Tighe&Bond

15-0173-002A July 19, 2021

Mr. Samuel B. Fuller FDSPIN 141 DR, LLC 1 North Water Street, Suite 100 South Norwalk, CT 06854

Re: Traffic Impact Statement 141 Danbury Road (U.S. Route 7) Redevelopment Wilton, Connecticut

Dear Mr. Fuller:

Tighe & Bond has prepared this traffic statement to review the potential traffic impact of the proposed redevelopment of the existing commercial property at 141 Danbury Road (U.S. Route 7) in Wilton into a 173 unit multi-family residential development. This traffic statement is provided in support of the Town of Wilton regulatory process. The resulting analysis shows that the proposed development traffic will not have a significant impact to traffic operations on Danbury Road.

Existing Conditions

The 141 Danbury Road site, shown in Figure 1, contains 47,040 square feet of commercial building surrounded by 229 surface parking spaces. The site is located approximately 700 feet south of the signalized intersection of Danbury Road and its south junction with State Route 33 (Westport Road). Access to the existing site is via a full access driveway on Danbury Road, which is stop controlled on the exiting approach. The existing site driveway is approximately 24 feet wide accommodating one entering and one exiting lane.

Danbury Road, designated as U.S. Route 7, is classified as an urban principal arterial by the Connecticut Department of Transportation (CTDOT). Danbury Road runs north to south and connects Wilton to the Town of Ridgefield to the north and the City of Norwalk to the south. Along the site frontage, the roadway is approximately 35 to 46 feet wide with two, 11 foot northbound travel lanes, one southbound travel lane, and 2 to 4 foot shoulders in each direction. No sidewalks are provided along the site frontage or on adjacent properties. The posted speed limit on Danbury Road is 40 miles per hour (mph) in the vicinity of the site. Danbury Road provides access to residential, office, and commercial uses near the site.

A review of CTDOT automatic traffic recorder (ATR) counts shows that Danbury Road, south of Route 33, carried approximately 26,700, 27,900, 25,300, and 18,500 vehicles per day in 2011, 2014, 2017 and 2020, respectively. It should be noted that the traffic counts in 2020 was collected in June 2020, during COVID-19 pandemic, and therefore traffic volumes were significantly lower than those collected during previous years. Further detail on the existing traffic volumes in the area is provided in the Existing Traffic Volumes section.

Development Plan

The proposed development will redevelop the 141 Danbury Road site, removing the existing 47,040 square foot general office building and replacing it with a multi-family residential building containing 173 residential units. The site driveway will remain close to the existing location and be widened to provide one entering lane, a median island, and two exiting lanes with a dedicated left-turn and dedicated right-turn lane. A total of 313 parking spaces including 18 accessible spaces will be provided on site via surface parking on all sides of the

building and parking below the building. Provided CTDOT approves, a sidewalk will be provided along the site frontage including a bus waiting area on the north side of the driveway. It is anticipated that the proposed development will be constructed and occupied by the end of 2023.

Existing Traffic Volumes

Based on the location of the site, existing traffic patterns, and expected limited increase in site-generated trips, the study area includes the site driveway intersection with Danbury Road. The study analyses focus on the weekday morning and weekday afternoon peak hours, the periods when residential and/or commuter related trips, and overall traffic volumes on Danbury Road are at their highest levels.

Given the on-going impact of COVID-19 restrictions and remote working on traffic volumes, the baseline peak hour through traffic volumes for Danbury Road in the vicinity of the site were developed based on the 2017 CTDOT ATR counts on Danbury Road south of Route 33. The 2017 volumes were projected based on a 0.6% annual growth rate to 2021, a conservative estimate that assumes a significant rebound of traffic volumes by the end of 2021. The directional split of traffic volumes on Danbury Road was estimated based on the CTDOT ATR counts collected in 2011 and 2020, which collected directional, hourly traffic volumes. The ATR data showed approximately 40% northbound and 60% southbound traffic during the weekday morning peak period, and the inverse of 60% northbound and 40% southbound during the weekday afternoon peak period. The raw CTDOT ATR data is included in Appendix A.

Due to the impacts of the pandemic, traffic counts could not be reliably conducted, therefore, in order to develop the traffic turning movement volumes at the site driveway intersection with Danbury Road under 2021 Existing Conditions, the site traffic that may be generated by the existing 47,040 square foot general office building, at full occupancy, was estimated based on data published in the Institute of Transportation Engineers (ITE) publication, Trip Generation, 10th edition, 2017. The site-generated weekday morning and weekday afternoon peak hour trips were estimated using ITE Land Use Code 710, General Office Building. Based on the published data, the existing 47,040 square foot general office building is expected to generate approximately 55 trips (47 entering, 8 exiting) during the weekday morning peak hour and 56 trips (9 entering, 47 exiting) during the weekday afternoon peak hour. Table 1 provides a summary of the trip generation for the existing site. The existing site-generated traffic was distributed to the site driveway based on U.S. Census journey to work data and existing travel patterns and was then added to the 2021 Existing Condition volumes of through traffic on Danbury Road, resulting in the 2021 Existing Condition weekday morning and afternoon peak hour traffic volumes shown in Figure 2.

The 2021 Existing Condition traffic volumes and the site-generated trips of the existing general office use were reviewed and approved by CTDOT Bureau of Policy and Planning in April 2021, as shown in the documentation included in Appendix B.

Background Traffic Volumes

To develop the traffic volumes for the 2023 Background Condition, when the proposed development is expected to be completed, the 2021 Existing Traffic volumes were grown by 0.6% per year to represent the general growth of traffic volume on the local roadway network. This growth rate was estimated based upon consultation with CTDOT Bureau of Policy and Planning as shown in the attached Appendix B.

CTDOT and the Town of Wilton Planning and Zoning Department records were also reviewed to determine if any additional pending or recently approved developments may add new traffic through the study area in the near future. No additional developments were identified within this review and the annual traffic growth rate was considered sufficient to project the 2021 existing volumes to 2023. The resulting 2023 Background Conditions traffic volumes for the weekday morning and weekday afternoon peak hours are presented in Figure 3.

Intersection Sight Distance

Intersection sight distance was reviewed at the site driveway intersection with Danbury Road in accordance with criteria set forth in the 2003 CTDOT Highway Design Manual (including revisions to June 2020).

Vehicle travel speed data was collected on Danbury Road as part of the CTDOT ATR counts in 2020. The data, included in Appendix A, showed that the 85th percentile speed, also known as the operating speed, of Danbury Road is 46 mph and 43 mph travelling northbound and southbound, respectively.

Based on the operating speeds, the minimum required sight distances for two northbound travel lanes and one southbound travel lane undivided roadway are 542 feet looking right (south) and 478 feet looking left (north). The site driveway provides sight distances looking in both directions that exceed the minimum intersection sight distance criteria published by CTDOT.

Collision History

Vehicle collision history for Danbury Road along the site frontage was collected from the Connecticut Crash Data Repository between January 2017 and May 2021 to include three years of data prior to the start of the COVID-19 pandemic. Table 2 provides a summary of the collisions by collision type and severity.

A total of seven collisions occurred on Danbury Road along the site frontage during the time period analyzed. Five rear-end and two angle collisions were reported, all of which resulted in minor injuries and/or property damage only. No pedestrian or bicycle collisions were recorded in vicinity of the site during the time period analyzed.

Trip Generation

Similar to the methodology utilized to establish the Existing Condition traffic volumes, sitegenerated traffic for the proposed residential development was estimated based on data published in the Institute of Transportation Engineers (ITE) publication, Trip Generation, 10th edition, 2017. The site-generated trips were estimated using ITE Land Use Code 221, Multifamily Housing (Mid-Rise). Based on the published data, the proposed 173 residential units are expected to generate 62 vehicle trips (16 entering, 46 exiting) during the weekday morning peak hour and 76 vehicle trips (46 entering, 30 exiting) during the weekday afternoon peak hour. Table 1 provides a summary of the site-generated traffic.

As mentioned, the existing commercial use on the site will be replaced by the proposed residential units. Therefore, the existing site-generated trips were subtracted from the proposed site-generated trips to obtain the net trips associated with the change in land use, above those already on the roadway network. Comparing the existing and proposed site-generated traffic estimates, the proposed development is expected to generate 7 additional trips (-31 entering, +38 exiting) during weekday morning peak hour and 20 additional trips (+37 Entering, -17 exiting) during weekday afternoon peak hour.

Traffic Distribution & Combined Traffic Volumes

The proposed site-generated traffic was distributed to the roadway network based on existing travel patterns and U.S. census journey-to-work data. The data indicates a distribution of 40% to/from the north and 60% to/from the south of the site. The resulting, distributed site-generated traffic for the weekday morning and afternoon peak hours are presented in Figure 4.

