

TECHNICAL MEMORANDUM

HNTB

To

Kumar Neppalli
Traffic Engineering Manager
Town of Chapel Hill

From

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HNTB North Carolina, P.C.

Cc

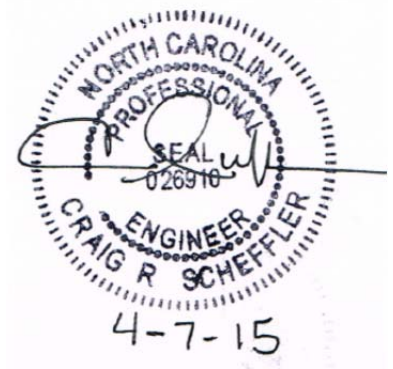
HNTB Project File: 38435

Subject

Obey Creek TIS –
2022 Peak Hour Capacity Analysis
for Southern Village Park-and-Ride
Redevelopment

Date

04/07/15



Per Town of Chapel Hill request related to the Obey Creek Traffic Impact Study, the following information represents intersection capacity analyses and queue length/storage information for estimated weekday AM, noon, and PM peak hour conditions in the 2022 analysis year previously studied in the Obey Creek Mixed-Use development project. This technical documentation examines the potential impacts at intersections along the US 15-501 corridor caused by a redevelopment of the existing Southern Village Park-and-Ride Lot into a mixed-use development. Trip generation, distribution and future traffic volume redistributions are also analyzed, based on conceptual site plan information provided by Town staff.

Trip Generation Analysis

HNTB conducted a detailed trip generation analysis for the proposed Park-and-Ride redevelopment, based on methodologies previously employed for trip generation estimates made for the Obey Creek development, since the developments both feature mixed-use components, are located directly adjacent from each other, and share some basic potential characteristics for internal trip-making, transit/pedestrian/bicycle trip reductions and “pass-by” type trip-making.

As part of the trip generation process, estimates of the net reduction in trips between the existing Park-and-Ride (390 spaces) and the projected amount of park-and-ride spaces available in the redevelopment (125 spaces) were made. The Institute of Transportation Engineers (ITE) *Trip Generation Manual* information was utilized to produce these estimates, as no existing field-collected trip generation data is available for peak periods at the existing Park-and-Ride Lot.

Table 1 provides basic redevelopment concept plan details, as provided by Town staff, that were used as a basis for estimating future trips from the redevelopment site.

Table 1. Park-and-Ride Redevelopment Scenario Comparison

Version 1	Version 2
Anchor Retail – 30,000 Square Feet	Anchor Retail – 11,000 Square Feet
In-Line Retail – 60,800 Square Feet	In-Line Retail – 60,800 Square Feet
Office – 50,000 Square Feet	Office – 90,000 Square Feet
Residential – 166 Units	Residential – 116 Units

Table 2 provides an overall summary of new “net” external vehicle trips produced by each redevelopment scenario. This information accounts for all projected internal trip, transit trip, pedestrian/bicycle trip and “pass-by” trip reductions that are initially calculated by the ITE Trip Generation Manual and adjusted by previous methodologies employed in the Obey Creek Traffic Impact Study, and are consistent with NCDOT guidelines for trip generation analyses. **Appendix A** contains the detailed trip generation spreadsheet output.

Table 2. Park-and-Ride Trip Generation Summary – New “Net” External Vehicle Trips

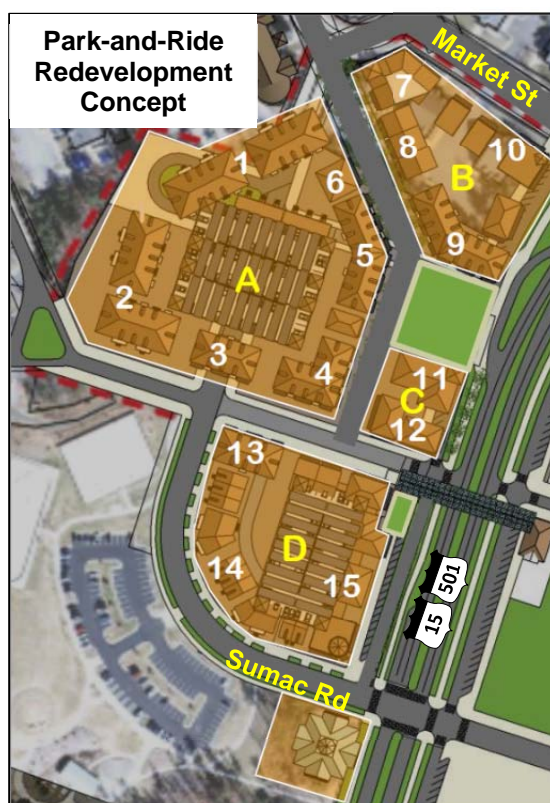
Scenario	Daily Trips	AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
		Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Version 1	4,754	16	67	83	114	116	230	128	113	241
Version 2	4,293	48	48	96	120	115	235	109	125	234

Based on the results from **Table 2**, Version 1 produces slightly higher “net” vehicular trip estimates for the daily and critical PM peak hour time periods. Therefore, the Version 1 redevelopment scenario was carried forward to the trip distribution/assignment step and eventual capacity analysis. Though Version 2 was not specifically analyzed for traffic operations impacts, the fact that the data shows that its trip-generating characteristics are very similar to Version 1 would likely produce the same capacity analysis impact conclusions.

