site, which have been addressed with various approval agencies. The site design provides access to all sides of the residential buildings while staying within approved uplands. The site design provides sufficient emergency access to the site while remaining environmentally responsible. Two exhibits prepared by SMMA illustrating fire truck access throughout the site are attached.

Milford Town Planner letter to the Planning Board (April 17, 2018) and Planning Board letter to the ZBA (April 18, 2018)

Concerns regarding adequate access to the development site and within the development

The Milford Fire Department has expressed that their concerns regarding emergency access to the residential development have been alleviated. As stated above, the site design provides full access for emergency vehicles to all areas of the site.

Appropriate circulation and access is provided for pedestrians, bicycles, and vehicles throughout the residential development as proposed. The addition of a drive aisle between Buildings "B" and "C" does not significantly improve emergency access to either building, adds more impervious coverage, and removes attractive green space for the residents of the development. The widening of the drive aisles throughout the site to 26-feet from the proposed 24-foot width would add an additional 0.18 acres of impervious coverage to the site. Emergency vehicles can adequately circulate the site within the 24-foot width aisles. Additional widening of residential roadways that provide on-street parking invites increased vehicular speeds and associated additional potential conflicts between parking vehicles and through vehicles. 24-foot drive aisles are appropriate to provide sufficient access for emergency vehicles, access to the on-street parking spaces and maintain slower speeds for circulating vehicles. The on-site roadways have been designed to encircle the buildings, provide emergency vehicle access and eliminate dead-end drive aisles, while maintaining green space and remaining sensitive to the environmental issues on the site.

Concern regarding the ratio of off-street parking provided

A total of 476 parking spaces are proposed to be provided on the site in support of the 272 residential apartments, at a ratio of 1.75 parking spaces per dwelling unit. The Institute of Transportation Engineer's publication, *Parking Generation, 4th Edition*, for Land Use Code 221 – Low/Mid-Rise Apartment, calculates a peak parking demand of 349 parking spaces for 272 units, or a ratio of 1.28 spaces per unit. The parking ratio supplied exceeds the anticipated demand as projected using this industry standard reference.

Milford Upper Charles Trail Committee letter to the Zoning Board (April 18, 2018)

Concern regarding pedestrian circulation and access to the Upper Charles Trail

Sidewalks are provided adjacent to the parking areas of the proposed residential development to allow for safe and efficient pedestrian movement throughout the site. Pedestrian access to the Upper Charles Trail is provided via a 5-foot sidewalk along the south side of Deer Street. This width is consistent with MassDOT and American with Disabilities Act (ADA) sidewalk design requirements. Bicycle access is provided along Deer Street, within the travel way in a shared use condition. The travel lanes along Deer Street are 11-feet in width with 2-foot shoulders. This is a typical width for local roadways and is designed for a lower vehicle speed, which will allow residents of the proposed development to use the roadway as designed to access area

trails and the adjacent street system. In addition, "Share the Road" and bicycle warning signs will be placed along Deer Street between the residential development and Cedar Street to warn motorists of the shared nature of the roadway. The Upper Charles Trail intersects Deer Street, allowing unique and attractive access to this trail system from the residential community. A Rectangular Rapid Flash Beacon (RRFB) is proposed to be located at Upper Charles Trail crossing of Deer Street to alert drivers to crossing bicyclists and pedestrians. A detail of the crossing location is attached. An illustration of the pedestrian circulation on the site is also attached.

We trust that the above information adequately addresses the comments regarding traffic for the Residences at Stone Ridge residential development in Milford. Please do not hesitate to contact me directly at (978) 794-1792 if you have any additional questions. Thank you for your consideration.

Sincerely,
TEC, Inc.
"The Engineering Corporation"



Elizabeth Oltman, PE
Transportation Planning Services Director

Attachments:

Pedestrian Circulation Plan
Pedestrian Crossing Plan (RRFB)
Revised Capacity Analyses
Signing and Striping Plans for Deer Street / Cedar Street
Ladder Truck Circulation Plan



Current Proposed Site Plan

Residences at Stone Ridge

Milford, MA

PEDSTRIAN CIRCULATION

03.02.2018

— Proposed Sidewalk Connection



SMMA



Intersection Capacity and Queue Analysis Summary – Revised

Intersection / Lane Group	2017 Existing				2024 Build with Existing Timings			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d	V/C	Delay	LOS	Queue
Cedar Street (Route 85) / I-495 NB Ramps								
<i>Weekday Morning Peak Period</i>								
I-495 NB Off-ramp WBL	0.52	18.1	B	47/98	0.55	20.2	C	62/135
I-495 NB Off-ramp WBR	0.00	0.0	A	<25/<25	0.00	0.0	A	<25/<25
Cedar Street NBL	0.68	8.5	A	85/178	0.77	9.5	A	105/257
Cedar Street NBT	0.41	6.2	A	71/143	0.51	6.7	A	208/111
Cedar Street SB Approach	0.40	15.6	B	48/105	0.53	17.0	B	94/200
Overall Intersection	0.58	11.3	B	-	0.53	12.5	B	-
<i>Weekday Evening Peak Period</i>								
I-495 NB Off-ramp WBL	0.63	22.1	C	67/135	0.68	26.1	C	95/151
I-495 NB Off-ramp WBR	0.00	0.0	A	<25/<25	0.00	0.0	A	<25/<25
Cedar Street NBL	0.83	10.3	B	131/260	0.92	18.4	B	219/422
Cedar Street NBT	0.26	5.0	A	48/77	0.39	5.5	A	89/128
Cedar Street SB Approach	0.65	16.5	B	125/204	0.69	17.8	B	201/267
Overall Intersection	0.51	14.0	B	-	0.59	16.9	B	-

^a Volume-to-capacity ratio

^b Delay expressed in seconds per vehicle (average)

^c Level of service

^d 50th/95th Percentile Queue for signalized intersections

Intersection Capacity and Queue Analysis Summary - Revised

Intersection / Lane Group	2024 No Build				2024 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d	V/C	Delay	LOS	Queue
Cedar Street (Route 85) / Deer Street								
<i>Weekday Morning Peak Period</i>								
Cedar Street NBL	0.06	8.2	A	<25	0.06	8.3	A	<25
Deer Street EBL	0.04	31.7	D	<25	0.28	44.3	E	25
Deer Street EBR	0.06	10.9	B	<25	0.19	11.9	B	<25
<i>Weekday Evening Peak Period</i>								
Cedar Street NBL	0.04	9.5	A	<25	0.16	10.2	B	<25
Deer Street EBL	0.04	30.2	D	<25	0.20	49.1	E	<25
Deer Street EBR	0.08	14.9	B	<25	0.20	16.5	C	<25

Intersection Capacity and Queue Analysis Summary - Revised

Intersection / Lane Group	2024 No Build				2024 Build			
	V/C ^a	Delay ^b	LOS ^c	Queue ^d	V/C	Delay	LOS	Queue
Cedar Street (Route 85) / I-495 SB Ramps								
<i>Weekday Morning Peak Period</i>								
Cedar Street SBL	0.29	15.0	C	<25	0.33	15.7	C	50
I-495 SB Off-ramp EBL	0.27	72.9	F	<25	0.54	129.9	F	50
I-495 SB Off-ramp EBR	1.11	90.5	F	543	1.14	102.5	F	580
<i>Weekday Evening Peak Period</i>								
Cedar Street SBL	0.60	23.1	C	<25	0.65	25.9	D	<25
I-495 SB Off-ramp EBL	>1.0	exceed	F	exceed	>1.0	exceed	F	exceed
I-495 SB Off-ramp EBR	1.23	141.3	F	642	1.24	147.3	F	655

^a Volume-to-capacity ratio

^b Delay expressed in seconds per vehicle (average)

^c Level of service

^d 95th Percentile Queue for unsignalized intersections

Lanes, Volumes, Timings

2017 Existing Conditions

1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 							 	
Traffic Volume (vph)	0	0	0	297	0	381	457	360	0	0	274	16
Future Volume (vph)	0	0	0	297	0	381	457	360	0	0	274	16
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Ped Bike Factor											1.00	
Frt						0.850					0.992	
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3400	0	1583	1719	1845	0	0	3467	0
Flt Permitted				0.950			0.443					
Satd. Flow (perm)	0	0	0	3400	0	1583	802	1845	0	0	3467	0
Satd. Flow (RTOR)						438					5	
Adj. Flow (vph)	0	0	0	341	0	438	519	409	0	0	301	18
Lane Group Flow (vph)	0	0	0	341	0	438	519	409	0	0	319	0
Turn Type				Prot		Free	pm+pt	NA			NA	
Protected Phases				4			1	6			2	
Permitted Phases						Free	6					
Detector Phase				4			1	6			2	
Switch Phase												
Minimum Initial (s)				6.0			6.0	10.0			10.0	
Minimum Split (s)				12.0			9.0	16.0			16.0	
Total Split (s)				41.0			38.0	79.0			41.0	
Total Split (%)				34.2%			31.7%	65.8%			34.2%	
Maximum Green (s)				35.0			35.0	73.0			35.0	
Yellow Time (s)				3.0			3.0	3.0			3.0	
All-Red Time (s)				3.0			0.0	3.0			3.0	
Lost Time Adjust (s)				0.0			0.0	0.0			0.0	
Total Lost Time (s)				6.0			3.0	6.0			6.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)				5.0			2.0	2.0			2.0	
Recall Mode				None			None	Min			Min	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 57.2

Natural Cycle: 45

Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

		
Ø1	Ø2	Ø4
38 s	41 s	41 s
		
Ø6		
79 s		

Queues

2017 Existing Conditions

1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

					
Lane Group	WBL	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	341	438	519	409	319
v/c Ratio	0.41	0.28	0.71	0.41	0.46
Control Delay	20.9	0.4	12.9	9.4	23.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	20.9	0.4	12.9	9.4	23.7
Queue Length 50th (ft)	47	0	85	71	48
Queue Length 95th (ft)	98	0	178	143	105
Internal Link Dist (ft)				790	406
Turn Bay Length (ft)					
Base Capacity (vph)	2142	1583	1111	1837	2186
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.16	0.28	0.47	0.22	0.15
Intersection Summary					

