CITY of NOVI CITY COUNCIL

Agenda Item E
November 24, 2014

SUBJECT: Approval of traffic control orders 14-21 through 14-24 for the placement of an all-way stop at the intersection of White Pines Drive and Moorgate Drive in Royal Crown subdivision.

SUBMITTING DEPARTMENT: Department of Public Services, Engineering Division

CITY MANAGER APPROVAL:

BACKGROUND INFORMATION:

Over the past six months, staff received three requests for stop signs along White Pines Drive between Bertram and Moorgate (see attached map). At Moorgate and White Pines, there is currently a yield sign controlling Moorgate. Bertram is also controlled by a yield sign at White Pines Drive. Staff requested a review of each intersection by the City's traffic consultant. The traffic consultant is recommending that the intersection of Moorgate and White Pines be controlled as an all-way stop, with stop signs proposed for installation on each leg of the intersection because both streets act as collector roads and the pedestrian volumes since this location is part of a school walk route. The traffic consultant did not propose any changes for the intersection of Bertram and White Pines primarily because there is adequate sight distance, lower traffic volumes and fewer pedestrians than at Moorgate and White Pines. The attached report provides additional technical support for these recommendations. The findings of the report have been shared with the Royal Crown Homeowners Association.

Traffic control orders are required under the Uniform Traffic Code to enforce traffic control signs that have been installed on public streets. Therefore, staff has proposed the following traffic control orders based on the recommendation of the consultant for approval by City Council. The signs will be scheduled for installation upon approval.

TCO No.	Description
14-21	Void TCO 00-22 for the existing yield sign for northbound Moorgate at White Pines
14-22	Northbound Moorgate to stop at White Pine
14-23	Eastbound White Pines Drive to stop at Moorgate
14-24	Westbound White Pines Drive to stop at Moorgate

RECOMMENDED ACTION: Approval of traffic control orders 14-21 through 14-24 for the placement of an all-way stop at the intersection of White Pines Drive and Moorgate Drive in Royal Crown subdivision.

	1	2	Y	N
Mayor Gatt				
Mayor Pro Tem Staudt				
Council Member Casey				
Council Member Markham				

	1	2	Y	N
Council Member Mutch				
Council Member Poupard				
Council Member Wrobel				

TCO for Moorgate & White Pines

CITY OF NOVI
cityofnovi.org

Map Produced Using the
City of Novi, Michigan
Internet Mapping Portal

Author:
Date: 11/17/2014

0 95 190 380
Feet
1 inch = 188 feet

MAP INTERPRETATION NOTICE

Map information depicted is not intended to replace or substitute for any official or primary source. This map was intended to meet National Map Accuracy Standards and use the most recent, accurate sources available to the people of the City of Novi. Boundary measurements and area calculations are approximate and should not be construed as survey measurements performed by a licensed Michigan Surveyor as defined in Michigan Public Act 132 of 1970 as amended. Pleased contact the City GIS Manager to confirm source and accuracy information related to this map. This map was produced under the terms of the City's Internet Site Use Policy available at http://cityofnovi.org/Resources/SiteUsePolicy.asp

CITY OF NOVI
TRAFFIC CONTROL ORDER

_____ SPEED
_____ PARKING
_X_ OTHER

DATE OF ORDER: 11/14/2014

CONTROL NUMBER: 14-21

PURSUANT TO CHAPTER NO. 33 OF THE CODE OF ORDINANCES OF THE CITY OF NOVI, MICHIGAN, SAME BEING THE UNIFORM TRAFFIC CODE FOR CITIES, TOWNSHIPS AND VILLAGES OF MICHIGAN AND IN THE INTEREST OF PUBLIC SAFETY AND CONVENIENCE THE FOLLOWING TRAFFIC CONTROL ORDER IS HEREBY ISSUED BY BRIAN COBURN, ENGINEERING MANAGER, DULY AUTHORIZED AS TRAFFIC ENGINEER, BY SEC. 33-51 OF THE AFORESAID CHAPTER.

ISSUANCE OF THIS TRAFFIC CONTROL ORDER WAS PRECEDED BY STUDY AND INVESTIGATION OF TRAFFIC CONDITIONS ON THE FOLLOWING PUBLIC ROAD OR ROADS IN THE CITY OF NOVI, MICHIGAN.

MOORGATE

AND AFTER SAID INVESTIGATION, IT IS HEREBY ORDERED AND DIRECTED THAT THE DEPARTMENT OF PUBLIC SERVICES ERECT AND MAINTAIN THE SIGN (S) IN ACCORDANCE WITH THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AS REQUIRED BY SEC. 33-51 OF THE AFORESAID CHAPTER, SAID SIGNS TO GIVE NOTICE OF THE FOLLOWING DETERMINATION:

VOID TCO 00-22

Brian Coburn, P.E. - Traffic Engineer
Dated: 11/14/2014

APPROVED BY CITY COUNCIL
TRAFFIC CONTROL ORDER NUMBER 14-21 HAVING BEEN PRESENTED TO THE COUNCIL OF THE CITY OF NOVI, MICHIGAN FOR STUDY AND APPROVAL, IS HEREBY APPROVED AND IT IS HEREBY ORDERED AND DIRECTED THAT THIS ORDER BE FILED IN THE OFFICE OF THE CITY CLERK AND A COPY THEROF IN THE OFFICE OF THE CHIEF OF POLICE OF SAID CITY.

IT IS FURTHER ORDERED AND DIRECTED THAT THIS ORDER SHALL BECOME EFFECTIVE UPON BEING FILED WITH THE CLERK AND UPON ERECTION OF ADEQUATE SIGNS GIVING NOTICE OF THE EXISTENCE OF AFORESAID,

VOID TCO 00-22

ADOPTED AT THE REGULAR MEETING OF CITY COUNCIL ON 11/24/2014.

By: _____
Robert J. Gatt, Mayor

By: _____
Maryanne Cornelius, Clerk

CITY OF NOVI
TRAFFIC CONTROL ORDER

_____ SPEED
_____ PARKING
__X__ OTHER

DATE OF ORDER: 11/14/2014

CONTROL NUMBER: 14-22

PURSUANT TO CHAPTER NO. 33 OF THE CODE OF ORDINANCES OF THE CITY OF NOVI, MICHIGAN, SAME BEING THE UNIFORM TRAFFIC CODE FOR CITIES, TOWNSHIPS AND VILLAGES OF MICHIGAN AND IN THE INTEREST OF PUBLIC SAFETY AND CONVENIENCE THE FOLLOWING TRAFFIC CONTROL ORDER IS HEREBY ISSUED BY BRIAN COBURN, ENGINEERING MANAGER, DULY AUTHORIZED AS TRAFFIC ENGINEER, BY SEC. 33-51 OF THE AFORESAID CHAPTER.

