



MEMORANDUM

TO: Kelli Jones
Sabak, Wilson & Lingo, Inc.

FROM: Adam Kirk
Adam Kirk Engineering
137 McClelland Springs Drive
Georgetown, KY 40324

DATE: January 12, 2023

RE: Xebec Pursuits
Traffic Impact Study Addendum (Signal Warrants and Interim Analysis)

Interim period analysis was conducted to assess the performance of the stop controlled intersection at the intersection of Tucker Station Road and S. Pope Lick Road for an initial reduced development intensity. This analysis assumed a Phase 1 construction of only Tracts 1 and 2, representing 390,000 s.f. of development. Trip generation for the proposed phase 1 development reduced the total number of trips generated in the AM and PM peak hours from 415 (405) vehicles per hour (vph) to 160 (156) vph, as shown in **Table 1**.

Table 1: Xebec Proposed Phase 1 Trip Generation

Tract	ITE Code	Ind. Var.	Units	AM Peak			PM Peak		
				Total	Entering	Exiting	Total	Entering	Exiting
Total				160	139	21	156	33	123
Tract 1	130	180	units	74	64	10	72	15	57
Tract 2	130	210	units	86	75	11	84	18	66
Tract 3	130	0	units	0	0	0	0	0	0
Tract 4	130	0	units	0	0	0	0	0	0
Tract 5	130	0	units	0	0	0	0	0	0

All-way stop control analysis was completed for the study intersection, assuming turning lanes improvements on the east and west approaches, while maintaining the existing traffic control. As shown in Table 2, the PM peak hour delay is reduced significantly from 117 seconds of delay during the No Build scenario, to 40 seconds under the build condition due to the improvements at the intersection. The AM peak hour increases the total intersection delay from 31 seconds to 67 seconds, however, this is a significant reduction of total delay at the intersection over the full build scenario (91.3 seconds). Highway Capacity Software output for this analysis is included in **Attachment A**.

Intersection	Approach	AM Peak Hour				PM Peak Hour			
		2023 No Build		2023 Build		2023 No Build		2023 Build	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
S. Pope Lick Road at Tucker Station Road	Intersection	D	31.2	F	67.6	F	117.6	E	40.0
	eastbound (Tucker Station)	B	11.1	B	10.6	F	277.1	F	57.1
	westbound (S. Pope Lick)	E	42.7	F	102.5	F	307.3	C	16.4
	northbound (Shute Station)	--	--	B	10.2	D	54.9	B	11.4
	southbound (Tuckjer Station)	B	11.7	B	14.4	E	61.0	C	20.9

Signal warrant analysis was also conducted for the intersections of S. Pope Lick at Tucker Station Road. And Bluegrass Parkway at Tucker Station Road for the following scenarios:

- Existing conditions
- No Build Conditions (includes existing plus Ball Homes S. Pope Lick Residential Development)
- Phase 1 Build Condition (S. Pope Lick at Tucker Station only)
- Full Build Condition

Signal warrant analysis was conducted for Signal Warrant 1A condition B for the 80% volume based on guidance provided in the Manual on Uniform Traffic Control Devices. Table 3, summarizes the results of this analysis and full analysis is presented in **Attachment B**.