HCM 2010 Signalized Intersection Summary

2017 Existing Conditions

1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	297	0	381	457	360	0	0	274	16
Future Volume (veh/h)	0	0	0	297	0	381	457	360	0	0	274	16
Number				7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1863	1810	1845	0	0	1842	1900
Adj Flow Rate, veh/h				341	0	0	519	409	0	0	301	0
Adj No. of Lanes				2	0	1	1	1	0	0	2	0
Peak Hour Factor				0.87	0.87	0.87	0.88	0.88	0.88	0.91	0.91	0.91
Percent Heavy Veh, %				3	0	2	5	3	0	0	3	3
Cap, veh/h				657	0	305	762	1009	0	0	759	0
Arrive On Green				0.19	0.00	0.00	0.27	0.55	0.00	0.00	0.22	0.00
Sat Flow, veh/h				3408	0	1583	1723	1845	0	0	3683	0
Grp Volume(v), veh/h				341	0	0	519	409	0	0	301	0
Grp Sat Flow(s),veh/h/ln				1704	0	1583	1723	1845	0	0	1750	0
Q Serve(g_s), s				4.1	0.0	0.0	9.4	5.9	0.0	0.0	3.4	0.0
Cycle Q Clear(g_c), s				4.1	0.0	0.0	9.4	5.9	0.0	0.0	3.4	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				657	0	305	762	1009	0	0	759	0
V/C Ratio(X)				0.52	0.00	0.00	0.68	0.41	0.00	0.00	0.40	0.00
Avail Cap(c_a), veh/h				2587	0	1202	1614	2920	0	0	2656	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				16.7	0.0	0.0	8.1	6.1	0.0	0.0	15.5	0.0
Incr Delay (d2), s/veh				1.4	0.0	0.0	0.4	0.1	0.0	0.0	0.1	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.1	0.0	0.0	4.3	3.0	0.0	0.0	1.6	0.0
LnGrp Delay(d),s/veh				18.1	0.0	0.0	8.5	6.2	0.0	0.0	15.6	0.0
LnGrp LOS				B			A	A			B	
Approach Vol, veh/h					341			928			301	
Approach Delay, s/veh					18.1			7.5			15.6	
Approach LOS					B			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	15.2	16.0		14.9		31.2						
Change Period (Y+Rc), s	3.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	35.0	35.0		35.0		73.0						
Max Q Clear Time (g_c+l1), s	11.4	5.4		6.1		7.9						
Green Ext Time (p_c), s	0.8	3.2		2.9		3.3						
Intersection Summary												
HCM 2010 Ctrl Delay				11.3								
HCM 2010 LOS				B								

Lanes, Volumes, Timings

2017 Existing Conditions

2: Cedar Street (Route 85) & I-495 Southbound Off-Ramps/I-495 Southbound On-Ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 			 	
Traffic Volume (vph)	15	0	563	0	0	0	0	802	324	117	454	0
Future Volume (vph)	15	0	563	0	0	0	0	802	324	117	454	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00
Frt			0.850					0.957				
Flt Protected	0.950										0.990	
Satd. Flow (prot)	1805	0	1568	0	0	0	0	3364	0	0	3511	0
Flt Permitted	0.950										0.990	
Satd. Flow (perm)	1805	0	1568	0	0	0	0	3364	0	0	3511	0
Adj. Flow (vph)	19	0	695	0	0	0	0	862	348	134	522	0
Lane Group Flow (vph)	19	0	695	0	0	0	0	1210	0	0	656	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Control Type: Unsignalized

Intersection												
Int Delay, s/veh	13.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	15	0	563	0	0	0	0	802	324	117	454	0
Future Vol, veh/h	15	0	563	0	0	0	0	802	324	117	454	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	0	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	25	25	25	93	93	93	87	87	87
Heavy Vehicles, %	0	0	3	0	0	0	0	3	2	1	2	0
Mvmt Flow	19	0	695	0	0	0	0	862	348	134	522	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	1222	-	261	-	0	0	1211	0	0
Stage 1	791	-	-	-	-	-	-	-	-
Stage 2	431	-	-	-	-	-	-	-	-
Critical Hdwy	6.8	-	6.96	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	-	3.33	-	-	-	2.21	-	-
Pot Cap-1 Maneuver	175	0	735	0	-	-	577	-	0
Stage 1	412	0	-	0	-	-	-	-	0
Stage 2	629	0	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	118	0	735	-	-	-	577	-	-
Mov Cap-2 Maneuver	118	0	-	-	-	-	-	-	-
Stage 1	277	0	-	-	-	-	-	-	-
Stage 2	629	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	44.8	0	3.8
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT
Capacity (veh/h)	-	-	118	735	577	-
HCM Lane V/C Ratio	-	-	0.157	0.946	0.233	-
HCM Control Delay (s)	-	-	41.1	44.9	13.1	1.4
HCM Lane LOS	-	-	E	E	B	A
HCM 95th %tile Q(veh)	-	-	0.5	13.8	0.9	-

Lanes, Volumes, Timings

2017 Existing Conditions

1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				 							 	
Traffic Volume (vph)	0	0	0	356	0	151	488	252	0	0	616	23
Future Volume (vph)	0	0	0	356	0	151	488	252	0	0	616	23
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Ped Bike Factor												
Frt						0.850					0.995	
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3467	0	1615	1752	1900	0	0	3558	0
Flt Permitted				0.950			0.232					
Satd. Flow (perm)	0	0	0	3467	0	1615	428	1900	0	0	3558	0
Satd. Flow (RTOR)						161					5	
Adj. Flow (vph)	0	0	0	379	0	161	561	290	0	0	655	24
Lane Group Flow (vph)	0	0	0	379	0	161	561	290	0	0	679	0
Turn Type				Prot		Free	pm+pt	NA			NA	
Protected Phases				4			1	6			2	
Permitted Phases						Free	6					
Detector Phase				4			1	6			2	
Switch Phase												
Minimum Initial (s)				6.0			6.0	10.0			10.0	
Minimum Split (s)				12.0			9.0	16.0			16.0	
Total Split (s)				21.0			28.0	64.0			36.0	
Total Split (%)				24.7%			32.9%	75.3%			42.4%	
Maximum Green (s)				15.0			25.0	58.0			30.0	
Yellow Time (s)				3.0			3.0	3.0			3.0	
All-Red Time (s)				3.0			0.0	3.0			3.0	
Lost Time Adjust (s)				0.0			0.0	0.0			0.0	
Total Lost Time (s)				6.0			3.0	6.0			6.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)				5.0			2.0	2.0			2.0	
Recall Mode				None			None	Min			Min	

Intersection Summary

Cycle Length: 85

Actuated Cycle Length: 64.2

Natural Cycle: 55

Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

 Ø1	 Ø2	 Ø4
28 s	36 s	21 s
 Ø6		
64 s		

Queues

2017 Existing Conditions

1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

Weekday Evening

					
Lane Group	WBL	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	379	161	561	290	679
v/c Ratio	0.52	0.10	0.88	0.26	0.70
Control Delay	27.6	0.1	27.6	6.5	25.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	27.6	0.1	27.6	6.5	25.8
Queue Length 50th (ft)	67	0	131	48	125
Queue Length 95th (ft)	135	0	#260	77	204
Internal Link Dist (ft)				790	406
Turn Bay Length (ft)					
Base Capacity (vph)	842	1615	811	1672	1730
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.45	0.10	0.69	0.17	0.39

Intersection Summary

- # 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary

2017 Existing Conditions

1: Cedar Street (Route 85) & I-495 Northbound On-Ramps/I-495 Northbound Off-ramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	356	0	151	488	252	0	0	616	23
Future Volume (veh/h)	0	0	0	356	0	151	488	252	0	0	616	23
Number				7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1881	0	1900	1845	1900	0	0	1882	1900
Adj Flow Rate, veh/h				379	0	0	561	290	0	0	655	0
Adj No. of Lanes				2	0	1	1	1	0	0	2	0
Peak Hour Factor				0.94	0.94	0.94	0.87	0.87	0.87	0.94	0.94	0.94
Percent Heavy Veh, %				1	0	0	3	0	0	0	1	1
Cap, veh/h				599	0	278	679	1129	0	0	1008	0
Arrive On Green				0.17	0.00	0.00	0.25	0.59	0.00	0.00	0.28	0.00
Sat Flow, veh/h				3476	0	1615	1757	1900	0	0	3764	0
Grp Volume(v), veh/h				379	0	0	561	290	0	0	655	0
Grp Sat Flow(s),veh/h/ln				1738	0	1615	1757	1900	0	0	1788	0
Q Serve(g_s), s				5.2	0.0	0.0	10.3	3.8	0.0	0.0	8.3	0.0
Cycle Q Clear(g_c), s				5.2	0.0	0.0	10.3	3.8	0.0	0.0	8.3	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				599	0	278	679	1129	0	0	1008	0
V/C Ratio(X)				0.63	0.00	0.00	0.83	0.26	0.00	0.00	0.65	0.00
Avail Cap(c_a), veh/h				1014	0	471	1087	2143	0	0	2086	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				19.8	0.0	0.0	9.0	5.0	0.0	0.0	16.2	0.0
Incr Delay (d2), s/veh				2.4	0.0	0.0	1.4	0.0	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.7	0.0	0.0	5.1	1.9	0.0	0.0	4.1	0.0
LnGrp Delay(d),s/veh				22.1	0.0	0.0	10.3	5.0	0.0	0.0	16.5	0.0
LnGrp LOS				C			B	A			B	
Approach Vol, veh/h					379			851			655	
Approach Delay, s/veh					22.1			8.5			16.5	
Approach LOS					C			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	16.1	20.5		14.9		36.6						
Change Period (Y+Rc), s	3.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	25.0	30.0		15.0		58.0						
Max Q Clear Time (g_c+l1), s	12.3	10.3		7.2		5.8						
Green Ext Time (p_c), s	0.8	4.2		1.7		4.7						
Intersection Summary												
HCM 2010 Ctrl Delay				14.0								
HCM 2010 LOS				B								

Lanes, Volumes, Timings

2017 Existing Conditions

2: Cedar Street (Route 85) & I-495 Southbound Off-Ramps/I-495 Southbound On-Ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 			 	
Traffic Volume (vph)	21	0	594	0	0	0	0	719	341	250	722	0
Future Volume (vph)	21	0	594	0	0	0	0	719	341	250	722	0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00
Frt			0.850					0.952				
Flt Protected	0.950										0.987	
Satd. Flow (prot)	1805	0	1583	0	0	0	0	3369	0	0	3510	0
Flt Permitted	0.950										0.987	
Satd. Flow (perm)	1805	0	1583	0	0	0	0	3369	0	0	3510	0
Adj. Flow (vph)	22	0	632	0	0	0	0	836	397	272	785	0
Lane Group Flow (vph)	22	0	632	0	0	0	0	1233	0	0	1057	0
Sign Control		Stop			Stop			Free			Free	