ISSUANCE OF THIS TRAFFIC CONTROL ORDER WAS PRECEDED BY STUDY AND INVESTIGATION OF TRAFFIC CONDITIONS ON THE FOLLOWING PUBLIC ROAD OR ROADS IN THE CITY OF NOVI, MICHIGAN.

MOORGATE

AND AFTER SAID INVESTIGATION, IT IS HEREBY ORDERED AND DIRECTED THAT THE DEPARTMENT OF PUBLIC SERVICES ERECT AND MAINTAIN THE STOP SIGN (S) IN ACCORDANCE WITH THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AS REQUIRED BY SEC. 33-51 OF THE AFORESAID CHAPTER, SAID SIGNS TO GIVE NOTICE OF THE FOLLOWING DETERMINATION:

NORTHBOUND MOORGATE TO STOP AT WHITE PINE

Brian Coburn, P.E. - Traffic Engineer
Dated: 11/14/2014

APPROVED BY CITY COUNCIL
TRAFFIC CONTROL ORDER NUMBER 14-22 HAVING BEEN PRESENTED TO THE COUNCIL OF THE CITY OF NOVI, MICHIGAN FOR STUDY AND APPROVAL, IS HEREBY APPROVED AND IT IS HEREBY ORDERED AND DIRECTED THAT THIS ORDER BE FILED IN THE OFFICE OF THE CITY CLERK AND A COPY THEROF IN THE OFFICE OF THE CHIEF OF POLICE OF SAID CITY.

IT IS FURTHER ORDERED AND DIRECTED THAT THIS ORDER SHALL BECOME EFFECTIVE UPON BEING FILED WITH THE CLERK AND UPON ERECTION OF ADEQUATE SIGNS GIVING NOTICE OF THE EXISTENCE OF AFORESAID,

NORTHBOUND MOORGATE TO STOP AT WHITE PINE

ADOPTED AT THE REGULAR MEETING OF CITY COUNCIL ON 11/24/2014.

By: _____
Robert J. Gatt, Mayor

By: _____
Maryanne Cornelius, Clerk

CITY OF NOVI
TRAFFIC CONTROL ORDER

_____ SPEED
_____ PARKING
_X_ OTHER

DATE OF ORDER: 11/14/2014

CONTROL NUMBER: 14-23

PURSUANT TO CHAPTER NO. 33 OF THE CODE OF ORDINANCES OF THE CITY OF NOVI, MICHIGAN, SAME BEING THE UNIFORM TRAFFIC CODE FOR CITIES, TOWNSHIPS AND VILLAGES OF MICHIGAN AND IN THE INTEREST OF PUBLIC SAFETY AND CONVENIENCE THE FOLLOWING TRAFFIC CONTROL ORDER IS HEREBY ISSUED BY BRIAN COBURN, ENGINEERING MANAGER, DULY AUTHORIZED AS TRAFFIC ENGINEER, BY SEC. 33-51 OF THE AFORESAID CHAPTER.

ISSUANCE OF THIS TRAFFIC CONTROL ORDER WAS PRECEDED BY STUDY AND INVESTIGATION OF TRAFFIC CONDITIONS ON THE FOLLOWING PUBLIC ROAD OR ROADS IN THE CITY OF NOVI, MICHIGAN.

WHITE PINES

AND AFTER SAID INVESTIGATION, IT IS HEREBY ORDERED AND DIRECTED THAT THE DEPARTMENT OF PUBLIC SERVICES ERECT AND MAINTAIN THE STOP SIGN (S) IN ACCORDANCE WITH THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AS REQUIRED BY SEC. 33-51 OF THE AFORESAID CHAPTER, SAID SIGNS TO GIVE NOTICE OF THE FOLLOWING DETERMINATION:

EASTBOUND WHITE PINES DRIVE TO STOP AT MOORGATE

Brian Coburn, P.E. - Traffic Engineer
Dated: 11/14/2014

APPROVED BY CITY COUNCIL
TRAFFIC CONTROL ORDER NUMBER 14-23 HAVING BEEN PRESENTED TO THE COUNCIL OF THE CITY OF NOVI, MICHIGAN FOR STUDY AND APPROVAL, IS HEREBY APPROVED AND IT IS HEREBY ORDERED AND DIRECTED THAT THIS ORDER BE FILED IN THE OFFICE OF THE CITY CLERK AND A COPY THEROF IN THE OFFICE OF THE CHIEF OF POLICE OF SAID CITY.

IT IS FURTHER ORDERED AND DIRECTED THAT THIS ORDER SHALL BECOME EFFECTIVE UPON BEING FILED WITH THE CLERK AND UPON ERECTION OF ADEQUATE SIGNS GIVING NOTICE OF THE EXISTENCE OF AFORESAID,

EASTBOUND WHITE PINES DRIVE TO STOP AT MOORGATE

ADOPTED AT THE REGULAR MEETING OF CITY COUNCIL ON 11/24/2014.

By: _____
Robert J. Gatt, Mayor

By: _____
Maryanne Cornelius, Clerk

CITY OF NOVI
TRAFFIC CONTROL ORDER

_____ SPEED
_____ PARKING
_X_ OTHER

DATE OF ORDER: 11/14/2014

CONTROL NUMBER: 14-24

PURSUANT TO CHAPTER NO. 33 OF THE CODE OF ORDINANCES OF THE CITY OF NOVI, MICHIGAN, SAME BEING THE UNIFORM TRAFFIC CODE FOR CITIES, TOWNSHIPS AND VILLAGES OF MICHIGAN AND IN THE INTEREST OF PUBLIC SAFETY AND CONVENIENCE THE FOLLOWING TRAFFIC CONTROL ORDER IS HEREBY ISSUED BY BRIAN COBURN, ENGINEERING MANAGER, DULY AUTHORIZED AS TRAFFIC ENGINEER, BY SEC. 33-51 OF THE AFORESAID CHAPTER.

ISSUANCE OF THIS TRAFFIC CONTROL ORDER WAS PRECEDED BY STUDY AND INVESTIGATION OF TRAFFIC CONDITIONS ON THE FOLLOWING PUBLIC ROAD OR ROADS IN THE CITY OF NOVI, MICHIGAN.

