



CITY of NOVI CITY COUNCIL

Agenda Item N
August 12, 2013

SUBJECT: Approval to award a contract for design engineering services for the Wixom Road and Glenwood Drive Signal to Orchard, Hiltz & McCliment for a design fee of \$12,736.

SUBMITTING DEPARTMENT: Department of Public Services, Engineering Division

CITY MANAGER APPROVAL: 

EXPENDITURE REQUIRED	\$ 12,736
AMOUNT BUDGETED	\$ 36,980
LINE ITEM NUMBER	204-204.00-863.503

BACKGROUND INFORMATION:

This project involves design of a traffic signal at the intersection of Wixom Road at Glenwood Drive. Engineering staff received separate requests from the Island Lake of Novi Homeowners Association and Novi Community Schools to evaluate this intersection for a traffic signal. The driveway for Deerfield Elementary is located across Wixom Road from Glenwood Drive and would also be served by a potential traffic signal.

The attached 2012 study recommends the installation of a traffic signal at Wixom Road and the Glenwood Drive/Deerfield Elementary School driveway based on vehicle volume during the peak hours of the day. In addition to the delays caused to motorists, the report also noted that the lack of adequate gaps in traffic made the crossing very difficult for pedestrians; therefore the addition of pedestrian signals at the intersection would improve the non-motorized use of the intersection. This intersection was identified in the Non-Motorized Master Plan 2011 as a proposed unsignalized mid-block road crossing; however, based on the findings of the study, it has been determined that this intersection requires a traffic signal in order to function as a mid-block crossing.

The installation of the traffic signal at Wixom and Glenwood/Deerfield along with the implementation of a school speed zone on Wixom Road and the construction of a sidewalk ramp at Wixom Road and 11 Mile Road would allow the school to revisit the issue of expanding the walk zone for Novi Middle and Deerfield Elementary and potentially eliminate some bus routes in Island Lake. We will be sending a copy of this report to the Novi Community School District for their future planning purposes.

OHM's engineering fees are based on the fixed fee schedule established in the Agreement for Professional Engineering Services for Public Projects. The design fees for this project will be \$12,736 (8.0% of the estimated construction cost of \$159,200). The construction phase engineering fees will be awarded at the time of construction award and will be based on the contractor's bid price and the fee percentage established in the Agreement for Professional Engineering Services for Public Projects. A draft of the Supplemental Professional Engineering Services Agreement for this project is enclosed and includes the project scope and estimate.

The design engineering would be completed in preparation for construction in early 2014.

RECOMMENDED ACTION: Approval to award a contract for design engineering services for the Wixom Road and Glenwood Drive Signal to Orchard, Hiltz & McCliment for a design fee of \$12,736.

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

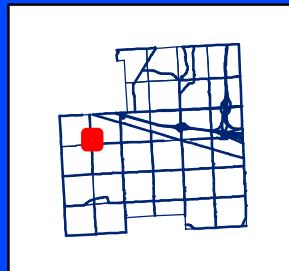
	1	2	Y	N
Council Member Margolis				
Council Member Mutch				
Council Member Wrobel				

Wxom Road and Glenwood Drive Signal

Location Map



Map Author: Croy
Date: 8/2/13
Project: Wixom Rd. and Glenwood Dr. Signal
Version #: v2.0



City of Novi

Engineering Division
Department of Public Services
26300 Lee BeGole Drive
Novi, MI 48375
cityofnovi.org



1 inch = 250 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. Please contact the City GIS Manager to confirm source and accuracy information related to this map.

SUPPLEMENTAL PROFESSIONAL ENGINEERING SERVICES AGREEMENT

WIXOM ROAD/GLENWOOD DRIVE SIGNAL

This Agreement shall be considered as made and entered into as of the date of the last signature hereon, and is between the City of Novi, 45175 W. Ten Mile Road, Novi, MI 48375-3024, hereafter, "City," and Orchard, Hiltz & McCliment, Inc., whose address is 34000 Plymouth Road, Livonia, Michigan 48150, hereafter, "Consultant."

RECITALS:

This Agreement shall be supplemental to, and hereby incorporates the terms and conditions of the AGREEMENT FOR PROFESSIONAL ENGINEERING SERVICES FOR PUBLIC PROJECTS, and attached exhibits, entered into between the City and the Consultant on December 18, 2012.

The project includes the design and the preparation of plans and specifications for a new traffic signal at the intersection of Wixom Road and Glenwood Drive, including pedestrian facilities at all four crossings as appropriate.

NOW, THEREFORE, in consideration of the foregoing, the City and Consultant agree as follows:

Section 1. Professional Engineering Services.

For and in consideration of payment by the City as provided under the "Payment for Engineering Services" section of this Agreement, Consultant shall perform the work described in the manner provided or required by the following Scope of Services, which is attached to and made a part of this Agreement as Exhibit A, all of said services to be done in a competent, efficient, timely, good and workmanlike manner and in compliance with all terms and conditions of this Agreement.

Exhibit A Scope of Services

Section 2. Payment for Professional Engineering Services.

1. Basic Fee.
 - a. Design Phase Services: The Consultant shall complete the design phase services as described herein for a lump sum fee of \$12,736, which is 8.0% of the estimated construction cost (\$159,200) as indicated on the design and construction engineering fee curve provided in Exhibit B of the Agreement for Professional Engineering Services for Public Projects.
 - b. Construction Phase Services will be awarded at the time of construction award, should it occur.

2. Payment Schedule for Professional Engineering Services Fee.

Consultant shall submit monthly statements for professional engineering services rendered. The statements shall be based on Consultant's estimate of the proportion of the total services actually completed for each task as set forth in Exhibit A at the time of billing. The City shall confirm the correctness of such estimates, and may use the City's own engineer for such purposes. The monthly statements should be accompanied by such properly completed reporting forms and such other evidence of progress as may be required by the City. Upon such confirmation, the City shall pay the amount owed within 30 days.

Final billing under this agreement shall be submitted in a timely manner but not later than three (3) months after completion of the services. Billings for work submitted later than three (3) months after completion of services will not be paid. Final payment will be made upon completion of audit by the City.

3. Payment Schedule for Expenses.

All expenses required to complete the scope of services described herein, including but not limited to costs related to mileage, vehicles, reproduction, computer use, etc., shall be included in the basic fee and shall not be paid separately. However, as compensation for expenses that are not included in the standard scope of services, when incurred in direct connection with the project, and approved by the City, the City shall pay the Consultant its actual cost times a factor of 1.15.

Section 4. Ownership of Plans and Documents; Records.