Intersection Summary

Control Type: Unsignalized

Intersection

Int Delay, s/veh 28.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	21	0	594	0	0	0	0	719	341	250	722	0
Future Vol, veh/h	21	0	594	0	0	0	0	719	341	250	722	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	0	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	25	25	25	86	86	86	92	92	92
Heavy Vehicles, %	0	0	2	0	0	0	0	2	2	3	1	0
Mvmt Flow	22	0	632	0	0	0	0	836	397	272	785	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	1746	-	392	-	0	0	1233	0	0
Stage 1	1328	-	-	-	-	-	-	-	-
Stage 2	418	-	-	-	-	-	-	-	-
Critical Hdwy	6.8	-	6.94	-	-	-	4.16	-	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	-	3.32	-	-	-	2.23	-	-
Pot Cap-1 Maneuver	79	0 ~	607	0	-	-	555	-	0
Stage 1	216	0	-	0	-	-	-	-	0
Stage 2	638	0	-	0	-	-	-	-	0
Platoon blocked, %					-	-			
Mov Cap-1 Maneuver	~ 10	0 ~	607	-	-	-	555	-	-
Mov Cap-2 Maneuver	~ 10	0	-	-	-	-	-	-	-
Stage 1	28	0	-	-	-	-	-	-	-
Stage 2	638	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	115.8	0	7.9
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT
Capacity (veh/h)	-	-	10	607	555	-
HCM Lane V/C Ratio	-	-	2.234	1.041	0.49	-
HCM Control Delay (s)	-	\$	1305.2	73.7	17.5	4.5
HCM Lane LOS	-	-	F	F	C	A
HCM 95th %tile Q(veh)	-	-	3.8	17	2.7	-

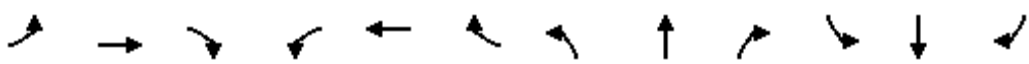
Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings

2024 No Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	314	0	433	490	454	0	0	365	37
Future Volume (vph)	0	0	0	314	0	433	490	454	0	0	365	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		220
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Ped Bike Factor											1.00	
Frt						0.850					0.986	
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3400	0	1583	1719	1845	0	0	3439	0
Flt Permitted				0.950			0.374					
Satd. Flow (perm)	0	0	0	3400	0	1583	677	1845	0	0	3439	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						498					9	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		300			300			870			436	
Travel Time (s)		6.8			6.8			19.8			9.9	
Confl. Peds. (#/hr)									1	2		
Confl. Bikes (#/hr)									2			2
Peak Hour Factor	0.25	0.25	0.25	0.87	0.87	0.87	0.88	0.88	0.88	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	3%	0%	2%	5%	3%	0%	0%	3%	6%
Shared Lane Traffic (%)												
Turn Type				Prot		Free	pm+pt	NA			NA	
Protected Phases				4			1	6			2	
Permitted Phases						Free	6					
Detector Phase				4			1	6			2	
Switch Phase												
Minimum Initial (s)				6.0			6.0	10.0			10.0	
Minimum Split (s)				12.0			9.0	16.0			16.0	
Total Split (s)				41.0			38.0	79.0			41.0	
Total Split (%)				34.2%			31.7%	65.8%			34.2%	
Maximum Green (s)				35.0			35.0	73.0			35.0	
Yellow Time (s)				3.0			3.0	3.0			3.0	
All-Red Time (s)				3.0			0.0	3.0			3.0	
Lost Time Adjust (s)				0.0			0.0	0.0			0.0	
Total Lost Time (s)				6.0			3.0	6.0			6.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)				5.0			2.0	2.0			2.0	
Recall Mode				None			None	Min			Min	

Intersection Summary

Area Type: Other
 Cycle Length: 120
 Actuated Cycle Length: 63.1
 Natural Cycle: 55
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps

 Ø1	 Ø2	 Ø4
38 s	41 s	41 s
 Ø6		
79 s		

Queues

2024 No Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps Wednesday Morning

					
Lane Group	WBL	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	361	498	557	516	442
v/c Ratio	0.44	0.31	0.78	0.50	0.57
Control Delay	23.9	0.5	16.4	10.4	26.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	23.9	0.5	16.4	10.4	26.0
Queue Length 50th (ft)	57	0	101	103	74
Queue Length 95th (ft)	121	0	215	198	156
Internal Link Dist (ft)				790	356
Turn Bay Length (ft)					
Base Capacity (vph)	1972	1583	1048	1786	1999
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.18	0.31	0.53	0.29	0.22
Intersection Summary					

HCM 2010 Signalized Intersection Summary 2024 No Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	314	0	433	490	454	0	0	365	37
Future Volume (veh/h)	0	0	0	314	0	433	490	454	0	0	365	37
Number				7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1863	1810	1845	0	0	1840	1900
Adj Flow Rate, veh/h				361	0	0	557	516	0	0	401	0
Adj No. of Lanes				2	0	1	1	1	0	0	2	0
Peak Hour Factor				0.87	0.87	0.87	0.88	0.88	0.88	0.91	0.91	0.91
Percent Heavy Veh, %				3	0	2	5	3	0	0	3	3
Cap, veh/h				665	0	309	741	1039	0	0	795	0
Arrive On Green				0.20	0.00	0.00	0.28	0.56	0.00	0.00	0.23	0.00
Sat Flow, veh/h				3408	0	1583	1723	1845	0	0	3679	0
Grp Volume(v), veh/h				361	0	0	557	516	0	0	401	0
Grp Sat Flow(s),veh/h/ln				1704	0	1583	1723	1845	0	0	1748	0
Q Serve(g_s), s				4.7	0.0	0.0	10.8	8.4	0.0	0.0	5.0	0.0
Cycle Q Clear(g_c), s				4.7	0.0	0.0	10.8	8.4	0.0	0.0	5.0	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				665	0	309	741	1039	0	0	795	0
V/C Ratio(X)				0.54	0.00	0.00	0.75	0.50	0.00	0.00	0.50	0.00
Avail Cap(c_a), veh/h				2398	0	1114	1479	2708	0	0	2460	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				18.0	0.0	0.0	8.8	6.6	0.0	0.0	16.8	0.0
Incr Delay (d2), s/veh				1.5	0.0	0.0	0.6	0.1	0.0	0.0	0.2	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.3	0.0	0.0	5.1	4.2	0.0	0.0	2.4	0.0
LnGrp Delay(d),s/veh				19.5	0.0	0.0	9.3	6.7	0.0	0.0	17.0	0.0
LnGrp LOS				B			A	A			B	
Approach Vol, veh/h					361			1073			401	
Approach Delay, s/veh					19.5			8.1			17.0	
Approach LOS					B			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	16.7	17.3		15.7		34.0						
Change Period (Y+Rc), s	3.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	35.0	35.0		35.0		73.0						
Max Q Clear Time (g_c+I1), s	12.8	7.0		6.7		10.4						
Green Ext Time (p_c), s	0.9	4.3		3.0		4.5						
Intersection Summary												
HCM 2010 Ctrl Delay				12.3								
HCM 2010 LOS				B								

Lanes, Volumes, Timings

2024 No Build Conditions (with Existing Timings)

2: Cedar Street (Route 85) & I-495 Southbound Off-ramps/I-495 Southbound On-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 			 	
Traffic Volume (vph)	16	0	604	0	0	0	0	928	347	125	554	0
Future Volume (vph)	16	0	604	0	0	0	0	928	347	125	554	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00
Frt			0.850					0.959				
Flt Protected	0.950										0.991	
Satd. Flow (prot)	1805	0	1568	0	0	0	0	3370	0	0	3514	0
Flt Permitted	0.950										0.991	
Satd. Flow (perm)	1805	0	1568	0	0	0	0	3370	0	0	3514	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		279			321			324			870	
Travel Time (s)		6.3			7.3			7.4			19.8	
Peak Hour Factor	0.81	0.81	0.81	0.25	0.25	0.25	0.93	0.93	0.93	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	2%	1%	2%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											

Intersection

Int Delay, s/veh 24.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	16	0	604	0	0	0	0	928	347	125	554	0
Future Vol, veh/h	16	0	604	0	0	0	0	928	347	125	554	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	0	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	25	25	25	93	93	93	87	87	87
Heavy Vehicles, %	0	0	3	0	0	0	0	3	2	1	2	0
Mvmt Flow	20	0	746	0	0	0	0	998	373	144	637	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	1423	-	318	-	0	0	1371	0	0
Stage 1	924	-	-	-	-	-	-	-	-
Stage 2	499	-	-	-	-	-	-	-	-
Critical Hdwy	6.8	-	6.96	-	-	-	4.12	-	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	-	3.33	-	-	-	2.21	-	-
Pot Cap-1 Maneuver	129	0 ~	675	0	-	-	502	-	0
Stage 1	352	0	-	0	-	-	-	-	0
Stage 2	581	0	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	72	0 ~	675	-	-	-	502	-	-
Mov Cap-2 Maneuver	72	0	-	-	-	-	-	-	-
Stage 1	196	0	-	-	-	-	-	-	-
Stage 2	581	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	90	0	4.6
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT
Capacity (veh/h)	-	-	72	675	502	-
HCM Lane V/C Ratio	-	-	0.274	1.105	0.286	-
HCM Control Delay (s)	-	-	72.9	90.5	15	2.3
HCM Lane LOS	-	-	F	F	C	A
HCM 95th %tile Q(veh)	-	-	1	21.7	1.2	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings
3: Cedar Street (Route 85) & Deer Street

2024 No Build Conditions (with Existing Timings)
Weekday Morning

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	36	36	851	366	5
Future Volume (vph)	5	36	36	851	366	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.998	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1745	1561	1805	1900	1896	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1745	1561	1805	1900	1896	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	352			436	370	
Travel Time (s)	8.0			9.9	8.4	
Peak Hour Factor	0.94	0.94	0.88	0.88	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 TWSC
3: Cedar Street (Route 85) & Deer Street

2024 No Build Conditions (with Existing Timings)

Weekday Morning

Intersection						
Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	36	36	851	366	5
Future Vol, veh/h	5	36	36	851	366	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	88	88	91	91
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	5	38	41	967	402	5
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	1454	405	408	0	-	0
Stage 1	405	-	-	-	-	-
Stage 2	1049	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	145	650	1162	-	-	-
Stage 1	678	-	-	-	-	-
Stage 2	340	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	140	650	1162	-	-	-
Mov Cap-2 Maneuver	140	-	-	-	-	-
Stage 1	678	-	-	-	-	-
Stage 2	328	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	13.4	0.3		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1162	-	140	650	-	-
HCM Lane V/C Ratio	0.035	-	0.038	0.059	-	-
HCM Control Delay (s)	8.2	-	31.7	10.9	-	-
HCM Lane LOS	A	-	D	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	0.2	-	-