WHITE PINES

AND AFTER SAID INVESTIGATION, IT IS HEREBY ORDERED AND DIRECTED THAT THE DEPARTMENT OF PUBLIC SERVICES ERECT AND MAINTAIN THE STOP SIGN (S) IN ACCORDANCE WITH THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES AS REQUIRED BY SEC. 33-51 OF THE AFORESAID CHAPTER, SAID SIGNS TO GIVE NOTICE OF THE FOLLOWING DETERMINATION:

WESTBOUND WHITE PINES DRIVE TO STOP AT MOORGATE

Brian Coburn, P.E. - Traffic Engineer
Dated: 11/14/2014

APPROVED BY CITY COUNCIL
TRAFFIC CONTROL ORDER NUMBER 14-24 HAVING BEEN PRESENTED TO THE COUNCIL OF THE CITY OF NOVI, MICHIGAN FOR STUDY AND APPROVAL, IS HEREBY APPROVED AND IT IS HEREBY ORDERED AND DIRECTED THAT THIS ORDER BE FILED IN THE OFFICE OF THE CITY CLERK AND A COPY THEROF IN THE OFFICE OF THE CHIEF OF POLICE OF SAID CITY.

IT IS FURTHER ORDERED AND DIRECTED THAT THIS ORDER SHALL BECOME EFFECTIVE UPON BEING FILED WITH THE CLERK AND UPON ERECTION OF ADEQUATE SIGNS GIVING NOTICE OF THE EXISTENCE OF AFORESAID,

WESTBOUND WHITE PINES DRIVE TO STOP AT MOORGATE

ADOPTED AT THE REGULAR MEETING OF CITY COUNCIL ON 11/24/2014.

By: _____
Robert J. Gatt, Mayor

By: _____
Maryanne Cornelius, Clerk

clearzoning®

MEMORANDUM

DATE: October 31, 2014

TO: Brian T. Coburn, P.E., Engineering Senior Manager, City of Novi

FROM: Rodney L. Arroyo, AICP, President
William A. Stimpson, P.E., Director of Traffic Engineering

SUBJECT: White Pines Drive All-Way Stop Study

Per our approved proposal of 9-17-14, we have evaluated the White Pines/Moorgate and White Pines/Bertram intersections for potential conversion to all-way STOP-sign control (Figures 1-2). Currently, the minor approach at each intersection (Moorgate and Bertram) is controlled by a YIELD sign, based on a sight-distance study we conducted for the City in 1999. The present evaluation comprehensively examines the criteria for "multi-way stop applications" outlined in Section 2B.07 of the 2011 *Michigan Manual on Uniform Traffic Control Devices.* The study's recommendations and supporting analyses are documented below.

Summary of Recommendations

1. The White Pines/Moorgate intersection should be controlled by STOP signs on all three approaches, each accompanied by an ALL WAY plate. To provide a treatment comparable to that previously installed at the first two Moorgate intersections south of White Pines (Irvine and Havergale), a stop bar should be installed on each approach. A ramped sidewalk stub should also be constructed on the north side of White Pines immediately west of Moorgate, and zebra-bar crosswalks should be added on the west and south sides of the intersection.

2. The existing YIELD sign on the Bertram approach to White Pines should be retained. No improvements are warranted at the White Pines/Bertram intersection.

Supporting Analyses

Criteria – The *Michigan Manual on Uniform Traffic Control Devices (MMUTCD)* limits what the City can legally do with respect to traffic control signs. That manual, in Section 2B.04, states that *"*YIELD *or* STOP *signs shall not be used for speed control."* Traffic engineering experience and past research have shown that installing STOP signs (in particular) to control speeds will – at least over a period of time – result in an excessive number of such signs, greater disrespect for them, more rolling stops, and higher speeds between the signs as drivers attempt to "make up for lost time." Young children stepping out from behind parked cars could be struck if they expect all vehicles to fully stop, whereas adults know many will not.

The *MMUTCD* (in the above-cited section) advises that "engineering judgment should be used to establish intersection control. The following factors should be considered:

