SMART SERVICES, INC.
Surveying ◆ Environmental ◆ Traffic ◆ CA/CM
An Ohio DBE/EDGE Certified Firm

March 23, 2018

Mr. John Piccin, PE, PS
Delaware County Engineer's Office
50 Channing Street
Delaware, OH 43015

Re: Benalcazar Property Traffic Analysis REV 2
Genoa Township, Delaware County, Ohio

Please consider this letter a summary of the analysis required for the subject development.

BACKGROUND

The subject site is proposed to be developed with 70 units that are marketed to "empty nesters". The site is located in the southeast quadrant of the intersection of Tussic Street Road & Oxbow Road. Figure 1 attached shows the location of the site. One full access is proposed on Tussic Street Road. Figure 2 attached shows the site plan. The permitting agency for the access is the Delaware County Engineer's Office (DCEO).

For access to the roadway, the DCEO's *TIS Standards* require a traffic impact study if the site generates 100 or more peak hour trips. The 70 proposed units will not exceed 100 peak hour trips. However, the DCEO has indicated a traffic analysis will be required.

The analyses required include a signal warrant analysis at the intersection of S. Old 3C Highway & Tussic Street Road/Vinmar Way and turn lane warrant analyses at the proposed site access on Tussic Street Road. An original submission of the traffic analysis dated December 4, 2017 was approved by the DCEO in an e-mail dated December 27, 2017. A revision of the analysis (REV. 1) was submitted to the DCEO on March 1, 2018. The DCEO provided comments in an e-mail dated March 22, 2018. The comments are attached to the letter. This revision addresses those comments.

EXISTING CONDITIONS

S. Old 3C Highway is currently a two-lane section with left turn lanes at the intersection of Old 3C Highway & Tussic Street Road/Vinmar Way. Tussic Street Road is a two-lane section along the site frontage. Both S. Old 3C Highway and Tussic Street Road have speed limits of 45 MPH and are classified as Major Collectors in the Delaware County Thoroughfare Plan.

PROJECTED SITE TRAFFIC

Trip Generation

Site traffic was computed using the *Trip Generation Manual, 10th Edition* published by ITE. Since the proposed zoning is not age restricted, the DCEO requires that a non-age related residential land use be applied. The most representative land use meeting this criterion is "Single-Family Detached Housing" (ITE Code #210). Table 1 attached shows the trip generation calculations.

EXHIBIT G-1

Trip Distribution

The original distribution of traffic was based upon the existing peak hour movements to and from Vinmar Way at the intersection S. Old 3C Highway & Tussic Street Road/Vinmar Way. Note that this is not the only access to the subdivision, but it is assumed that residents leave at the closest access point, so it would reflect the overall distribution. The original distribution was calculated by weighted average of the Outbound AM Peak and Inbound PM Peak (from-AM Peak+to-PM Peak/Total) and was as follows:

- 25% [(23+11)/137] to/from the north on Old 3C Highway
- 55% [(43+32)/137] to/from the south on Old 3C Highway
- 20% [(12+16)/137] to/from the south on Tussic Street Road

Because the location of the access was adjusted to the south on the site, 15% more traffic was assumed to be oriented south on Tussic Street Road. Therefore, the revised distribution is as follows:

- 25% to/from the north on Old 3C Highway
- 40% to/from the south on Old 3C Highway
- 35% to/from the south on Tussic Street Road

Figure 3, which is attached, shows the resulting daily traffic assignment. Figure 4 shows the AM & PM Peak hour site generated traffic.

ANALYSES

Signal Warrant

A signal warrant analysis was performed for the intersection of S. Old 3C Highway & Tussic Street Road/Vinmar Way. There are a total of 9 warrants in the *Ohio Manual of Uniform Traffic Control Devices, 2012 Edition (OMUTCD)*. If any of these are met, a signal is "warranted." If a signal is warranted, it means it is above the minimum level that a signal is desirable and may or may not be recommended for installation. A listing of the 9 warrants follows:

- Warrant # 1 – Eight-Hour Vehicular Volume
- Warrant # 2 – Four-Hour Vehicular Volume
- Warrant # 3 – Peak Hour
- Warrant # 4 – Pedestrian Volume
- Warrant # 5 – School Crossing
- Warrant # 6 – Coordinated Signal System
- Warrant # 7 – Crash Experience
- Warrant # 8 – Roadway Network
- Warrant # 9 – Intersection near a Grade Crossing

For the vehicular volume-based warrants, the *OMUTCD* specifies two levels of volume criteria depending on the 85th percentile speed and the population of the municipality. The volumes necessary are lower for speeds greater than 40 MPH or for communities with a population less than 10,000. For the higher speed or lower population criteria, traffic volumes required to meet the warrants are 70 percent of the volumes required for a lower speed or high population community. When speed data is not collected as part of the study, it is common practice to use the speed limit.

For the analysis, daily distributions for the site had to be projected for use in the warrant analyses. For the residential distribution for the site, the data was based on a count Smart Services, Inc. had on file. Supporting calculations of the daily distribution are attached.

The *OMUTCD* states under "guidance" that engineering judgment should be used to determine what portion of the right-turn vehicles from the minor street approach should be

deducted in the analysis. The DCEO's practice is not to discount minor street right turns in the analysis.

The DCEO considers the Eight Hour warrant when going forward with the installation of a traffic signal. The Eight Hour warrant is not met with the existing or existing plus site traffic. The warrant worksheets are attached.

Turn Lane Warrants

Left Turn Lanes – Per the DCEO's Draft *TIS Standards* that went into effect on 1/1/2018, a left turn lane is warranted on major collector streets that have speeds greater than 40 MPH, greater than 10 peak hour left turning vehicles, and greater than 100 design hourly volume (DHV). Counts on Tussic Street Road at the site access are not available but the existing volume on Tussic Street Road at Old 3C Highway exceeds 100 DHV so it is assumed the DHV at the site access will be greater than 100. As shown in Figure 4, there are 29 southbound left turning vehicles in the PM Peak at the proposed site access on Tussic Street Road. The 29 left turning vehicles exceeds the DCEO's threshold of "more than 10" for Tussic Street Road (a Major Collector having a speed greater than 40 MPH) so a southbound left turn lane is warranted.

Right Turn Lanes - Per the *TIS Standards,* the procedure for determining whether a right turn lane is required is according to the procedures found in the *SHAMM.* The site traffic assignment in Figure 4 shows there will be 16 right turns into the site in the PM Peak Hour. To warrant a right turn lane, there will be would need to be approximately 1040 vehicles northbound on Tussic Street Road in the PM Peak Hour at the site access. Since there are only 85 existing westbound vehicles on Tussic Street Road at the intersection of S. Old 3C Highway & Tussic Street Road, the right turn warrant is not met by inspection. The graph from the *SHAMM* is attached for reference.

Left Turn Lane Length

Turn lane lengths for the warranted southbound left turn lane on Tussic Street Road were computed using the method in Section 400 of the *ODOT L&D Manual*. The speed limit of 45 MPH on Tussic Street Road was used in the calculation. The result is a southbound left turn lane length of 175' which includes the 50' diverging taper. The detailed turn lane length calculation is attached.

Sight Distance

The sight distance exhibits that are provided by the site engineer, Civil & Environmental Consultants (CEC), are intended for zoning purposes only. Proposed improvements are subject to change per final engineering design. A field survey has not been performed. Existing topography was obtained via Ohio Geographically Reference Information Program (OGRIP), dated October 2017.

Intersection Sight Distance - The DCEO has indicated that sight distance can be based on the posted speed limit which is 45 MPH on Tussic Street Road. A summary of the computations of the required intersection sight distance is shown in Tables 2 and 3. It is noted that the most critical case was evaluated that would include the additional distance required with the warranted left turn lane.