Lanes, Volumes, Timings

2024 No Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	378	0	183	523	329	0	0	723	42
Future Volume (vph)	0	0	0	378	0	183	523	329	0	0	723	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		220
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Ped Bike Factor											1.00	
Frt						0.850					0.992	
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3467	0	1615	1752	1900	0	0	3543	0
Flt Permitted				0.950			0.166					
Satd. Flow (perm)	0	0	0	3467	0	1615	306	1900	0	0	3543	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						195					8	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		300			300			870			436	
Travel Time (s)		6.8			6.8			19.8			9.9	
Confl. Peds. (#/hr)									11	11		
Confl. Bikes (#/hr)									2			4
Peak Hour Factor	0.25	0.25	0.25	0.94	0.94	0.94	0.87	0.87	0.87	0.94	0.94	0.94
Heavy Vehicles (%)	0%	0%	0%	1%	0%	0%	3%	0%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Turn Type				Prot		Free	pm+pt	NA			NA	
Protected Phases				4			1	6			2	
Permitted Phases						Free	6					
Detector Phase				4			1	6			2	
Switch Phase												
Minimum Initial (s)				6.0			6.0	10.0			10.0	
Minimum Split (s)				12.0			9.0	16.0			16.0	
Total Split (s)				21.0			28.0	64.0			36.0	
Total Split (%)				24.7%			32.9%	75.3%			42.4%	
Maximum Green (s)				15.0			25.0	58.0			30.0	
Yellow Time (s)				3.0			3.0	3.0			3.0	
All-Red Time (s)				3.0			0.0	3.0			3.0	
Lost Time Adjust (s)				0.0			0.0	0.0			0.0	
Total Lost Time (s)				6.0			3.0	6.0			6.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)				5.0			2.0	2.0			2.0	
Recall Mode				None			None	Min			Min	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 73.6
 Natural Cycle: 60
 Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps

 Ø1 28 s	 Ø2 36 s	 Ø4 21 s
 Ø5 64 s		

Queues

2024 No Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps Monday Evening

					
Lane Group	WBL	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	402	195	601	378	814
v/c Ratio	0.61	0.12	0.93	0.31	0.76
Control Delay	33.4	0.2	40.8	6.5	28.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	33.4	0.2	40.8	6.5	28.7
Queue Length 50th (ft)	93	0	206	69	187
Queue Length 95th (ft)	151	0	#409	102	249
Internal Link Dist (ft)				790	356
Turn Bay Length (ft)					
Base Capacity (vph)	725	1615	713	1508	1488
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.12	0.84	0.25	0.55

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary 2024 No Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	378	0	183	523	329	0	0	723	42
Future Volume (veh/h)	0	0	0	378	0	183	523	329	0	0	723	42
Number				7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1881	0	1900	1845	1900	0	0	1882	1900
Adj Flow Rate, veh/h				402	0	0	601	378	0	0	769	0
Adj No. of Lanes				2	0	1	1	1	0	0	2	0
Peak Hour Factor				0.94	0.94	0.94	0.87	0.87	0.87	0.94	0.94	0.94
Percent Heavy Veh, %				1	0	0	3	0	0	0	1	1
Cap, veh/h				595	0	277	660	1178	0	0	1114	0
Arrive On Green				0.17	0.00	0.00	0.26	0.62	0.00	0.00	0.31	0.00
Sat Flow, veh/h				3476	0	1615	1757	1900	0	0	3764	0
Grp Volume(v), veh/h				402	0	0	601	378	0	0	769	0
Grp Sat Flow(s),veh/h/ln				1738	0	1615	1757	1900	0	0	1788	0
Q Serve(g_s), s				6.2	0.0	0.0	11.9	5.4	0.0	0.0	10.8	0.0
Cycle Q Clear(g_c), s				6.2	0.0	0.0	11.9	5.4	0.0	0.0	10.8	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				595	0	277	660	1178	0	0	1114	0
V/C Ratio(X)				0.68	0.00	0.00	0.91	0.32	0.00	0.00	0.69	0.00
Avail Cap(c_a), veh/h				907	0	421	974	1917	0	0	1866	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				22.3	0.0	0.0	9.8	5.2	0.0	0.0	17.4	0.0
Incr Delay (d2), s/veh				2.8	0.0	0.0	7.0	0.1	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				3.2	0.0	0.0	7.0	2.9	0.0	0.0	5.4	0.0
LnGrp Delay(d),s/veh				25.2	0.0	0.0	16.8	5.2	0.0	0.0	17.6	0.0
LnGrp LOS				C			B	A			B	
Approach Vol, veh/h					402			979			769	
Approach Delay, s/veh					25.2			12.3			17.6	
Approach LOS					C			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	17.7	23.9		15.8		41.6						
Change Period (Y+Rc), s	3.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	25.0	30.0		15.0		58.0						
Max Q Clear Time (g_c+I1), s	13.9	12.8		8.2		7.4						
Green Ext Time (p_c), s	0.9	5.1		1.6		6.1						
Intersection Summary												
HCM 2010 Ctrl Delay				16.6								
HCM 2010 LOS				B								

Lanes, Volumes, Timings

2024 No Build Conditions (with Existing Timings)

2: Cedar Street (Route 85) & I-495 Southbound Off-ramps/I-495 Southbound On-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	0	639	0	0	0	0	830	366	268	833	0
Future Volume (vph)	23	0	639	0	0	0	0	830	366	268	833	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00
Frt			0.850					0.954				
Flt Protected	0.950										0.988	
Satd. Flow (prot)	1805	0	1583	0	0	0	0	3376	0	0	3514	0
Flt Permitted	0.950										0.988	
Satd. Flow (perm)	1805	0	1583	0	0	0	0	3376	0	0	3514	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		289			302			324			870	
Travel Time (s)		6.6			6.9			7.4			19.8	
Peak Hour Factor	0.94	0.94	0.94	0.25	0.25	0.25	0.86	0.86	0.86	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	0%	0%	0%	0%	2%	2%	3%	1%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											

Intersection

Int Delay, s/veh 4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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Lane Configurations												
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Traffic Vol, veh/h	23	0	639	0	0	0	0	830	366	268	833	0
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Future Vol, veh/h	23	0	639	0	0	0	0	830	366	268	833	0
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Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
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Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
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RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
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Storage Length	0	-	0	-	-	-	-	-	-	-	-	-
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Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
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Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
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Peak Hour Factor	94	94	94	25	25	25	86	86	86	92	92	92
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Heavy Vehicles, %	0	0	2	0	0	0	0	2	2	3	1	0
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Mvmt Flow	24	0	680	0	0	0	0	965	426	291	905	0
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Major/Minor Minor2

Major1

Major2

Conflicting Flow All	1971	-	453	-	0	0	1391	0	0
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Stage 1	1488	-	-	-	-	-	-	-	-
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Stage 2	483	-	-	-	-	-	-	-	-
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Critical Hdwy	6.8	-	6.94	-	-	-	4.16	-	-
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Critical Hdwy Stg 1	5.8	-	-	-	-	-	-	-	-
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Critical Hdwy Stg 2	5.8	-	-	-	-	-	-	-	-
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Follow-up Hdwy	3.5	-	3.32	-	-	-	2.23	-	-
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Pot Cap-1 Maneuver	56	0 ~ 554	0	-	-	483	-	0
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Stage 1	177	0	-	0	-	-	-	0
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Stage 2	592	0	-	0	-	-	-	0
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Platoon blocked, %				-	-	-	-	
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Mov Cap-1 Maneuver	0	0 ~ 554	-	-	-	483	-	-
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Mov Cap-2 Maneuver	0	0	-	-	-	-	-	-
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Stage 1	0	0	-	-	-	-	-	-
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Stage 2	592	0	-	-	-	-	-	-
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Approach EB

NB

SB

HCM Control Delay, s		0	10.9
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HCM LOS	-		
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Minor Lane/Major Mvmt NBT NBR EBLn1 EBLn2 SBL SBT

Capacity (veh/h)	-	-	-	554	483	-
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HCM Lane V/C Ratio	-	-	-	1.227	0.603	-
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HCM Control Delay (s)	-	-	-	141.3	23.1	7
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HCM Lane LOS	-	-	-	F	C	A
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HCM 95th %tile Q(veh)	-	-	-	25.7	3.9	-
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Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings
3: Cedar Street (Route 85) & Deer Street

2024 No Build Conditions (with Existing Timings)
Weekday Evening

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	31	31	481	734	5
Future Volume (vph)	5	31	31	481	734	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.999	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1745	1561	1805	1900	1898	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1745	1561	1805	1900	1898	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	317			436	370	
Travel Time (s)	7.2			9.9	8.4	
Peak Hour Factor	0.96	0.96	0.87	0.87	0.94	0.94
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 TWSC
3: Cedar Street (Route 85) & Deer Street

2024 No Build Conditions (with Existing Timings)
Weekday Evening

Intersection

Int Delay, s/veh 0.7

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	5	31	31	481	734	5
Future Vol, veh/h	5	31	31	481	734	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	87	87	94	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	5	32	36	553	781	5

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	1408	784	786	0	-	0
Stage 1	784	-	-	-	-	-
Stage 2	624	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	155	396	842	-	-	-
Stage 1	453	-	-	-	-	-
Stage 2	538	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	148	396	842	-	-	-
Mov Cap-2 Maneuver	148	-	-	-	-	-
Stage 1	453	-	-	-	-	-
Stage 2	515	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	17	0.6	0
HCM LOS	C		

Minor Lane/Major Mvmt NBL NBT EBLn1 EBLn2 SBT SBR

Capacity (veh/h)	842	-	148	396	-	-
HCM Lane V/C Ratio	0.042	-	0.035	0.082	-	-
HCM Control Delay (s)	9.5	-	30.2	14.9	-	-
HCM Lane LOS	A	-	D	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	0.3	-	-