Table 3: Signal Warrant Analysis Summary

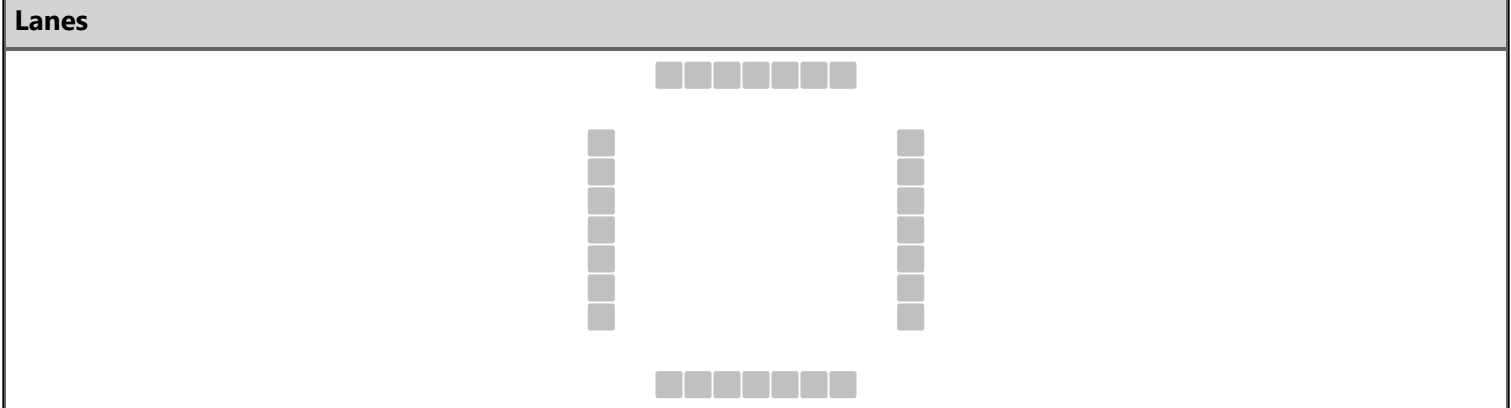
Intersection	Number of hours meeting warrant			
	Existing	No Build	Xebec (Phase 1)	Xebec (Full Build)
S. Pope Lick Rd at Tucker Station Rd	1	7	9	10
Bluegrass Pkwy at Tucker Station Rd	5	5	--	10

Attachment A

HCS Output

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	AJK	Intersection	Tucker Station at S. Pope Lick
Agency/Co.	AKE	Jurisdiction	Jefferson
Date Performed	2/20/2023	East/West Street	S. Pope Lick
Analysis Year	2023	North/South Street	Tucker Station
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	2023 AM No Build		
Project Description	Xebec Development		



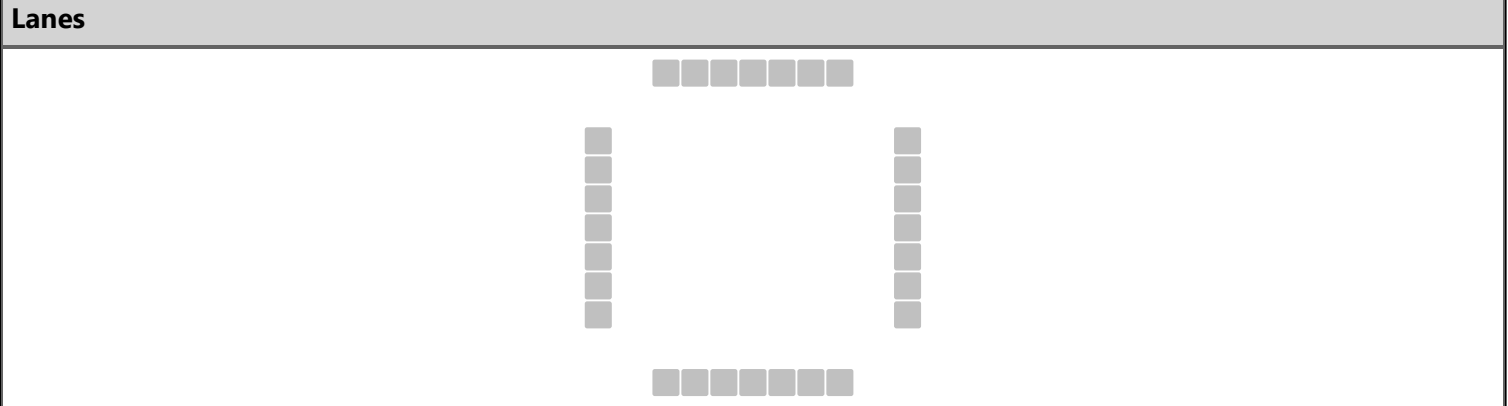
Vehicle Volume and Adjustments												
Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	71	107			512	144				30		177
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT			TR						LR		
Flow Rate, v (veh/h)	193			713						225		
Percent Heavy Vehicles	2			2						2		

Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20			3.20						3.20		
Initial Degree of Utilization, x	0.172			0.634						0.200		
Final Departure Headway, hd (s)	5.64			4.79						5.66		
Final Degree of Utilization, x	0.303			0.948						0.354		
Move-Up Time, m (s)	2.0			2.0						2.0		
Service Time, ts (s)	3.64			2.79						3.66		

Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	193			713						225		
Capacity	639			752						636		
95% Queue Length, Q ₉₅ (veh)	1.3			14.1						1.6		
Control Delay (s/veh)	11.1			42.7						11.7		
Level of Service, LOS	B			E						B		
Approach Delay (s/veh)	11.1			42.7						11.7		
Approach LOS	B			E						B		
Intersection Delay, s/veh LOS	31.2						D					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	AJK	Intersection	Tucker Station at S. Pope Lick
Agency/Co.	AKE	Jurisdiction	Jefferson
Date Performed	2/20/2023	East/West Street	S. Pope Lick
Analysis Year	2023	North/South Street	Tucker Station
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	2023 AM Build (Phase 1)		
Project Description	Xebec Development		



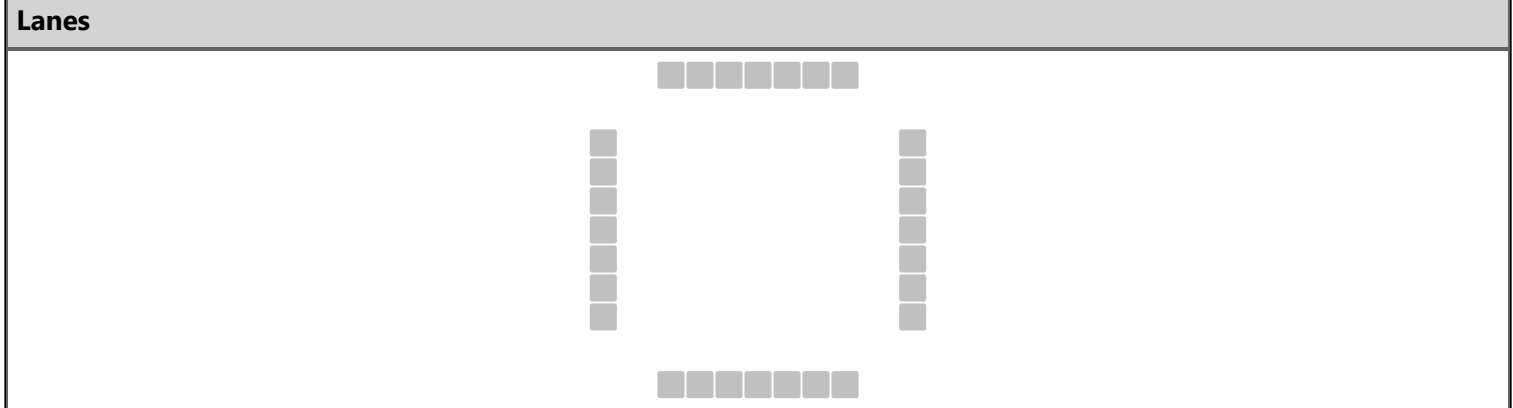
Vehicle Volume and Adjustments												
Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	71	111	14	10	537	144	2	4	1	30	28	177
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		LTR		
Flow Rate, v (veh/h)	77	136		11	740		2	5		255		
Percent Heavy Vehicles	2	2		2	2		2	2		2		

Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20		
Initial Degree of Utilization, x	0.069	0.121		0.010	0.658		0.002	0.005		0.227		
Final Departure Headway, hd (s)	6.69	6.12		6.22	5.57		7.92	7.29		6.34		
Final Degree of Utilization, x	0.143	0.231		0.019	1.146		0.005	0.011		0.450		
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.0		
Service Time, ts (s)	4.39	3.82		3.92	3.27		5.62	4.99		4.34		

Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	77	136		11	740		2	5		255		
Capacity	538	588		578	646		455	494		568		
95% Queue Length, Q ₉₅ (veh)	0.5	0.9		0.1	23.5		0.0	0.0		2.3		
Control Delay (s/veh)	10.5	10.6		9.0	103.9		10.7	10.1		14.4		
Level of Service, LOS	B	B		A	F		B	B		B		
Approach Delay (s/veh)	10.6			102.5			10.2			14.4		
Approach LOS	B			F			B			B		
Intersection Delay, s/veh LOS	67.6						F					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	AJK	Intersection	Tucker Station at S. Pope Lick
Agency/Co.	AKE	Jurisdiction	Jefferson
Date Performed	2/20/2023	East/West Street	S. Pope Lick
Analysis Year	2023	North/South Street	Tucker Station
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	2023 PM No Build		
Project Description	Xebec Development		



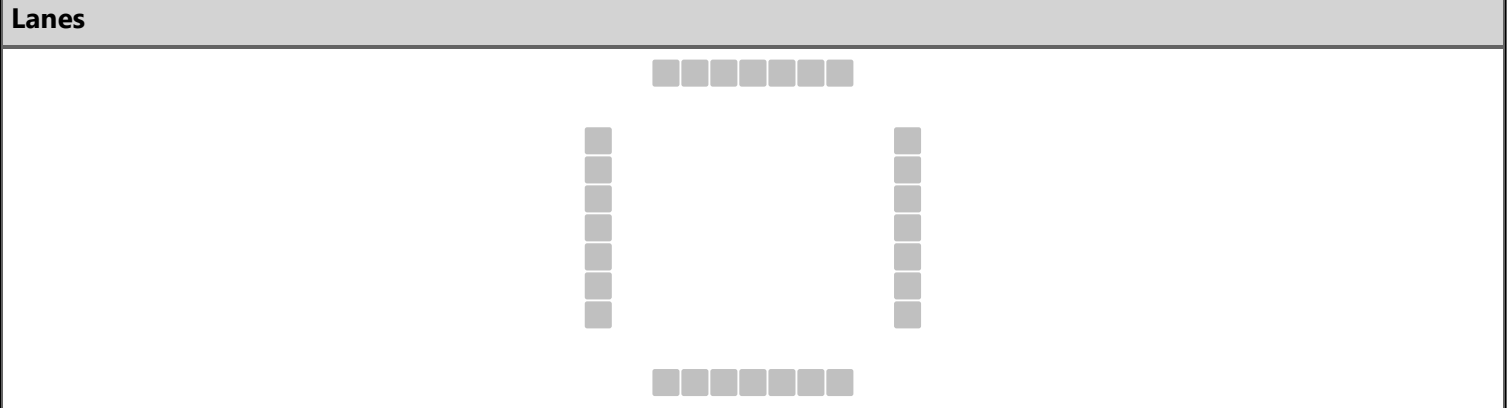
Vehicle Volume and Adjustments												
Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	229	511			142	100				111		191
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT			TR						LR		
Flow Rate, v (veh/h)	804			263						328		
Percent Heavy Vehicles	2			2						2		

Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20			3.20						3.20		
Initial Degree of Utilization, x	0.715			0.234						0.292		
Final Departure Headway, hd (s)	5.51			5.73						6.01		
Final Degree of Utilization, x	1.231			0.419						0.548		
Move-Up Time, m (s)	2.0			2.0						2.0		
Service Time, ts (s)	3.51			3.73						4.01		

Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	804			263						328		
Capacity	653			628						599		
95% Queue Length, Q ₉₅ (veh)	29.2			2.1						3.3		
Control Delay (s/veh)	136.4			12.8						16.1		
Level of Service, LOS	F			B						C		
Approach Delay (s/veh)	136.4			12.8						16.1		
Approach LOS	F			B						C		
Intersection Delay, s/veh LOS	84.8						F					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	AJK	Intersection	Tucker Station at S. Pope Lick
Agency/Co.	AKE	Jurisdiction	Jefferson
Date Performed	2/20/2023	East/West Street	S. Pope Lick
Analysis Year	2023	North/South Street	Tucker Station
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	2023 PM Build (Phase 1)		
Project Description	Xebec Development		



Vehicle Volume and Adjustments												
Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	229	533	3	2	148	100	12	25	9	111	7	191
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	L	TR		L	TR		L	TR		LTR		
Flow Rate, v (veh/h)	249	583		2	270		13	37		336		
Percent Heavy Vehicles	2	2		2	2		2	2		2		

Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20		3.20	3.20		3.20		
Initial Degree of Utilization, x	0.221	0.518		0.002	0.240		0.012	0.033		0.299		
Final Departure Headway, hd (s)	6.95	6.44		7.62	6.84		8.59	7.92		6.81		
Final Degree of Utilization, x	0.481	1.043		0.005	0.512		0.031	0.081		0.636		
Move-Up Time, m (s)	2.3	2.3		2.3	2.3		2.3	2.3		2.0		
Service Time, ts (s)	4.65	4.14		5.32	4.54		6.29	5.62		4.81		

Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	249	583		2	270		13	37		336		
Capacity	518	559		473	526		419	455		528		
95% Queue Length, Q ₉₅ (veh)	2.6	16.4		0.0	2.9		0.1	0.3		4.4		
Control Delay (s/veh)	15.9	74.6		10.4	16.5		11.6	11.3		20.9		
Level of Service, LOS	C	F		B	C		B	B		C		
Approach Delay (s/veh)	57.1			16.4			11.4			20.9		
Approach LOS	F			C			B			C		
Intersection Delay, s/veh LOS	40.0						E					

Attachment B
Signal Warrant Analysis

Tucker Station at S. Pope Lick (No Build)

Warrant 1A: Eight-Hour Vehicular Volume

Time Period	Major Street (S. Pope Lick)	Warrant Met	Ball Homes	Major Street	Warrant Met
7:00	553	1	193	746	1
8:00	463	0	180	643	1
9:00	273	0	132	405	0
10:00	225	0	138	363	0
11:00	270	0	146	416	0
12:00	363	0	160	523	1
13:00	333	0	170	503	1
14:00	294	0	183	477	0
15:00	402	0	204	606	1
16:00	668	1	245	913	1
17:00	732	1	237	969	1
18:00	348	0	196	544	1
Total Hrs Met		3			8

Time Period	Minor Street (Tucker St. SB)	Warrant Met (2 lane; 80%)	Ball Homes	Minor Street	Warrant Met (2 lane; 80%)
7:00	170	1	11	181	1
8:00	153	0	14	167	1
9:00	148	0	12	160	0
10:00	161	1	15	176	1
11:00	190	1	19	209	1
12:00	208	1	21	229	1
13:00	198	1	22	220	1
14:00	200	1	26	226	1
15:00	212	1	31	243	1
16:00	121	0	38	159	0
17:00	151	0	36	187	1
18:00	187	1	31	218	1
Total Hrs Met		8			10

Total Hours Met Both Approaches	1			7
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Tucker Station at S. Pope Lick (Xebec Ph. 1)

Warrant 1A: Eight-Hour Vehicular Volume

Time Period	Major Street (S. Pope Lick)	Warrant Met	Xebec (Phase 1)	Major Street	Warrant Met
7:00	746	1	59	805	1
8:00	643	1	40	683	1
9:00	405	0	34	439	0
10:00	363	0	36	399	0
11:00	416	0	33	449	0
12:00	523	1	45	568	1
13:00	503	1	38	541	1
14:00	477	0	36	513	1
15:00	606	1	36	642	1
16:00	913	1	30	943	1
17:00	969	1	29	998	1
18:00	544	1	4	548	1
Total Hrs Met		8			9