	ODOT Criteria = 1.47 x V_{major} x t_g
Westbound Left turn movement Viewing traffic approaching from left	530’
Westbound Left turn movement Viewing traffic approaching from right	530’
Westbound Right turn movement Viewing traffic approaching from left	430’

V_{major} = 45 MPH (Design Speed of Major Road) t_g = (See Table 3)

Table 2 – Sight Distance Summary

	Base t_g (2 lane road)	**Additional lanes to cross**	**Adjustment to t_g for additional lane(s) (0.5 s per add. lane)**	**Actual t_g**
Passenger Car Left turn from a stop (NB)	7.5	1	0.5 s	8.0s
Passenger Car Right turn from a stop (NB)	6.5	0	0.0 s	6.5 s

Table 3 – Time gap adjustment calculation

CEC has provided a preliminary exhibit that shows that intersection sight distance is met. The exhibit is attached.

Left Turn Decision - A final exhibit showing decision sight distance will be required as part of the development plan. The DCEO requirement per Supplemental Specifications-Appendix B Section 602 E.1 is decision sight distance for 40 MPH from a location 200 feet in advance of the access. From the *ODOT L&D Manual*, the decision sight distance for 40 MPH is 330 feet which results in a location 130’ beyond the access. The preliminary sight distance exhibit provided by CEC shows that the DCEO’s left turn decision sight distance would be met.

CONCLUSIONS

The 70 proposed units will not exceed the 100 peak hour trip threshold in the DCEO’s *TIS Standards* for a traffic impact study. However, the DCEO requested a signal warrant analysis at the intersection of S. Old 3C Highway & Tussic Street Road/Vinmar Way and a turn lane warrant analyses at the site access. The following are the conclusions of the study at each intersection:

S. Old 3C Highway & Tussic Street Road/Vinmar Way

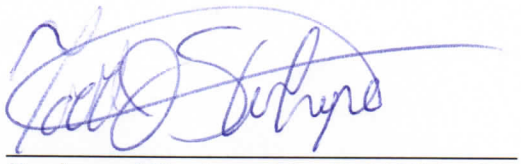
- The Eight-Hour Warrant, which is the warrant the DCEO considers when going forward with the installation of a traffic signal, is not met with or without the site traffic.

Tussic Street Road & Prop. Site Access

- A southbound left turn lane is warranted. The length of the lane is 175 feet which includes the diverging taper.
- A northbound right turn lane is not warranted.
- A preliminary assessment of sight distance indicates that the intersection and left turn decision sight distance would be met.

Please let me know if you have any questions. Thank you.

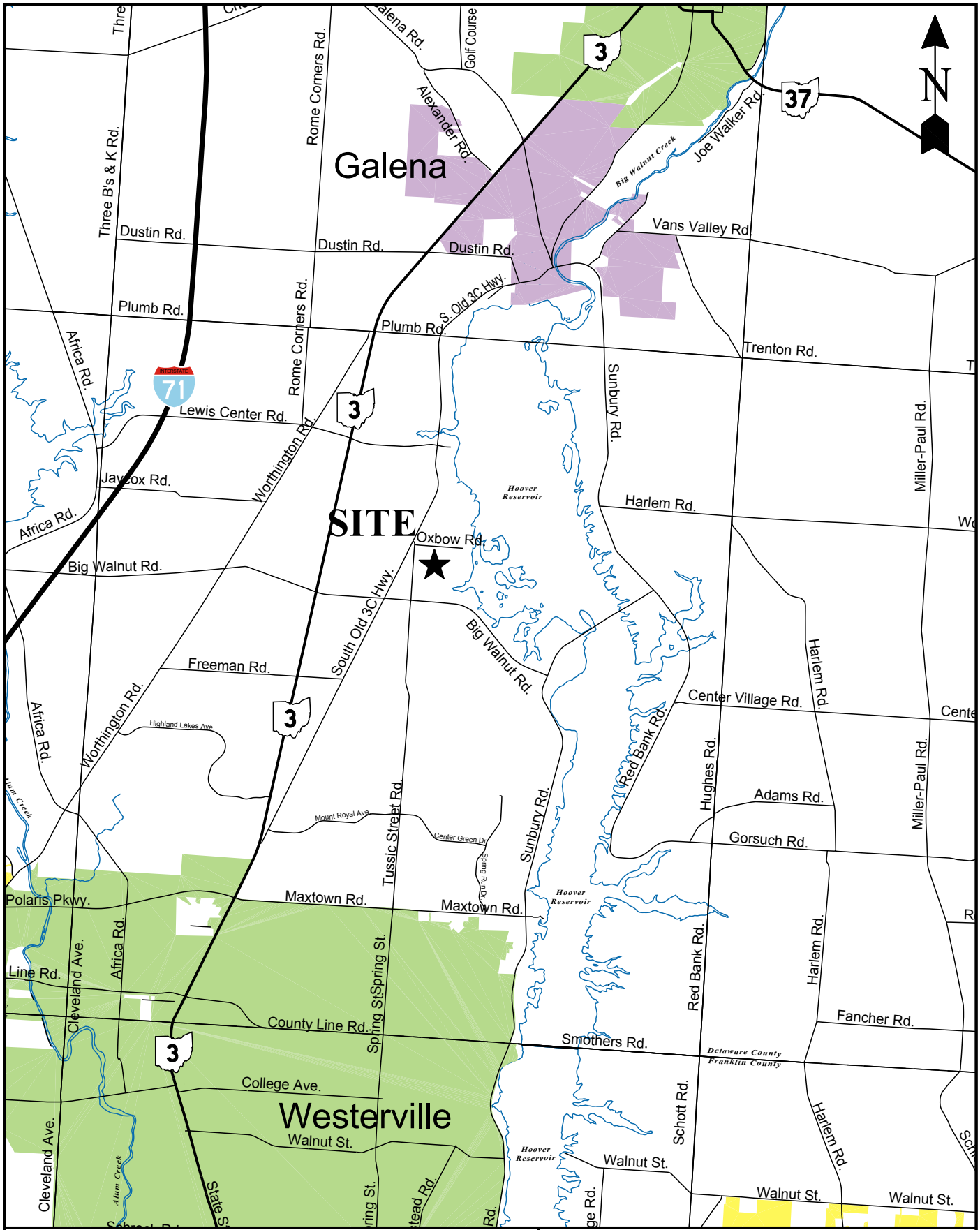
Sincerely,
SMART SERVICES, INC.