Lanes, Volumes, Timings

2024 Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	314	0	437	490	472	0	0	414	70
Future Volume (vph)	0	0	0	314	0	437	490	472	0	0	414	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		220
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Ped Bike Factor											1.00	
Frt						0.850					0.978	
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3400	0	1583	1719	1845	0	0	3402	0
Flt Permitted				0.950			0.306					
Satd. Flow (perm)	0	0	0	3400	0	1583	554	1845	0	0	3402	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						502					16	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		300			300			870			436	
Travel Time (s)		6.8			6.8			19.8			9.9	
Confl. Peds. (#/hr)									1	2		
Confl. Bikes (#/hr)									2			2
Peak Hour Factor	0.25	0.25	0.25	0.87	0.87	0.87	0.88	0.88	0.88	0.91	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	3%	0%	2%	5%	3%	0%	0%	3%	6%
Shared Lane Traffic (%)												
Turn Type				Prot		Free	pm+pt	NA			NA	
Protected Phases				4			1	6			2	
Permitted Phases						Free	6					
Detector Phase				4			1	6			2	
Switch Phase												
Minimum Initial (s)				6.0			6.0	10.0			10.0	
Minimum Split (s)				12.0			9.0	16.0			16.0	
Total Split (s)				41.0			38.0	79.0			41.0	
Total Split (%)				34.2%			31.7%	65.8%			34.2%	
Maximum Green (s)				35.0			35.0	73.0			35.0	
Yellow Time (s)				3.0			3.0	3.0			3.0	
All-Red Time (s)				3.0			0.0	3.0			3.0	
Lost Time Adjust (s)				0.0			0.0	0.0			0.0	
Total Lost Time (s)				6.0			3.0	6.0			6.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)				5.0			2.0	2.0			2.0	
Recall Mode				None			None	Min			Min	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 68.3
Natural Cycle: 45
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps

 Ø1	 Ø2	 Ø4
38 s	41 s	41 s
 Ø6		
79 s		

Queues

2024 Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps Wednesday Morning

					
Lane Group	WBL	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	361	502	557	536	532
v/c Ratio	0.46	0.32	0.81	0.50	0.64
Control Delay	26.8	0.5	19.2	10.1	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	0.5	19.2	10.1	27.9
Queue Length 50th (ft)	62	0	105	111	94
Queue Length 95th (ft)	135	0	257	208	200
Internal Link Dist (ft)				790	356
Turn Bay Length (ft)					
Base Capacity (vph)	1843	1583	996	1738	1851
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.20	0.32	0.56	0.31	0.29
Intersection Summary					

HCM 2010 Signalized Intersection Summary 2024 Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Off-ramps

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	314	0	437	490	472	0	0	414	70
Future Volume (veh/h)	0	0	0	314	0	437	490	472	0	0	414	70
Number				7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1863	1810	1845	0	0	1837	1900
Adj Flow Rate, veh/h				361	0	0	557	536	0	0	455	0
Adj No. of Lanes				2	0	1	1	1	0	0	2	0
Peak Hour Factor				0.87	0.87	0.87	0.88	0.88	0.88	0.91	0.91	0.91
Percent Heavy Veh, %				3	0	2	5	3	0	0	3	3
Cap, veh/h				657	0	305	724	1057	0	0	855	0
Arrive On Green				0.19	0.00	0.00	0.27	0.57	0.00	0.00	0.24	0.00
Sat Flow, veh/h				3408	0	1583	1723	1845	0	0	3674	0
Grp Volume(v), veh/h				361	0	0	557	536	0	0	455	0
Grp Sat Flow(s),veh/h/ln				1704	0	1583	1723	1845	0	0	1745	0
Q Serve(g_s), s				4.9	0.0	0.0	10.9	9.0	0.0	0.0	5.8	0.0
Cycle Q Clear(g_c), s				4.9	0.0	0.0	10.9	9.0	0.0	0.0	5.8	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				657	0	305	724	1057	0	0	855	0
V/C Ratio(X)				0.55	0.00	0.00	0.77	0.51	0.00	0.00	0.53	0.00
Avail Cap(c_a), veh/h				2329	0	1082	1438	2629	0	0	2385	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				18.7	0.0	0.0	8.9	6.6	0.0	0.0	16.8	0.0
Incr Delay (d2), s/veh				1.5	0.0	0.0	0.7	0.1	0.0	0.0	0.2	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.4	0.0	0.0	5.1	4.5	0.0	0.0	2.8	0.0
LnGrp Delay(d),s/veh				20.2	0.0	0.0	9.5	6.7	0.0	0.0	17.0	0.0
LnGrp LOS				C			A	A			B	
Approach Vol, veh/h					361			1093			455	
Approach Delay, s/veh					20.2			8.2			17.0	
Approach LOS					C			A			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	16.8	18.5		15.9		35.3						
Change Period (Y+Rc), s	3.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	35.0	35.0		35.0		73.0						
Max Q Clear Time (g_c+I1), s	12.9	7.8		6.9		11.0						
Green Ext Time (p_c), s	0.9	4.7		3.0		5.0						
Intersection Summary												
HCM 2010 Ctrl Delay				12.5								
HCM 2010 LOS				B								

Lanes, Volumes, Timings

2024 Build Conditions (with Existing Timings)

2: Cedar Street (Route 85) & I-495 Southbound Off-ramps/I-495 Southbound On-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 			 	
Traffic Volume (vph)	24	0	604	0	0	0	0	938	347	141	587	0
Future Volume (vph)	24	0	604	0	0	0	0	938	347	141	587	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00
Frt			0.850					0.960				
Flt Protected	0.950										0.990	
Satd. Flow (prot)	1805	0	1568	0	0	0	0	3374	0	0	3510	0
Flt Permitted	0.950										0.990	
Satd. Flow (perm)	1805	0	1568	0	0	0	0	3374	0	0	3510	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		279			321			324			870	
Travel Time (s)		6.3			7.3			7.4			19.8	
Peak Hour Factor	0.81	0.81	0.81	0.25	0.25	0.25	0.93	0.93	0.93	0.87	0.87	0.87
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	2%	1%	2%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											

Intersection

Int Delay, s/veh 28.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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Lane Configurations												
Traffic Vol, veh/h	24	0	604	0	0	0	0	938	347	141	587	0
Future Vol, veh/h	24	0	604	0	0	0	0	938	347	141	587	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	0	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	81	81	81	25	25	25	93	93	93	87	87	87
Heavy Vehicles, %	0	0	3	0	0	0	0	3	2	1	2	0
Mvmt Flow	30	0	746	0	0	0	0	1009	373	162	675	0

Major/Minor	Minor2			Major1		Major2		
Conflicting Flow All	1503	-	337	-	0	0	1382	0
Stage 1	999	-	-	-	-	-	-	-
Stage 2	504	-	-	-	-	-	-	-
Critical Hdwy	6.8	-	6.96	-	-	-	4.12	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	-	3.33	-	-	-	2.21	-
Pot Cap-1 Maneuver	114	0 ~	656	0	-	-	497	-
Stage 1	322	0	-	0	-	-	-	-
Stage 2	578	0	-	0	-	-	-	-
Platoon blocked, %					-	-		-
Mov Cap-1 Maneuver	55	0 ~	656	-	-	-	497	-
Mov Cap-2 Maneuver	55	0	-	-	-	-	-	-
Stage 1	154	0	-	-	-	-	-	-
Stage 2	578	0	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	103.5	0	5.3
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT
Capacity (veh/h)	-	-	55	656	497	-
HCM Lane V/C Ratio	-	-	0.539	1.137	0.326	-
HCM Control Delay (s)	-	-	129.9	102.5	15.7	2.8
HCM Lane LOS	-	-	F	F	C	A
HCM 95th %tile Q(veh)	-	-	2.1	23.2	1.4	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings
3: Cedar Street (Route 85) & Deer Street

2024 Build Conditions (with Existing Timings)
Weekday Morning

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	33	118	58	851	366	11
Future Volume (vph)	33	118	58	851	366	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.996	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1745	1561	1805	1900	1892	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1745	1561	1805	1900	1892	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	299			436	370	
Travel Time (s)	6.8			9.9	8.4	
Peak Hour Factor	0.94	0.94	0.88	0.88	0.91	0.91
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

Intersection

Int Delay, s/veh 2.2

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	33	118	58	851	366	11
Future Vol, veh/h	33	118	58	851	366	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	88	88	91	91
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	35	126	66	967	402	12

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	1507	408	414	0	-	0
Stage 1	408	-	-	-	-	-
Stage 2	1099	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	134	648	1156	-	-	-
Stage 1	676	-	-	-	-	-
Stage 2	322	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	126	648	1156	-	-	-
Mov Cap-2 Maneuver	126	-	-	-	-	-
Stage 1	676	-	-	-	-	-
Stage 2	304	-	-	-	-	-

Approach EB NB SB

HCM Control Delay, s	19	0.5	0
HCM LOS	C		

Minor Lane/Major Mvmt NBL NBT EBLn1 EBLn2 SBT SBR

Capacity (veh/h)	1156	-	126	648	-	-
HCM Lane V/C Ratio	0.057	-	0.279	0.194	-	-
HCM Control Delay (s)	8.3	-	44.3	11.9	-	-
HCM Lane LOS	A	-	E	B	-	-
HCM 95th %tile Q(veh)	0.2	-	1.1	0.7	-	-

Lanes, Volumes, Timings

2024 Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	378	0	199	523	400	0	0	749	60
Future Volume (vph)	0	0	0	378	0	199	523	400	0	0	749	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	0		0	0		220
Storage Lanes	0		0	2		1	1		0	0		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Ped Bike Factor											1.00	
Frt						0.850					0.989	
Flt Protected				0.950			0.950					
Satd. Flow (prot)	0	0	0	3467	0	1615	1752	1900	0	0	3531	0
Flt Permitted				0.950			0.151					
Satd. Flow (perm)	0	0	0	3467	0	1615	279	1900	0	0	3531	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						212					11	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		300			300			870			436	
Travel Time (s)		6.8			6.8			19.8			9.9	
Confl. Peds. (#/hr)									11	11		
Confl. Bikes (#/hr)									2			4
Peak Hour Factor	0.25	0.25	0.25	0.94	0.94	0.94	0.87	0.87	0.87	0.94	0.94	0.94
Heavy Vehicles (%)	0%	0%	0%	1%	0%	0%	3%	0%	0%	0%	1%	0%
Shared Lane Traffic (%)												
Turn Type				Prot		Free	pm+pt	NA			NA	
Protected Phases				4			1	6			2	
Permitted Phases						Free	6					
Detector Phase				4			1	6			2	
Switch Phase												
Minimum Initial (s)				6.0			6.0	10.0			10.0	
Minimum Split (s)				12.0			9.0	16.0			16.0	
Total Split (s)				21.0			28.0	64.0			36.0	
Total Split (%)				24.7%			32.9%	75.3%			42.4%	
Maximum Green (s)				15.0			25.0	58.0			30.0	
Yellow Time (s)				3.0			3.0	3.0			3.0	
All-Red Time (s)				3.0			0.0	3.0			3.0	
Lost Time Adjust (s)				0.0			0.0	0.0			0.0	
Total Lost Time (s)				6.0			3.0	6.0			6.0	
Lead/Lag							Lead				Lag	
Lead-Lag Optimize?							Yes				Yes	
Vehicle Extension (s)				5.0			2.0	2.0			2.0	
Recall Mode				None			None	Min			Min	