Time Period	Minor Street (Tucker St. SB)	Warrant Met (2 lane; 80%)	Ball Homes	Minor Street	Warrant Met (2 lane; 80%)
7:00	181	1	11	192	1
8:00	167	1	14	181	1
9:00	160	0	12	172	1
10:00	176	1	15	191	1
11:00	209	1	19	228	1
12:00	229	1	21	250	1
13:00	220	1	22	242	1
14:00	226	1	26	252	1
15:00	243	1	31	274	1
16:00	159	0	38	197	1
17:00	187	1	36	223	1
18:00	218	1	31	249	1
Total Hrs Met		10			12

Total Hours Met Both Approaches	7			9
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Tucker Station at S. Pope Lick (Full Build)

Warrant 1A: Eight-Hour Vehicular Volume

Time Period	Major Street (S. Pope Lick)	Warrant Met	Xebec (Full Build)	Major Street	Warrant Met
7:00	746	1	156	902	1
8:00	643	1	106	749	1
9:00	405	0	89	494	0
10:00	363	0	94	457	0
11:00	416	0	87	503	1
12:00	523	1	118	641	1
13:00	503	1	99	602	1
14:00	477	0	96	573	1
15:00	606	1	95	701	1
16:00	913	1	78	991	1
17:00	969	1	77	1046	1
18:00	544	1	11	555	1
Total Hrs Met		8			10

Time Period	Minor Street (Tucker St. SB)	Warrant Met (1 lane)	Xebec (Full Build)	Minor Street	Warrant Met (1 lane)
7:00	181	1	72	253	1
8:00	167	1	43	210	1
9:00	160	0	29	189	1
10:00	176	1	31	207	1
11:00	209	1	26	235	1
12:00	229	1	36	265	1
13:00	220	1	34	254	1
14:00	226	1	29	255	1
15:00	243	1	24	267	1
16:00	159	0	16	175	1
17:00	187	1	5	192	1
18:00	218	1	0	218	1
Total Hrs Met		10			12

Total Hours Met Both Approaches	7			10
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Tucker Station at BG Parkway

Warrant 1A: Eight-Hour Vehicular Volume

Time Period	Major Street (BG Parkway)	Warrant Met	Ball Homes	Xebec	Major Street Vol.	Warrant Met (No Build)	Warrant Met (Full Build)
7:00	723	1	145	112	980	1	1
8:00	879	1	138	89	1106	1	1
9:00	376	0	104	88	568	0	1
10:00	310	0	112	94	516	0	1
11:00	372	0	122	92	586	0	1
12:00	501	1	133	122	756	1	1
13:00	459	0	141	95	695	1	1
14:00	405	0	154	99	658	1	1
15:00	555	1	176	108	839	1	1
16:00	846	1	211	95	1152	1	1
17:00	885	1	203	118	1206	1	1
18:00	480	0	170	17	667	1	1
Total Hrs Met		6				9	12

Time Period	Minor Street (Tucker St NB)	80% Warrant Met (No Build)	Ball Homes	Xebec	Minor Street	80% Warrant Met (No Build)	80% Warrant Met (Full Build)
7:00	96	0	6	39	141	0	1
8:00	133	1	8	24	165	1	1
9:00	141	1	7	16	164	1	1
10:00	70	0	8	17	95	0	0
11:00	143	1	11	14	168	1	1
12:00	144	1	11	20	175	1	1
13:00	103	0	12	19	134	0	1
14:00	113	0	14	16	143	0	1
15:00	191	1	17	13	221	1	1
16:00	225	1	21	9	255	1	1
17:00	306	1	20	3	329	1	1
18:00	97	0	17	0	114	0	0
Total Hrs Met		7				7	7

Total Hours Met Both Approaches	5					5	10
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