Registered Engineer No. E-64507, Ohio
Todd J. Stanhope, PE, PTOE
Director of Traffic Engineering

3-23-2018
Date

Cc: B. Benalcazar
Submitted: One electronic copy (PDF format) via e-mail



BENALCAZAR PROPERTY TRAFFIC ANALYSIS

PREPARED BY: SMART SERVICES, INC. 11/2017

FIGURE 1

SITE LOCATION

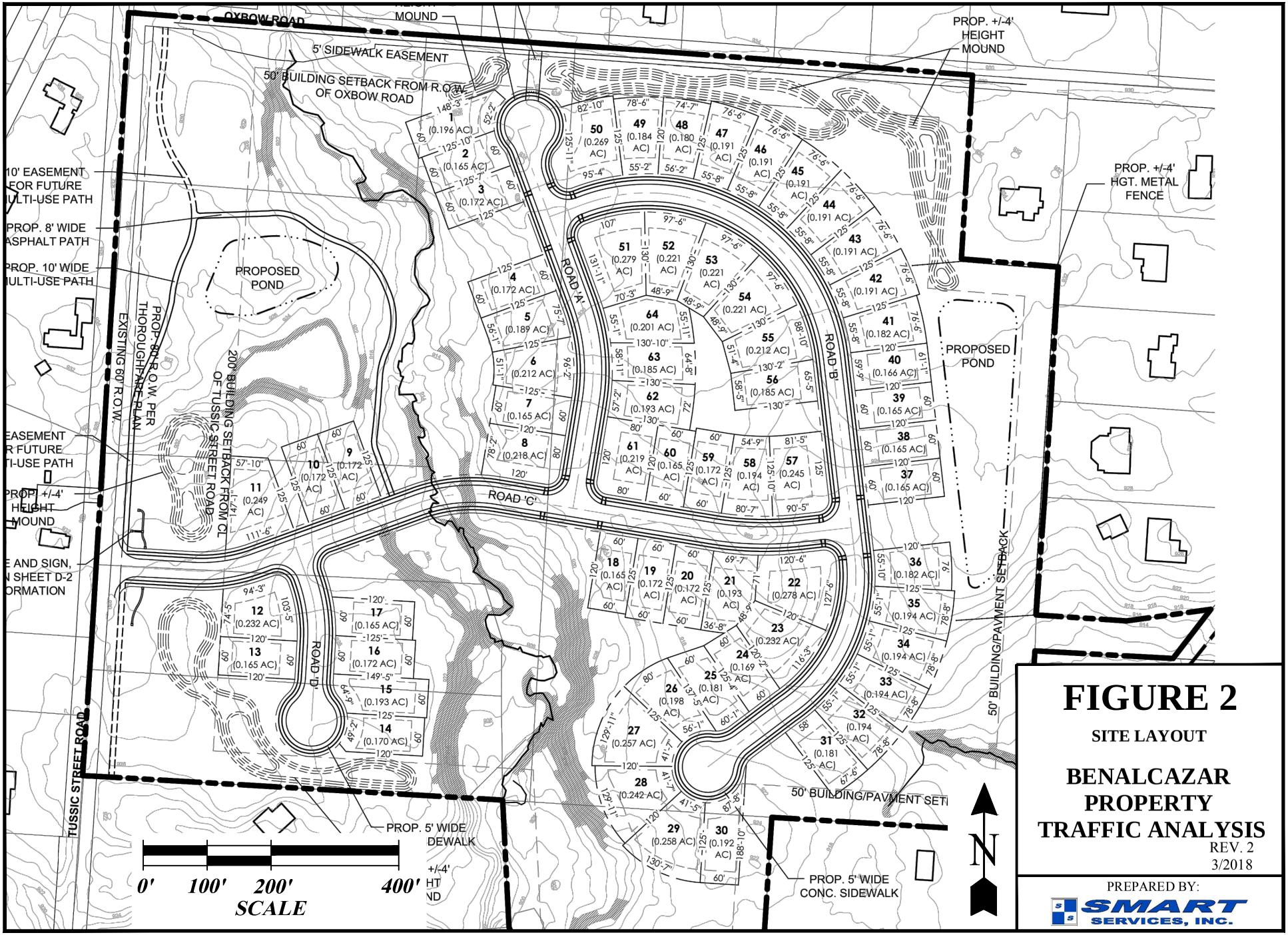


FIGURE 2

SITE LAYOUT

BENALCAZAR PROPERTY TRAFFIC ANALYSIS

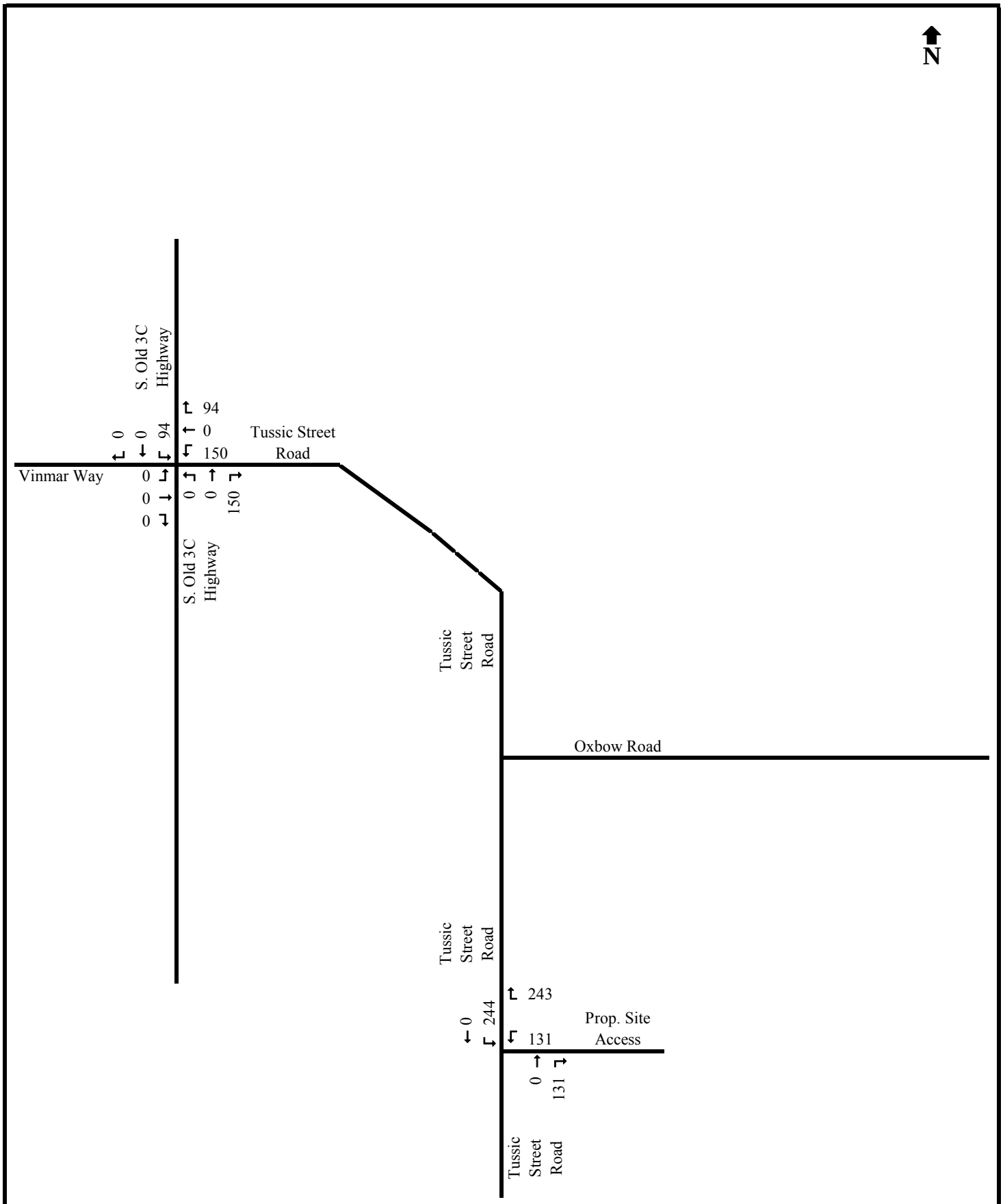
REV. 2
3/2018

PREPARED BY:
SMART SERVICES, INC.