Intersection Summary

Area Type: Other
Cycle Length: 85
Actuated Cycle Length: 76
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps

 Ø1 28 s	 Ø2 36 s	 Ø4 21 s
 Ø6 64 s		

Queues

2024 Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps Monday Evening

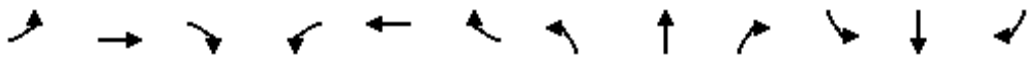
					
Lane Group	WBL	WBR	NBL	NBT	SBT
Lane Group Flow (vph)	402	212	601	460	861
v/c Ratio	0.62	0.13	0.94	0.37	0.78
Control Delay	34.7	0.2	42.8	6.9	29.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	34.7	0.2	42.8	6.9	29.5
Queue Length 50th (ft)	95	0	219	89	201
Queue Length 95th (ft)	151	0	#422	128	267
Internal Link Dist (ft)				790	356
Turn Bay Length (ft)					
Base Capacity (vph)	696	1615	687	1477	1426
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.58	0.13	0.87	0.31	0.60

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

HCM 2010 Signalized Intersection Summary 2024 Build Conditions (with Existing Timings)

1: Cedar Street (Route 85) & I-495 Northbound On-ramps/I-495 Northbound Offramps

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	378	0	199	523	400	0	0	749	60
Future Volume (veh/h)	0	0	0	378	0	199	523	400	0	0	749	60
Number				7	4	14	1	6	16	5	2	12
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1881	0	1900	1845	1900	0	0	1883	1900
Adj Flow Rate, veh/h				402	0	0	601	460	0	0	797	0
Adj No. of Lanes				2	0	1	1	1	0	0	2	0
Peak Hour Factor				0.94	0.94	0.94	0.87	0.87	0.87	0.94	0.94	0.94
Percent Heavy Veh, %				1	0	0	3	0	0	0	1	1
Cap, veh/h				588	0	273	657	1193	0	0	1150	0
Arrive On Green				0.17	0.00	0.00	0.26	0.63	0.00	0.00	0.32	0.00
Sat Flow, veh/h				3476	0	1615	1757	1900	0	0	3765	0
Grp Volume(v), veh/h				402	0	0	601	460	0	0	797	0
Grp Sat Flow(s),veh/h/ln				1738	0	1615	1757	1900	0	0	1788	0
Q Serve(g_s), s				6.4	0.0	0.0	12.3	7.0	0.0	0.0	11.5	0.0
Cycle Q Clear(g_c), s				6.4	0.0	0.0	12.3	7.0	0.0	0.0	11.5	0.0
Prop In Lane				1.00		1.00	1.00		0.00	0.00		0.00
Lane Grp Cap(c), veh/h				588	0	273	657	1193	0	0	1150	0
V/C Ratio(X)				0.68	0.00	0.00	0.92	0.39	0.00	0.00	0.69	0.00
Avail Cap(c_a), veh/h				881	0	409	949	1861	0	0	1813	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh				23.1	0.0	0.0	10.4	5.4	0.0	0.0	17.5	0.0
Incr Delay (d2), s/veh				3.0	0.0	0.0	8.0	0.1	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				3.3	0.0	0.0	10.6	3.6	0.0	0.0	5.7	0.0
LnGrp Delay(d),s/veh				26.1	0.0	0.0	18.4	5.5	0.0	0.0	17.8	0.0
LnGrp LOS				C			B	A			B	
Approach Vol, veh/h					402			1061			797	
Approach Delay, s/veh					26.1			12.8			17.8	
Approach LOS					C			B			B	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4		6						
Phs Duration (G+Y+Rc), s	18.1	25.0		16.0		43.2						
Change Period (Y+Rc), s	3.0	6.0		6.0		6.0						
Max Green Setting (Gmax), s	25.0	30.0		15.0		58.0						
Max Q Clear Time (g_c+I1), s	14.3	13.5		8.4		9.0						
Green Ext Time (p_c), s	0.8	5.5		1.6		6.9						
Intersection Summary												
HCM 2010 Ctrl Delay				16.9								
HCM 2010 LOS				B								

Lanes, Volumes, Timings

2024 Build Conditions (with Existing Timings)

2: Cedar Street (Route 85) & I-495 Southbound Off-ramps/I-495 Southbound On-ramps

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 			 	
Traffic Volume (vph)	56	0	637	0	0	0	0	868	366	276	851	0
Future Volume (vph)	56	0	637	0	0	0	0	868	366	276	851	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	1.00
Frt			0.850					0.955				
Flt Protected	0.950										0.988	
Satd. Flow (prot)	1805	0	1583	0	0	0	0	3380	0	0	3514	0
Flt Permitted	0.950										0.988	
Satd. Flow (perm)	1805	0	1583	0	0	0	0	3380	0	0	3514	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		289			302			324			870	
Travel Time (s)		6.6			6.9			7.4			19.8	
Peak Hour Factor	0.94	0.94	0.94	0.25	0.25	0.25	0.86	0.86	0.86	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	2%	0%	0%	0%	0%	2%	2%	3%	1%	0%
Shared Lane Traffic (%)												
Sign Control		Stop			Stop			Free			Free	
Intersection Summary												
Area Type:	Other											
Control Type:	Unsignalized											

Intersection

Int Delay, s/veh 4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	56	0	637	0	0	0	0	868	366	276	851	0
Future Vol, veh/h	56	0	637	0	0	0	0	868	366	276	851	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	None	-	-	None	-	-	None
Storage Length	0	-	0	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	16979	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	25	25	25	86	86	86	92	92	92
Heavy Vehicles, %	0	0	2	0	0	0	0	2	2	3	1	0
Mvmt Flow	60	0	678	0	0	0	0	1009	426	300	925	0

Major/Minor	Minor2			Major1			Major2		
Conflicting Flow All	2030	-	463	-	0	0	1435	0	0
Stage 1	1525	-	-	-	-	-	-	-	-
Stage 2	505	-	-	-	-	-	-	-	-
Critical Hdwy	6.8	-	6.94	-	-	-	4.16	-	-
Critical Hdwy Stg 1	5.8	-	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.8	-	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	-	3.32	-	-	-	2.23	-	-
Pot Cap-1 Maneuver	~ 51	0	~ 546	0	-	-	464	-	0
Stage 1	169	0	-	0	-	-	-	-	0
Stage 2	577	0	-	0	-	-	-	-	0
Platoon blocked, %					-	-		-	
Mov Cap-1 Maneuver	0	0	~ 546	-	-	-	464	-	-
Mov Cap-2 Maneuver	0	0	-	-	-	-	-	-	-
Stage 1	0	0	-	-	-	-	-	-	-
Stage 2	577	0	-	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s		0	12.2
HCM LOS	-		

Minor Lane/Major Mvmt	NBT	NBR	EBLn1	EBLn2	SBL	SBT
Capacity (veh/h)	-	-	-	546	464	-
HCM Lane V/C Ratio	-	-	-	1.241	0.647	-
HCM Control Delay (s)	-	-	-	147.3	25.9	7.8
HCM Lane LOS	-	-	-	F	D	A
HCM 95th %tile Q(veh)	-	-	-	26.2	4.5	-

Notes

~: Volume exceeds capacity \$: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Lanes, Volumes, Timings
3: Cedar Street (Route 85) & Deer Street

2024 Build Conditions (with Existing Timings)
Weekday Evening

						
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	20	75	118	481	734	27
Future Volume (vph)	20	75	118	481	734	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	12	12	12	12
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.995	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1745	1561	1805	1900	1890	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1745	1561	1805	1900	1890	0
Link Speed (mph)	30			30	30	
Link Distance (ft)	323			436	370	
Travel Time (s)	7.3			9.9	8.4	
Peak Hour Factor	0.96	0.96	0.91	0.91	0.94	0.94
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)						
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					

HCM 2010 TWSC
3: Cedar Street (Route 85) & Deer Street

2024 Build Conditions (with Existing Timings)
Weekday Evening

Intersection

Int Delay, s/veh 2.3

Movement EBL EBR NBL NBT SBT SBR

Lane Configurations						
Traffic Vol, veh/h	20	75	118	481	734	27
Future Vol, veh/h	20	75	118	481	734	27
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	0	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	96	96	91	91	94	94
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	21	78	130	529	781	29

Major/Minor Minor2 Major1 Major2

Conflicting Flow All	1583	795	810	0	-	0
Stage 1	795	-	-	-	-	-
Stage 2	788	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	121	391	825	-	-	-
Stage 1	448	-	-	-	-	-
Stage 2	452	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	102	391	825	-	-	-
Mov Cap-2 Maneuver	102	-	-	-	-	-
Stage 1	448	-	-	-	-	-
Stage 2	381	-	-	-	-	-

Approach EB NB SB

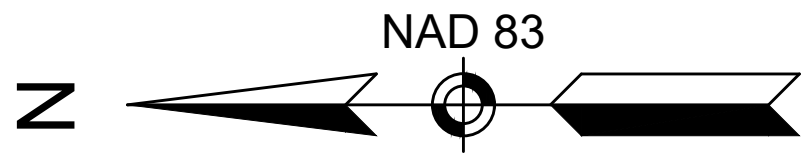
HCM Control Delay, s	23.4	2	0
HCM LOS	C		

Minor Lane/Major Mvmt NBL NBT EBLn1 EBLn2 SBT SBR

Capacity (veh/h)	825	-	102	391	-	-
HCM Lane V/C Ratio	0.157	-	0.204	0.2	-	-
HCM Control Delay (s)	10.2	-	49.1	16.5	-	-
HCM Lane LOS	B	-	E	C	-	-
HCM 95th %tile Q(veh)	0.6	-	0.7	0.7	-	-

- NOTES:
- ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
 - ALL PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK SHALL BE THERMOPLASTIC MATERIALS.
 - THE MINIMUM MOUNTING HEIGHT OF POST-MOUNTED SIGNS, MEASURED VERTICALLY FROM THE BOTTOM OF THE SIGN TO THE TOP OF CURB OR SIDEWALK, OR THE ELEVATION OF THE NEAR EDGE OF TRAVEL WAY, SHALL BE 7 FEET UNLESS OTHERWISE SPECIFIED.
 - A MINIMUM OF 3'-0" PATH OF TRAVEL CLEARANCE, EXCLUDING CURB, IS REQUIRED WHEN PLACING SIGNS.