Trip Distribution and Assignment

The new “net” trips that are projected for the Southern Village Park-and-Ride Version 1 redevelopment concept were distributed onto the US 15-501 corridor in the following manner:

- External trips: Trip distribution percentages assumed in the Obey Creek Traffic Impact Study – 2022 Concept Analysis were utilized for the park-and-ride redevelopment. These percentages were



based on region-wide daily and peak hour traffic flows to external streets along US 15-501 and beyond the immediate project redevelopment site.

- **Driveway Trips:** Both “net” new external trips and “pass-by” type trips, which are only added to the network at the Park-and-Ride redevelopment access points along US 15-501, were assigned to the study area network by using some of the preliminary assumptions of land uses, redevelopment densities, and parking locations on the *Park-and-Ride Draft Scenario: 3 Concept Plan*. Trips were assigned to either Market Street or Sumac Road based on the relative percentage weight of predicted trip originations/destinations within the redevelopment site. “Pass-by” trips were estimated by comparing directional flows along US 15-501 based on existing traffic volumes, with overall weight at each driveway as described above. **Table 3** highlights the assumptions in distributing site trips.

Table 3. Driveway Trip Distribution Estimation

Access Point	By Location & Development Density	By Location & Parking Spaces	Estimated Driveway Access Percentages
Market Street	<ul style="list-style-type: none"> • 25% Block A (30,000 SF) • Block B (63,000 SF) • Block C (21,600 SF) Total = <u>115,000 SF</u> (40% - Park-and-Ride traffic)	<ul style="list-style-type: none"> • 25% Block A (183 Spaces) • Block B – 37 Spaces • Block C (12 Spaces) Total = <u>232 Spaces</u> (24%)	30%
Sumac Road	<ul style="list-style-type: none"> • 75% Block A (90,000 SF) • Block D (69,000 SF) • Park-and-Ride in Block A Garage Total = <u>159,000 SF</u> (60% + Park-and-Ride traffic)	<ul style="list-style-type: none"> • 75% Block A (549 Spaces – Park-and-Ride in Garage) • Block D (190 Spaces) Total = <u>739 Spaces</u> (76%)	70%

2022 Future Traffic Volume Development

Initial 2022 peak hour traffic volume estimates were taken from previously completed traffic projections for the Obey Creek project at full build-out, with the full access assumption at Sumac Road. This work accounted for the growth of background traffic in the Obey Creek study area due to regional traffic growth and several specific approved background generating development projects. The Southern Village Park-and-Ride redevelopment traffic volume assignments were applied to these 2022 “base” volumes to be used as inputs on the intersection capacity analyses. **Appendix B** provides details on the trip distribution/assignment and overall traffic volume development process used in this technical memorandum.

2022 Peak Hour Capacity Analysis Methodology

HNTB updated the previously completed 2022 AM, Noon, and PM peak hour Synchro intersection capacity analysis networks to account for additional future Park-and-Ride redevelopment traffic along US 15-501 adjacent to the existing Park-and-Ride / future Obey Creek sites. This analysis includes the intersections from Market Street/Obey Creek Site Driveway #4 (Market Street East) through Dogwood

Acres Drive. The capacity analysis Synchro networks also included the adjacent signalized intersections at Dogwood Acres Drive and Arlen Park Drive/Bennett Road, though these intersections were included only to provide more accurate estimates of traffic signal progression along the US 15-501 corridor and actual traffic capacity impacts from the proposed Park-and-Ride redevelopment at these locations is expected to be negligible.

The analysis also includes the assumption that Sumac Road/Obey Creek Site Driveway #3 would have full access, and that potential right-turn in/right-turn out only (RIRO) driveways from the redevelopment site and Obey Creek and any frontage roads along US 15-501 (as shown on the Concept Plan) were not part of this initial analysis and will need to be analyzed in greater detail at a later date.

Three analysis scenarios were developed for this technical memorandum and include:

- **2022 No-Build** – This analysis assumes full build-out of the Obey Creek development, full access for Sumac Road, and contains the original *Obey Creek Traffic Impact Study – 2022 Concept Analysis* projected traffic volumes along the US 15-501 corridor. The assumed study area intersection geometrics and signal timings were taken from original and modified recommendations made for the Market Street and Sumac Road intersections by both HNTB, NCDOT and Town staff.
- **2022 Build** – This analysis assumes full build-out of the Southern Village Park-and-Ride redevelopment, reduction of existing park-and-ride parking spaces, full access at Sumac Road and additional redistribution of existing traffic volumes that access the Scroggs Elementary School in Southern Village. These redistributions were included because the Park-and-Ride Redevelopment Concept plans show a new local street network access point for the school to/from Sumac Road – with the possibility that some existing AM peak hour northbound school-related trips may use this access point instead of existing Market Street to access the school. This scenario assumes the same geometric and signal timing assumptions featured in the 2022 No-Build analysis.
- **2022 Build + Improvements** – This analysis was completed after initial 2022 Build scenario results were reviewed to determine if the Market Street and Sumac Road intersections with US 15-501 provide adequate vehicular capacity and Level-of-Service (LOS) in the three peak hour analysis periods. In addition, if potential queuing issues were projected to occur in this scenario, additional geometric and/or traffic signal timing/phasing strategies were incorporated into the analysis.

Projected No-Build and Build 2022 AM/noon/PM peak hour traffic volumes for the US 15-501 study area network are shown on **Figures 1 and 2**. **Figure 3** shows the assumed 2022 study area laneage utilized in the No-Build and Build Scenario analyses.