Traffic Study Subarea	Land Use	Time of Day	Data Set from: *Trip Generation Manual, 10th Edition* (Unless noted Otherwise)	Overide with Average	Regression Equation from: *Trip Generation Manual 10th Edition*	Total Trips	Entering		Exiting	
							%	Total Trips	%	Total Trips
1	Single-Family Detached Housing (ITE Code #210) Ind. Variable (X) = 70 Dwelling Units	Daily	Weekday	☐	ln(T)=0.92ln(X)+2.71	749	50%	375	50%	374
		AM Peak	Peak Hour of Adj. Street Traffic, One Hour between 7 & 9 AM	☐	T=0.71(X)+4.80	55	25%	14	75%	41
		PM Peak	Peak Hour of Adj. Street Traffic, One Hour between 4 & 6 PM	☐	ln(T)=0.96ln(X)+0.20	72	63%	45	37%	27
				☐						
TOTALS				☐						
		Daily				**749**		**375**		**374**
		AM Peak				**55**		**14**		**41**
		PM Peak				**72**		**45**		**27**

Benalcazar Property Traffic Analysis - 11/2017

TABLE 1 - SITE TRIP GENERATION SUMMARY

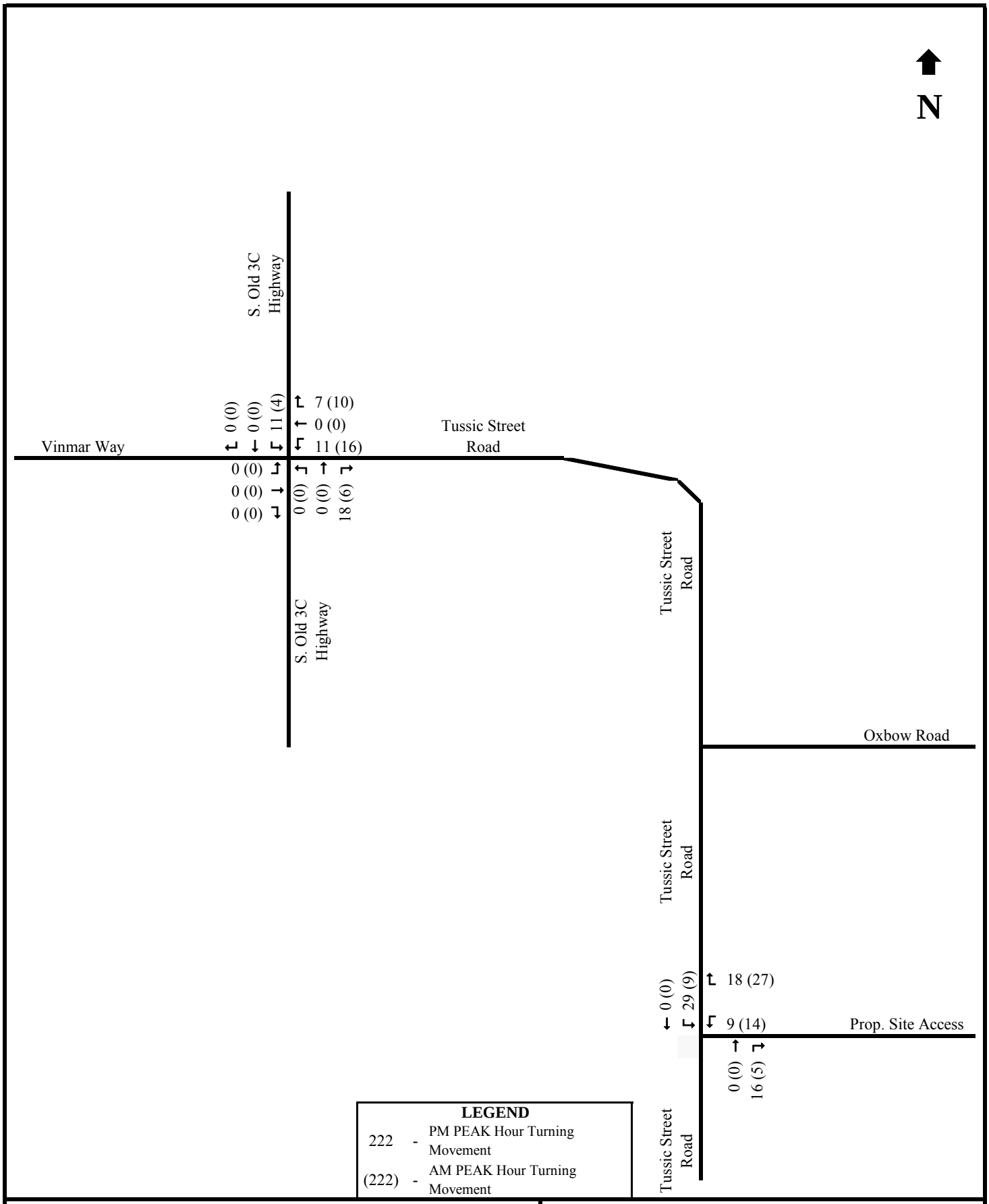


BENALCAZAR PROPERTY TRAFFIC ANALYSIS

PREPARED BY: SMART SERVICES, INC. REV. 1 3/2018

FIGURE 3

SITE GENERATED TRAFFIC - DAILY



BENALCAZAR PROPERTY TRAFFIC ANALYSIS

PREPARED BY: SMART SERVICES, INC. REV. 1 3/2018

FIGURE 4

SITE GENERATED TRAFFIC

From:	Love, Michael
To:	tstanhope@smartservices-inc.com
Cc:	Piccin, John
Subject:	RE: Tussic Street & Oxbow
Date:	Thursday, March 22, 2018 8:31:29 AM
Attachments:	2018-03-22 Benalcazar Property - Traffic Memo REV 1 NOT APPROVED.PDF

Todd

The Traffic Analysis submitted 3/1/2018 shows the site entrance located in an area where intersection sight distance (ISD) is not met. Therefore the report cannot be approved at this time. The location of the site access will need to be (1) re-located so ISD is met or (2) adjustments to the Tussic Street Road profile will be required.

Call me if you have any questions

Mike

Smart Services, Inc.

88 W. Church Street
Newark, OH 43055
(740) 345-4700

File Name : Old_3C_Highway_&_Tussic_Street_Rd_Vinmar_Way_464163_10-26-2017
Site Code : 464163
Start Date : 10/26/2017
Page No : 1