The site-generated traffic volumes were then added to the 2023 Background Condition traffic volumes, replacing the existing site-generated traffic volumes, and resulting in the 2023 Combined Condition traffic volumes presented in Figure 5.

Traffic Operations

Capacity and queue analyses were performed for the study intersections for the 2021 Existing Condition, 2023 Background Condition, and 2023 Combined Condition traffic volumes during the weekday morning and weekday afternoon peak hours using Trafficware Synchro Studio 10 – Traffic Analysis Software. The software conducts the analyses based upon the methodology provided in the *Highway Capacity Manual (HCM), 6th Edition*. The analysis results are categorized in terms of Level of Service (LOS), which describes the intersection operational conditions based on the calculated average delay per vehicle. The queue analysis results are summarized based upon the 95th percentile queues (design queues) on an intersection approach for unsignalized intersections. For discussion purposes, queues will be summarized in terms of car lengths, which are approximately 25 feet. A summary of the HCM capacity analysis methodology is included in Appendix C. Tables 3 and 4 summarize the capacity analysis results for LOS and queues, respectively. The capacity analysis worksheets showing the full capacity analysis results are enclosed in Appendix D.

As shown in Table 3 and 4, under 2021 Existing and 2023 Background Conditions, vehicles entering the site driveway operate efficiently at LOS B for left turns and no control delay for right turns (free flow), while the exiting movements experience LOS F delays during the peak hours. It is common for stop controlled driveway approaches to experience poor LOS and longer delay at the intersections on three or four lane principal arterial roadways such as Danbury Road due to the heavy volume of through traffic. The entering left turn is expected to have a queue of less than 1 vehicle, while the existing movements queues are 1 vehicle in the weekday morning and just 2-3 vehicles during the weekday afternoon peak hour.

As mentioned previously, the development proposes to widen the existing site driveway for an additional exiting lane to provide one dedicated left-turn lane and one dedicated right-turn lane exiting the site. The separation of left-turn lane and right-turn lane exiting the site will improve the traffic operation and reduce vehicle delays and queues particularly for the rightturn movements. Under 2023 Combined Conditions, vehicles entering the site driveway will continue to operate at the same LOS B as under 2021 Existing and 2023 Background conditions during the peak hours. The right-turn exiting movements experience an improvement to LOS E and C delays in the morning and afternoon peak hours respectively, while the left-turn exiting movements continue to operate at LOS F as they had in Existing and Background Conditions due to the high volume of through traffic on Danbury Road. A review of the queue analysis shows that all movements will have queues of less than two vehicles during the peak hours under 2023 Combined Conditions. The site driveway has sufficient storage to accommodate expected queues.



Conclusion

Based on the results of the analyses, it is the professional opinion of Tighe & Bond that the additional traffic volume generated by the proposed residential redevelopment is not expected to impact traffic operations along Danbury Road (U.S. Route 7).

Sincerely,

TIGHE & BOND, INC.

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Craig D. Yannes, PE, PTOE, RSP1 Project Manager

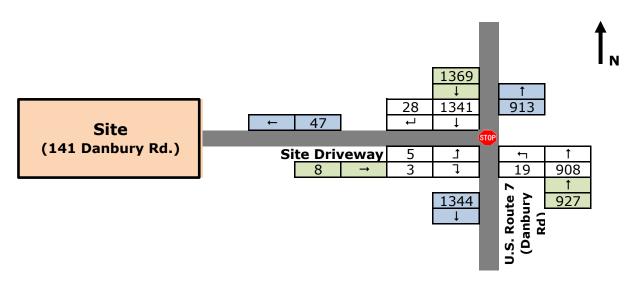
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John W. Block, PE, L.S. Senior Vice President

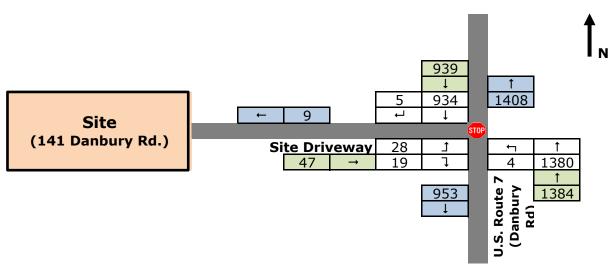
Attachments: Figure 1 – Site Location Map Figure 2 to 5 – Traffic Volume Figures Table 1 – Trip Generation Summary Table 2 – Collision History Summary Table 3 – Level of Service Summary Table 4 – 95th Percentile Queue Summary Appendix A – CTDOT ATR Traffic Data Appendix B – CTDOT Traffic Volume Approval Appendix C – Capacity Analysis Methodology Appendix D – Capacity Analysis Worksheets

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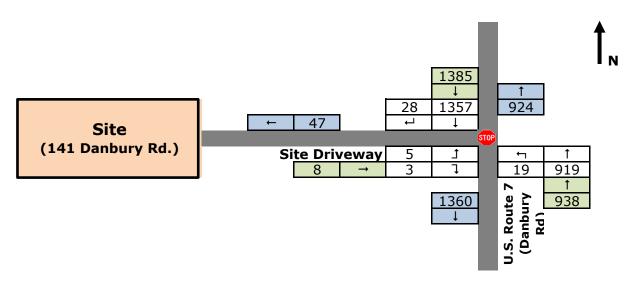




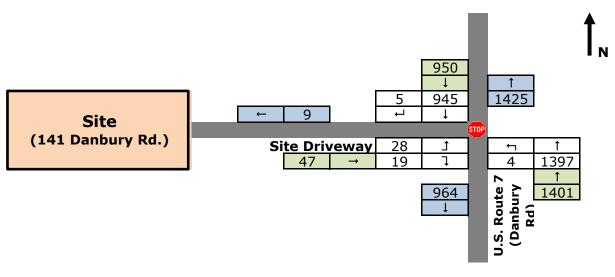




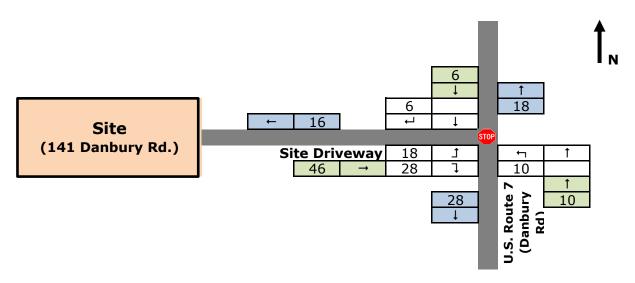
2021 Existing Traffic Volumes 141 Danbury Road Wilton, CT



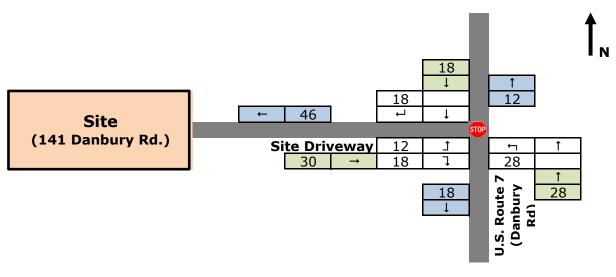




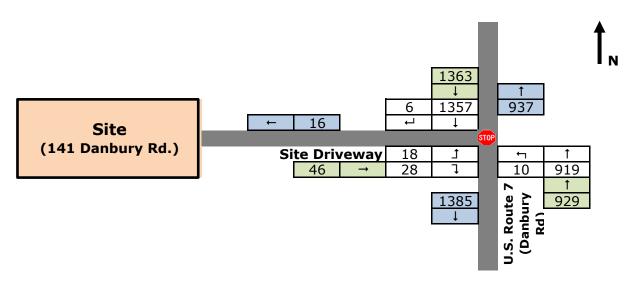
2023 Background Traffic Volumes 141 Danbury Road Wilton, CT



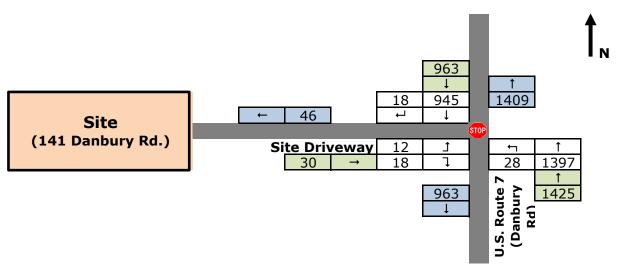




Site-Generated Traffic Volumes 141 Danbury Road Wilton, CT







2023 Combined Traffic Volumes 141 Danbury Road Wilton, CT

TABLE 1

Proposed Site-Generated Traffic Summary

Proposed - 173 Residential Un	nits		
Peak Hour Period	Enter	Exit	Total
Weekday Morning	16	46	62
Weekday Afternoon	46	30	76
Previously Approved - 47,040 Peak Hour Period	SF Commercial Use Enter	Exit	Total
Weekday Morning	47	8	55
Weekday Afternoon	9	47	56
Net Vehicle Trips			
Peak Hour Period	Enter	Exit	Total
Weekday Morning	-31	38	7
Weekday Afternoon	37	-17	20