1. Upon completion or termination of this agreement, all documents prepared by the Consultant, including tracings, drawings, estimates, specifications, field notes, investigations, studies, etc., as instruments of service shall become the property of the City.

2. The City shall make copies, for the use of the Consultant, of all of its maps, records, laboratory tests, or other data pertinent to the work to be performed by the Consultant under this Agreement, and also make available any other maps, records, or other materials available to the City from any other public agency or body.

3. The Consultant shall furnish to the City, copies of all maps, records, field notes, and soil tests that were developed in the course of work for the City and for which compensation has been received by the Consultant.

Section 5. Termination.

1. This Agreement may be terminated by either party upon 7- days' prior written notice to the other party in the event of substantial failure by the other party to fulfill its obligations under this agreement through no fault of the terminating party.

2. This Agreement may be terminated by the City for its convenience upon 90 days' prior written notice to the Consultant.

3. In the event of termination, as provided in this Article, the Consultant shall be paid as compensation in full for services performed to the date of that termination, an amount calculated in accordance with Section 2 of this Agreement. Such amount shall be paid by the

City upon the Consultant's delivering or otherwise making available to the City, all data, drawings, specifications, reports, estimates, summaries, and that other information and materials as may have been accumulated by the Consultant in performing the services included in this Agreement, whether completed or in progress.

Section 6. Disclosure.

The Consultant affirms that it has not made or agreed to make any valuable gift whether in the form of service, loan, thing, or promise to any person or any of the person's immediate family, having the duty to recommend, the right to vote upon, or any other direct influence on the selection of consultants to provide professional engineering services to the City within the two years preceding the execution of this Agreement. A campaign contribution, as defined by Michigan law shall not be considered as a valuable gift for the purposes of this Agreement.

Section 7. Insurance Requirements.

1. The Consultant shall maintain at its expense during the term of this Agreement, the following insurance:

- A. Worker's Compensation insurance relative to all Personnel engaged in performing services pursuant to this Agreement, with coverage not less than that required by applicable law.
- B. Comprehensive General Liability insurance with maximum bodily injury limits of \$1,000,000 (One Million Dollars) each occurrence and/or aggregate and minimum Property Damage limits of \$1,000,000 (One Million Dollars) each occurrence and/or aggregate.
- C. Automotive Liability insurance covering all owned, hired, and non-owned vehicles with Personal Protection insurance to comply with the provisions of the Michigan No Fault Insurance Law including Residual Liability insurance with minimum bodily injury limits of \$1,000,000 (One Million Dollars) each occurrence and/or aggregate minimum property damage limits of \$1,000,000 (One Million Dollars) each occurrence and/or aggregate.
- D. The Consultant shall provide proof of Professional Liability coverage in the amount of not less than \$1,000,000 (One Million Dollars) per occurrence and/or aggregate, and Environmental Impairment coverage.

2. The Consultant shall be responsible for payment of all deductibles contained in any insurance required hereunder.

3. If during the term of this Agreement changed conditions or other pertinent factors should in the reasonable judgment of the City render inadequate insurance limits, the Consultant will furnish on demand such additional coverage as may reasonably be required under the circumstances. All such insurance shall be effected at the Consultant's expense, under valid and enforceable policies, issued by the insurers of recognized responsibility which are well-rated by national rating organizations and are acceptable to the City.

4. All policies shall name the Consultant as the insured and shall be accompanied by a commitment from the insurer that such policies shall not be canceled or reduced without at least thirty (30) days prior notice to the City.

With the exception of professional liability, all insurance policies shall name the City of Novi, its officers, agents, and employees as additional insured. Certificates of Insurance evidencing such coverage shall be submitted to Sue Morianti, Purchasing Manager, City of Novi, 45175 West Ten Mile Road, Novi, MI 48375-3024 prior to commencement of performance under this Agreement and at least fifteen (15) days prior to the expiration dates of expiring policies.

5. If any work is sublet in connection with this Agreement, the Consultant shall require each subconsultant to effect and maintain at least the same types and limits of insurance as fixed for the Consultant.

6. The provisions requiring the Consultant to carry said insurance shall not be construed in any manner as waiving or restricting the liability of the Consultant under this Agreement.

Section 8. Indemnity and Hold Harmless.

A. The Consultant agrees to indemnify and hold harmless the City, its elected and appointed officials and employees, from and against any and all claims, demands, suits, losses and settlements, including actual attorney fees incurred and all costs connected therewith, for any damages which may be asserted, claimed or recovered against the City by reason of personal injury, death and/or property damages which arises out of or is in any way connected or associated with the actions or inactions of the Consultant in performing or failing to perform the work.

The Consultant agrees that it is its responsibility and not the responsibility of the City to safeguard the property and materials used in performing this Agreement. Further, this Consultant agrees to hold the City harmless for any loss of such property and materials used pursuant to the Consultant's performance under this Agreement.

Section 9. Nondiscrimination.

The Consultant shall not discriminate against any employee, or applicant for employment because of race, color, sex, age or handicap, religion, ancestry, marital status, national origin, place of birth, or sexual preference. The Consultant further covenants that it will comply with the Civil Rights Act of 1973, as amended; and the Michigan Civil Rights Act of 1976 (78. Stat. 252 and 1976 PA 4563) and will require a similar covenant on the part of any consultant or subconsultant employed in the performance of this Agreement.

Section 10. Applicable Law.

This Agreement is to be governed by the laws of the State of Michigan and the City of Novi Charter and Ordinances.

Section 11. Approval; No Release.

Approval of the City shall not constitute nor be deemed release of the responsibility and liability of Consultant, its employees, associates, agents and subconsultants for the accuracy and competency of their designs, working drawings, and specifications, or other documents and services; nor shall that approval be deemed to be an assumption of that responsibility by the City for any defect in the designs, working drawings and specifications or other documents prepared by Consultant, its employees, subconsultants, and agents.

After acceptance of final plans and special provisions by the City, Consultant agrees, prior to and during the construction of this project, to perform those engineering services as may be required by City to correct errors or omissions on the original plans prepared by Consultant and to change the original design as required.

Section 12. Compliance With Laws.

This Contract and all of Consultants professional services and practices shall be subject to all applicable state, federal and local laws, rules or regulations, including without limitation, those which apply because the City is a public governmental agency or body. Consultant represents that it is in compliance with all such laws and eligible and qualified to enter into this Agreement.

Section 13. Notices.

Written notices under this Agreement shall be given to the parties at their addresses on page one by personal or registered mail delivery to the attention of the following persons:

City: Rob Hayes, P.E., Director of Public Services and Maryanne Cornelius, Clerk, with a copy to Thomas R. Schultz, City Attorney

Consultant: James Stevens, P.E.