Groups Printed- Cars - Trucks

	Old 3C Highway Southbound				Tussic Street Rd Westbound				Old 3C Highway Northbound				Vinmar Way Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	3	9	0	12	0	0	2	2	0	2	0	2	1	0	3	4	20
06:15 AM	4	9	0	13	0	0	1	1	1	6	0	7	0	1	3	4	25
06:30 AM	11	22	0	33	1	0	3	4	3	1	1	5	2	3	7	12	54
06:45 AM	4	21	0	25	1	0	4	5	1	6	1	8	5	3	12	20	58
Total	22	61	0	83	2	0	10	12	5	15	2	22	8	7	25	40	157
07:00 AM	12	26	1	39	3	1	12	16	0	8	0	8	8	2	19	29	92
07:15 AM	10	21	2	33	1	2	8	11	2	15	0	17	10	3	8	21	82
07:30 AM	11	29	4	44	0	1	10	11	1	10	0	11	3	4	7	14	80
07:45 AM	12	39	0	51	0	0	8	8	1	11	0	12	2	3	9	14	85
Total	45	115	7	167	4	4	38	46	4	44	0	48	23	12	43	78	339
08:00 AM	9	32	1	42	2	0	7	9	0	11	0	11	3	5	9	17	79
08:15 AM	8	20	2	30	1	1	3	5	2	4	0	6	2	3	15	20	61
08:30 AM	5	22	2	29	0	1	4	5	3	7	0	10	1	2	6	9	53
08:45 AM	11	27	0	38	1	0	4	5	4	6	0	10	2	3	4	9	62
Total	33	101	5	139	4	2	18	24	9	28	0	37	8	13	34	55	255
09:00 AM	9	15	1	25	3	5	2	10	4	6	2	12	1	3	8	12	59
09:15 AM	5	16	1	22	0	0	2	2	1	14	3	18	0	2	5	7	49
09:30 AM	7	26	0	33	2	0	5	7	2	10	1	13	1	0	1	2	55
09:45 AM	2	11	1	14	1	1	2	4	0	12	0	12	0	0	3	3	33
Total	23	68	3	94	6	6	11	23	7	42	6	55	2	5	17	24	196
10:00 AM	5	11	2	18	1	1	5	7	2	7	0	9	1	1	3	5	39
10:15 AM	2	8	2	12	0	0	3	3	1	6	0	7	6	1	4	11	33
10:30 AM	5	15	0	20	0	1	2	3	3	14	0	17	2	0	3	5	45
10:45 AM	8	12	0	20	0	2	4	6	0	12	1	13	0	0	1	1	40
Total	20	46	4	70	1	4	14	19	6	39	1	46	9	2	11	22	157
11:00 AM	4	15	2	21	1	0	4	5	4	7	1	12	0	1	6	7	45
11:15 AM	6	10	0	16	0	0	9	9	0	11	1	12	0	1	4	5	42
11:30 AM	8	12	3	23	1	1	6	8	5	13	1	19	2	1	3	6	56
11:45 AM	4	14	4	22	1	3	4	8	7	11	1	19	0	1	3	4	53
Total	22	51	9	82	3	4	23	30	16	42	4	62	2	4	16	22	196
12:00 PM	2	12	1	15	2	1	6	9	2	8	0	10	1	0	5	6	40
12:15 PM	2	18	1	21	0	1	9	10	1	14	0	15	0	0	6	6	52
12:30 PM	8	8	0	16	0	0	3	3	1	12	0	13	0	2	4	6	38
12:45 PM	2	19	1	22	1	6	12	19	4	17	0	21	1	2	5	8	70
Total	14	57	3	74	3	8	30	41	8	51	0	59	2	4	20	26	200

Smart Services, Inc.

88 W. Church Street
Newark, OH 43055
(740) 345-4700

File Name : Old_3C_Highway_&_Tussic_Street_Rd_Vinmar_Way_464163_10-26-2017
Site Code : 464163
Start Date : 10/26/2017
Page No : 2

Groups Printed- Cars - Trucks

	Old 3C Highway Southbound				Tussic Street Rd Westbound				Old 3C Highway Northbound				Vinmar Way Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
01:00 PM	3	8	0	11	0	0	9	9	0	14	0	14	0	2	3	5	39
01:15 PM	4	12	1	17	0	2	4	6	5	9	1	15	1	0	2	3	41
01:30 PM	2	11	1	14	0	1	7	8	4	20	0	24	0	1	2	3	49
01:45 PM	10	12	3	25	1	1	3	5	4	10	0	14	3	0	2	5	49
Total	19	43	5	67	1	4	23	28	13	53	1	67	4	3	9	16	178
02:00 PM	3	14	0	17	2	0	10	12	2	19	1	22	0	1	5	6	57
02:15 PM	5	18	3	26	0	1	9	10	7	10	0	17	0	0	1	1	54
02:30 PM	9	13	6	28	1	1	5	7	2	13	0	15	2	2	2	6	56
02:45 PM	8	17	3	28	2	2	9	13	3	22	1	26	2	1	7	10	77
Total	25	62	12	99	5	4	33	42	14	64	2	80	4	4	15	23	244
03:00 PM	6	22	3	31	1	0	8	9	4	13	1	18	3	1	7	11	69
03:15 PM	11	15	4	30	0	0	14	14	13	16	2	31	2	1	2	5	80
03:30 PM	12	19	7	38	2	5	15	22	5	28	0	33	0	0	8	8	101
03:45 PM	8	26	1	35	0	2	14	16	7	19	2	28	2	1	6	9	88
Total	37	82	15	134	3	7	51	61	29	76	5	110	7	3	23	33	338
04:00 PM	9	14	2	25	0	1	12	13	8	24	1	33	2	0	0	2	73
04:15 PM	6	17	7	30	1	2	7	10	5	31	3	39	1	2	2	5	84
04:30 PM	11	19	5	35	2	1	16	19	8	26	0	34	6	2	4	12	100
04:45 PM	7	29	0	36	1	3	15	19	7	33	1	41	4	2	4	10	106
Total	33	79	14	126	4	7	50	61	28	114	5	147	13	6	10	29	363
05:00 PM	18	22	4	44	0	6	17	23	3	42	0	45	4	4	3	11	123
05:15 PM	10	19	2	31	1	5	22	28	14	29	2	45	1	3	6	10	114
05:30 PM	9	29	5	43	2	2	11	15	8	27	0	35	5	5	5	15	108
05:45 PM	9	15	3	27	1	0	12	13	13	35	0	48	3	1	5	9	97
Total	46	85	14	145	4	13	62	79	38	133	2	173	13	13	19	45	442
06:00 PM	6	13	4	23	1	0	14	15	5	22	1	28	1	0	7	8	74
06:15 PM	3	15	3	21	1	0	9	10	7	25	0	32	1	0	8	9	72
06:30 PM	6	23	0	29	0	0	5	5	12	25	0	37	2	0	9	11	82
06:45 PM	6	11	1	18	1	0	3	4	7	18	0	25	0	3	5	8	55
Total	21	62	8	91	3	0	31	34	31	90	1	122	4	3	29	36	283
Grand Total	360	912	99	1371	43	63	394	500	208	791	29	1028	99	79	271	449	3348
Apprch %	26.3	66.5	7.2		8.6	12.6	78.8		20.2	76.9	2.8		22	17.6	60.4		
Total %	10.8	27.2	3	40.9	1.3	1.9	11.8	14.9	6.2	23.6	0.9	30.7	3	2.4	8.1	13.4	
Cars	344	889	91	1324	41	60	379	480	206	762	29	997	95	75	267	437	3238
% Cars	95.6	97.5	91.9	96.6	95.3	95.2	96.2	96	99	96.3	100	97	96	94.9	98.5	97.3	96.7
Trucks	16	23	8	47	2	3	15	20	2	29	0	31	4	4	4	12	110
% Trucks	4.4	2.5	8.1	3.4	4.7	4.8	3.8	4	1	3.7	0	3	4	5.1	1.5	2.7	3.3

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Site Code : 464163
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	Old 3C Highway Southbound				Tussic Street Rd Westbound				Old 3C Highway Northbound				Vinmar Way Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**12**	26	1	39	**3**	1	**12**	**16**	0	8	0	8	8	2	**19**	**29**	**92**
07:15 AM	10	21	2	33	1	**2**			**2**	**15**		**17**	**10**	3	8	21	82
07:30 AM	11	29	**4**											**4**			
07:45 AM	**12**	**39**	**0**	**51**	0	0	8	8	1	11	0	12	2	3	9	14	85
Total Volume	45	115	7	167	4	4	38	46	4	44	0	48	23	12	43	78	339
% App. Total	26.9	68.9	4.2		8.7	8.7	82.6		8.3	91.7	0		29.5	15.4	55.1		
PHF	.938	.737	.438	.819	.333	.500	.792	.719	.500	.733	.000	.706	.575	.750	.566	.672	.921
Peak Hour Analysis From 12:00 PM to 06:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	7	**29**	**0**	**36**	**1**	**3**	**15**	**19**	**7**	**33**	**1**	**41**	**4**	**2**	**4**	**10**	**106**
05:00 PM	**18**			**44**		**6**	**17**	**23**	**3**	**42**	**0**	**45**					**123**
05:15 PM	10	19	2	31	1	5	**22**	**28**	**14**	29	**2**	**45**	**1**	**3**	**6**	**10**	**114**
05:30 PM	**9**	**29**	**5**	**43**	**2**								**5**	**5**	**5**	**15**	
Total Volume	44	99	11	154	4	16	65	85	32	131	3	166	14	14	18	46	451
% App. Total	28.6	64.3	7.1		4.7	18.8	76.5		19.3	78.9	1.8		30.4	30.4	39.1		
PHF	.611	.853	.550	.875	.500	.667	.739	.759	.571	.780	.375	.922	.700	.700	.750	.767	.917