Source: Institute of Transportation Engineering, Trip Generation, 10th Edition, 2017. Land Use - 221 Multifamily Housing (Mid-Rise) Land Use - 710 General Office Building

TABLE 2 Collision History Summary Intersection: Danbury Road (U.S. Route 7) at 141 Danbury Road Site Driveway

COLLISION TYPE

	2017	2018	2019	2020	2021	Total	Percent
Rear-End	2	1	1	1	0	5	71.4%
Angle	0	0	2	0	0	2	28.6%
TOTAL	2	1	3	1	0	7	100%
SEVERITY							
	2017	2018	2019	2020	2021	Total	Percent
Fatal	0	0	0	0	0	0	0.0%
Serious Injury	0	0	0	0	0	0	0.0%
Minor Injury / Property Damage Only (PDO)	2	1	3	1	0	7	100.0%
TOTAL	2	1	3	1	0	7	100%

TABLE 3 Intersection Operation Summary - Vehicular Levels of Service / Average Delay (sec/veh)

		Weekda	ay Morning Pe	eak Hour	Weekday Afternoon Peak Hour						
	Lane Use	2021 Existing	2023 Background	2023 Combined	2021 Existing	2023 Background	2023 Combined				
Unsignalized TWSC - Danbu						D / 10 C	D (10.0				
Unsignalized TWSC - Danbu Danbury Road (U.S. Route 7)	n y Road NBL NBT	(U.S. Rout B / 13.7 A / 0.7	<mark>e 7) at 141 D</mark> B / 13.9 A / 0.7	anbury Road I B / 13.5 A / 0.4	Driveway B / 10.5 A / 0.2	B / 10.6 A / 0.2	B / 10.9 A / 1.6				

TABLE 4

Intersection Operation Summary - Vehicular 50th / 95th Percentile Queue (In Feet)

			Weekda	ay Morning Pe	ak Hour	Weekda	y Afternoon I	Peak Hour
	Lane Use	Available Storage	2021 Existing	2023 Background	2023 Combined	2021 Existing	2023 Background	2023 I Combined
Unsignalized TWSC - Danbu			e 7) at 141	Danbury Roa	d Driveway			
Unsignalized TWSC - Danbu Danbury Road (U.S. Route 7)	iry Roa NBL	i d (U.S. Rout >500	:e 7) at 141 3	Danbury Roa	d Driveway 3	0	0	3
<u> </u>			:e 7) at 141 3 10	Danbury Roa 5 10	d Driveway 3 	0 53	0 55	3
<u> </u>	NBL	>500	3	5	3	0 53 	0 55 	3 23

APPENDIX A CTDOT ATR Traffic Counts

Status: OK	North	Combined	South	Class	Speed
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WILT-179 - Combined - n/s

Collected during COVID-19 epoch	29-Jun Mon	30-Jun Tue	01-Jul Wed
Town	2:00am 1:00am 2:00am 2:00am 3:00am 4:00am 5:00am 6:00am 7:00am 8:00am 9:00am 1261 1:00am 1267 2:00pm 1372 1:00pm 1434 2:00pm 1524 4:00pm 1524 4:00pm 1525 6:00pm 1525 6:00pm 1717 7:00pm 797 8:00pm 522 9:00pm 346 0:00pm 155	87 33 40 42 80 524 936 1215 1361 1282 1282 1308 1446 1420 1444 1487 1471 1461 1160 853 611 383 316 186	75 28 33 42 85 477 898 1252 1348 1292 x
Tc	otals 14591	20428	5530

Status: OK	North	Combined	South	Class	Speed
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WILT-179 - North

Collected during COVID-19 epoch	29-Jun Mon	30-Jun Tue	01-Jul Wed
Town	2:00am 1:00am 2:00am 3:00am 4:00am 5:00am 6:00am 7:00am 8:00am 9:00am 74 1:00pm 774 3:00pm 813 4:00pm 839 5:00pm 847 6:00pm 683 7:00pm 456 8:00pm 274 9:00pm 155 0:00pm 131 1:00pm	53 16 23 28 24 135 330 531 586 553	45 20 20 22 32 121 303 496 566 567 x
Тс	otals 7641	10051	2192

Status: OK	North	Combined	South	Class	Speed
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WILT-179 - South

Collected during COVID-19 epoch		29-Jun Mon	30-Jun Tue	01-Jul Wed
Town	12:00am 01:00am 02:00am 03:00am 04:00am 05:00am 07:00am 07:00am 10:00am 11:00am 11:00am 12:00pm 02:00pm 03:00pm 03:00pm 05:00pm 07:00pm 07:00pm 08:00pm 10:00pm	Mon	Tue 34 17 14 56 389 606 684 775 729 656 699 721 689 714 699 648 611 488 397 303 191 155 85	wed 30 8 13 20 53 356 595 756 782 725 x
	11:00pm Totals	6950	10377	3338

WILT-179 - Combined - n/s

WILT-179 - Combined - n/s	nouce ,	5.5	U IIII	bouch	. 01 1.0	ace 55	(0 000	-1							
Collected during COVID-19 epoch	Hour	MPH 0-15	MPH 16-20	MPH 21-25	MPH 26-30	MPH 31-35	MPH 36-40	MPH 41-45	MPH 46-50	MPH 51-55	MPH 56-60	MPH 61-65	MPH 66-60	MPH 71-75	MPI 76-
Town	Monday 29-Jun 12:00am 01:00am 02:00am 03:00am	0 10	10 20		20 00	51 55			10 00	01 00		01 00			, ,
All Vehicles Average Speed	04:00am 05:00am 06:00am 07:00am 08:00am 09:00am 10:00am	х 3	× 11	x 13	× 50	x 239	x 477	x 352	x 96	x 19	x 1	x	x	x	2
All Report Days 85th Percentile Speed	11:00am 12:00pm 01:00pm 02:00pm 03:00pm 05:00pm 06:00pm 07:00pm 08:00pm 09:00pm	11 4 3 2 3 1 2	20 6 7 3 5 1 1 1	8 25 22 5 18 8 2 2 2 2 1	46 93 70 29 30 49 53 4 5 8 10	211 234 269 229 262 219 222 106 50 55 45	487 507 489 494 528 567 525 406 266 190 120	409 394 453 500 509 493 529 485 343 196 125	89 72 100 137 142 138 148 133 114 57 36	16 15 18 30 41 28 33 29 16 12 6	1 1 5 2 4 5 3 1	· 2 1 · · ·	· · · ·		
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Omitted Vehicles Too Slow (0%)17 Sampled Vehicles (26%)2116 <u>Tuesday 30-Jun-2020</u> 85th Percentile Speed	12:00am 01:00am 02:00am 03:00am 04:00am 05:00am 06:00am 07:00am	1 1	1	1 5 19	1	9 3 5 2 23 79 205	22 8 12 10 30 126 300 395	39 13 17 21 36 265 361 388	8 6 3 4 9 78 125 107	5 1 1 1 17 43 37	1 2 7 6	· · · ·	2	1	
All Hours Total Vehicles	08:00am 09:00am 10:00am 11:00am 12:00pm 01:00pm	2 3 8 2 2	1 9 6 5 8 3	19 12 19 18 32 37 4	87 77 71 101 90 51	203 314 250 286 275 313 336	595 504 479 450 479 500 540	341 346 351 317 408 404	77 77 74 82 78 68	19 21 16 12 10 14	4 1 2 2	2 1	· · · ·		
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	11:00am 12:00pm 01:00pm 03:00pm 04:00pm 05:00pm 07:00pm 07:00pm 09:00pm 10:00pm	117	53		250	007	1040	1651	407	100	10				
	Totals Percent	117 2.12	53 0.96	57 1.03	259 4.68		1848 33.42		487 8.81	128 2.31	18 0.33	5 0.09	0.00	0 0.00	(0.0(