Section 14. Waivers.

No waiver of any term or condition of this Agreement shall be binding and effective unless in writing and signed by all parties, with any such waiver being limited to that circumstance only and not applicable to subsequent actions or events.

Section 15. Inspections, Notices, and Remedies Regarding Work.

During the performance of the professional services by Consultant, City shall have the right to inspect the services and its progress to assure that it complies with this Agreement. If such inspections reveal a defect in the work performed or other default in this Agreement, City shall provide Consultant with written notice to correct the defect or default within a specified number of days of the notice. Upon receiving such a notice, Consultant shall correct the specified defects or defaults within the time specified. Upon a failure to do so, the City may terminate this Agreement by written notice and finish the work through whatever method it deems appropriate, with the cost in doing so being a valid claim and charge against Consultant;

or, the City may preserve the claims of defects or defaults without termination by written notice to Consultant.

All questions which may arise as to the quality and acceptability of work, the manner of performance and rate of progress of the work, and the interpretation of plans and specifications shall be decided by the City. All questions as to the satisfactory and acceptable fulfillment of the terms of this agreement shall be decided by the City.

Section 16. Delays.

No charges or claims for damages shall be made by the Consultant for delays or hindrances from any cause whatsoever during the progress of any portions of the services specified in this agreement, except as hereinafter provided.

In case of a substantial delay on the part of the City in providing to the Consultant either the necessary information or approval to proceed with the work, resulting, through no fault of the Consultant, in delays of such extent as to require the Consultant to perform its work under changed conditions not contemplated by the parties, the City will consider supplemental compensation limited to increased costs incurred as a direct result of such delays. Any claim for supplemental compensation must be in writing and accompanied by substantiating data.

When delays are caused by circumstances or conditions beyond the control of the Consultant as determined by the City, the Consultant shall be granted an extension of time for such reasonable period as may be mutually agreed upon between the parties, it being understood, however, that the permitting of the Consultant to proceed to complete the services, or any part of them, after the date to which the time of completion may have been extended, shall in no way operate as a waiver on the part of the City of any of its rights herein set forth.

Section 17. Assignment.

No portion of the project work, heretofore defined, shall be sublet, assigned, or otherwise disposed of except as herein provided or with the prior written consent of the City. Consent to sublet, assign, or otherwise dispose of any portion of the services shall not be construed to relieve the Consultant of any responsibility for the fulfillment of this agreement.

Section 18. Dispute Resolution.

The parties agree to try to resolve any disputes as to professional engineering services or otherwise in good faith. In the event that the parties cannot resolve any reasonable dispute, the parties agree to seek alternative dispute resolution methods agreeable to both parties and which are legally permissive at the time of the dispute. The parties agree to use their best efforts to resolve any good faith dispute within 90 (ninety) days notice to the other party. In the event the parties cannot resolve that dispute as set forth above, they may seek such remedies as may be permitted by law.

WITNESSES

Orchard, Hiltz & McCliment, Inc.

By:

Its:

The foregoing _____ was acknowledged before me this _____ day of _____,
20____, by _____ on behalf of

_____.

Notary Public

_____ County, Michigan

My Commission Expires: _____

WITNESSES

CITY OF NOVI

By: Robert J. Gatt

Its: Mayor

The foregoing _____ was acknowledged before me this _____ day of _____,
20____, by _____ on behalf of the City of Novi.

Notary Public

Oakland County, Michigan

My Commission Expires: _____

EXHIBIT A - SCOPE OF SERVICES

Consultant shall provide the City professional engineering services in all phases of the Project to which this Agreement applies as hereinafter provided. These services will include serving as the City's professional engineering representative for the Project, providing professional engineering consultation and advice and furnishing customary civil, structural, mechanical and electrical engineering services and customary engineering services incidental thereto, as described below.

A. Basic Services.

[see attached]

B. Performance.

1. The Consultant agrees that, immediately upon the execution of this Agreement, it will enter upon the duties prescribed in this agreement, proceed with the work continuously, and make the various submittals on or before the dates specified in the attached schedule. The City is not liable and will not pay the Consultant for any services rendered before written authorization is received by the Consultant.
2. The Consultant shall submit, and the City shall review and approve a timeline for submission of plans and/or the completion of any other work required pursuant to this Scope of Services. The Consultant shall use its best efforts to comply with the schedule approved by the City.
3. If any delay is caused to the Consultant by order of the City to change the design or plans; or by failure of the city to designate right-of-way, or to supply or cause to be supplied any data not otherwise available to the Consultant that is required in performing the work described; or by other delays due to causes entirely beyond the control of the Consultant; then, in that event, the time schedules will be adjusted equitably in writing, as mutually agreed between the City and the Consultant at the moment a cause for delay occurs.
4. Since the work of the Consultant must be coordinated with the activities of the City (including firms employed by and governmental agencies and subdivisions working with the City), the Consultant shall advise the City in advance, of all meetings and conferences between the Consultant and any party, governmental agency, political subdivision, or third party which is necessary to the performance of the work of the Consultant.

EXHIBIT A - Scope of Services

Wixom and Glenwood Traffic Signal

OHM Advisors is pleased to provide engineering services to the City of Novi. We understand that the City wishes to install a traffic signal at the intersection of Wixom Road and Glenwood Drive. In addition, the intersection's pedestrian facilities will be upgraded along with the installation of pedestrian countdown signals.

The scope of engineering services shall include the following tasks:

1. Perform the necessary topographical survey of the project area based upon the planned improvements.
2. Conduct an initial site design visit. The field information pertaining to the following plan elements would be gathered to produce useable drawing(s):
 - a. Streets laneage, lane use, parking, stop bars, and crosswalks on each leg.
 - b. Curb radius, sidewalks, poles, pedestals, fire hydrant, right-of-way, buildings, and any other existing above-ground facilities.
 - c. Posted speeds for all approaches.
2. Prepare a drawing (1"=30') with all the above features shown. We will request information from the utility companies that may be located in the vicinity of the proposed project. We will utilize this information in the design to avoid conflicts, aerial and underground, with proposed signal structures. If the design cannot be adjusted to avoid utility conflicts, we will organize and attend a utility coordination meeting to resolve any conflicts.
3. Arrange an on-site meeting with representatives designated by the City of Novi, including staff from the City, Road Commission for Oakland County (RCOC), and (if applicable) various utility companies that may be located in the vicinity of the proposed project. At the on-site meeting, using the knowledge of attending representatives and/or our own investigations, obtain all necessary information to produce a traffic signal design preliminary plan, which shows the following:
 - a. Removal plan, if needed, with appropriate bid items.
 - b. Installation plan drawing showing traffic and pedestrian signal head placement, supporting structures (poles and pedestals), new conduit, handholes, controllers, signal head mounting details, any necessary phasing diagrams or span calculation diagrams, the reinstallation of any other items disturbed by this design such as street lights, etc., and material list showing all appropriate pay items and quantities.
 - c. Sidewalk and sidewalk ramp upgrades to current standards.
4. Coordinate with the City's Geotechnical Engineer on soil borings, if applicable.
5. Prepare the plans and specifications in accordance with the City of Novi and RCOC standards. We will send preliminary plans for review to the City of Novi, RCOC, and other concerned agencies. Plans will be modified based on recommendations by the reviewing agencies. We will schedule necessary on-site visit(s) to resolve any conflicts with all parties involved.
6. Prepare final plans with any changes that have occurred due to utility conflicts. Prepare final specifications, measurement and payment items, and engineer's estimate.