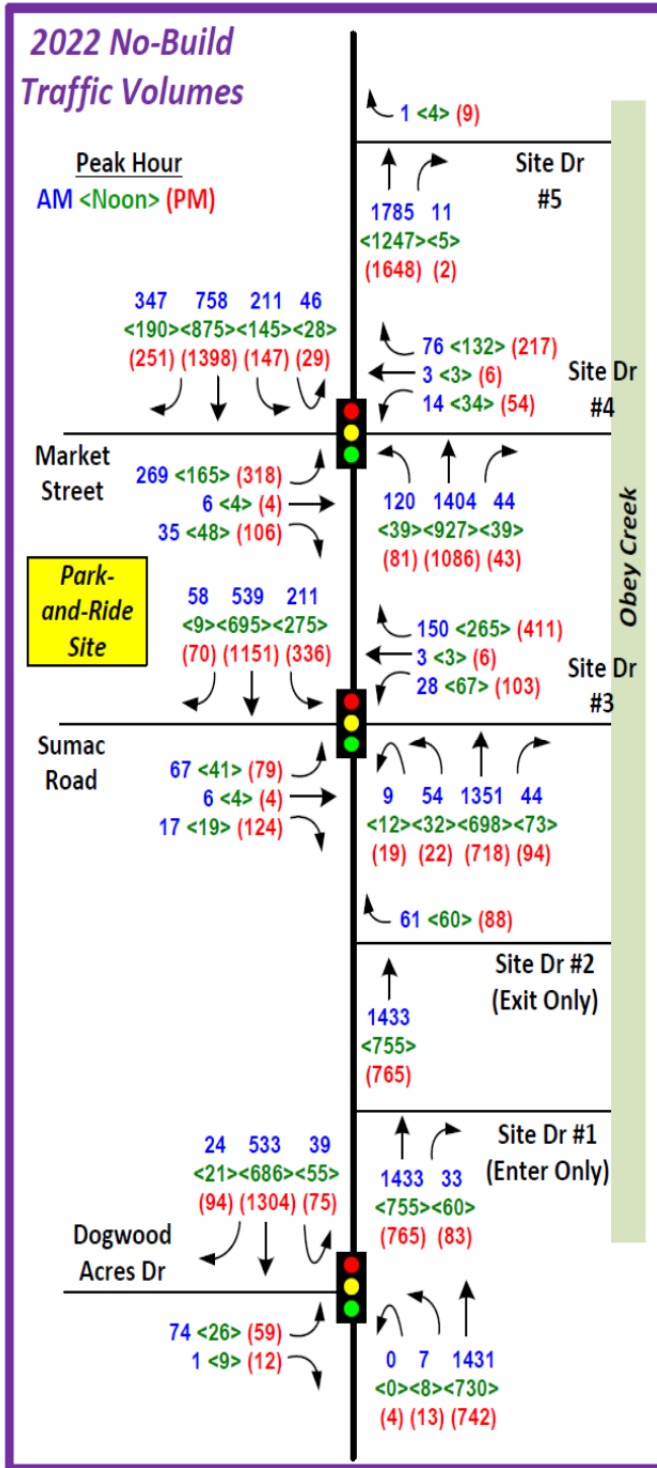


Figure 1 – 2022 Peak Hour Traffic Volumes No-Build Scenario (Existing Park-and-Ride)

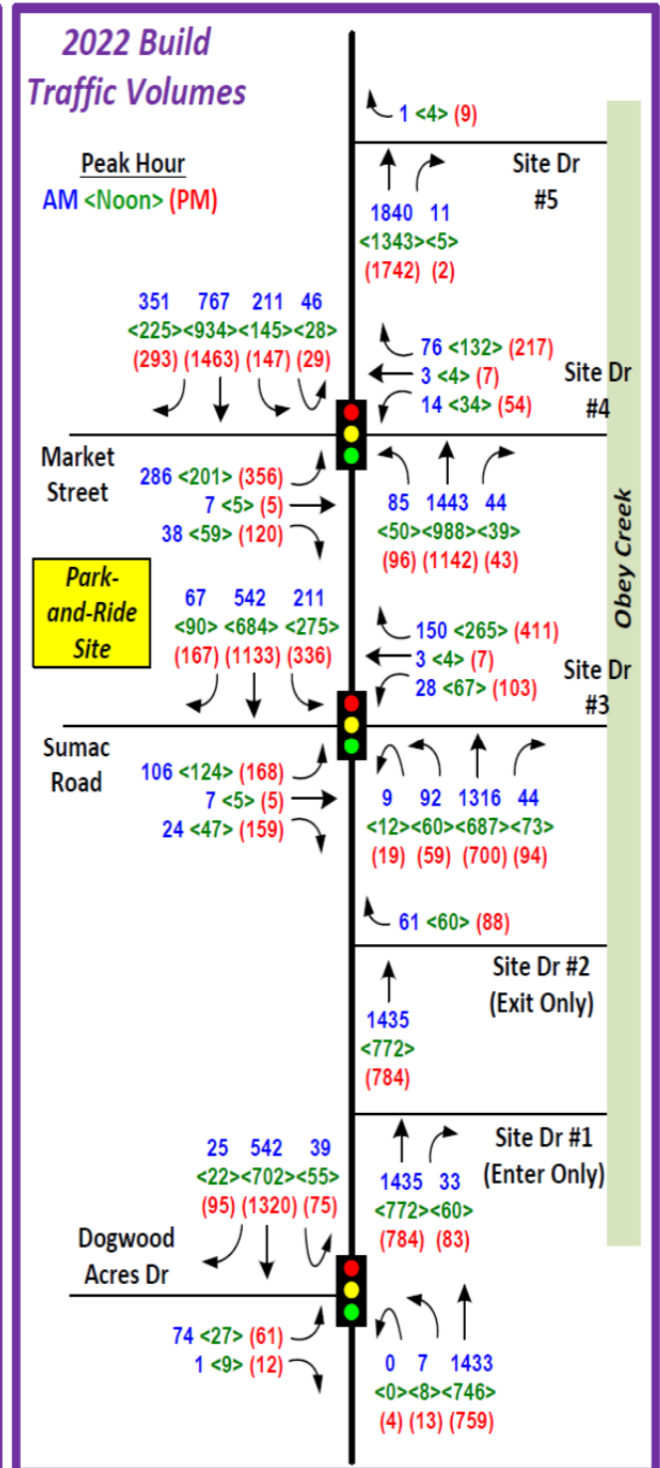


Figure 2 – 2022 Peak Hour Traffic Volumes Build Scenario (Park-and-Ride Redevelopment)