WILT-179 - North

Status: OK North Combined South

WILI-179 - NORTH															
Collected during COVID-19 epoch	Hour	MPH 0-15	MPH 16-20	MPH 21-25	MPH 26-30	MPH 31-35	MPH 36-40	MPH 41-45	MPH 46-50	MPH 51-55	MPH 56-60	MPH 61-65	MPH 66-60	MPH 71-75	MP] 76-
Town	Monday 29-Jun 12:00am 01:00am 02:00am 03:00am														
All Vehicles Average Speed	04:00am 05:00am 06:00am 07:00am 08:00am 09:00am	x	x	x	x	x	x	x	x	x	x	x	x	x	3
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	Percent						30.57							0.00	

WILT-179 - South

Status: OK North Combined South

WILI-179-South	-														
Collected during COVID-19 epoch	Hour	MPH 0-15	MPH 16-20	MPH 21-25	MPH 26-30	MPH 31-35	MPH 36-40	MPH 41-45	MPH 46-50	MPH 51-55	MPH 56-60	MPH 61-65	MPH 66-60	MPH 71-75	MP: 76-
Posted Speed Limit	Monday 29-Jun 12:00am 01:00am 02:00am 03:00am														
All Vehicles Average Speed	04:00am 05:00am 06:00am 07:00am 08:00am 09:00am 10:00am	х 3	x 11	x 13	x 45	x 182	x 288	x 114	× 27	x 4	x	x	x	x	2
All Report Days 85th Percentile Speed	11:00am 12:00pm 01:00pm 02:00pm 03:00pm 04:00pm 05:00pm 06:00pm 06:00pm 08:00pm	11 4 3 1 3 2	20 6 4 3 5 1 1 1 1	5 22 19 3 4 12 7 1 1	43 80 62 23 27 42 50 3 4 7 8	164 166 210 177 220 162 162 71 33 41 35	301 243 249 299 297 299 281 239 152 108 80	143 140 116 141 123 144 154 138 124 81 57	20 15 10 14 26 14 19 29 25 7 7	1 2 10 4 4 2 3 2	· · · · · · · · ·	1			
85th Percentile Speed	10:00pm 11:00pm Totals Percent Tuesday 30-Jun	27 0.39	53 0.76	87 1.25	1 2 397 5.71	12 6 1641 23.61	60 32 2928 42.13	41 27 1543 22.20	6 9 228 3.28	1 5 43 0.62	1 2 0.03	1 0.01	0 0.00	0 0.00	0.00
Omitted Vehicles Too Slow (0%)15 Sampled Vehicles (23%)936 <u>Tuesday 30-Jun-2020</u> 85th Percentile Speed	12:00am 01:00am 02:00am 03:00am 04:00am 05:00am 06:00am 07:00am 08:00am 10:00am 11:00am	1 1 2 3 8 1 2		1 5 17 11 15 13 29	1 12 16 37 77 67 59 91	4 3 4 1 19 73 165 251 168 198 208 208	12 4 7 5 20 93 253 259 284 307 242 258	17 7 3 5 28 204 210 164 127 146 117 92	2 1 3 7 52 42 29 16 14 13 13	1	· · · · · · · · · · · · · · · · · · ·	· · · · · ·	· · · · · · ·		
Wednesday 01-Jul-2020 85th Percentile Speed	12:00pm 01:00pm 02:00pm 03:00pm 05:00pm 06:00pm 06:00pm 08:00pm 10:00pm 11:00pm Totals Percent		8 3 12 4 2 1 2 1 63 0.61	32 2 20 17 22 8 6 1 1 99 1.92	77 45 71 77 51 34 18 2 8 744 7.17	231 258 204 197 159 163 36 39 11 8 2545 24.53		108 90 148 133 157 140 143 165 67 65 33 2471 23.81	8 8 16 13 24 22 30 16 10 19 11 382 3.68	3 2 1 1 7 9 2 2 6 56 0.54		· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	(0.0(
	Wednesda 01-Jul 12:00am 01:00am 02:00am 03:00am 05:00am 06:00am 07:00am 08:00am 09:00am 10:00am	y	1 5 4 40 x		1 1 3 12 70 78 61 x	5 6 7 3 15 17 78 175 246 157 x	18 1 3 10 21 91 227 287 306 214 x	6 1 2 6 11 179 216 164 120 105 x	2 52 57 33 17 13 x	1 13 3 2 2 3 x					1
	11:00am 12:00pm 01:00pm 02:00pm 03:00pm 05:00pm 06:00pm 07:00pm 09:00pm 10:00pm 11:00pm Totals Percent	116 3.48	51 1.53	45 1.35	230 6.89		1178 35.29	810 24.27	174 5.21	24 0.72	1 0.03	00.00	00.00	00.00	(0.0(

Combined North Status: OK

South

WILT-179 - Combined - n/s

Collected during COVID-19 epoch	Hour	Motor Cycle	Pass Cars	Single Unit	Combo Unit	Day Total
Town.	29-Jun Mon 12:00am 01:00am 02:00am 03:00am 04:00am 05:00am 06:00am 07:00am 09:00am 10:00am 11:00am 11:00am 11:00pm 02:00pm 03:00pm	X	x 1165 1179 1286 1339 1348 1440	x 81 67 70 86 88 78	x 15 21 16 9 4 6	0 0 0 0 0 0 0 1261 1267 1372 1434 1440 1524
Passenger Cars 38209 94.23% 8.0-25.0	04:00pm		1469	51	4	1524
Single-Unit Trucks 2019 4.98% 25.0-50.0	05:00pm		1478	42	5	1525
Combination Trucks 321 0.79% 50.0 >	06:00pm		1126	42	3	1171
Total Vehicles 40549	07:00pm		771	26		797
	08:00pm		515	7		522
<u>Single</u> <u>Combo</u>	09:00pm	•	332	10	4	346
Peak Hour Truck Volume	10 : 00pm	•	247	5	1	253
<pre>% Total Peak Hour Volume 4.0% 0.5%</pre>	11:00pm	•	154	1	•	155
24 Hour Truck Volume	Totals	0	13849	654	88	14591
All-Vehicle Annualized ADT 18500 18500	Percent	0.00	94.91	4.48	0.60	
24Hour T-Vol % of A-V AADT 5.4% 0.9%	30-Jun					
PeakHr T-Vol % of A-V AADT 0.3% 0.0%	Tue					
K-Factor (Peak/AADT) 8.0% 8.0%	12 : 00am		82	5		87
(AADT & Legacy AADT match)	01:00am		27	5	1	33
(02:00am		31	6	3	40
	03:00am	•	31	9	2	42
	04:00am	•	65	9	6	80
	05:00am	•	502	17	5	524
	06:00am	•	885	45	6	936
	07:00am	•	1123	81	11	1215
	08:00am	•	1238	102	21	1361
	09:00am	•	1198	70	14	1282
	10:00am	•	1179	85	18	1282
	11:00am	•	1234	66	8	1308
	12:00pm	•	1365	69	12	1446
	01:00pm	•	1336	77	7	1420
	02:00pm	•	1363	71	10	1444
	03:00pm	•	1419	60	8	1487
	04:00pm	•	1411	55	5	1471
	05:00pm	•	1399	57	5	1461
	06:00pm	•	1117	39	4	1160
	07:00pm	•	819	30	4	853
	08:00pm	•	599	7	5	611
	09:00pm	•	369	12	2	383
	10:00pm	•	304	9	3	316
	11:00pm		182	4		186
	Totals	0	19278	990	160	20428
	Percent	0.00	94.37	4.85	0.78	

2020 WILT-179 - Class

1-Jul	
Wed	

01-Jul Wed					
12:00am		66	9		75
01:00am	•	27	1		28
02:00am	•	23	9	1	33
03:00am		32	5	5	42
04:00am		77	6	2	85
05:00am		448	23	6	477
06:00am		849	40	9	898
07:00am		1152	86	14	1252
08:00am		1224	107	17	1348
09:00am		1184	89	19	1292
10:00am	Х	x	x	х	0
11:00am					0
12:00pm					0
01:00pm					0
02:00pm					0
03:00pm					0
04:00pm					0
05:00pm					0
06:00pm					0
07:00pm					0
08:00pm					0
09:00pm					0
10:00pm					0
11:00pm	0	F 0 0 0	275		0
Totals	0	5082	375	73	5530
Percent	0.00	91.90	6.78	1.32	