FOR SIGN SUMMARY: SEE SHEET 12



N/F
ANDREW & MARYELLEN YAROSHEFSKI
PID 19-0-5
BK. 53125, PG. 4

N/F
495 COMMERCE PARK LIMITED
PID 19-0-6A
BK. 9051, PG. 39

N/F
JOSEPH, JOAN & EDWARD DONEGAN
PID 15-0-2
BK. 51133, PG. 350

PROJECT BEGIN
STA 12+50
N2887474.1613
E653775.1738

N/F
JOSEPH &
DIANE DONEGAN
PID 19-0-18B
BK. 25990, PG. 320

N/F
JOSEPH & DIANE DONEGAN
PID 19-0-18
BK. 25990, PG. 320

EXISTING SIGN LEGEND



M1-1(495)

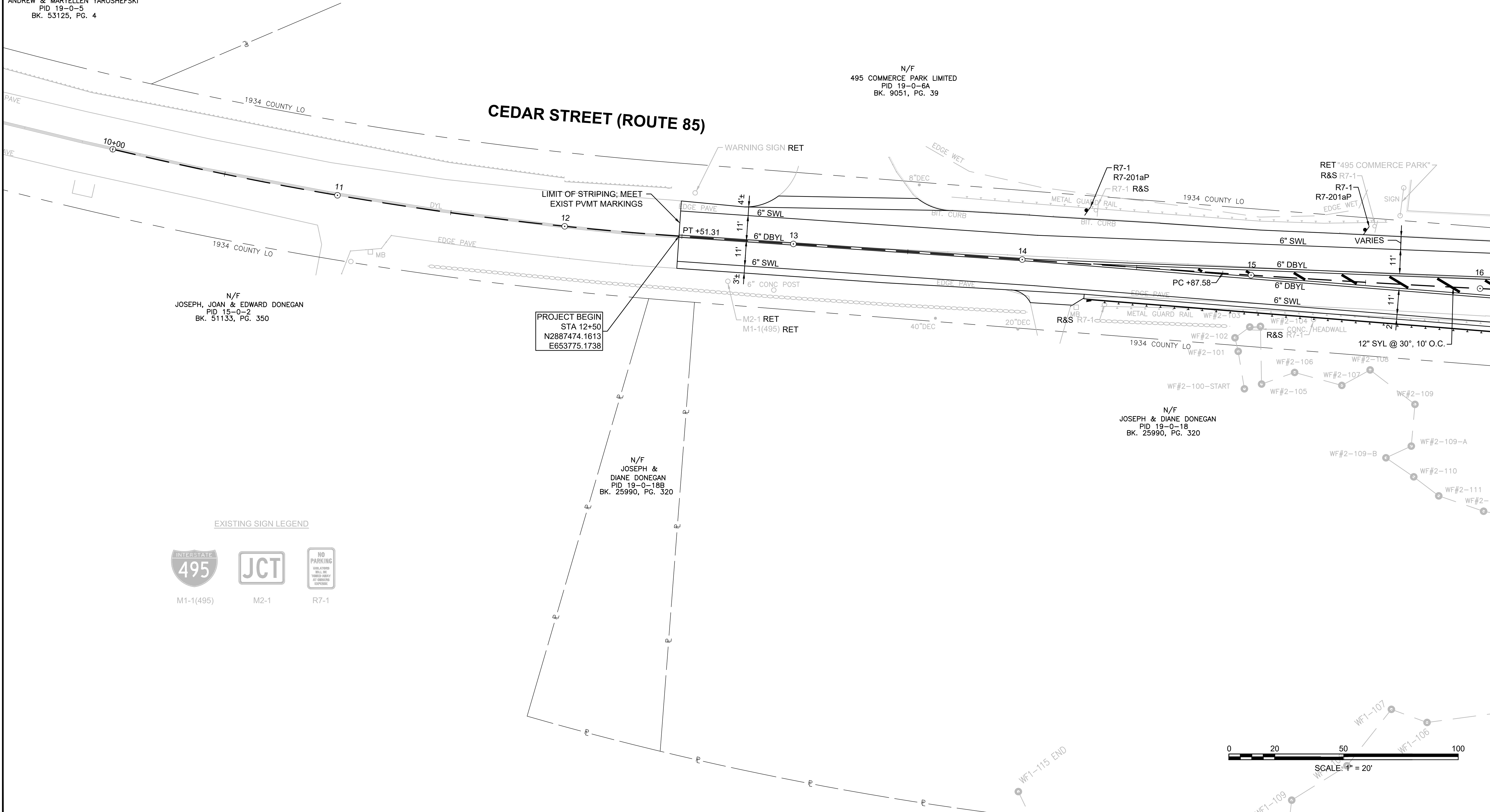


M2-1

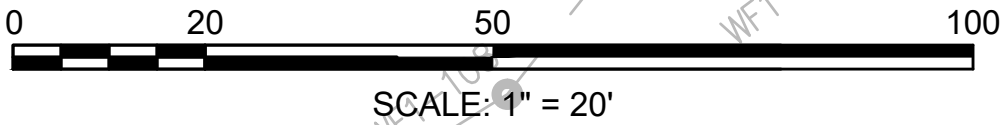


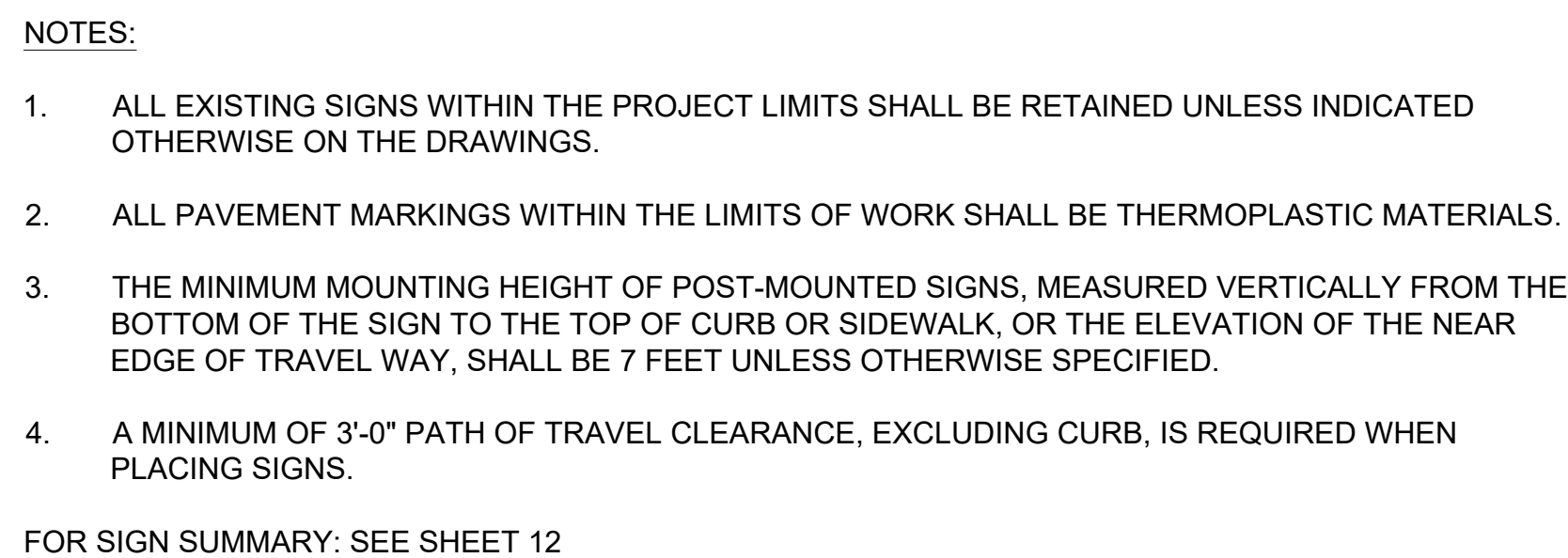
R7-1

CEDAR STREET (ROUTE 85)



CONTINUED ON
SHEET NO. 11

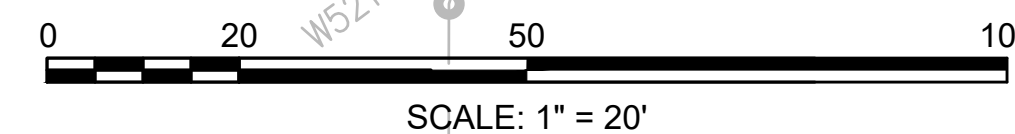




N/F
495 COMMERCE PARK LIMITED
PID 19-0-6B
BK. 9051. PG. 39

**NO
PARKING**
VIOLATORS
WILL BE
TOWED AWAY
AT OWNERS
EXPENSE

R7



- NOTES:
- ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
 - ALL PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK SHALL BE THERMOPLASTIC MATERIALS.
 - THE MINIMUM MOUNTING HEIGHT OF POST-MOUNTED SIGNS, MEASURED VERTICALLY FROM THE BOTTOM OF THE SIGN TO THE TOP OF CURB OR SIDEWALK, OR THE ELEVATION OF THE NEAR EDGE OF TRAVEL WAY, SHALL BE 7 FEET UNLESS OTHERWISE SPECIFIED.
 - A MINIMUM OF 3'-0" PATH OF TRAVEL CLEARANCE, EXCLUDING CURB, IS REQUIRED WHEN PLACING SIGNS.
 - SEE 2009 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS FOR TEXT AND LEGEND DIMENSIONS.

FOR SIGN SUMMARY: SEE SHEET 12

N/F
NEW ENGLAND POWER CO.
PID 19-0-7

N/F
CEDAR ENTERPRISEES, LLC
PID 19-0-6C
BK. 40837, PG. 382

CEDAR STREET (ROUTE 85)

CONTINUED ON
SHEET NO. 11

6" DWLEx (2' LINE W/ 6' GAP) (210')
12" SYL @ 30", 10' O.C.