2022 Peak Hour Capacity and Queue Analysis Results

Using the traffic volume data from **Figures 1 and 2**, HNTB updated the previously submitted 2022 peak hour Synchro capacity analysis networks to include these changes, along with the incorporation of the assumed geometrics and laneage shown in **Figure 3**. Corridor signal operations were re-optimized following the laneage and volume updates.

Tables 4, 5, and 6 show the operational analysis results for the US 15-501 intersections with Market Street and Sumac Road for the 2022 No-Build, Build, and Build with Improvements Scenarios, respectively. All overall intersection and movement Level-of-Service (LOS) results are shown along with corresponding delay (seconds per vehicle) information. In addition to the operational results, projected 2022 peak hour maximum (Synchro 95th percentile) queue lengths are shown for each intersection movement and are compared to existing or proposed queue storage lengths. Storage lengths for US 15-501 through movements are shown in areas where intersection spacing might be close enough to warrant a check as to whether mainline traffic may spill back to an upstream intersection. Similarly, for select minor street approaches, a through movement queue storage is provided for short links that may impact an upstream intersection.

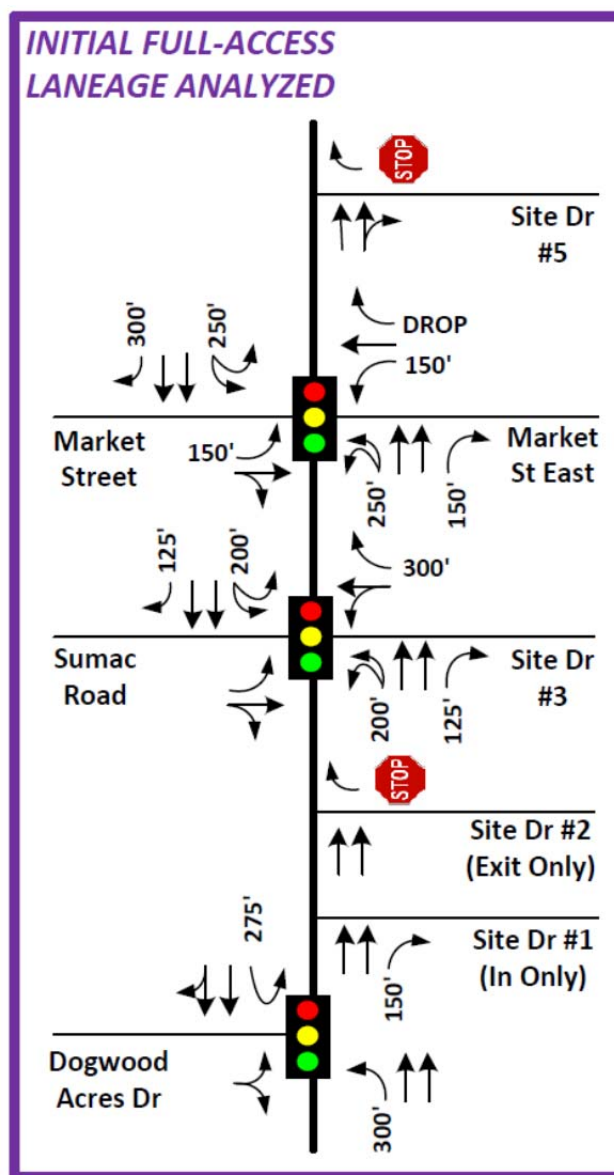


Figure 3 – 2022 Assumed Study Area Geometrics and Traffic Control

As shown in **Tables 4, 5 and 6**, the two signalized intersections in the immediate vicinity of the existing Southern Village Park-and-Ride are expected to operate at an overall LOS D or better in all the 2022 peak hours, regardless of the redevelopment of the existing Park-and-Ride. Overall LOS is the threshold value used by the Town and NCDOT as a measure of adequate operational performance to determine when additional mitigation may be necessary to offset development-related impacts (typically LOS D is used as a threshold).

There are several instances of individual movement LOS/delay exceeding the LOS D threshold for each scenario. This is commonly experienced on most lower volume side streets along high volume arterials where optimized/coordinated traffic signal timings will favor larger amounts of green time be allocated to the higher volume facilities. A discussion of queue storage impacts for each scenario follows the tables.