7. Provide copies of the plans and specifications to facilitate the bidding process.

The following services are not anticipated to be required for this project and have not included:

- ▼ Permit or application fees
- ▼ Coordination or design for utility relocations or repairs
- ▼ Remediation or removal of contaminated or hazardous soils or materials.
- ▼ Preparation of signal timing permit.

We can perform any of these above-mentioned services. In the event any of these services are required, an addendum to the supplemental engineering agreement will be submitted for your approval prior to performing said services.

Tentative Schedule:

1. Design completed by January, 2014
 - Initial on-site meeting with City of Novi, RCOC, and utilities – October, 2013
 - Preliminary plan submittal to City of Novi and RCOC – November, 2013
 - Final submittal – December, 2013
2. Bids received March 2014.
3. Construction to begin June 2014 (School is out of session).

City of Novi

Wixom Road / Glenwood Traffic Signal Intersection Improvements

Capital Improvement Plan: Engineer's Opinion of Probable Construction Cost

Project Assumptions:

- 1 Box span configuration with span wire per RCOC standards.
- 2 Signal components will meet RCOC standards.
- 3 Dedicated left turn phasing is desired.
- 4 Pedestrian crossings are desired on all four quadrants.

Item #	Item Description	Quantity	Unit	Unit Price	Cost
1	Pavement and curb removals	880	Syd	\$ 10.00	\$ 8,800.00
7	Concrete Sidewalk, Ramps, and Pavement Markings	1300	Sft	\$ 8.00	\$ 10,400.00
2	Steel Strain Pole and Foundation	4	Ea	\$ 11,000.00	\$ 44,000.00
3	Span wire, Box (RCOC Spec)	1	LS	\$ 2,000.00	\$ 2,000.00
4	Traffic Signal, Span Wire Mounted, LED (RCOC Spec)	10	Ea	\$ 1,000.00	\$ 10,000.00
5	Pedestrian TS, Countdown, LED	8	Ea	\$ 1,000.00	\$ 8,000.00
6	Pushbutton, signs, and pedestals	8	Ea	\$ 1,500.00	\$ 12,000.00
7	Controller, cabinet, and foundation	1	Ea	\$ 15,000.00	\$ 15,000.00
8	Optical Priority Control System (RCOC spec)	1	Ea	\$ 5,000.00	\$ 5,000.00
9	RCOC Force Account (controller program, autoscope cameras, SCATS)	1	LS	\$ 30,000.00	\$ 30,000.00
10	Mobilization (10%)	1	LS	\$ 14,000.00	\$ 14,000.00
11	Contingency (10%)	1	LS	\$ 14,000.00	\$ 14,000.00

TOTAL \$ 173,200.00

November 13, 2012

Brian T. Coburn, P.E.
Engineering Manager
Dept. of Public Services, City of Novi
26300 Lee BeGole Drive
Novi, MI 48375



Subject: Signal Warrant Study at Wixom Road and Glenwood Drive / Deerfield Elementary

Dear Mr. Coburn:

We have completed the signal warrant study outlined in our approved proposal of October 4, 2012. At your suggestion after the study began, we have also revisited our 2010 recommendation that a school speed zone be installed on Wixom Road near the two schools (by law, this requires a formal request by the school district). This letter presents our key findings, conclusions, recommendations, and supporting analyses.

Key Findings, Conclusions, and Recommendations

1. Existing conditions satisfy one signal installation warrant (#3B: Peak-Hour Vehicular Volume, during both the AM and PM peak hours) and nearly meets a second signal installation warrant (#2: Four-Hour Vehicular Volume, falling only four vehicles or 6.7% short in one hour).
2. Traffic volumes on Wixom Road have increased about 20% in the past two years, and the 85th-percentile speed near Deerfield Elementary is slightly higher than previously determined (at 40.5 mph).
3. Motorists waiting to turn left onto Wixom Road often reduce their long delays by pulling forward over the crosswalk and accepting smaller-than-desirable gaps in through traffic. The resulting increase in traffic conflicts should be considered problematic given the presence of pedestrians and school buses.
4. Gaps in through traffic are inadequate for safe pedestrian crossing of Wixom Road. During the AM peak hour of October 25, for example, 14 crossing pedestrians had to choose among only 22 adequate gaps. To reduce the gap size accepted and therefore the delay, crossing pedestrians often run.
5. There is likely a latent pedestrian crossing demand – stemming from the presence of athletic facilities and schools east of the road and most nearby homes west of the road – that would materialize if a traffic signal were installed. Currently, there is no safe pedestrian crossing location between Ten Mile Road and Catholic Central High School (a distance of 1¾ miles).
6. A signal at Glenwood would aid left turns from 11 Mile Road (0.21 mile to the south) – by creating gaps in southbound traffic – as well as left turns from Island Lake Drive (0.25 mile to the north) – by creating gaps in northbound traffic. The new signal would be 0.51 mile from the first existing signal to the north.
7. Considering all of the above factors, we believe that the City would be well-advised to install a signal at the intersection of Wixom and Glenwood/Deerfield Elementary. We again recommend that such a signal be semi-actuated and operate in a flashing mode overnight (9:00 p.m.-6:00 a.m.). Count-down pedestrian signals with push buttons, and improved intersection lighting, should be included.
8. We recommend that you urge the Superintendent of Schools to request the posting of a 25-mph school speed zone on Wixom Road, from 200 ft south of 11 Mile to 650 ft north of Glenwood.