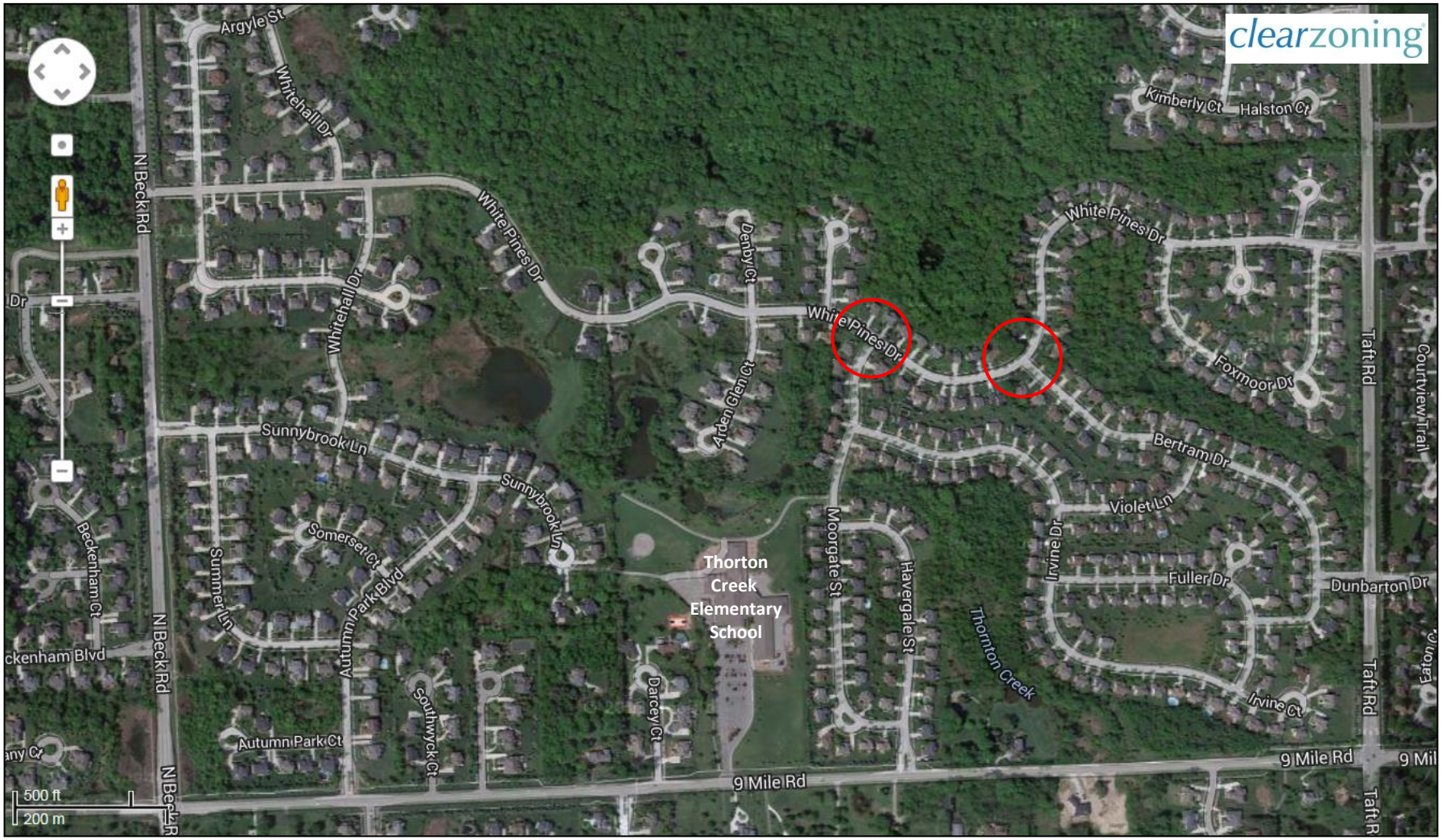

Figure 1. Vicinity Aerial – White Pines Drive

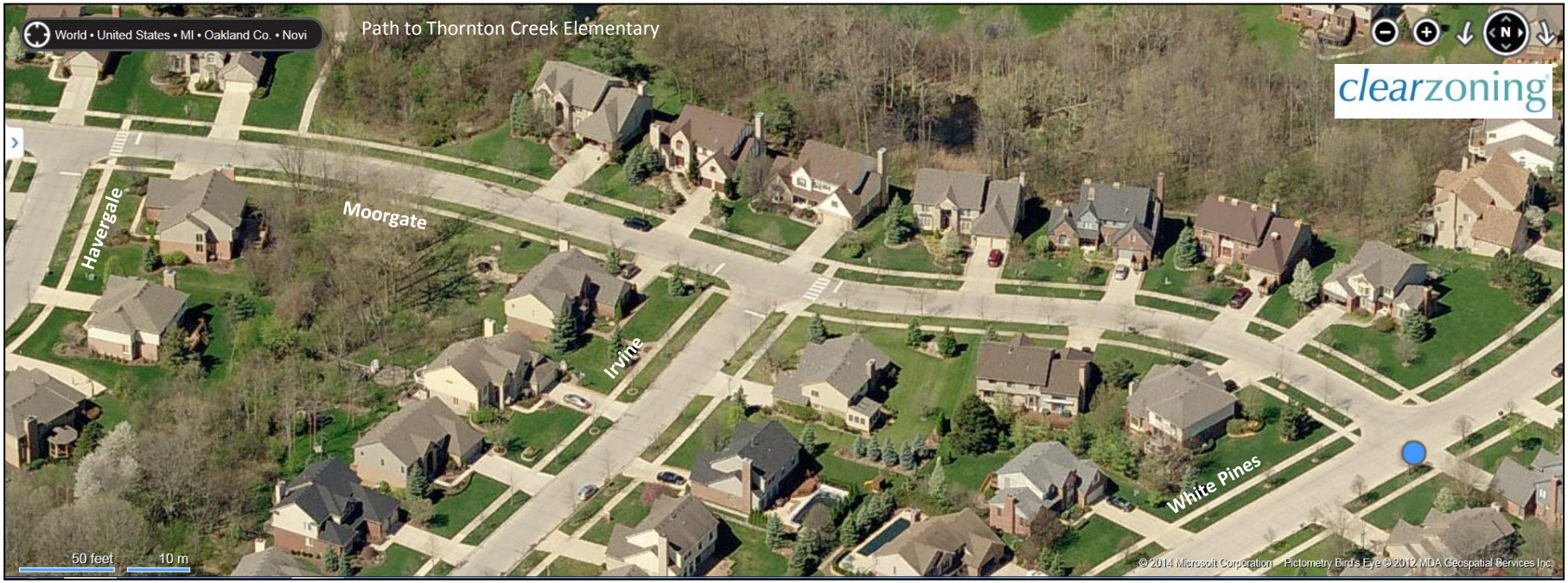

Figure 2. North End of Moorgate

A. Vehicular, bicycle, and pedestrian traffic volumes on all approaches;
B. Number and angle of approaches;
C. Approach speeds;
D. Sight distance available on each approach; and
E. Reported crash experience.

YIELD or STOP signs should be used at an intersection if one or more of the following conditions exist:

A. An intersection of a less important road with a main road where application of the normal right-of-way rule would not be expected to provide reasonable compliance with the law;
B. A street entering a designated through highway or street; and/or
C. An unsignalized intersection in a signalized area."

Further, "Once the decision has been made to control an intersection, the decision regarding the appropriate roadway to control should be based on engineering judgment. In most cases, the roadway carrying the lowest volume of traffic should be controlled. A YIELD or STOP sign should not be installed on the higher volume roadway unless justified by an engineering study.

The following are considerations that might influence the decision regarding the appropriate roadway upon which to install a YIELD or STOP sign where two roadways with relatively equal volumes and/or characteristics intersect:

A. Controlling the direction that conflicts the most with established pedestrian crossing activity or school walking routes;
B. Controlling the direction that has obscured vision, dips, or bumps that already require drivers to use lower operating speeds; and
C. Controlling the direction that has the best sight distance from a controlled position to observe conflicting traffic."

The Road Commission for Oakland County (RCOC) has long recommended a procedure for choosing between stop and yield control on the minor approach(es) to a local intersection, based on the available corner sight distance and resulting "Critical Approach Speed" (CAS). According to RCOC, CAS values of 0-10 mph warrant a STOP sign and 10-30 mph warrant a YIELD sign. However, we look carefully at intersections where the CAS is 10-15 mph and use professional judgment to determine if a STOP sign would be a better choice than a YIELD sign. We have applied this slightly modified RCOC procedure here, as we have previously at numerous intersections throughout Novi.

The *MMUTCD* also states (in Section 2B.07) that "multi-way stop control can be useful as a safety measure if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multi-way stop control is [typically] used where the volume of traffic on intersecting roads is approximately equal.