Signal Warrant #1 Worksheet (Ref. #1)

S. Old 3C Highway & Vinmar Way/Tussic Street Road

Exisiting (2017)

Speed Limit on S. Old 3C Highway: 45 MPH (Community Population >10,000)

CONDITION	# OF LANES	S. OLD 3C HIGHWAY					VINMAR WAY/TUSSIC STREET ROAD					WARRANT #1 - CONDITION A				WARRANT #1 - CONDITION B			
		MAJOR STREET					MINOR STREET												
		Existing		Total			Existing		Total										
		NB	SB	NB	SB	2-WAY	EB	WB	EB	WB	MAX 1-WAY	MAJOR		MINOR		MAJOR		MINOR	
												100%	80%	100%	80%	100%	80%	100%	80%
Warrant	1											500	400	150	120	750	600	75	60
Warrant	2											600	480	200	160	900	720	100	80
70% Warrant	1					X					X	**350**	**280**	**105**	**84**	**525**	**420**	**53**	**42**
70% Warrant	2											420	336	140	112	630	504	70	56
6-7 AM		22	83	22	83	**105**	40	12	40	12	**40**	NO	NO	NO	NO	NO	NO	NO	NO
7-8 AM		48	167	48	167	**215**	78	46	78	46	**78**	NO	NO	NO	NO	NO	NO	YES	YES
8-9 AM		37	139	37	139	**176**	55	24	55	24	**55**	NO	NO	NO	NO	NO	NO	YES	YES
9-10 AM		55	94	55	94	**149**	24	23	24	23	**24**	NO	NO	NO	NO	NO	NO	NO	NO
10-11 AM		46	70	46	70	**116**	22	19	22	19	**22**	NO	NO	NO	NO	NO	NO	NO	NO
11-12 Noon		62	82	62	82	**144**	22	30	22	30	**30**	NO	NO	NO	NO	NO	NO	NO	NO
12-1 PM		59	74	59	74	**133**	26	41	26	41	**41**	NO	NO	NO	NO	NO	NO	NO	NO
1-2 PM		67	67	67	67	**134**	16	28	16	28	**28**	NO	NO	NO	NO	NO	NO	NO	NO
2-3 PM		80	99	80	99	**179**	23	42	23	42	**42**	NO	NO	NO	NO	NO	NO	NO	YES
3-4 PM		110	134	110	134	**244**	33	61	33	61	**61**	NO	NO	NO	NO	NO	NO	YES	YES
4-5 PM		147	126	147	126	**273**	29	61	29	61	**61**	NO	NO	NO	NO	NO	NO	YES	YES
5-6 PM		173	145	173	145	**318**	45	79	45	79	**79**	NO	YES	NO	NO	NO	NO	YES	YES
6-7 PM		122	91	122	91	**213**	36	34	36	34	**36**	NO	NO	NO	NO	NO	NO	NO	NO
											WARRANT STATUS	**0 Hours Met (8 Required) CONDITION NOT MET**				**0 Hours Met (8 Required) CONDITION NOT MET**			

	WARRANT #1 - COMBINATION OF 80% CONDITION A & 80% CONDITION B
WARRANT STATUS	**0 Hours Met (8 Required) CONDITION NOT MET**

WARRANT #1 : NOT MET

NOTE(S)

Existing traffic component on S. Old 3C Highway is based on count taken 10/26/2017.

Existing traffic component on Vinmar Way/Tussic Street Road is based on count taken 10/26/2017.

Prepared By:

SMART SERVICES, INC.

11/2017

Appendix

Time	Residential Source: *Locust Curve Drive - Delaware, Ohio*																		TOTAL DAILY DISTRIBUTION								
	% of 24 Hour Entering (Weekday)	% of 24 Hour Exiting (Weekday)	Volume Entering (Weekday)								Volume Exiting (Weekday)								Volume							
			NB	SB	EB			WB			NB	SB	EB			WB			NB	SB	EB			WB		
					LT	TH	RT	LT	TH	RT			LT	TH	RT	LT	TH	RT			LT	TH	RT	LT	TH	RT
			150	94	0	0	0	0	0	0	0	0	0	0	0	150	0	94	150	94	0	0	0	150	0	94
000	0.2%	0.1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0.3%	0.0%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
200	0.5%	0.1%	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
300	0.2%	0.1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
400	0.0%	0.3%	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0
500	0.1%	1.5%	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	2	0	1
600	1.2%	5.7%	2	1	0	0	0	0	0	0	0	0	0	0	0	9	0	5	2	1	0	0	0	9	0	5
700	3.3%	13.5%	5	3	0	0	0	0	0	0	0	0	0	0	0	20	0	13	5	3	0	0	0	20	0	13
800	5.0%	9.5%	7	5	0	0	0	0	0	0	0	0	0	0	0	14	0	9	7	5	0	0	0	14	0	9
900	4.4%	6.4%	7	4	0	0	0	0	0	0	0	0	0	0	0	10	0	6	7	4	0	0	0	10	0	6
1000	4.6%	4.5%	7	4	0	0	0	0	0	0	0	0	0	0	0	7	0	4	7	4	0	0	0	7	0	4
1100	5.5%	5.2%	8	5	0	0	0	0	0	0	0	0	0	0	0	8	0	5	8	5	0	0	0	8	0	5
1200	5.4%	7.1%	8	5	0	0	0	0	0	0	0	0	0	0	0	11	0	7	8	5	0	0	0	11	0	7
1300	4.5%	4.6%	7	4	0	0	0	0	0	0	0	0	0	0	0	7	0	4	7	4	0	0	0	7	0	4
1400	5.3%	4.8%	8	5	0	0	0	0	0	0	0	0	0	0	0	7	0	5	8	5	0	0	0	7	0	5
1500	6.9%	4.9%	10	6	0	0	0	0	0	0	0	0	0	0	0	7	0	5	10	6	0	0	0	7	0	5
1600	7.4%	6.8%	11	7	0	0	0	0	0	0	0	0	0	0	0	10	0	6	11	7	0	0	0	10	0	6
1700	11.8%	6.7%	18	11	0	0	0	0	0	0	0	0	0	0	0	10	0	6	18	11	0	0	0	10	0	6
1800	8.7%	6.3%	13	8	0	0	0	0	0	0	0	0	0	0	0	9	0	6	13	8	0	0	0	9	0	6
1900	8.3%	4.8%	13	8	0	0	0	0	0	0	0	0	0	0	0	7	0	5	13	8	0	0	0	7	0	5
2000	7.9%	3.8%	12	7	0	0	0	0	0	0	0	0	0	0	0	6	0	4	12	7	0	0	0	6	0	4
2100	4.6%	2.0%	7	4	0	0	0	0	0	0	0	0	0	0	0	3	0	2	7	4	0	0	0	3	0	2
2200	2.8%	1.1%	4	3	0	0	0	0	0	0	0	0	0	0	0	2	0	1	4	3	0	0	0	2	0	1
2300	1.0%	0.1%	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0
TOTAL	100.00%	100.0%	150	94	0	0	0	0	0	0	0	0	0	0	0	150	0	94	150	94	0	0	0	150	0	94