WILT-179 - North

		Motor	Pass	Single	Combo	Day
Collected during COVID-19 epoch	Hour	Cycle	Cars	Unit	Unit	Total
	nour	0,010	ourb	01110	011110	TOCAL
TownWilton						
Station	29-Jun					
	Mon					
Posted Speed Limit	12:00am					0
2015-Principal Arterial - Other 32015-Urban	01.00					0
Start Report	0.0					0
All Vehicle Peak Hour	03:00am					0
End Report	04:00am					0
Annualized ADT	05:00am					0
24-Hour Count	06:00am					0
Day $1 \dots +10051 * G4(0.91) = 18173.6$	07:00am					0
UnRounded AADT	08:00am					0
OK 2020 Mon 29-Jun -this report18500	09:00am	х	х	х	х	0
OK 2017 Wed 15-Nov25300	10:00am	-	518	46	10	574
OK 2014 Mon 01-Dec	11:00am		546	37	- 0	590
REV 2011 Mon 14-Mar26700	12:00pm		620	44	10	674
OK 2008 Wed 05-Mar26900	01:00pm	•	704	50	3	757
	02:00pm	•	715	57	2	774
<u>Count</u> <u>Percent</u> <u>Veh.Feet</u>	03:00pm	•	765	44	4	813
Motorcycles 0 0.00% 0.0- 8.0	04:00pm	•	801	36	2	839
Passenger Cars 18529 93.19% 8.0-25.0	05:00pm	•	816	28	3	847
Single-Unit Trucks 1185 5.96% 25.0-50.0	06:00pm	•	650	31	2	683
Combination Trucks 170 0.85% 50.0 >	07:00pm	•	435	21	2	456
Total Vehicles 19884	07:00pm 08:00pm	•	433 271	3	•	274
	09:00pm	•	152	3	•	155
<u>Single</u> <u>Combo</u>	10:00pm	•	127	4	•	131
Peak Hour Truck Volume442	11:00pm	•	74		•	74
<pre>% Total Peak Hour Volume 5.2% 0.2%</pre>	Totals	• 0	7194	• 404	• 43	7641
24 Hour Truck Volume 587 84	Percent	0.00	94.15	5.29	0.56	1041
All-Vehicle Annualized ADT 9100 9100	30-Jun	0.00	94.13	5.29	0.50	
24Hour T-Vol % of A-V AADT 6.5% 0.9%	JU UUII Tue					
PeakHr T-Vol % of A-V AADT 0.5% 0.0%	10.00		49	4		53
K-Factor (Peak/AADT) 9.3% 9.3%	01:00am	•	49 14	1	• 1	16
(AADT & Legacy AADT match)	02:00am	•	18	2	3	23
	02:00am	•	18	8	2	23
	04:00am	•	10	3	2	24
	04.00am 05:00am	•	122	11	2	135
	06:00am	•	300	28	2	330
	07:00am	•	483	2 0 4 4	4	531
	08:00am	•	405 519	54	13	586
	09:00am	•	506	54 41	13	553
	10:00am	•	572	43	11	626
	10.00am 11:00am	•	572	34	4	609
	12:00am	•	672	44	9	725
	01:00pm	•	689	38	4	731
	01:00pm 02:00pm	•	686	39	5	731
	02:00pm 03:00pm	•	743	42	3	788
	-	•	745	38	5	823
	04:00pm 05:00pm	•	804	58 44	2	823 850
	05:00pm 06:00pm	•	642	44 29	2	672
	08:00pm 07:00pm	•	642 435	29 19	1	672 456
	07:00pm 08:00pm	•	435 302	19	2	456 308
	_	•			2 1	308 192
	09:00pm 10:00pm	•	183 155	8 6	T	192
	-	•	98	6 3	•	101
	11:00pm Totals	• 0	98 9380	3 587	84	10051
	Percent	0.00		5.84	0.84	TOOOT
	rercent	0.00	93.32	J.84	0.04	

2020 WILT-179 - C	lass				
01-Jul					
Wed					
12:00am		42	3		45
01:00am		19	1		20
02:00am		16	3	1	20
03:00am		15	4	3	22
04:00am		25	6	1	32
05:00am	•	105	11	5	121
06:00am	•	276	23	4	303
07:00am		443	42	11	496
08:00am		499	57	10	566
09:00am		515	44	8	567
10:00am	Х	Х	X	х	0
11:00am					0
12:00pm					0
01:00pm					0
02:00pm					0
03:00pm					0
04:00pm					0
05:00pm					0
06:00pm					0
07:00pm					0
08:00pm					0
09:00pm					0
10:00pm					0
11:00pm					0
Totals	0	1955	194	43	2192
Percent	0.00	89.19	8.85	1.96	

Status: OK North Combined South

WILT-179 - South

Collected during COVID-19 epoch		Motor	Pass	Single	Combo	Day
	Hour	Cycle	Cars	Unit	Unit	Total
TownWilton						
Station	29-Jun					
Location	Mon					
2015-Principal Arterial - Other 32015-Urban	12:00am					0
Start Report	01:00am					0
All Vehicle Peak Hour	02:00am					0
End Report	03:00am					0
Annualized ADT9400	04:00am					0
24-Hour Count10271 * G4(0.91) = 9346.6	05:00am 06:00am					0 0
Day 1+ $10377 \times G4(0.91) = 18789.7$	07:00am					0
UnRounded AADT	08:00am					0
OK 2020 Mon 29-Jun -this report18500 OK 2017 Wed 15-Nov25300	09:00am	Х	х	Х	Х	0
OK 2017 Wed 13-NOV23300 OK 2014 Mon 01-Dec27900	10:00am		647	35	5	687
REV 2011 Mon 14-Mar	11:00am		633	30	14	677
OK 2008 Wed 05-Mar	12:00pm		666	26	6	698
	01:00pm	•	635	36	6	677
<u>Count</u> <u>Percent</u> <u>Veh.Feet</u>	02:00pm	•	633	31	2	666
Motorcycles 0 0.00% 0.0- 8.0	03:00pm	•	675	34	2	711
Passenger Cars 19680 95.23% 8.0-25.0	04:00pm 05:00pm	•	668 662	15 14	2 2	685 678
Single-Unit Trucks 834 4.04% 25.0-50.0	06:00pm	•	476	14	1	488
Combination Trucks 151 0.73% 50.0 > Total Vehicles 20665	07:00pm		336	5		341
Total venicles 20665	08:00pm		244	4	•	248
<u>Single</u> <u>Combo</u>	09:00pm		180	7	4	191
Peak Hour Truck Volume	10:00pm		120	1	1	122
% Total Peak Hour Volume 6.2% 1.0%	11 : 00pm	•	80	1	•	81
24 Hour Truck Volume 403 76	Totals	0	6655	250	45	6950
All-Vehicle Annualized ADT 9400 9400	Percent	0.00	95.76	3.60	0.65	
24Hour T-Vol % of A-V AADT 4.3% 0.8%	30-Jun Tue					
PeakHr T-Vol % of A-V AADT 0.5% 0.1%	12:00am		33	1		34
K-Factor (Peak/AADT) 8.2% 8.2%	01:00am	•	13	4	•	17
(AADT & Legacy AADT match)	02:00am		13	4	•	17
	03:00am		13	1		14
	04:00am		46	6	4	56
	05:00am	•	380	6	3	389
	06:00am	•	585	17	4	606
	07:00am	•	640	37	7	684
	08:00am	•	719	48 29	8	775 729
	09:00am 10:00am	•	692 607	29 42	8 7	656
	11:00am	•	663	32	4	699
	12:00pm		693	25	3	721
	01:00pm		647	39	3	689
	02:00pm		677	32	5	714
	03:00pm		676	18	5	699
	04:00pm	•	631	17	•	648
	05:00pm	•	595	13	3	611
	06:00pm	•	475	10	3	488
	07:00pm	•	384	11	2 3	397
	08:00pm 09:00pm	•	297 186	3 4	3 1	303 191
	10:00pm	•	149	4	3	151
	11:00pm		84	1	•	85
	Totals	0	9898	403	76	10377
	Percent	0.00	95.38	3.88	0.73	

2020 WILT-179 - Class

01-Jul	
Mod	

01-Jul					
Wed					
12:00am	•	24	6		30
01:00am		8			8
02:00am		7	6		13
03:00am		17	1	2	20
04:00am		52		1	53
05:00am	•	343	12	1	356
06:00am	•	573	17	5	595
07:00am	•	709	44	3	756
08:00am	•	725	50	7	782
09:00am	•	669	45	11	725
10:00am	Х	Х	Х	Х	0
11:00am					0
12 : 00pm					0
01:00pm					0
02:00pm					0
03:00pm					0
04:00pm					0
05:00pm					0
06:00pm					0
07:00pm					0
08:00pm					0
09:00pm					0
10:00pm					0
11:00pm					0
Totals	0	3127	181	30	3338
Percent	0.00	93.68	5.42	0.90	