The decision to install multi-way stop control should be based on an engineering study." Within such a study, the manual indicates that multi-way stop control can be considered where one or more of the following is true:

A. Eventual signal installation is likely.

B. Five or more police-reported crashes in a 12-month period may have been avoided.

C. Over eight hours of an average day, there are at least 300 vehicles per hour on the major street and 200 "traffic units" (cars, pedestrians, and bikes) per hour on the minor street.

D. Where neither B nor C is satisfied, but where both are satisfied to at least the 80% level.

E. There is a need to "control left-turn conflicts."

F. There is a need to control vehicle/pedestrian conflicts near high pedestrian generators.

G. A driver, after stopping, cannot see conflicting cross traffic, and where that cross traffic must also stop in order to provide a reasonable level of safety.

H. Two residential collector streets of similar design are intersecting and the "traffic operational characteristics" of the intersection would be improved.

Sight Distance Findings – At White Pines and Moorgate, our recent site inspection and evaluation produced a Critical Approach Speed of 20 mph, based on the most-restrictive sight line being limited by the cluster of evergreen trees on the southeast corner (Figure 3). Hence, based on sight distance alone, the previously recommended and installed YIELD sign on Moorgate is still appropriate.

At White Pines and Bertram, conditions on both the southeast and southwest corners (Figures 5-6) were found to produce a Critical Approach Speed of 27 mph. Again, the existing YIELD sign on Bertram remains the most appropriate form of intersection control.

Crash History – As can be seen in Figure 7, there were no reported crashes at or near the subject intersections between 2009 and 2013 (inclusive). Thus, criterion B (above) is not met.

Volumes and Speeds – City forces used its computerized road tubes to collect traffic volume and speed data at the subject intersections. We have summarized the hourly volumes at White Pines/Moorgate and White Pines/Bertram in Tables 1 and 2, respectively. Note that the maximum two-way hourly volume on White Pines was found to be 99 vehicles at Moorgate and 93 vehicles at Bertram. The intersection volumes are therefore well short of the minimum 200 vehicles per hour over 8 hours needed to warrant all-way stop control. Thus, neither criterion C nor D (above) is met.

Clearzoning staff made manual counts of both vehicular turning movements and pedestrian crossing volumes at the two intersections. The results of these counts are detailed in the attached spread-sheets and summarized in Tables 3-4 below. Note, in particular, the 6-7 pedestrians per hour crossing White Pines on the west side of its intersection with Moorgate, along a natural route for school children living north of White Pines and going to or coming from the school path ending at Moorgate (Figure 1). As can be seen in Figure 8, there is currently a north-south sidewalk stub at this location only on the south side of White Pines. Motorists – especially unfamiliar ones – have no reason to expect pedestrian crossing activity at this location, given the lack of markings and/or signs.

Figure 3. View of WB White Pines from NB Moorgate

Figure 4. View of EB White Pines from NB Moorgate

Figure 5. View of SWB White Pines from NWB Bertram

Figure 6. View of NEB White Pines from NWB Bertram

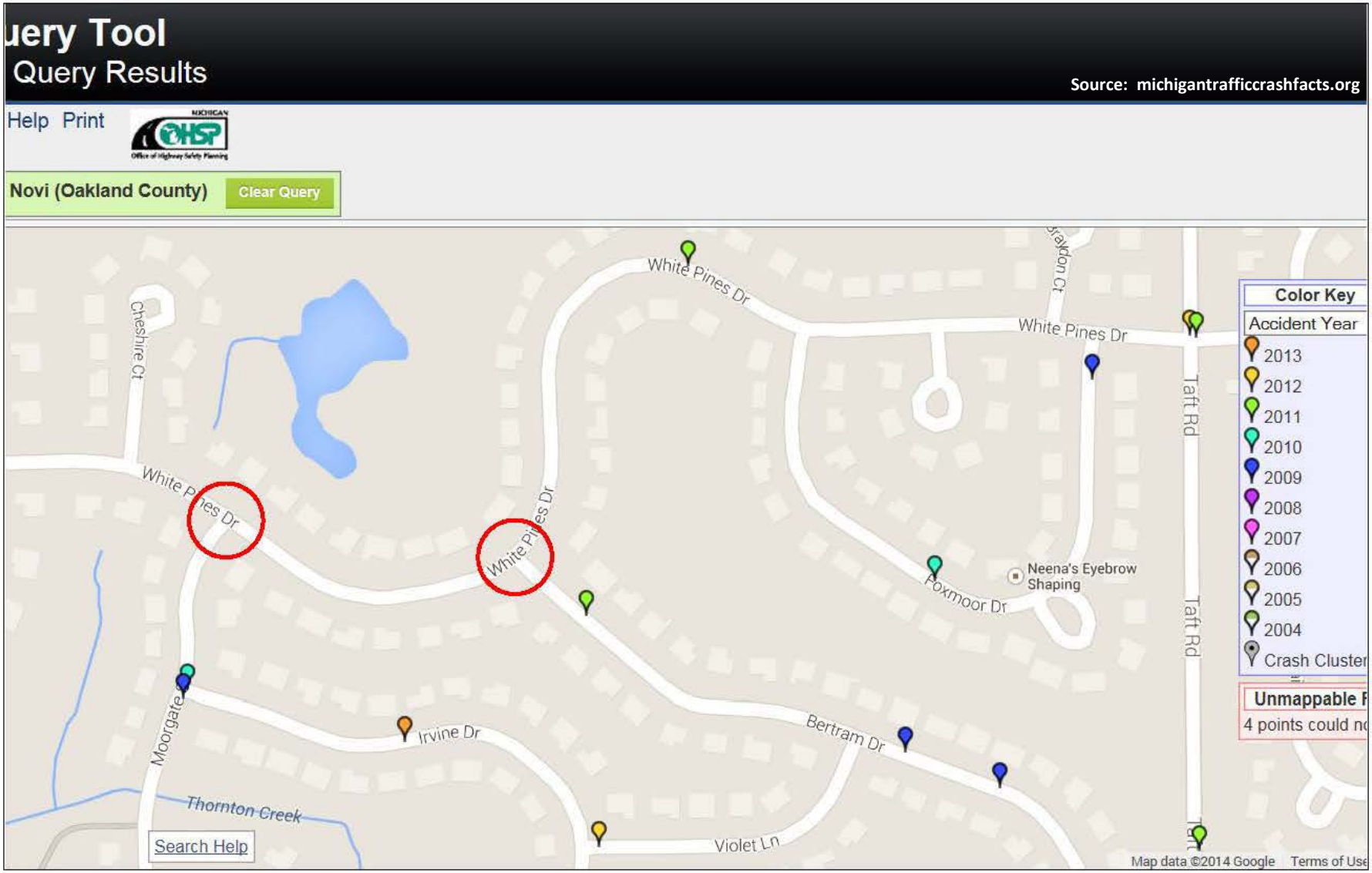

Figure 7. Reported Traffic Crashes in General Vicinity of Subject Intersections, 2009-2013