TABLE - Daily Site Traffic Distribution-S. Old 3C Highway & Vinmar Way/Tussic Street Road (Ref. #2)

Signal Warrant #1 Worksheet (Ref. #2)

S. Old 3C Highway & Vinmar Way/Tussic Street Road

Exisiting + Site Traffic (2017)

Speed Limit on S. Old 3C Highway: 45 MPH (Community Population >10,000)

CONDITION	# OF LANES	S. OLD 3C HIGHWAY							VINMAR WAY/TUSSIC STREET ROAD							WARRANT #1 - CONDITION A				WARRANT #1 - CONDITION B			
		MAJOR STREET							MINOR STREET														
		Existing		Site		Total			Existing		Site		Total										
		NB	SB	NB	SB	NB	SB	2-WAY	EB	WB	EB	WB	EB	WB	MAX 1-WAY	MAJOR		MINOR		MAJOR		MINOR	
																100%	80%	100%	80%	100%	80%	100%	80%
Warrant	1															500	400	150	120	750	600	75	60
Warrant	2															600	480	200	160	900	720	100	80
70% Warrant	1							X							X	**350**	**280**	**105**	**84**	**525**	**420**	**53**	**42**
70% Warrant	2															420	336	140	112	630	504	70	56
7-8 AM		48	167	5	3	53	170	**223**	78	46	0	33	78	79	**79**	NO	NO	NO	NO	NO	NO	YES	YES
8-9 AM		37	139	7	5	44	144	**188**	55	24	0	23	55	47	**55**	NO	NO	NO	NO	NO	NO	YES	YES
9-10 AM		55	94	7	4	62	98	**160**	24	23	0	16	24	39	**39**	NO	NO	NO	NO	NO	NO	NO	NO
10-11 AM		46	70	7	4	53	74	**127**	22	19	0	11	22	30	**30**	NO	NO	NO	NO	NO	NO	NO	NO
11-12 Noon		62	82	8	5	70	87	**157**	22	30	0	13	22	43	**43**	NO	NO	NO	NO	NO	NO	NO	YES
12-1 PM		59	74	8	5	67	79	**146**	26	41	0	17	26	58	**58**	NO	NO	NO	NO	NO	NO	YES	YES
1-2 PM		67	67	7	4	74	71	**145**	16	28	0	11	16	39	**39**	NO	NO	NO	NO	NO	NO	NO	NO
2-3 PM		80	99	8	5	88	104	**192**	23	42	0	12	23	54	**54**	NO	NO	NO	NO	NO	NO	YES	YES
3-4 PM		110	134	10	6	120	140	**261**	33	61	0	12	33	73	**73**	NO	NO	NO	NO	NO	NO	YES	YES
4-5 PM		147	126	11	7	158	133	**291**	29	61	0	17	29	78	**78**	NO	YES	NO	NO	NO	NO	YES	YES
5-6 PM		173	145	18	11	191	156	**347**	45	79	0	16	45	95	**95**	NO	YES	NO	YES	NO	NO	YES	YES
6-7 PM		122	91	13	8	135	99	**234**	36	34	0	15	36	49	**49**	NO	NO	NO	NO	NO	NO	NO	YES
															WARRANT STATUS	**0 Hours Met (8 Required) CONDITION NOT MET**				**0 Hours Met (8 Required) CONDITION NOT MET**			

	WARRANT #1 - COMBINATION OF 80% CONDITION A & 80% CONDITION B
WARRANT STATUS	**0 Hours Met (8 Required) CONDITION NOT MET**

WARRANT #1 : NOT MET

NOTE(S)

Existing traffic component on S. Old 3C Highway is based on count taken 10/26/2017.

Existing traffic component on Vinmar Way/Tussic Street Road is based on count taken 10/26/2017.

Prepared By:

SMART SERVICES, INC.

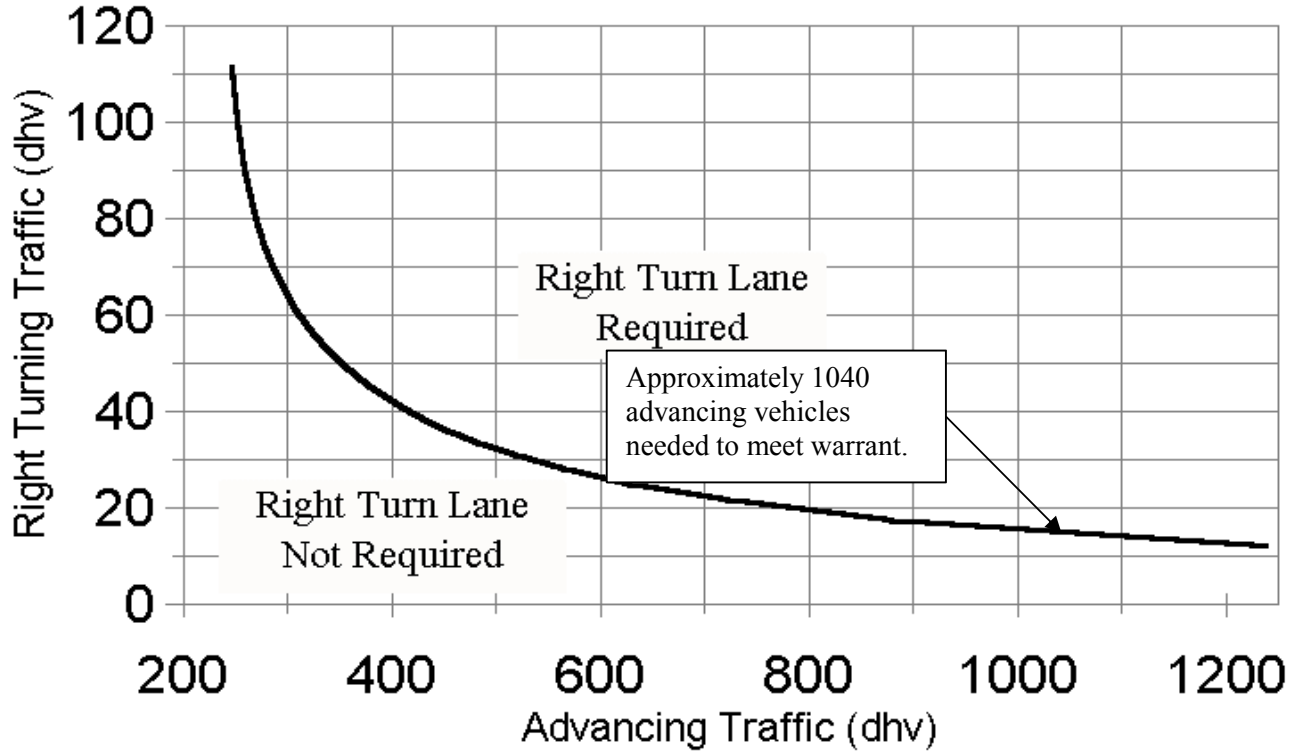
REV. 1

3/2018

Appendix

2-Lane Highway Right Turn Lane Warrant

> 40 mph or 70 kph Posted Speed



WARRANT SUMMARY

ID	INTERSECTION [MOVEMENT] - VOLUME SET	AM PEAK (A)	PM PEAK (P)		RESULT

BENALCAZAR PROPERTY
TRAFFIC ANALYSIS
PREPARED BY: SMART SERVICES, INC. REV. 1 3/2018

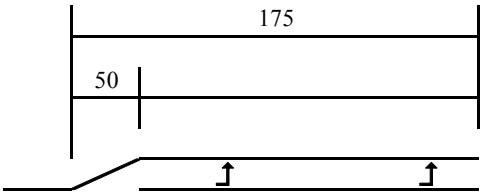
APPENDIX

2 LANE HIGHWAY RIGHT TURN LANE WARRANT (> 40 MPH)

(1) TUSSIC STREET ROAD & PROP. SITE ACCESS - SB LT - 2028 'BUILD'

Critical Analysis Period: PM PEAK

Type =	Unsignalized Through Road				
Speed =	45	MPH	Storage Length (Adj) =	50	feet
Cycle Length =	60	seconds	Deceleration/Div. Taper =	125	feet
Turning Volume =	29	VPH	Turn Lane Length =	175	feet



Design Condition = C

Storage Length (Calc) = 50 feet

Calculations based on 401-7E in ODOT L&D Manual. All dimensions are in feet.