PT +62.62

STA 22+32
BEGIN TAPER
TO MEET EXIST

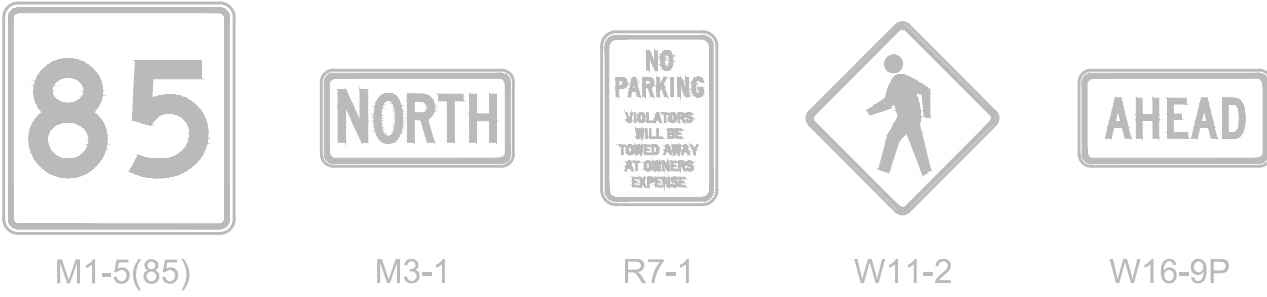
PROJECT END
STA 24+72
N2886253.4735
E653763.0879

TRAFFIC SIGN SUMMARY

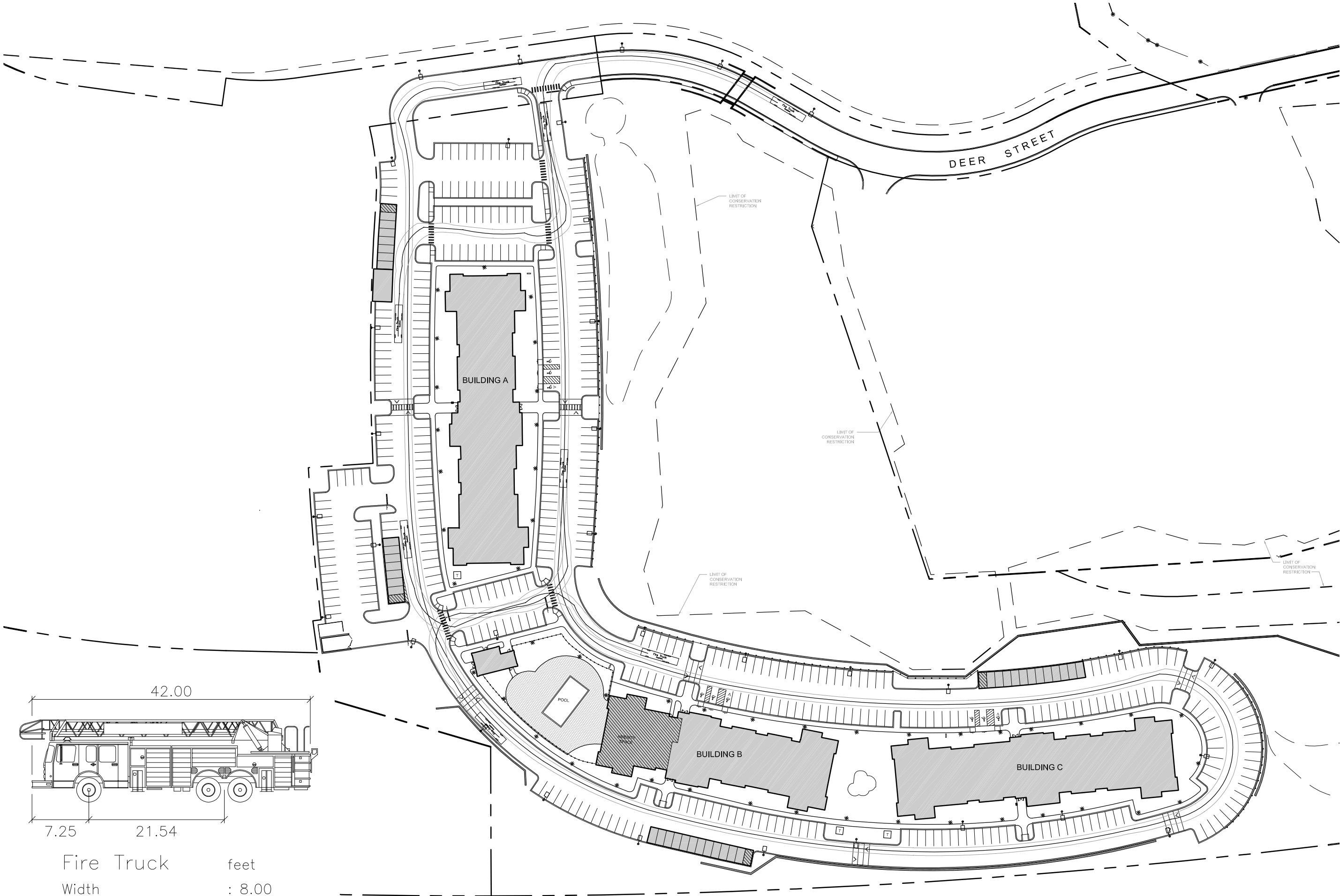
IDENTIFICATION NUMBER	SIZE OF SIGN (in)		LEGEND	TEXT DIMENSIONS (in)			NUMBER OF SIGNS REQUIRED	COLOR			SIZE AND NUMBER OF POSTS REQUIRED	UNIT AREA (SF)	TOTAL AREA (SF)
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR		BACK-GROUND	LEGEND	BORDER			
R1-1	36	36					1	RED	WHITE	WHITE	1	9.00	9.00
R3-7L	36	36					2	WHITE	BLACK	BLACK	2	9.00	18.00
R3-8	30	30					1	WHITE	BLACK	BLACK	1	6.25	6.25
R7-1	12	18					12	WHITE	RED	RED	12	1.50	18.00
R7-201aP	12	6					12	WHITE	RED	RED	0 MOUNT 13 W/ R7-1	0.50	6.00

N/F
NEW ENGLAND POWER CO.
PID 19-0-9

EXISTING SIGN LEGEND



0 20 50 100
SCALE: 1" = 20'



Fire Truck	feet
Width	: 8.00
Track	: 8.00
Lock to Lock Time	: 6.0
Steering Angle	: 40.0

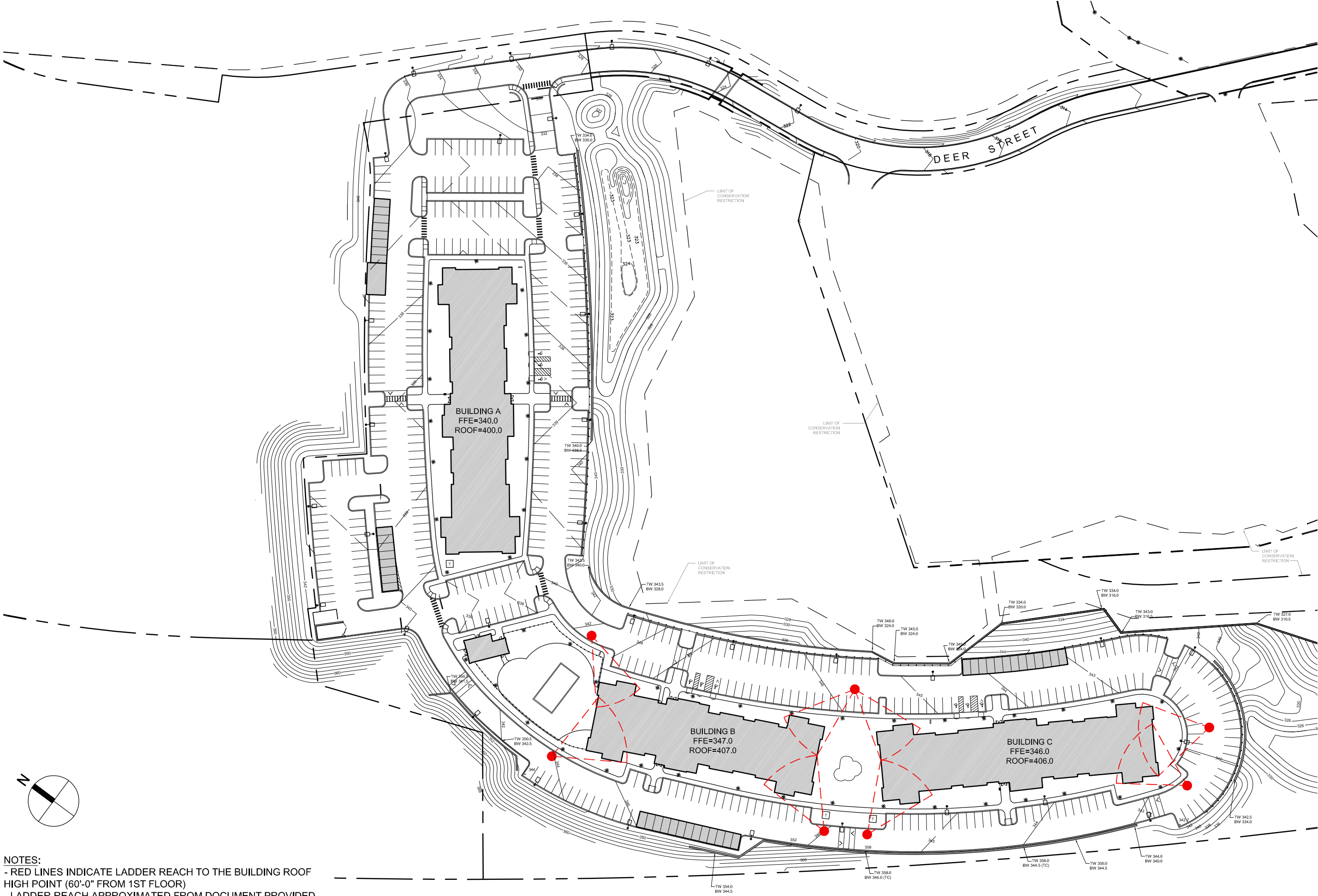
TURNING

FIRE TRUCK
TURNING MOVEMENTS

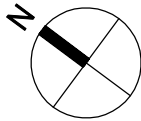
DATE:	03/21/2018
ISSUE:	
SCALE:	1"=100"
REF:	
DR BY:	WMP
CK BY:	JAH

Residences at Stone Ridge

Deer Street
Milford, MA
JOB NO.: 17095



NOTES:
- RED LINES INDICATE LADDER REACH TO THE BUILDING ROOF HIGH POINT (60'-0" FROM 1ST FLOOR)
- LADDER REACH APPROXIMATED FROM DOCUMENT PROVIDED BY THE MILFORD FIRE DEPARTMENT ENTITLED "HEIGHT AND REACH CHART - 109' AERIALCAT REARMOUNT LADDER"



LADDER

Residences at Stone Ridge

SMMA

FIRE TRUCK
LADDER REACH

Deer Street
Milford, MA
JOB NO.: 17095

DATE:	04/12/2018
ISSUE:	
SCALE:	1"=100"
REF:	
DR BY:	WWP
CK BY:	JAH

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