Table 1. Hourly Traffic Volumes Approaching White Pines/Moorgate

Hour Ending	EB White Pines				WB White Pines				NB Moorgate				Total E-W on W.P.
	Tue, 9-30	Wed, 10-1	Thu, 10-2	Average	Tue, 9-30	Wed, 10-1	Thu, 10-2	Average	Tue, 9-30	Wed, 10-1	Thu, 10-2	Average	
1:00a		5	1	3		2	1	2		1	0	1	5
2:00a		0	2	1		0	0	0		0	3	2	1
3:00a		0	0	0		0	0	0		0	0	0	0
4:00a		0	0	0		0	0	0		0	0	0	0
5:00a		2	3	3		2	1	2		0	3	2	4
6:00a		9	5	7		6	6	6		0	1	1	13
7:00a		24	28	26		22	23	23		9	13	11	49
8:00a		46	41	**44**		55	55	**55**		15	14	**15**	**99**
9:00a		37	29	33		39	31	35		21	17	19	68
10:00a		15	18	17		19	23	21		17	11	14	38
11:00a		22	21	22		21	16	19		7	16	12	40
12:00p		20	16	18		18	12	15		23	22	23	33
1:00p	22	21		22	23	18		21	22	15		19	42
2:00p	18	17		18	19	11		15	17	20		19	33
3:00p	24	29		27	21	21		21	18	22		20	48
4:00p	32	40		**36**	27	30		**29**	35	37		**36**	**65**
5:00p	25	36		31	28	32		30	27	27		27	61
6:00p	29	43		36	27	36		32	25	24		25	68
7:00p	26	33		30	26	30		28	24	21		23	58
8:00p	31	35		33	28	19		24	15	14		15	57
9:00p	17	12		15	9	6		8	9	6		8	22
10:00p	17	11		14	8	9		9	7	6		7	23
11:00p	4	6		5	2	5		4	1	2		2	9
12:00a	2	2		2	2	1		2	0	2		1	4
Total	247	465	164	**438**	220	402	168	**395**	200	289	100	**295**	**833**

Table 2. Hourly Traffic Volumes Approaching White Pines/Bertram

Hour Ending	EB White Pines				WB White Pines				NB Bertram				Total E-W on W.P.
	Tue, 9-30	Wed, 10-1	Thu, 10-2	Average	Tue, 9-30	Wed, 10-1	Thu, 10-2	Average	Tue, 9-30	Wed, 10-1	Thu, 10-2	Average	
1:00a		3	1	2		4	3	4		0	0	0	6
2:00a		0	0	0		0	0	0		0	0	0	0
3:00a		2	2	2		1	0	1		1	2	2	3
4:00a		0	0	0		0	0	0		0	0	0	0
5:00a		1	2	2		2	2	2		0	0	0	4
6:00a		4	3	4		8	6	7		0	1	1	11
7:00a		6	5	6		21	23	22		8	9	9	28
8:00a		14	12	13		35	36	36		15	8	12	49
9:00a		14	16	**15**		32	35	**34**		14	14	**14**	**49**
10:00a		17	14	16		16	19	18		14	13	14	33
11:00a		9	12	11		23	17	20		19	7	13	31
12:00p		17	16	17		16	19	18		5	3	4	34
1:00p	14	9		12	35	14		25	6	6		6	36
2:00p	12	18		15	30	20		25	4	18		11	40
3:00p	18	19		19	26	21		24	11	12		12	42
4:00p	24	30		27	36	44		40	16	29		23	67
5:00p	33	22		28	34	25		30	18	17		18	57
6:00p	32	45		39	42	68		55	17	26		22	94
7:00p	50	36		**43**	54	45		**50**	28	21		**25**	**93**
8:00p	31	35		33	31	38		35	16	9		13	68
9:00p	20	26		23	22	32		27	10	3		7	50
10:00p	15	13		14	13	17		15	6	12		9	29
11:00p	2	5		4	3	7		5	3	4		4	9
12:00a	1	3		2	1	2		2	3	1		2	4
Total	252	348	83	**342**	327	491	160	**489**	138	234	57	**215**	**831**

Table 3. Vehicular Turning-Movement and Pedestrian Volumes at White Pines/Moorgate

Peak Hour Starting	EB White Pines			WB White Pines			NB Moorgate			Total Vehicles
	TH	RT	**Peds[1]**	LT	TH	Peds	LT	TH	Peds	
7:45 am	19	7	**6**	3	11	0	4	6	0	50
3:30 pm	25	6	**7**	6	28	0	6	8	1	79

Table 4. Vehicular Turning-Movement and Pedestrian Volumes at White Pines/Bertram

Peak Hour Starting	EB White Pines			WB White Pines			NB Bertram			Total Vehicles
	TH	RT	Peds	LT	TH	Peds	LT	TH	**Peds**	
7:45 am	16	9	0	3	11	0	4	5	**5**	48
3:30 pm	18	12	2	4	22	0	11	2	**6**	69

Figure 8. Proposed White Pines Crosswalk Location on West Side of Moorgate (Looking North)

The pedestrian crossing activity observed at the above location – likely due to the intersection's proximity to Thornton Creek Elementary – appears to satisfy criterion F (above), specifically that "There is a need to control vehicle/pedestrian conflicts near high pedestrian generators."

The statistics for the City's speed sampling at the two intersections are summarized in Table 5. The average speeds on White Pines were found to range from 22.4-24.6 mph, and the corresponding 85th-percentile speeds were found to range from 28.3-29.6 mph. These results are very typical for curvilinear subdivision streets. Relatively few vehicles were tracked at speeds of 35 mph or more (on average, only 0-6 vehicles per day).