9. About a month after the above new traffic controls have been implemented, we recommend that you conduct a follow-up speed study at the locations monitored in our 2010 study, to determine whether or not the road's overall 35-mph speed limit should be changed. (The signal and school speed zone may have some carryover effectiveness in reducing speeds away from their immediate location.)
10. Lastly, we suggest that you begin planning for the eventual installation of a roundabout at the intersection of Wixom and 11 Mile. In conjunction with a signal at Glenwood, a roundabout at 11 Mile would serve to calm traffic and help maintain Wixom Road's status as a residential-oriented minor arterial (as opposed to a more prominent commuter arterial route).

Existing Conditions

Design Issues – As indicated above, signaling the subject intersection would provide an ample ½ mile between the new signal and the first existing signal to the north (at Catholic Central High School / Novi Promenade Shopping Center; see Figure 1). This is a nearly ideal signal spacing for a suburban road, and as such, may tend to calm speeds somewhat.

The first existing signal to the south is at Wixom and 10 Mile, nearly 1¼ mile away. The 0.21-mile spacing relative to a possible future signal at Wixom and 11 Mile would be slightly less than the ¼-mile spacing normally considered the minimum desirable distance between suburban signals, but would be mitigated by Wixom Road's lower-than-normal arterial speed limit of 35 mph. Also, if and when upgraded traffic control becomes warranted at Wixom and 11 Mile, the City may have the option of installing a roundabout there in lieu of a signal, potentially calming traffic even more effectively than another signal (Figure 2).

As illustrated in Figure 3, the subject intersection has a unique design aligning the east-west left turns (for good visibility and safety), despite the presence of a boulevard island on one side of Wixom Road but not the other. Also, it should be noted that smooth westbound through movements are facilitated by a taper on one side of Glenwood's island (although the right-only arrow on the opposing school drive is incorrect and should be a combined through-right arrow). Given the presence of turn lanes on all approaches as well as the carefully coordinated lane alignments, the intersection was designed to be, and remains, signal-ready.

Hourly Approach Volumes – Most signal warrants of interest evaluate hourly approach volumes. For this study, City personnel installed automated (hose) counting equipment on all four intersection approaches and collected 48 hours of volume and speed data, beginning around midday on a recent Tuesday. We have summarized the raw volume data provided by the City in a single table; see appendix Table A-1.

Table A-1 shows that the average daily approach volumes were 378 vehicles eastbound, 706 vehicles westbound, 5,148 vehicles northbound, and 5,233 vehicles southbound. Noteworthy is the fact that the new counts indicate a two-way ADT volume on Wixom at Glenwood of 10,381, a value about 20% higher than our November 2010 speed study determined just ¼ mile up the road at Island Lake Drive.

Speed Data – The hose setups used by the City to determine approach volumes were also able to record speeds. Table 1 (below) summarizes the speed data collected, in the format we have used in past speed limit evaluation studies.

Table 1 shows that the average daily speed is now 36.7 mph and the 85th-percentile is 40.5 mph. In our November 2010 sample nearer Island Lake Drive, the average speed was 34.5 mph and the 85th-percentile was 39.9 mph. The 2.2-mph increase in average speed is probably statistically significant, but the 0.6-mph



Figure 1. Wixom Road North of 11 Mile Road



Figure 2. Deerfield Elementary / Novi Middle School Campus





Figure 3. Intersection of Wixom Road, Glenwood Drive, and School Driveway

**Table 1. Summary of Speed Statistics for Wixom Road
for October 23-26, 2012**

Sampling Location	Dir.	Date	Sample Size	Speed (mph)			
				Average	85th %tile	10-mph Pace	% in Pace
On NB & SB approaches to Glenwood Dr / Deerfield Elementary	NB	10-23-12 (> 1 pm)	2276	38.1	42.8	35-45	76.4%
		10-24-12	5271	36.5	39.7	30-40	86.0%
		10-25-12	5314	38.6	43.1	35-45	79.8%
		10-26-12 (< 1 pm) ¹	2582	35.9	39.4	30-40	88.4%
		Average Day	5148	37.4	41.3	-	82.9%
	SB	10-23-12 (> 1 pm)	3301	36.1	39.6	30-40	86.5%
		10-24-12	5353	35.9	39.6	30-40	86.4%
		10-25-12	5356	36.0	39.7	30-40	85.4%
		10-26-12 (< 1 pm) ¹	1690	35.7	39.5	30-40	85.0%
		Average Day	5233	36.0	39.6	30-40	85.9%
	Both	Average Day	10381	36.7	40.5	30-40	86.2%

¹ Since sampling on last day stopped 1 hr short of 72 hrs, volume this day was increased here by average of 12-1 pm volume on 2 earlier days.
Note: On Nov 15-17, 2010, 2-way ADT volume on Wixom just north of Island Lake Dr was 8704 and 85th-percentile speed was 39.9 mph.

increase in 85th-percentile speed is likely not. However, the above trends in speed as well as volume may be matters of concern relative to school traffic safety.

Peak-Hour Turning-Movement Volumes – To facilitate an analysis of intersection operations with and without a signal, Birchler Arroyo staff made manual turning-movement counts during three periods of a recent weekday bracketing the school dismissal peak hour as well as the usual commuting peak hours. The weather was pleasant and unusually warm for late October; hence, the volumes observed are likely conservatively high. The results of our manual traffic counting are detailed in Appendix A and summarized in Table 2 (below). As indicated in the table, the peak hours corresponding to the three periods were found to be 7:00-8:00 a.m., 2:30-3:30 p.m., and 5:00-6:00 p.m.

Gap Data – With the City's concurrence, Traffic Data Collection (TDC) was retained (due to its unique expertise) to automatically determine and record traffic gaps near the subject intersection. At our request, gaps northbound, southbound, and north- versus southbound were determined (see TDC's raw data in Tables B-1, B-2, and B-3, respectively). Gaps northbound are relevant to right turns from the school drive; gaps southbound are relevant to right turns from Glenwood; and gaps in opposing directions of traffic are relevant to left turns from both minor approaches. The latter type of gap is also highly relevant relative to the pedestrian crossing of Wixom Road at this location.

As can be seen in the above-cited appendix tables, gaps were compiled (at our request) in the following "bins": 1-5 sec, 6-9 sec, 10-13 sec, 14-16 sec, 17-19 sec, 20-22 sec, six successive 2-sec intervals, and finally, 35-9999 sec. According to the *Traffic Engineering Handbook* (ITE, 1992), the first six of the preceding gap sizes are typically accepted by zero, one, two, three, four, and five side-road drivers, respectively. As many as six such drivers are typically assumed able to accept gaps of 23 sec or longer.