**Table 4. 2022 AM/Noon/PM Peak Hour Intersection Capacity and Queue Analysis Results
No-Build Alternative – Existing Park-and-Ride and Full Obey Creek Build-out**

ID #	Intersections / Movements	AM PEAK HOUR			NOON PEAK HOUR			PM PEAK HOUR			Queue Storage (ft)
		LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	
12	US 15-501 & Market Street / Site Driveway #4	D	37.0	--	C	23.3	--	C	34.0	--	--
	EB LT	<i>F</i>	<i>96.4</i>	<i>425</i>	<i>E</i>	<i>60.4</i>	<i>200</i>	<i>E</i>	<i>73.8</i>	<i>450</i>	150
	EB THRT	D	41.0	75	C	32.5	100	C	33.5	125	350
	WB LT	<i>E</i>	<i>65.6</i>	50	<i>E</i>	<i>62.4</i>	75	<i>F</i>	<i>91.9</i>	125	300
	WB TH	<i>E</i>	<i>62.0</i>	25	D	51.3	25	<i>E</i>	<i>57.7</i>	25	300
	WB RT	D	43.7	125	C	28.9	100	<i>E</i>	<i>55.1</i>	275	300
	NB LT	<i>F</i>	<i>86.5</i>	200	<i>E</i>	<i>78.8</i>	75	<i>E</i>	<i>78.2</i>	175	250
	NB TH	C	28.9	875	B	17.8	225	C	29.3	575	925
	NB RT	B	12.1	25	B	15.0	50	B	16.6	50	150
	SB LT/U-TURN	<i>E</i>	<i>64.1</i>	<i>450</i>	D	47.5	200	<i>E</i>	<i>70.8</i>	250	350
	SB TH	C	20.8	375	B	14.3	200	C	21.2	500	-
SB RT	B	13.4	<i>350</i>	A	2.8	25	A	3.4	50	300	
13	US 15-501 & Sumac Road / Obey Creek Site Driveway #3 - FULL ACCESS	C	20.6	--	B	18.0	--	C	22.0	--	--
	EB LT	<i>E</i>	<i>79.5</i>	125	D	55.0	75	D	52.8	125	-
	EB THRT	<i>E</i>	<i>59.9</i>	75	D	48.1	75	<i>E</i>	<i>57.7</i>	225	-
	WB LTTH	<i>E</i>	<i>63.2</i>	75	<i>E</i>	<i>60.1</i>	125	<i>F</i>	<i>87.0</i>	175	300
	WB RT	D	36.9	175	C	21.6	200	C	22.1	300	300
	NB LT	<i>E</i>	<i>69.3</i>	125	D	52.0	75	<i>E</i>	<i>62.6</i>	100	200
	NB TH	B	14.1	250	B	19.7	325	C	26.1	250	1,400
	NB RT	B	10.2	25	B	15.4	50	C	23.6	100	150
	SB LT	<i>E</i>	<i>64.5</i>	325	C	24.4	275	C	31.5	<i>400</i>	350
	SB TH	A	1.0	25	A	1.7	50	A	2.8	75	925
	SB RT	A	1.0	25	A	1.7	25	A	2.4	25	150

RED LOS/DELAY VALUES – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines

RED QUEUE LENGTH/STORAGE VALUES – Synchro Estimated Queue Length Potentially Exceeds Existing/Future Storage

-- = Queue Storage Calculation Not Relevant for Specified Movement

**Table 5. 2022 AM/Noon/PM Peak Hour Intersection Capacity and Queue Analysis Results
Build Alternative – Redeveloped Park-and-Ride and Full Obey Creek Build-out**

ID #	Intersections / Movements	AM PEAK HOUR			NOON PEAK HOUR			PM PEAK HOUR			Queue Storage (ft)
		LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	
12	US 15-501 & Market Street / Site Driveway #4	D	40.0	--	C	24.5	--	D	36.7	--	--
	EB LT	<i>F</i>	<i>110.4</i>	<i>475</i>	<i>E</i>	<i>64.6</i>	<i>250</i>	<i>F</i>	<i>83.0</i>	<i>525</i>	150
	EB THRT	D	38.9	75	C	32.5	100	C	33.8	150	350
	WB LT	<i>E</i>	<i>67.4</i>	50	<i>E</i>	<i>64.9</i>	75	<i>F</i>	<i>97.5</i>	125	300
	WB TH	<i>E</i>	<i>62.0</i>	25	D	52.0	25	<i>E</i>	<i>57.9</i>	25	300
	WB RT	D	43.0	125	C	29.2	100	<i>E</i>	<i>55.6</i>	275	300
	NB LT	<i>F</i>	<i>83.9</i>	125	<i>E</i>	<i>78.0</i>	100	<i>F</i>	<i>92.8</i>	200	250
	NB TH	C	32.7	900	B	18.3	275	C	31.1	600	925
	NB RT	B	11.2	25	B	13.7	25	B	16.9	50	150
	SB LT/U-TURN	<i>E</i>	<i>74.6</i>	<i>450</i>	D	47.3	200	<i>E</i>	<i>70.6</i>	225	350
	SB TH	B	19.7	375	B	15.4	200	C	23.7	700	-
SB RT	B	12.7	<i>350</i>	A	2.6	25	A	3.4	75	300	
13	US 15-501 & Sumac Road / Obey Creek Site Driveway #3 - FULL ACCESS	C	23.6	--	C	23.5	--	C	25.7	--	--
	EB LT	<i>E</i>	<i>76.9</i>	175	<i>F</i>	<i>91.7</i>	200	<i>E</i>	<i>74.8</i>	275	-
	EB THRT	D	54.0	75	D	49.3	100	<i>E</i>	<i>60.2</i>	275	-
	WB LTTH	D	54.8	75	D	53.5	125	<i>F</i>	<i>101.6</i>	225	300
	WB RT	C	32.0	175	B	18.2	200	B	18.6	300	300
	NB LT	<i>E</i>	<i>65.3</i>	175	<i>E</i>	<i>58.1</i>	100	<i>F</i>	<i>84.8</i>	175	200
	NB TH	B	17.8	275	C	23.7	325	C	29.1	225	1,400
	NB RT	B	12.3	25	B	17.0	50	C	25.2	100	150
	SB LT	<i>E</i>	<i>59.2</i>	325	C	23.9	275	C	29.0	<i>375</i>	350
	SB TH	A	3.4	50	A	2.6	50	A	3.5	75	925
	SB RT	A	3.3	25	A	2.1	25	A	3.0	25	150