Discussion – Tables 1 and 2 show that the daily approach volumes are more comparable between the two intersecting streets at White Pines/Moorgate than at White Pines/Bertram, thus favoring the former over the latter as a potential location for all-way stop (see the MMUTCD language quoted near the middle of our page 4 above). The fact that Moorgate intersects White Pines near a school and provides a street connection to 9 Mile Road appears consistent with the intent of criterion H above; i.e., that "two residential collector streets of similar design are intersecting and the 'traffic operational characteristics' of the intersection would be improved." Perhaps most importantly, the implementation of all-way stop and enhanced pavement markings at White Pines/Moorgate would address pedestrian route continuity and safety at a key intersection only a short distance north of two other intersections previously improved in a similar manner (Moorgate/Irvine and Moorgate/ Havergale).

At White Pines/Bertram, there is better corner sight distance, less comparable approach volumes, and significantly fewer pedestrians crossing White Pines in an unassisted fashion. This intersection does not warrant any improvements of the type we are recommending at the other intersection.

Table 5. Speed Summary for Two White Pines Intersections

Location	Direction	Day, Date	Speed Statistic			
			Sample Size	Average	85th %tile	No. > 35 mph
Intersection of White Pines and Moorgate						
White Pines west of Moorgate	EB	Tue, 9-30-14	247	24.0	29.5	6
		Wed, 10-1-14	465	24.7	29.5	2
		Thur, 10-2-14	164	25.3	30.0	2
		Average Day	438	24.6	29.6	3
White Pines east of Moorgate	WB	Tue, 9-30-14	220	23.7	29.1	8
		Wed, 10-1-14	402	24.8	29.3	6
		Thur, 10-2-14	168	25.4	29.4	2
		Average Day	395	24.6	29.3	6
Moorgate south of White Pines	NB	Tue, 9-30-14	200	18.0	22.8	0
		Wed, 10-1-14	289	18.7	23.6	0
		Thur, 10-2-14	100	19.4	23.8	0
		Average Day	295	18.6	23.4	0
Intersection of White Pines and Bertram						
White Pines west of Bertram	EB	Tue, 9-30-14	252	22.5	28.4	1
		Wed, 10-1-14	348	22.7	28.4	0
		Thur, 10-2-14	83	20.8	27.5	0
		Average Day	342	22.4	28.3	0
White Pines east of Bertram	WB	Tue, 9-30-14	327	23.6	28.8	1
		Wed, 10-1-14	491	24.1	28.8	0
		Thur, 10-2-14	160	25.0	29.8	4
		Average Day	489	24.1	29.0	1
Bertram south of White Pines	NB	Tue, 9-30-14	138	23.5	27.9	3
		Wed, 10-1-14	234	22.8	28.1	1
		Thur, 10-2-14	57	22.7	28.3	0
		Average Day	215	23.0	28.1	2

MANUAL TRAFFIC COUNTS

CITY OF NOVI TRAFFIC STUDY
AM Turning-Movement Count for Intersection of White Pines & Moorgate
Tuesday, 10-08-14

Cumulative Turning-Movement Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
8:00	10	3	0	2	0	2	17
8:15	13	3	0	6	0	4	26
8:30	18	3	1	10	1	5	38
8:45	19	7	3	11	4	6	50
9:00	25	7	4	13	6	7	62
9:15	31	7	5	14	6	11	74

Turning-Movement Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
8:00	10	3	0	2	0	2	17
8:15	3	0	0	4	0	2	9
8:30	5	0	1	4	1	1	12
8:45	1	4	2	1	3	1	12
9:00	6	0	1	2	2	1	12
9:15	6	0	1	1	0	4	12
Total	31	7	5	14	6	11	74

Hourly Total

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
7:45	19	7	3	11	4	6	50
8:00	15	4	4	11	6	5	45
8:15	18	4	5	8	6	7	48

AM School Arrival Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
7:45	**19**	**7**	**3**	**11**	**4**	**6**	**50**
PHF (Peak-Hour Factor)	0.48	0.44	0.38	0.69	0.33	0.75	0.74
	0.50		0.70		0.63		

CITY OF NOVI TRAFFIC STUDY
AM Pedestrian Crossing Count for Intersection of White Pines & Moorgate
Tuesday, 10-08-14

Cumulative Pedestrian Crossing Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
8:00	0	0	0	0	0	0	0
8:15	1	0	0	0	0	0	1
8:30	1	0	0	0	0	0	1
8:45	6	0	0	0	0	0	6
9:00	6	2	0	0	0	0	8
9:15	6	2	0	0	0	0	8

Pedestrian Crossing Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
8:00	0	0	0	0	0	0	0
8:15	1	0	0	0	0	0	1
8:30	0	0	0	0	0	0	0
8:45	5	0	0	0	0	0	5
9:00	0	2	0	0	0	0	2
9:15	0	0	0	0	0	0	0
Total	6	2	0	0	0	0	8

Hourly Total

[1] Peak hour for vehicular traffic.

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
7:45[1]	**6**	**0**	**0**	**0**	**0**	**0**	**6**
8:00	6	2	0	0	0	0	8
8:15	5	2	0	0	0	0	7

AM School Arrival Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
8:00	**6**	**2**	**0**	**0**	**0**	**0**	**8**
PHF (Peak-Hour Factor)	0.30	0.25	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.40
	0.40		#DIV/0!		#DIV/0!		

CITY OF NOVI TRAFFIC STUDY
PM Turning-Movement Count for Intersection of White Pines & Moorgate
Tuesday, 10-08-14

Cumulative Turning-Movement Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
3:15	7	0	0	5	2	3	17
3:30	10	2	0	9	4	3	28
3:45	10	3	4	15	4	4	40
4:00	20	4	6	27	7	6	70
4:15	26	6	6	31	9	7	85
4:30	35	8	6	37	10	11	107
							0
							0

Turning-Movement Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
3:15	7	0	0	5	2	3	17
3:30	3	2	0	4	2	0	11
3:45	0	1	4	6	0	1	12
4:00	10	1	2	12	3	2	30
4:15	6	2	0	4	2	1	15
4:30	9	2	0	6	1	4	22
Total	35	8	6	37	10	11	107

Hourly Total

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
3:00	20	4	6	27	7	6	70
3:15	19	6	6	26	7	4	68
3:30	25	6	6	28	6	8	79

PM School Dismissal Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	TH	RT	LT	TH	LT	RT	
3:30	**25**	**6**	**6**	**28**	**6**	**8**	**79**
PHF (Peak-Hour Factor)	0.63	0.75	0.38	0.58	0.50	0.50	0.66
	0.70		0.61		0.70		

CITY OF NOVI TRAFFIC STUDY
PM Pedestrian Crossing Count for Intersection of White Pines & Moorgate
Tuesday, 10-08-14

Cumulative Pedestrian Crossing Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:15	0	0	0	0	0	0	0
3:30	2	0	0	0	0	2	4
3:45	4	0	0	0	0	3	7
4:00	4	5	0	0	0	3	12
4:15	4	5	0	0	0	3	12
4:30	4	5	0	0	0	3	12
							0
							0

Pedestrian Crossing Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:15	0	0	0	0	0	0	0
3:30	2	0	0	0	0	2	4
3:45	2	0	0	0	0	1	3
4:00	0	5	0	0	0	0	5
4:15	0	0	0	0	0	0	0
4:30	0	0	0	0	0	0	0
Total	4	5	0	0	0	3	12

Hourly Total

[1] Peak hour for vehicular traffic.