Status: OK

WILT-179 - North & South

Location	12:00am 01:00am 02:00am 03:00am 04:00am 05:00am 06:00am 07:00am 08:00am 09:00am 10:00am 11:00am 11:00am 01:00pm 02:00pm 03:00pm 04:00pm 05:00pm 06:00pm 07:00pm 08:00pm 10:00pm 10:00pm	15-Nov Wed	16-Nov Thu 105 59 57 66 120 565 1308 2009 2228 1835 1487 1511 1402 1602 1684 1871 1911 2291 1976 1320 894 636
	IULAIS	205	20931

Status: OK

WILT-179 - North & South

Town.	02:00am	01-Dec Mon 1454 2134 2244 1995 1478 1620 1797 1700 1853 2017 2038 2250 2031 1490 875 560 378 219 28133	02-Dec Tue 95 69 37 64 138 577 1483 2463
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WILT-179 - Combined - n/s

Location	154 384 1238 2043 2281 1750 1396 1496 1684 1664 1619 1846 1928 2253 2030 1267 798 540 354 226	44 51 263
Totals	26951	263

WILT-179 - North

Town.	12:00am 01:00am 02:00am 03:00am 04:00am 05:00am 06:00am 07:00am 09:00am 10:00am 11:00am	201 131	15-Mar Tue 61 35 23 20
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WILT-179 - South

Town	12:00am 01:00am 02:00am 03:00am 05:00am 05:00am 07:00am 07:00am 09:00am 10:00am 11:00am	153 95	15-Mar Tue 44 28 21 31
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WILT-179 - Combined - n/s

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Route 7 - 5.96 mi South of Route 33 (S Jct)
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Town. Wilton Station. 179 Location. 41.180594,-73.416057 2015-Principal Arterial - Other 32015-Urban 01:00am Start Report. 06-Mar-2008 03:00AM End Report. 06-Mar-2008 03:00AM Axle Correction Factor. None Annualized ADT. 26906.2 UnRounded AADT. 26906.2 OK 2020 Mon 29-Jun 08:00am OK 2017 Wed 15-Nov 25300 OK 2014 Mon 01-Dec 27900 OK 2008 Wed 05-Mar -this report- 26900 Ol:00pm 01:00pm 02:00pm 02:00pm 03:00pm 02:00pm 04:00pm 02:00pm 05:00pm 02:00pm 06:00pm 01:00pm 07:00pm 02:00pm 01:00pm 02:00pm 02:00pm 03:00pm 03:00pm 02:00pm 03:00pm 02:00pm 04:00pm 02:00pm 05:00pm 02:00pm 07:00pm 02:00pm 07:00pm 02:00pm 07:00pm 02:00pm <th>05-Mar Wed 56 114 318 1144 1897 2193 1803 1440 1562 1747 1688 1691 1791 1922 2234 1920 1281 845 688 380 246 26960</th> <th>06-Mar Thu 99 77 42 218</th>	05-Mar Wed 56 114 318 1144 1897 2193 1803 1440 1562 1747 1688 1691 1791 1922 2234 1920 1281 845 688 380 246 26960	06-Mar Thu 99 77 42 218
iotais	20000	210

WILT-179 - North

Totals 13753 119	TownWilton Station	Jam J	06-Mar Thu 59 43 17 17
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WILT-179 - South

Location	12:00am 01:00am	05-Mar Wed	06-Mar Thu 40 34
Start Report	02:00am	2.2	25
End Report	03:00am	33 62	
Axle Correction Factor	04:00am		
Annualuzed AD'L' \ldots	05:00am	231	
24 - Hour (Count 13306 * (4(0.99)) = 13172.9	06:00am	817	
UnRounded AADT	07:00am	1152	
$OK = ZUZU MON ZY - JUN \dots \dots$	08:00am	1302	
OK 2017 Wed 15-Nov	09:00am	1087	
OK 2014 Mon 01-Dec	10:00am	810	
REV 2011 Mon 14-Mar	11:00am	798	
UK ZUUS WED US-Mar -this report	12:00pm	894	
	01:00pm	818	
	02:00pm	789	
	03:00pm	763	
	04:00pm	780	
	05:00pm	846	
	06:00pm	694	
	07:00pm	483	
	08:00pm	304	
	09:00pm	285	
	10:00pm	166	
	11:00pm	93	
	Totals	13207	99

APPENDIX B CTDOT Traffic Volumes Approval

Jianhong Wang

From: Sent: To: Cc: Subject: Craig D. Yannes Friday, April 30, 2021 2:52 PM Hiller, Todd Sojka, Gary J; Jacobson, Richard C RE: Traffic Volume Review Request: Wilton

Todd,

Thank you for the feedback. We will use Option 1 and include the updated net new trips as directed.

Have a great weekend!

Craig

Craig D. Yannes, PE, PTOE, RSP1 | Project Manager Tighe&Bond | 1000 Bridgeport Avenue, Suite 320 | Shelton, CT 06484 | 203.712.1114 | Cell 203.530.1753 www.tighebond.com | Follow us on: Twitter Facebook LinkedIn

RT Group has joined Tighe & Bond!

From: Hiller, Todd <Todd.Hiller@ct.gov>
Sent: Friday, April 30, 2021 2:03 PM
To: Craig D. Yannes <CDYannes@tigheBond.com>
Cc: Sojka, Gary J <Gary.Sojka@ct.gov>; Jacobson, Richard C <Richard.Jacobson@ct.gov>
Subject: RE: Traffic Volume Review Request: Wilton

[Caution - External Sender]

Craig,

Your submission is acceptable. Please use "Option 1-2017 ATR Data" for your submission. In regard to your question about whether or not to consider all the trips as "new" trips since there is no existing OSTA Certificate, I think it is helpful to provide the trip generation tables for both land uses and the net "new" trips just as you did in your original email to our office. Your directional assignment and growth rate are also acceptable. There are no other MTGs in the area that would impact your volumes. One minor adjustment to make, on your "Table 1", the Afternoon Peak hour is labeled as the morning peak hour. If you have any questions, feel free to contact our office.

Have a great weekend!

Todd



Currently Teleworking-Please reach me via email or Microsoft Teams.

From: Sojka, Gary J <<u>Gary.Sojka@ct.gov</u>>
Sent: Thursday, April 29, 2021 1:37 PM
To: Hiller, Todd <<u>Todd.Hiller@ct.gov</u>>
Cc: Jacobson, Richard C <<u>Richard.Jacobson@ct.gov</u>>
Subject: FW: Traffic Volume Review Request: Wilton

Gary J. Sojka

Transportation Supervising Planner Connecticut Department of Transportation Bureau of Policy and Planning 2800 Berlin Turnpike Newington, CT 06111 Email: <u>gary.sojka@ct.gov</u> telephone: (860) 594-2025

From: Craig Yannes <<u>CDYannes@tigheBond.com</u>>
Date: Friday, April 23, 2021 at 9:57 AM
To: "Sojka, Gary J" <<u>Gary.Sojka@ct.gov</u>>
Cc: Jianhong Wang <<u>JWang@TigheBond.com</u>>
Subject: Traffic Volume Review Request: Wilton

EXTERNAL EMAIL: This email originated from outside of the organization. Do not click any links or open any attachments unless you trust the sender and know the content is safe.

Gary,

Tighe & Bond is working on a project at 141 Danbury Road (on U.S. Route 7) in Wilton. The project will replace the existing ~47,040 square foot general office building with ~173 residential units in a 4-story building and ~319 parking spaces. Due to the proposed size of the development, an OSTA AD approval will be required. The driveway will remain in the existing location and no changes to Route 7 are proposed. The site is not currently certified by OSTA.

Based on the project information, we request a review of the following documents attached to facilitate the OSTA AD submission and traffic study of the area:

- A. <u>Trip Generation and Net New Trips:</u> Site generated traffic estimates for the existing office building and proposed residential development are provided in the attached table. Please let us know if you have any comments on the estimates. Also, as a general question, are we to consider all trips from the proposed residential development to be new since the site is not currently certified or can net, new traffic be included within the AD?
- B. <u>Existing Volumes</u>: Local Town approval will require a traffic study for the development and we are hoping that you could offer your advice on the existing/background traffic volumes for Route 7 in this area. Due to the impact of the pandemic on the existing office use and traffic on Route 7, we are proposing to utilize historical CTDOT ATR data and the trip generation estimates to establish the 2021 Existing Traffic Volumes at the site driveway intersection with Route 7. We have attached the available data, along with two options for the existing traffic volumes that we have calculated as follows:

<u>Option 1 – 2021 Volumes Based on 2014 ATR Data</u>: This option assumes 2021 volumes are equal to the 2014 ATR data, the peak data collected in the last 12 years.

<u>Option 2 – 2021 Volumes Based on 2017 ATR Data</u>: This option utilized the 2017 ATR data with a 0.6% growth rate to 2021. The growth rate was the same provided for the recent Wilton Corporate Park (60 Danbury Road, Wilton) OSTA AD 711 (OSTA No. 161-2004-01).