Appendix Tables B-1a, B-1b, B-2a, and B-2b apply the preceding gap acceptance assumptions to estimate the number of "effective gaps" for turning movements from the two side streets involved here, and Table 3 (below) summarizes the implications of resultant findings. Note that the number of turning vehicles in each peak hour generally represent relatively low percentages of the effective gaps available: only 4-11% except for right turns from Deerfield Elementary in the AM peak hour, where the percentage rises to 27%. ITE advises that "if the volume of traffic projected to enter from the cross street is about one-half the number of gaps available, no traffic control [i.e., signal] is likely to be needed." Absent concern about the delays incurred by side-street vehicles and their possible effects on gap acceptance and safety, the gap data collected does not appear to strongly support signalization from the standpoint of serving side-street traffic.

With respect to the pedestrian crossing of Wixom Road at this location, which is 70 ft wide at the marked crosswalk, a minimum gap size of 23 sec is desirable. This is based on assuming a pedestrian start-up time of 3 sec (per the Iowa DOT in its recommended method for evaluating school crossings) as well as the nationally recommended crossing speed of 3.5 ft per second.

Table 4 (below) shows that the number of pedestrians already crossing Wixom Road in the school arrival and dismissal peak periods represent fairly significant percentages of the number of safe gaps (64% and 50%, respectively). Even more prominently than in the gap study for side-street vehicles, it is apparent that those waiting for gaps in traffic are impatient and therefore inclined to accept small-than-desirable gaps. During our manual traffic counting periods, it was noted that a majority of crossing pedestrians appeared to feel rushed, and many ran across the road to avoid extended wait times.

Table 2. Peak-Hour Turning-Movement Volumes and Percent Trucks¹

Approach	Movement	7:00-8:00 AM Peak Hour			2:30-3:30 PM Peak Hour			5:00-6:00 PM Peak Hour		
		Trks/Buses	Total Veh.	%Trks/Buses	Trks/Buses	Total Veh.	%Trks/Buses	Trks/Buses	Total Veh.	%Trks/Buses
EB	LT	0	16	0%	1	17	6%	0	14	0%
	TH	0	3	0%	0	1	0%	0	3	0%
	RT	1	26	4%	1	17	6%	0	18	0%
WB	LT	0	5	0%	0	6	0%	0	27	0%
	TH	3	5	60%	0	2	0%	0	5	0%
	RT	0	89	0%	0	55	0%	0	52	0%
NB	LT	1	10	10%	2	10	20%	0	19	0%
	TH	0	757	0%	13	327	4%	6	386	2%
	RT	0	20	0%	0	13	0%	0	22	0%
SB	LT	0	50	0%	0	18	0%	0	64	0%
	TH	3	320	1%	3	587	1%	1	578	0%
	RT	0	7	0%	0	14	0%	2	19	11%

¹ See detailed count data, for Thursday, 10-25-12, in Appendix A.

Table 3. Evaluation of Gaps for Turns Out of Side Streets¹

Peak Hour	Left Turns			Right Turns					
				From Deerfield Elementary			From Glenwood Drive		
	Volume EB+WB	NB v. SB Effective Gaps	% Volume to Gaps	Volume WB	NB Effective Gaps	% Volume to Gaps	Volume EB	SB Effective Gaps	% Volume to Gaps
7:00-8:00 am	21	328	6%	89	334	27%	26	511	5%
2:30-3:30 pm	23	408	6%	55	578	10%	17	482	4%
5:00-6:00 pm	41	361	11%	52	530	10%	18	461	4%

¹ See Table 2 for volumes and appendix Tables B-1a, B-1b, B-2a, and B-2b for available gaps.

Table 4. Evaluation of Gaps for School-Related Pedestrian Crossing

Pedestrian Peak Period ¹	Volume of EB+WB Pedestrians ²	No. of Gaps \geq 23 sec ³			% Volume to Gaps
		10-24-12	10-25-12	Average	
7:45-9:15 am	14	25	19	22	64%
2:15-4:30 pm	15	31	29	30	50%

¹ AM period reflects only elementary students, and PM period reflects both middle school and elementary students.

² See appendix Table A-2.

³ Equal to ped start-up time (3.0 sec, per Iowa DOT School Crossing Study) + crossing distance (70 ft) divided by crossing speed (3.5 ft/sec).

Recent Crash History – Five full calendar years of summary crash data (2007-2011) were obtained from the Traffic Improvement Association (see Appendix C). Somewhat surprisingly, given our observations of current traffic conditions, there were only three police-reported crashes:

- At 6:35 p.m. on June 4, 2008, a driver slowed for geese in the road, and a following driver was unable to stop in time to avoid both a rear-end crash and a rebound into the roadside grass. The presence of a traffic signal would only have made a difference if the geese decided to cross while that signal was red for Wixom Road traffic.
- At 10:00 a.m. on August 5, 2010, a driver turning left out of the school driveway failed to yield to a northbound vehicle. This crash would likely not have occurred if a signal existed.
- At 6:00 p.m. on December 23, 2011, a southbound vehicle hit an animal in the road. Again, it is not obvious that a signal would have made a difference.

Evaluation of Signal Installation Warrants

As discussed at some length in the 2011 *Michigan Manual on Uniform Traffic Control Devices*, new traffic signals can offer disadvantages to the motoring public – such as increased rear-end crashes – as well as (the more obvious) advantages – such as more orderly movement of traffic and decreased side-road delays. Hence, the installation of a new signal requires careful engineering study. A key part of such study is the evaluation of a series of warrants prescribed by the *MMUTCD*. Although strictly speaking, the need for a signal can be justified with the satisfaction of only one warrant, meeting multiple warrants can be

viewed as establishing a stronger case for signal installation. In no case does warrant satisfaction require that a signal be actually installed; engineers are repeatedly advised to consider alternatives (see, for instance, *MMUTCD* Section 4B.04).