BENALCAZAR PROPERTY
TRAFFIC ANALYSIS

PREPARED BY: SMART SERVICES, INC. REV. 1 3/2018

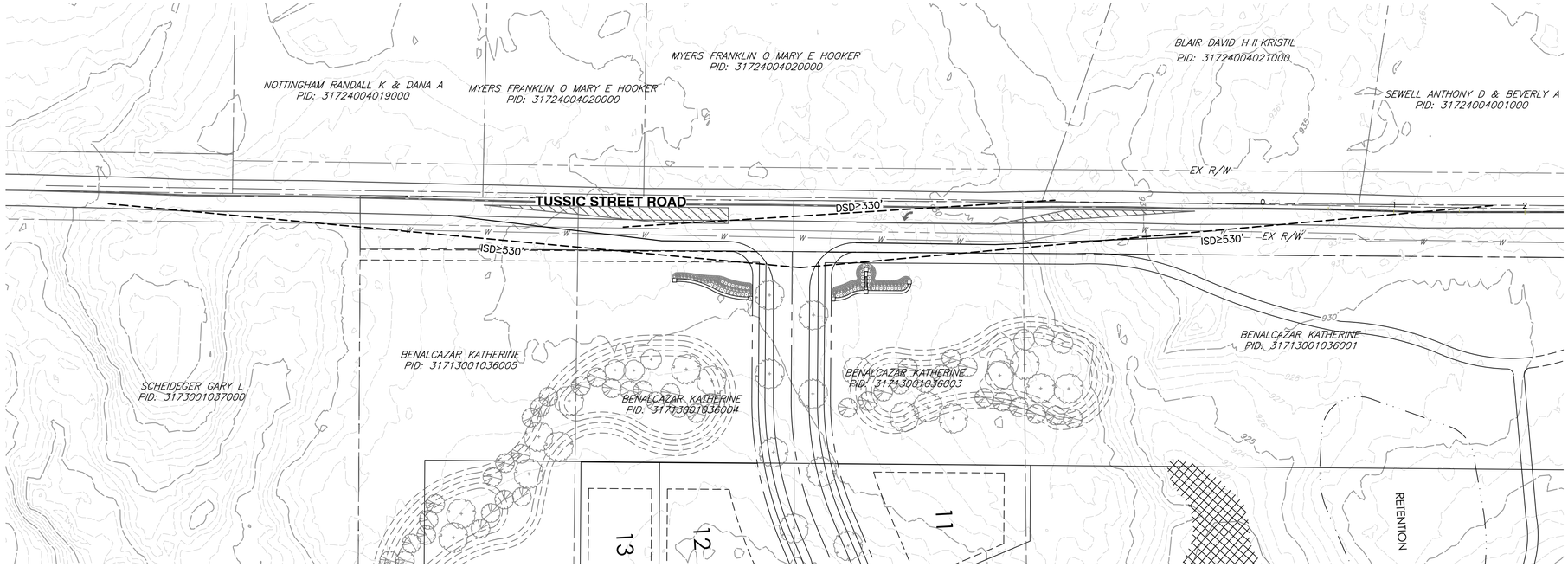
APPENDIX

LEFT TURN LANE CALCULATIONS

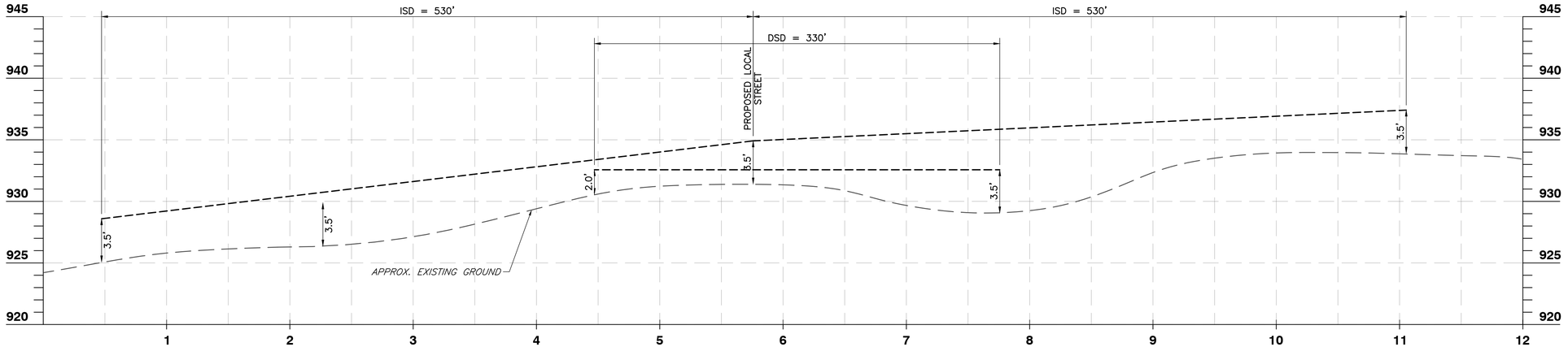
NORTH

SCALE IN FEET

0 100 200



PLAN VIEW



INTERSECTION SIGHT DISTANCE PROFILE FOR TUSSIC STREET ROAD

SCALE H:1"=50'; V:1"=5'

SCALE IN FEET

0 5 10

SCALE IN FEET

0 50 100

NOTES

1. POSTED SPEED: 45 MPH
   DESIGN SPEED: 45 MPH
   LEFT TURN INTERSECTION SIGHT DISTANCE: 530 FT*
   RIGHT TURN INTERSECTION SIGHT DISTANCE: 530 FT*

*PER ODOT LOCATION AND DESIGN MANUAL, VOL. 1, 201–5E, SUPPLEMENTED BY DELAWARE COUNTY ENGINEER'S OFFICE APPENDIX B.

A FIELD SURVEY HAS NOT BEEN PERFORMED. EXISTING TOPOGRAPHY OBTAINED OHIO GEOGRAPHICALLY REFERENCE INFORMATION PROGRAM, OCTOBER 2017.

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
250 Old Wilson Bridge Road · Suite 250 · Worthington, OH 43085
614-540-6633 · 888-598-6808
www.cecinc.com

RAVINES AT HOOVER RUN
GENOA TOWNSHIP
DELAWARE COUNTY, OHIO

INTERSECTION SIGHT DISTANCE EXHIBIT

DATE:	3/22/2018
DRAWN BY:	BAS
DWG SCALE:	AS NOTED
CHECKED BY:	DRAFT
PROJECT NO:	174-470
APPROVED BY:	DRAFT

DRAWING NO.: 3

SHEET 1 OF 1

P:\2017\174-470\-CADD\Dwg\Exhibits\174470-Sight Distance Exhibit_ALT.dwg[TUSSIC ENTRANCE (2)] LS:(3/22/2018 - bsiembida) - LP: 3/22/2018 3:28 PM