Both options are likely overly conservative and assume a significant rebound of traffic volumes by the end of 2021. Please let us know if you agree with one of the options or if you have an alternative that could more accurately represent existing conditions.

Note: The 2014 and 2017 ATR data were not collected by direction so the directional flows were estimated based on the 2011 and 2020 data that shows approximately 40% NB/60% SB during the weekday AM and 60% NB/40% SB during the weekday PM. And, the existing site generated traffic from the office use was split with 60% to/from the north and 40% to/from the south.

- C. <u>Growth Rate:</u> as mentioned above, an approximate 0.6% annual growth rate was utilized in previous projects in the area. Please let us know if that is sufficient for projection of the existing traffic volumes to a project opening year of 2023.
- D. <u>Other Developments</u>: based on our review of OSTA records, we do not see any recently approved/pending developments that would add significant traffic to the area. Please let us know if you agree.

Please let us know if you have any questions and have a nice weekend!

Craig

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APPENDIX C Capacity Analysis Methodology

CAPACITY ANALYSIS METHODOLOGY

A primary result of capacity analysis is the assignment of levels of service to traffic facilities under various traffic flow conditions. The capacity analysis methodology is based on the concepts and procedures in the *Highway Capacity Manual* (HCM).¹ The concept of level of service (LOS) is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with LOS A representing the best operating conditions and LOS F the worst. Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year. A description of the operating condition under each level of service is provided below:

- LOS A describes conditions with little to no delay to motorists.
- LOS B represents a desirable level with relatively low delay to motorists.
- LOS C describes conditions with average delays to motorists.
- *LOS D* describes operations where the influence of congestion becomes more noticeable. Delays are still within an acceptable range.
- *LOS E* represents operating conditions with high delay values. This level is considered by many agencies to be the limit of acceptable delay.
- *LOS F* is considered to be unacceptable to most drivers with high delay values that often occur, when arrival flow rates exceed the capacity of the intersection.

Signalized Intersections

Levels of service for signalized intersections are also calculated using the operational analysis methodology of the HCM. The methodology for signalized intersections assesses the effects of signal type, timing, phasing, and progression; vehicle mix; and geometrics on average *control* delay. Control delay is used to establish the operating characteristics for an intersection or an approach to an intersection. Volume-to-capacity (v/c) ratios are also used to help signify the utilization of a lane group's capacity at an intersection. A v/c ratio of ≥ 1.00 represents conditions when the traffic signal cycle capacity is fully utilized and indicates a capacity failure. The level-of-service criteria for signalized intersections are shown in Table A-1.

¹*Highway Capacity Manual,* 6TH *Edition: A Guide for Multimodal Mobility Analysis.* Washington, D.C.: Transportation Research Board, 2016.

Unsignalized Intersections

Levels of service for unsignalized intersections are calculated using the operational analysis methodology of the HCM. The procedure accounts for lane configuration on both the minor and major street approaches, conflicting traffic stream volumes, and the type of intersection control (STOP, YIELD, or all-way STOP control). The definition of level of service for unsignalized intersections is a function of average *control* delay. Control delay at an unsignalized intersection is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This time includes the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position.

Volume-to-capacity (v/c) ratios are also used to help signify the utilization of a movement's capacity at an intersection. A v/c ratio of ≥ 1.00 represents conditions when the movement is fully utilized and indicates a capacity failure. The capacity of the movements is based on the distribution of gaps in the major street traffic stream, the selection of gaps to complete the desired movement, and the follow-up headways for each driver in the queue. When an unsignalized intersection is located within 0.25 miles of a signalized intersection, traffic flows may not be random and some platoon structure may exist, thereby affecting the minor street operations. The level-of-service criteria for unsignalized intersections are shown in Table A-1.

TABLE A-1

Level of Service	Signalized Intersection Criteria Average Control Delay (Seconds per Vehicle)	Unsignalized Intersection Criteria Average Control Delay (Seconds per Vehicle)	V/C Ratio >1.00ª
А	≤10	≤10	F
В	>10 and \leq 20	>10 and ≤15	F
С	>20 and ≤35	>15 and ≤25	F
D	>35 and ≤55	>25 and ≤35	F
Е	>55 and ≤80	>35 and ≤50	F
F	>80	>50	F

Level-of-Service Criteria for Intersections

Note: ^aFor approach-based and intersection-wide assessments, LOS is defined solely by control delay.

Source: *Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis.* Washington, D.C.: Transportation Research Board, 2016. Exhibit 19-8, Pg. 19-16.

For signalized intersections, this delay criterion may be applied in assigning level-of-service designations to individual lane groups, to individual intersection approaches, or to the entire intersection. For unsignalized intersections, this delay criterion may be applied in assigning level-of-service designations to individual lane groups on the minor street approaches or to the left turns from the major street approaches.

APPENDIX D Capacity Analysis Worksheets

Int Delay, s/veh	0.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y			- € †	ţ,	
Traffic Vol, veh/h	5	3	19	908	1341	28
Future Vol, veh/h	5	3	19	908	1341	28
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	-	-	-	-	-
Veh in Median Storage	,# 0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	6	6	6	6	6	6
Mvmt Flow	5	3	21	987	1458	30

Major/Minor	Minor2	1	Major1	Ν	/lajor2	
Conflicting Flow All	2009	1473	1488	0	-	0
Stage 1	1473	-	-	-	-	-
Stage 2	536	-	-	-	-	-
Critical Hdwy	6.69	6.29	4.19	-	-	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.89	-	-	-	-	-
Follow-up Hdwy	3.557	3.357	2.257	-	-	-
Pot Cap-1 Maneuver	56	150	434	-	-	-
Stage 1	203	-	-	-	-	-
Stage 2	542	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	50	150	434	-	-	-
Mov Cap-2 Maneuver	50	-	-	-	-	-
Stage 1	181	-	-	-	-	-
Stage 2	542	-	-	-	-	-
Approach	EB		NB		SB	
HCM Control Delay, s			1		0	
HCM LOS	F		1		U	
	1					
Minor Lane/Major Mvi	nt	NBL	NBT I	EBLn1	SBT	SBR
Capacity (veh/h)		434	-	67	-	-
HCM Lane V/C Ratio		0.048	-	0.13	-	-
HCM Control Delay (s	5)	13.7	0.7	66.6	-	-
HCM Lane LOS		В	А	F	-	-

0.1

0.4

-

HCM 95th %tile Q(veh)

Int Delay, s/veh 1.4 EBL Movement EBR NBL NBT SBT SBR **4↑** 1380 Y Lane Configurations Þ 934 28 Traffic Vol, veh/h 19 5 4 Future Vol, veh/h 28 19 4 1380 934 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 -----Veh in Median Storage, # 0 --0 0 -Grade, % 0 0 0 ---Peak Hour Factor 92 92 92 92 92 92 Heavy Vehicles, % 6 6 6 6 6 6 Mvmt Flow 30 21 4 1500 1015 5

Major/Minor	Minor2		Major1	Ν	/lajor2	
Conflicting Flow All	1776	1018	1020	0	-	0
Stage 1	1018	-	-	-	-	-
Stage 2	758	-	-	-	-	-
Critical Hdwy	6.69	6.29	4.19	-	-	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.89	-	-	-	-	-
Follow-up Hdwy	3.557	3.357	2.257	-	-	-
Pot Cap-1 Maneuver	79	280	659	-	-	-
Stage 1	340	-	-	-	-	-
Stage 2	416	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	76	280	659	-	-	-
Mov Cap-2 Maneuver	76	-	-	-	-	-
Stage 1	328	-	-	-	-	-
Stage 2	416	-	-	-	-	-
Approach	EB		NB		SB	
			0.2		0	
HCM Control Delay, s HCM LOS	65.2 F		0.2		0	
	Г					
Minor Lane/Major Mvr	nt	NBL	NBT E	EBLn1	SBT	SBR
Capacity (veh/h)		659	-	108	-	-
		0.007		0 470		

	000		100		
HCM Lane V/C Ratio	0.007	-	0.473	-	-
HCM Control Delay (s)	10.5	0.2	65.2	-	-
HCM Lane LOS	В	А	F	-	-
HCM 95th %tile Q(veh)	0	-	2.1	-	-