RED LOS/DELAY VALUES – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines

RED QUEUE LENGTH/STORAGE VALUES – Synchro Estimated Queue Length Potentially Exceeds Existing/Future Storage

-- = Queue Storage Calculation Not Relevant for Specified Movement

**Table 6. 2022 AM/Noon/PM Peak Hour Intersection Capacity and Queue Analysis Results
Build Alternative + Geometric Improvements – Redeveloped Park-and-Ride and Full Obey Creek Build-out**

ID #	Intersections / Movements	AM PEAK HOUR			NOON PEAK HOUR			PM PEAK HOUR			Queue Storage (ft)
		LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	LOS	Avg Delay (sec/veh)	95 th % Queue Length (ft)	
12	US 15-501 & Market Street / Site Driveway #4	C	26.3	--	C	20.9	--	C	27.0	--	--
	EB LT	<i>E</i>	<i>67.4</i>	200	<i>E</i>	<i>55.6</i>	125	<i>E</i>	<i>66.5</i>	225	225 Dual
	EB THRT	D	44.4	100	D	39.1	100	D	43.3	175	350
	WB LT	<i>E</i>	<i>67.4</i>	50	<i>E</i>	<i>61.8</i>	75	<i>F</i>	<i>87.7</i>	125	300
	WB TH	<i>E</i>	<i>62.0</i>	25	D	51.0	25	<i>E</i>	<i>56.7</i>	25	300
	WB RT	D	50.6	125	D	39.4	125	<i>E</i>	<i>55.1</i>	275	300
	NB LT	<i>F</i>	<i>83.4</i>	150	<i>E</i>	<i>69.5</i>	100	<i>E</i>	<i>62.0</i>	125	250
	NB TH	B	12.9	250	B	12.0	225	B	18.2	475	925
	NB RT	A	9.1	25	A	9.8	25	B	12.8	25	150
	SB LT/U-TURN	<i>E</i>	<i>60.7</i>	175	D	46.2	125	<i>E</i>	<i>56.2</i>	100	250 Dual
	SB TH	B	18.8	350	B	12.0	175	B	14.9	300	-
SB RT	B	13.1	<i>350</i>	A	3.3	50	A	2.9	25	300	
13	US 15-501 & Sumac Road / Obey Creek Site Driveway #3 - FULL ACCESS	C	24.1	--	C	26.1	--	C	29.1	--	--
	EB LT	<i>E</i>	<i>73.3</i>	175	<i>E</i>	<i>59.7</i>	175	<i>E</i>	<i>71.3</i>	250	250
	EB THRT	D	45.8	75	C	30.2	75	D	36.4	225	-
	WB LTTH	<i>E</i>	<i>76.8</i>	75	<i>E</i>	<i>65.5</i>	125	<i>F</i>	<i>81.6</i>	200	300
	WB RT	<i>E</i>	<i>62.3</i>	225	C	28.2	175	C	27.5	275	300
	NB LT	<i>E</i>	<i>61.6</i>	175	<i>E</i>	<i>58.3</i>	100	<i>E</i>	<i>71.2</i>	150	250
	NB TH	B	14.4	250	C	24.6	350	C	34.9	400	1,400
	NB RT	B	10.5	25	B	19.9	50	C	26.6	100	150
	SB LT	<i>E</i>	<i>63.5</i>	175	C	32.5	150	C	33.4	200	250 Dual
	SB TH	A	4.8	50	B	11.5	125	B	13.4	375	925
SB RT	A	2.2	25	A	1.7	25	A	2.5	25	150	

RED LOS/DELAY VALUES – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines

RED QUEUE LENGTH/STORAGE VALUES – Synchro Estimated Queue Length Potentially Exceeds Existing/Future Storage

“-“ = Queue Storage Calculation Not Relevant for Specified Movement

BLUE STORAGE VALUES – Recommended Geometric Improvements to Initial Turn Bay Storage Assumptions

As noted in **Tables 4 and 5**, several peak hour queuing issues may also arise, based on the estimated queue results compared to existing/projected queue storage for both the No-Build and Build scenarios.

- US 15-501 / Market Street / Site Driveway #4 (Market St East) – projected eastbound left-turn lane maximum queues will far exceed the existing 150 foot storage length. Southbound left-turn queue lengths into the future Obey Creek development may exceed preliminary single left-turn lane storage provisions of 350 feet in the 2022 AM peak hour.
- US 15-501 / Sumac Road / Site Driveway #3 – even without additional traffic generated by the Park-and-Ride redevelopment, potential heavy southbound left-turn traffic into the Obey Creek development may exceed the current planned single left-turn bay storage of 350 feet. Provision of full access at Sumac Road may also produce northbound left-turn queues that approach the 200 foot planned left-turn lane (from original Obey Creek concept plan data). With the existing RIRO eastbound approach at Sumac Road and US 15-501, no provision is needed for separate turning lanes. In the future, if full access is granted, the current Sumac Road cross-section was also assumed to be restriped and widened for a left-turn lane and a through right-turn lane. This lane’s storage requirements were determined by analysis results shown in **Table 6**.