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:00	4	5	0	0	0	3	12
3:15	4	5	0	0	0	3	12
3:30[1]	**2**	**5**	**0**	**0**	**0**	**1**	**8**

PM School Dismissal Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Moorgate		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:00	**4**	**5**	**0**	**0**	**0**	**3**	**12**
PHF (Peak-Hour Factor)	0.50	0.25	#DIV/0!	#DIV/0!	#DIV/0!	0.38	0.60
	0.45		#DIV/0!		0.38		

CITY OF NOVI TRAFFIC STUDY
AM Turning-Movement Count for Intersection of White Pines & Bertram
Tuesday, 10-08-14

Cumulative Turning-Movement Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
8:00	5	4	1	1	2	0	13
8:15	10	7	1	5	2	2	27
8:30	15	9	1	10	3	5	43
8:45	16	9	3	11	4	5	48
9:00	21	12	3	12	6	6	60
9:15	29	13	4	14	7	7	74

Turning-Movement Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
8:00	5	4	1	1	2	0	13
8:15	5	3	0	4	0	2	14
8:30	5	2	0	5	1	3	16
8:45	1	0	2	1	1	0	5
9:00	5	3	0	1	2	1	12
9:15	8	1	1	2	1	1	14
Total	29	13	4	14	7	7	74

Hourly Total

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
7:45	16	9	3	11	4	5	48
8:00	16	8	2	11	4	6	47
8:15	19	6	3	9	5	5	47

AM School Arrival Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
7:45	**16**	**9**	**3**	**11**	**4**	**5**	**48**
PHF (Peak-Hour Factor)	0.80	0.56	0.38	0.55	0.50	0.42	0.75
	0.69		0.70		0.56		

CITY OF NOVI TRAFFIC STUDY
AM Pedestrian Crossing Count for Intersection of White Pines & Bertram
Tuesday, 10-08-14

Cumulative Pedestrian Crossing Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
8:00	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0
8:30	0	0	0	0	0	1	1
8:45	0	0	0	0	1	4	5
9:00	0	0	0	0	3	6	9
9:15	0	0	0	0	3	6	9

Pedestrian Crossing Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
8:00	0	0	0	0	0	0	0
8:15	0	0	0	0	0	0	0
8:30	0	0	0	0	0	1	1
8:45	0	0	0	0	1	3	4
9:00	0	0	0	0	2	2	4
9:15	0	0	0	0	0	0	0
Total	0	0	0	0	3	6	9

Hourly Total

[1] Peak hour for vehicular traffic.

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
7:45[1]	**0**	**0**	**0**	**0**	**1**	**4**	**5**
8:00	0	0	0	0	3	6	9
8:15	0	0	0	0	3	6	9

AM School Arrival Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
8:00	**0**	**0**	**0**	**0**	**3**	**6**	**9**
PHF (Peak-Hour Factor)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.38	0.50	0.56
	#DIV/0!		#DIV/0!		0.56		

CITY OF NOVI TRAFFIC STUDY
PM Turning-Movement Count for Intersection of White Pines & Bertram
Tuesday, 10-08-14

Cumulative Turning-Movement Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
3:15	5	4	0	2	4	3	18
3:30	7	4	0	4	6	4	25
3:45	7	5	3	11	9	4	39
4:00	11	7	3	21	12	4	58
4:15	15	11	4	23	14	4	71
4:30	25	16	4	26	17	6	94
							0
							0

Turning-Movement Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
3:15	5	4	0	2	4	3	18
3:30	2	0	0	2	2	1	7
3:45	0	1	3	7	3	0	14
4:00	4	2	0	10	3	0	19
4:15	4	4	1	2	2	0	13
4:30	10	5	0	3	3	2	23
Total	25	16	4	26	17	6	94

Hourly Total

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
3:00	11	7	3	21	12	4	58
3:15	10	7	4	21	10	1	53
3:30	18	12	4	22	11	2	69

PM School Dismissal Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	TH	RT	LT	TH	LT	RT	
3:30	**18**	**12**	**4**	**22**	**11**	**2**	**69**
PHF (Peak-Hour Factor)	0.45	0.60	0.33	0.55	0.92	0.25	0.75
	0.50		0.65		0.65		

CITY OF NOVI TRAFFIC STUDY
PM Pedestrian Crossing Count for Intersection of White Pines & Bertram
Tuesday, 10-08-14

Cumulative Pedestrian Crossing Counts

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:15	0	0	0	0	0	0	0
3:30	0	0	0	0	1	2	3
3:45	0	1	0	0	1	3	5
4:00	1	1	0	0	1	4	7
4:15	1	1	0	0	5	4	11
4:30	1	1	0	0	5	4	11
							0
							0

Pedestrian Crossing Counts by 15-Minute Interval

15 Minutes Ending	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:15	0	0	0	0	0	0	0
3:30	0	0	0	0	1	2	3
3:45	0	1	0	0	0	1	2
4:00	1	0	0	0	0	1	2
4:15	0	0	0	0	4	0	4
4:30	0	0	0	0	0	0	0
Total	1	1	0	0	5	4	11

Hourly Total

[1] Peak hour for vehicular traffic.

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:00	1	1	0	0	1	4	7
3:15	1	1	0	0	5	4	11
3:30[1]	**1**	**1**	**0**	**0**	**4**	**2**	**8**

PM School Dismissal Peak Hour

Hour Beginning	EB White Pines		WB White Pines		NB Bertram		Total
	N to S	S to N	N to S	S to N	W to E	E to W	
3:15	**1**	**1**	**0**	**0**	**5**	**4**	**11**
PHF (Peak-Hour Factor)	0.25	0.25	#DIV/0!	#DIV/0!	0.31	0.50	0.69
	0.50		#DIV/0!		0.56		