Warrants Evaluated – The *MMUTCD* offers nine different signal warrants for possible evaluation, some containing multiple parts. Not all warrants apply to a given situation. Since experience has shown that most warrants will not be met if Warrant 3B, the Peak-Hour Volume Warrant, is not also met, we prefer to first evaluate only the applicable volume-related warrants; in this case the following:

- ❑ **Warrant 1, Eight-Hour Vehicular Volume** – This warrant includes two conditions: A - Minimum Vehicular Volume and B – Interruption of Continuous Traffic. A is “intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal,” and B is “intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.” Warrant 1 is treated as a single warrant: If A is satisfied, Warrant 1 is satisfied and further analysis of the warrant is unnecessary; if A is not satisfied but B is, further analysis is similarly unnecessary; however, if neither A nor B is satisfied, Warrant 1 is satisfied if both A and B are satisfied at the 80% level. Warranting volumes are presented in our Results section (below).
- ❑ **Warrant 2, Four-Hour Vehicular Volume** – This warrant is “intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.” The warrant is considered satisfied if, for each of any four hours of an average day, the combination of major and minor approach volumes defines a point located above the applicable curve of the appropriate figure in the *MMUTCD*.
- ❑ **Warrant 3, Peak Hour** – This warrant is “intended for use at a location where traffic conditions are such that for a minimum of one hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.” A related *MMUTCD* “standard” states: “This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.” Similar to Warrant 1, Warrant 3 has two parts: A – Combination of minor-approach stopped delay, minor-approach volume, and total volume entering intersection, and B – At least one point located above an applicable curve. Warrant 3 is met if conditions in either part are met; since part B was first found to be met, the evaluation of part A was found unnecessary and therefore not done.
- ❑ **Warrant 7, Crash Experience** – This warrant is “intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.” This warrant is met only if three separate criteria are demonstrated: A – Adequate trial of alternatives (to signalization) has failed to reduce crash frequency; B – There were five or more reported crashes, of types susceptible to “correction” by a signal, within a 12-month period; and C – Eight-hour volumes reached or exceeded threshold values specified in the Manual.

Speeds on Major Street – The *MMUTCD* reduces the threshold values by 30% when the major street’s posted or statutory speed limit, or 85th-percentile speed, exceeds 40 mph. Since this study found a current 85th-percentile speed on Wixom Road of 40.5 mph, this warrant reduction applies here.

Warrant Evaluation Results – Table 5 (below) summarizes our evaluation of Warrants 1A, 1B, 2, and 3B, and Table 6 (below) summarizes our evaluation of the Warrant 1 Combination of A and B. Key findings are as follows:

- ❑ Warrant 1A, Eight-Hour Minimum Vehicular Volume, is not met since the required minor-approach hourly volume (105 vehicles) exists during only one hour of the day.
- ❑ Warrant 1B, Eight-Hour Interruption of Continuous Traffic, is not met since the required minor-approach hourly volume (53 vehicles) exists in only five rather than eight (or more) hours.
- ❑ Warrant 1, Combination of A and B, is not met. Table 6 shows that 1B is met at the 80% level in seven (of the needed minimum of eight) hours; however, 1A is met at that level in only two hours.
- ❑ Warrant 2, Four-Hour Vehicular Volume, is *very nearly* met. Volumes on both streets exceeded the threshold values plotted in MMUTCD Figure 4C-2 in three of the four necessary hours: 7:00-8:00 a.m., 3:00-4:00 p.m., and 5:00-6:00 p.m. In the one intervening hour, 4:00-5:00 p.m., there was an adequate volume of through traffic, but the minor approach volume was 56 vehicles – just four short of the 60 needed for this hour to qualify and the overall warrant to be satisfied. It is quite possible that a random traffic volume fluctuation on another counting day would have produced the warranting volume.
- ❑ Warrant 3B, Peak-Hour Volume, IS met. Volumes on both streets exceeded the threshold values plotted in MMUTCD Figure 4C-4 in two hours (one more than the minimum necessary): 7:00-8:00 a.m. and 5:00-6:00 p.m.
- ❑ Warrant 7, Crash Experience, is not met, since there were not five or more preventable crashes within a 12-month period.

Peak-Hour Capacity Analyses

The *MMUTCD* states (in Section 4C.01) that “A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.” To assist in an operational evaluation of the subject intersection, this study modeled peak-hour intersection operation under existing volumes, both with and without a fully-actuated (SCATS) signal. The study also modeled both unsignalized and signalized operation for the year 2032, assuming an overall traffic growth of 22% (i.e., 1% per year compounded annually for 20 years).

Method and Criteria – Intersection capacity analyses were conducted using Synchro 7 software, based on methodologies contained in the Highway Capacity Manual (Transportation Research Board, 2000). The primary objective of such analyses is to determine the level of service, a qualitative measure of the “ease” of traffic flow based on average vehicular delay. Analytical models are used to estimate the average control delay for specific vehicular (through or turning) movements – and in the case of all-way stop-controlled and signalized intersections – each approach and the overall intersection as well. The models account for lane configuration, grade (if any), type of traffic control, traffic volume and composition, and other traffic flow parameters. Detailed printouts from the Synchro analyses are presented in Appendix D.

Level of service (LOS) is expressed using a letter grading scale, with A being the highest level and F being the lowest level. Achieving an overall intersection and/or approach LOS of D or better is the normal

Table 5. Evaluation of Signal Warrants 1A, 1B, 2, and 3B at Wixom and Glenwood / Deerfield Elementary: >40 mph, One Lane v. One Lane¹

Hour Beginning	Weekday Hourly Volumes (October 2012)		Warrant 1A (8 hrs - Minimum Vehicular Volume)			Warrant 1B (8 hrs - Interruption of Continuous Traffic)			Warrant 2 (4-Hr Veh. Vol.)	Warrant 3B (Peak Hr - Vol.)
	Wixom Road - Major Road: Total of NB & SB Approaches	Deerfield - Minor Road: WB Approach	Meets Major Street Warrant? (350)	Meets Minor Street Warrant? (105)	Meets Both (Major + Minor) Warrants?	Meets Major Street Warrant? (525)	Meets Minor Street Warrant? (53)	Meets Both (Major + Minor) Warrants?	Meets Warrant? (4 hrs re: MMUTCD Fig. 4C-2)	Meets Warrant? (1 hr re: MMUTCD Fig. 4C-4)
12 a.m.	39	0								
1 a.m.	19	0								
2 a.m.	9	0								
3 a.m.	12	0								
4 a.m.	28	1								
5 a.m.	96	0								
6 a.m.	368	16	Y							
7 a.m.	1024	91	Y			Y	Y	Y	Y	Y
8 a.m.	670	48	Y			Y				
9 a.m.	505	40	Y							
10 a.m.	455	11	Y							
11 a.m.	490	19	Y							
12 p.m.	556	25	Y			Y				
1 p.m.	429	18	Y							
2 p.m.	700	46	Y			Y				
3 p.m.	881	65	Y			Y	Y	Y	Y	
4 p.m.	898	56	Y			Y	Y	Y	4 veh short	
5 p.m.	972	108	Y	Y	Y	Y	Y	Y	Y	Y
6 p.m.	822	39	Y			Y				
7 p.m.	579	62	Y			Y	Y	Y		
8 p.m.	398	55	Y				Y			
9 p.m.	270	1								
10 p.m.	110	1								
11 p.m.	50	3								
Total	10381	705	Yes (15)	No (1<8)	NO (1<8)	Yes (9)	No (6<8)	NO (5<8)	ALMOST (3)	YES (2)

Ref: *Michigan Manual on Uniform Traffic Control Devices (MMUTCD)*, published in December 2011 by Michigan Departments of Transportation and State Police.