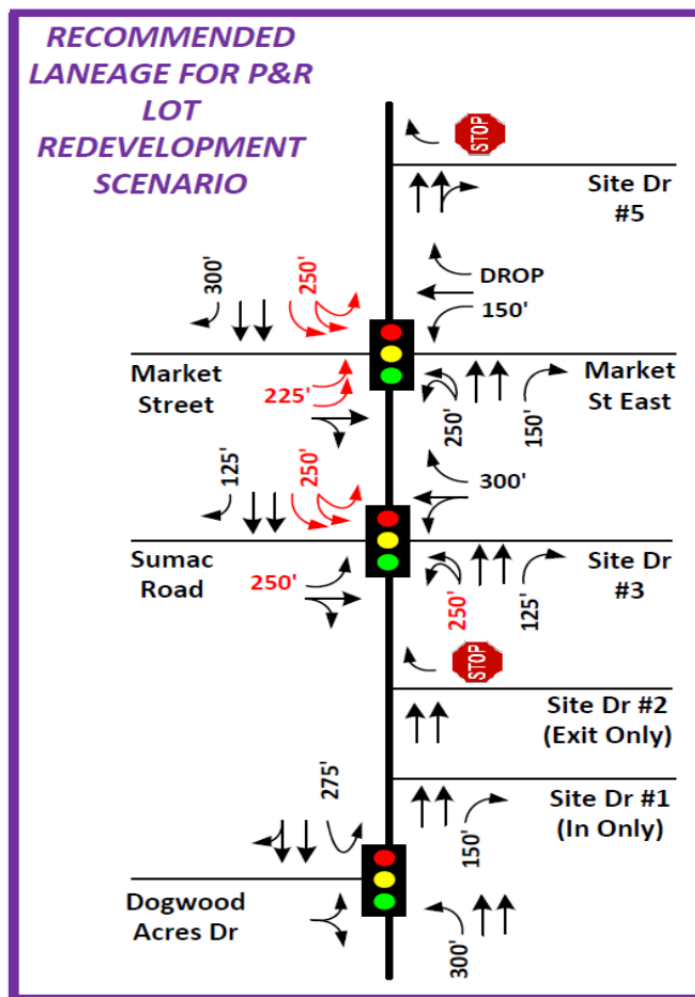


Figure 4 – 2022 Geometric Improvement Recommendations

Figure 4 shows recommended geometric improvements to provide adequate turning lane storage capacity to accommodate projected 2022 peak hour maximum vehicle queues. Southbound dual left-turn lanes from US 15-501 into the Obey Creek development are recommended, along with the widening and additional eastbound left-turn lane required for the Market Street approach to US 15-501. At Sumac Road and US 15-501, separate eastbound left-turn and through/right-turn lanes are recommended, along with the provision of 250 feet of left-turn bay storage and a dedicated protected or protected+permitted left-turn signal phase for this approach. The future design for a northbound left-turn bay into Sumac Road should provide at least 250 feet of single-lane vehicle storage.

Conclusions

The results of this preliminary study into the potential traffic operations impacts due to a proposed redevelopment of the existing Southern Village Park-and-Ride indicate that, for the proposed mixed-use development intensities and location of major access points, a full access intersection along US 15-501 at Sumac Road can be designed to mitigate projected 2022 peak hour operational issues caused by both the park-and-ride redevelopment as well as the full build-out of Obey Creek. Additional study will be necessary to examine the impacts of proposed frontage roads, on-street bus drop-off points along US 15-501, and potential mid-block local RIRO access locations that are shown on the Park-and-Ride Concept Plan.

A full access intersection with US 15-501 at Sumac Road will help distribute local traffic that accesses Southern Village, the Park-and-Ride redevelopment and Obey Creek and, as the preliminary results show, should not significantly impair individual intersection operations along the US 15-501 corridor. It will also provide a direct and efficient means for serving the existing high frequency transit service to the park-and-ride lot area by allowing bus routes to enter at Market Street and exit at Sumac Road, with the possibility of extending the existing routes across through the internal street network of Obey Creek.

Appendix A – Trip Generation Details

SOUTHERN VILLAGE PARK & RIDE REDEVELOPMENT - TRIP GENERATION DATA - ALTERNATIVE 1

3/23/2015

1. ITE RAW TRIP GENERATION CALCULATIONS - TOTAL NEW DEVELOPMENT

Land Use	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	166	DU	565	565	1,130	17	68	85	22	27	49	71	38	109
General Office Building	710	50	1000 SF	388	388	776	97	13	110	45	47	92	23	111	134
Shopping Center	820	90.8	1000 SF	3,189	3,189	6,378	91	56	147	181	174	355	270	292	562
TOTAL				4,142	4,142	8,284	205	137	342	248	247	495	364	441	805
2. INTERNAL CAPTURE (FROM ITE CALCULATIONS)				414	414	828	10	10	20	46	46	92	81	81	162
EXTERNAL TRIP GENERATION BEFORE MODAL REDUCTION				3,728	3,728	7,456	195	127	322	202	201	403	283	360	643

3. TRANSIT TRIP REDUCTIONS

TRANSIT TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	1.67	--	--	15%	--	--	7.5%	--	--	15%
General Office Building	--	--	0.85	--	--	15%	--	--	7.5%	--	--	15%
Shopping Center	--	--	2.21	--	--	15%	--	--	10.0%	--	--	15%

TRANSIT TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ridership			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	166	DU	139	139	277	2	10	12	1	2	3	9	5	13
General Office Building	710	50	1000 SF	21	21	43	14	2	16	3	3	6	3	13	16
Shopping Center	820	90.8	1000 SF	100	100	201	13	8	21	15	14	29	32	35	67
TOTAL				260	260	520	29	19	48	19	19	37	44	53	96