0.6					
EBL	EBR	NBL	NBT	SBT	SBR
Y			-۠	et i	
5	3	19	919	1357	28
5	3	19	919	1357	28
0	0	0	0	0	0
Stop	Stop	Free	Free	Free	Free
-	None	-	None	-	None
0	-	-	-	-	-
e, # 0	-	-	0	0	-
0	-	-	0	0	-
92	92	92	92	92	92
6	6	6	6	6	6
5	3	21	999	1475	30
	EBL 5 5 0 Stop - 0 , # 0 0 92 6	EBL EBR Y S 5 3 5 3 0 0 Stop Stop Stop Stop , # 0 - 92 92 6 6	EBL EBR NBL ✔ 5 3 19 5 3 19 0 0 0 Stop Stop Free - None - 0 - - , # 0 - - 92 92 92 6 6 6	EBL EBR NBL NBT ✓ ✓ ✓ ✓ 5 3 19 919 5 3 19 919 0 0 0 0 Stop Stop Free Free None - None - 0 - - 0 0 - - 0 0 - - 0 92 92 92 92 6 6 6 6	EBL EBR NBL NBT SBT Y

Major/Minor N	Minor2	1	Major1	Ν	/lajor2	
Conflicting Flow All	2032	1490	1505	0	-	0
Stage 1	1490	-	-	-	-	-
Stage 2	542	-	-	-	-	-
Critical Hdwy	6.69	6.29	4.19	-	-	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.89	-	-	-	-	-
Follow-up Hdwy	3.557	3.357		-	-	-
Pot Cap-1 Maneuver	54	147	427	-	-	-
Stage 1	199	-	-	-	-	-
Stage 2	539	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	48	147	427	-	-	-
Mov Cap-2 Maneuver	48	-	-	-	-	-
Stage 1	177	-	-	-	-	-
Stage 2	539	-	-	-	-	-
Approach	EB		NB		SB	
HCM Control Delay, s	69.9		1		0	
HCM LOS	09.9 F				0	
	I					
Minor Lane/Major Mvm	nt	NBL	NBT E	BLn1	SBT	SBR
Capacity (veh/h)		427	-	64	-	-

			• •		
HCM Lane V/C Ratio	0.048	-	0.136	-	-
HCM Control Delay (s)	13.9	0.7	69.9	-	-
HCM Lane LOS	В	A	F	-	-
HCM 95th %tile Q(veh)	0.2	-	0.4	-	-

Int Delay, s/veh 1.5 EBL Movement EBR NBL NBT SBT SBR **4↑** 1397 Y Lane Configurations Þ 28 945 Traffic Vol, veh/h 19 5 4 Future Vol, veh/h 28 19 4 1397 945 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 -----Veh in Median Storage, # 0 --0 0 -Grade, % 0 0 0 ---Peak Hour Factor 92 92 92 92 92 92 Heavy Vehicles, % 6 6 6 6 6 6 Mvmt Flow 30 21 4 1518 1027 5

Major/Minor	Minor2	1	Major1	Ν	/lajor2	
Conflicting Flow All	1797	1030	1032	0	-	0
Stage 1	1030	-	-	-	-	-
Stage 2	767	-	-	-	-	-
Critical Hdwy	6.69	6.29	4.19	-	-	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.89	-	-	-	-	-
Follow-up Hdwy	3.557		2.257	-	-	-
Pot Cap-1 Maneuver	77	276	652	-	-	-
Stage 1	335	-	-	-	-	-
Stage 2	412	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	74	276	652	-	-	-
Mov Cap-2 Maneuver	74	-	-	-	-	-
Stage 1	322	-	-	-	-	-
Stage 2	412	-	-	-	-	-
Approach	EB		NB		SB	
HCM Control Delay, s	68.2		0.2		0	
HCM LOS	F				v	
	1	NDI			ODT	000
Minor Lane/Major Mvm	It	NBL	NBT E		SBT	SBR
Capacity (veh/h)		652	-	105	-	-

HCM Lane V/C Ratio	0.007	- ().487	-	-
HCM Control Delay (s)	10.6	0.2	68.2	-	-
HCM Lane LOS	В	А	F	-	-
HCM 95th %tile Q(veh)	0	-	2.2	-	-

Int Delay, s/veh 1.5 EBL Movement EBR NBL NBT SBT SBR Lane Configurations ٦ 1 41 Þ 1357 18 919 Traffic Vol, veh/h 28 10 6 Future Vol, veh/h 18 28 10 919 1357 6 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 ----Veh in Median Storage, # 0 --0 0 -Grade, % 0 0 0 ---Peak Hour Factor 92 92 92 92 92 92 Heavy Vehicles, % 6 6 6 6 6 6 Mvmt Flow 20 30 11 999 1475 7

Major/Minor	Minor2		Major1	Ma	jor2	
Conflicting Flow All	2001	1479	1482	0	-	0
Stage 1	1479	-	-	-	-	-
Stage 2	522	-	-	-	-	-
Critical Hdwy	6.69	6.29	4.19	-	-	-
Critical Hdwy Stg 1	5.49	-	-	-	-	-
Critical Hdwy Stg 2	5.89	-	-	-	-	-
Follow-up Hdwy		3.357		-	-	-
Pot Cap-1 Maneuver	56	149	436	-	-	-
Stage 1	202	-	-	-	-	-
Stage 2	551	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver		149	436	-	-	-
Mov Cap-2 Maneuver	53	-	-	-	-	-
Stage 1	190	-	-	-	-	-
Stage 2	551	-	-	-	-	-
Approach	EB		NB		SB	
HCM Control Delay, s			0.5		0	
HCM LOS			0.0		0	
	1					

Minor Lane/Major Mvmt	NBL	NBT EE	3Ln1 E	EBLn2	SBT	SBR	
Capacity (veh/h)	436	-	53	149	-	-	
HCM Lane V/C Ratio	0.025	- 0	.369	0.204	-	-	
HCM Control Delay (s)	13.5	0.4 1	08.3	35.3	-	-	
HCM Lane LOS	В	А	F	Е	-	-	
HCM 95th %tile Q(veh)	0.1	-	1.3	0.7	-	-	

Int Delay, s/veh	1.7						
Movement	EBL	EBR	NBL	NBT	SBT	SBR	ł
Lane Configurations	٢	1		- € †	ħ		
Traffic Vol, veh/h	12	18	28	1397	945	18	;
Future Vol, veh/h	12	18	28	1397	945	18	;
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	-	-	-	-	-
Veh in Median Storage,	# 0	-	-	0	0	-	-
Grade, %	0	-	-	0	0	-	
Peak Hour Factor	92	92	92	92	92	92	į
Heavy Vehicles, %	6	6	6	6	6	6	;
Mvmt Flow	13	20	30	1518	1027	20	1

Minor2	I	Major1	Мај	or2	
1856	1037	1047	0	-	0
1037	-	-	-	-	-
819	-	-	-	-	-
6.69	6.29	4.19	-	-	-
5.49	-	-	-	-	-
5.89	-	-	-	-	-
3.557	3.357	2.257	-	-	-
70	273	643	-	-	-
333	-	-	-	-	-
387	-	-	-	-	-
			-	-	-
	273	643	-	-	-
49	-	-	-	-	-
234	-	-	-	-	-
387	-	-	-	-	-
EB		NB		SB	
52.0 F		1.0		9	
	1037 819 6.69 5.49 3.557 70 333 387 49 49 234 387 EB 52.8	1856 1037 1037 - 819 - 6.69 6.29 5.49 - 3.557 3.357 70 273 333 - 387 - 49 273 49 - 234 - 387 - EB 52.8	1856 1037 1047 1037 - - 819 - - 6.69 6.29 4.19 5.49 - - 3.557 3.357 2.257 70 273 643 333 - - 387 - - 234 - - 387 - - 234 - - 387 - - 234 - - 255 - - 887 - - 234 - - 252.8 NB	1856 1037 1047 0 1037 - - 819 - - 6.69 6.29 4.19 - 5.49 - - 3.557 3.357 2.257 - 70 273 643 - 333 - - - 387 - - - 49 273 643 - 234 - - - 387 - - - 234 - - - 387 - - - 234 - - - 287 - - - 287 - - - 234 - - - 52.8 1.8 1.8 -	1856 1037 1047 0 - 1037 - - - - 819 - - - - 6.69 6.29 4.19 - - 5.49 - - - - 5.89 - - - - 3.557 3.357 2.257 - - 70 273 643 - - 333 - - - - 387 - - - - 49 273 643 - - 234 - - - - 234 - - - - 387 - - - - 387 - - - - 387 - - - - 234 - - - - EB NB SB 52.8 1.8 0

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	643	-	49	273	-	-
HCM Lane V/C Ratio	0.047	-	0.266	0.072	-	-
HCM Control Delay (s)	10.9	1.6	103.3	19.2	-	-
HCM Lane LOS	В	А	F	С	-	-
HCM 95th %tile Q(veh)	0.1	-	0.9	0.2	-	-