4. PED/BIKE TRIP REDUCTIONS

PED/BIKE TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	0.167	--	--	1.5%	--	--	0.8%	--	--	1.5%
General Office Building	--	--	0.085	--	--	1.5%	--	--	0.8%	--	--	1.5%
Shopping Center	--	--	0.221	--	--	1.5%	--	--	1.0%	--	--	1.5%

PED/BIKE TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ped/Bike Trips			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	166	DU	14	14	28	0	1	1	0	0	0	1	0	1
General Office Building	710	50	1000 SF	2	2	4	1	0	2	0	0	1	0	1	2
Shopping Center	820	90.8	1000 SF	10	10	20	1	1	2	1	1	3	3	3	7
TOTAL				26	26	52	3	2	5	2	2	4	4	5	10

TOTAL NEW EXTERNAL VEHICLE TRIPS (DRIVEWAY VOLUMES)	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	3,442	3,442	6,884	163	106	269	181	181	362	235	302	537

5.PASS-BY TRIPS	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Pass-By Trip Rates - Shopping Center	820	90.8	1000 SF	17%	17%	17%	0%	0%	0%	34%	34%	34%	34%	34%	34%
Pass-By Trips				471	471	942	0	0	0	45	43	88	60	69	130
Adjusted Pass-By Trips				471	471	942	0	0	0	44	44	88	65	65	130
TOTAL				471	471	942	0	0	0	44	44	88	65	65	130

TOTAL NEW EXTERNAL VEHICLE TRIPS ADDED TO ADJACENT STREETS	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	2,971	2,971	5,942	163	106	269	137	137	274	170	237	407
Park & Ride Net Trip Generation Reduction	594	594	1,188	147	39	186	24	21	44	42	124	166
Net Total External Vehicle Trips Added to Adjacent Streets	2,377	2,377	4,754	16	67	83	114	116	229	128	113	241

SOUTHERN VILLAGE PARK & RIDE REDEVELOPMENT - TRIP GENERATION DATA - ALTERNATIVE 2

3/23/2015

1. ITE RAW TRIP GENERATION CALCULATIONS - TOTAL NEW DEVELOPMENT

Land Use	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	116	DU	414	414	828	12	49	61	17	20	36	53	28	81
General Office Building	710	90	1000 SF	606	606	1,212	155	21	176	70	64	134	30	149	179
Shopping Center	820	71.8	1000 SF	2,738	2,738	5,476	79	48	127	155	149	304	230	250	480
TOTAL				3,758	3,758	7,516	246	118	364	241	232	474	313	427	740
2. INTERNAL CAPTURE (FROM ITE CALCULATIONS)				376	376	752	13	13	26	38	38	76	62	62	124
EXTERNAL TRIP GENERATION BEFORE MODAL REDUCTION				3,382	3,382	6,764	233	105	338	203	194	398	251	365	616

3. TRANSIT TRIP REDUCTIONS

TRANSIT TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	1.67	--	--	15%	--	--	7.5%	--	--	15%
General Office Building	--	--	0.85	--	--	15%	--	--	7.5%	--	--	15%
Shopping Center	--	--	2.21	--	--	15%	--	--	10.0%	--	--	15%

TRANSIT TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ridership			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	116	DU	97	97	194	2	7	8	1	1	2	7	3	10
General Office Building	710	90	1000 SF	38	38	77	22	3	25	4	4	8	4	19	22
Shopping Center	820	71.8	1000 SF	79	79	159	11	7	18	13	13	26	29	31	60
TOTAL				214	214	429	34	16	51	18	18	36	39	53	92

4. PED/BIKE TRIP REDUCTIONS

PED/BIKE TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	0.167	--	--	1.5%	--	--	0.8%	--	--	1.5%
General Office Building	--	--	0.085	--	--	1.5%	--	--	0.8%	--	--	1.5%
Shopping Center	--	--	0.221	--	--	1.5%	--	--	1.0%	--	--	1.5%

PED/BIKE TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ped/Bike Trips			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	116	DU	10	10	19	0	1	1	0	0	0	1	0	1
General Office Building	710	90	1000 SF	4	4	8	2	0	2	0	0	1	0	2	2
Shopping Center	820	71.8	1000 SF	8	8	16	1	1	2	1	1	3	3	3	6
TOTAL				21	21	43	3	2	5	2	2	4	4	5	9

TOTAL NEW EXTERNAL VEHICLE TRIPS (DRIVEWAY VOLUMES)	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	3,146	3,146	6,292	195	87	282	183	175	358	208	306	514

5.PASS-BY TRIPS	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Pass-By Trip Rates - Shopping Center	820	71.8	1000 SF	17%	17%	17%	0%	0%	0%	34%	34%	34%	34%	34%	34%
Pass-By Trips				405	405	811	0	0	0	40	38	78	53	62	115
Adjusted Pass-By Trips				405	405	811	0	0	0	39	39	78	57	57	115
TOTAL				405	405	811	0	0	0	39	39	78	57	57	115

TOTAL NEW EXTERNAL VEHICLE TRIPS ADDED TO ADJACENT STREETS	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	2,741	2,741	5,481	195	87	282	144	136	280	151	249	399
Park & Ride Net Trip Generation Reduction	594	594	1,188	147	39	186	24	21	44	42	124	166
Net Total External Vehicle Trips Added to Adjacent Streets	2,147	2,147	4,293	48	48	96	120	115	236	109	125	233

Appendix B – 2022 Traffic Volume Development