¹ Since 85th-percentile speed on Wixom is 40.5 mph, MMUTCD's "70% Factor" applies (+ Figs 4C-2, 4C-4). Turn-lane volumes on both roads are minor; per MMUTCD, turn lanes not counted.

Table 6. Evaluation of Signal Warrant 1 - Combination of A and B - at Wixom and Glenwood / Deerfield Elementary

Hour Beginning	Weekday Hourly Volumes (October 2012)		80% of Warrant 1.A (8 hrs)			80% of Warrant 1.B (8 hrs)			Combination Warrant (8 hrs)
	Wixom Road - Major Road: Total of NB & SB Approaches	Deerfield - Minor Road: WB	Meets Major Street Warrant? (280)	Meets Minor Street Warrant? (84)	Meets Both Warrants?	Meets Major Street Warrant? (420)	Meets Minor Street Warrant? (42)	Meets Both Warrants?	Meets 80% of Warrants 1.A & 1.B?
12 a.m.	39	0							
1 a.m.	19	0							
2 a.m.	9	0							
3 a.m.	12	0							
4 a.m.	28	1							
5 a.m.	96	0							
6 a.m.	368	16	Y						
7 a.m.	1024	91	Y	Y	Y	Y	Y	Y	Y
8 a.m.	670	48	Y			Y	Y	Y	
9 a.m.	505	40	Y			Y			
10 a.m.	455	11	Y			Y			
11 a.m.	490	19	Y			Y			
12 p.m.	556	25	Y			Y			
1 p.m.	429	18	Y			Y			
2 p.m.	700	46	Y			Y	Y	Y	
3 p.m.	881	65	Y			Y	Y	Y	
4 p.m.	898	56	Y			Y	Y	Y	
5 p.m.	972	108	Y	Y	Y	Y	Y	Y	Y
6 p.m.	822	39	Y			Y			
7 p.m.	579	62	Y			Y	Y	Y	
8 p.m.	398	55	Y				Y		
9 p.m.	270	1							
10 p.m.	110	1							
11 p.m.	50	3							
Total	10381	705	Yes (15)	No (2<8)	NO (2<8)	Yes (13)	Yes (8)	NO (7<8)	NO (2<8)

Ref: Michigan Manual on Uniform Traffic Control Devices (MMUTCD), published in December 2011 by Michigan Departments of Transportation and State Police.

¹ Since 85th-percentile speed on Wixom is 40.5 mph, the 56% columns in MMUTCD Table 4C-1 apply. Turn-lane volumes on both roads are minor; per MMUTCD, turn lanes not counted.

objective in an urbanized area. Table 7 defines LOS, in terms of average control delay per vehicle, for signalized intersections and unsignalized intersections, respectively.

Table 7. Level of Service Criteria

Level of Service	Control Delay per Vehicle (sec)	
	Signalized Intersections	Unsignalized Intersections
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Results for Unsignalized Intersection Operation – The top one third of Table 8 (on next page) shows relatively poor intersection operation in all three peak hours evaluated (side-road levels of service of E-F, primarily F). Most noteworthy is the AM peak hour, when the model predicts an average delay for the eastbound left turn of some 500 seconds (and as can be seen in the Appendix D Synchro printouts, delay for this movement in the future would become so high as to be incalculable). Would-be left-turn drivers are likely reducing their actual delays somewhat by accepting smaller – i.e., less safe – gaps than Synchro assumes. However, impatient drivers distracted by difficulty entering the traffic stream are a matter of significant concern at this particular location, given the school turning traffic, buses, and occasional child pedestrians.

Results for Signalized Intersection Operation – The middle and bottom thirds of Table 8 show that the installation of a SCATS traffic signal at this location can be expected to produce an overall level of service (LOS) of B in both the current and future peak hours. Under current volumes, typical signal operation would afford LOS C on the minor approaches in the morning and late-afternoon peak hours and LOS B in the school dismissal peak hour. Through traffic on Wixom Road would experience LOS A or B.

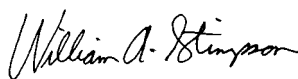
In summary, then, inadequate gaps in Wixom Road traffic significantly increase risks for crossing pedestrians as well as motorists approaching from Glenwood or the school campus. Peak-hour traffic volumes meet signal installation warrants. A signal at this location would aid crossing pedestrians and likely increase their numbers; assist drivers in safely turning both from and to the minor approaches; and generally calm traffic. Finally, with or without a signal, the installation of a 25-mph school speed zone during appropriate hours would provide a significant safety benefit.

Feel free to call us with any questions regarding this report.

Sincerely,
BIRCHLER ARROYO ASSOCIATES, INC.



Rodney L. Arroyo, AICP
Vice President



William A. Stimpson, P.E.
Director of Traffic Engineering

Table 8. Peak-Hour Levels of Service

Approach	Movement	AM Peak Hour			Dismissal Peak Hour			PM Peak Hour		
		Volume	Delay	LOS	Volume	Delay	LOS	Volume	Delay	LOS
Current Traffic with East-West STOP Signs										
EB	L	16	500.1	F	17	46.0	E	14	85.7	F
	T + R	29	14.2	B	18	14.4	B	21	19.9	C
WB	L	5	57.2	F	6	29.3	D	27	95.4	F
	T + R	94	51.9	F	57	12.5	B	57	15.6	C
NB	L	10	8.1	A	10	9.5	A	19	9.8	A
SB	L	50	10.6	B	18	8.1	A	64	8.5	A
Current Traffic with SCATS Signal										
All		1308	16.2	B	1067	10.6	B	1207	12.1	B
EB	L	16	26.2	C	17	19.9	B	14	21.5	C
	T + R	29	25.3	C	18	19.3	B	21	21.0	C
WB	L	5	25.5	C	6	19.6	B	27	22.7	C
	T + R	94	26.1	C	57	19.6	B	57	21.4	C
NB	L	10	5.5	A	10	6.3	A	19	7.9	A
	T	757	18.0	B	327	7.3	A	386	8.2	A
	R	20	5.9	A	13	5.7	A	22	6.3	A
SB	L	50	11.7	B	18	5.4	A	64	4.7	A
	T	320	6.5	A	587	10.5	B	578	13.2	B
	R	7	5.1	A	14	5.7	A	19	5.4	A
Future Traffic with SCATS Signal¹										
All		1596	21.5	B	1302	12.1	B	1473	14.6	B
EB	L	20	37.1	D	21	21.9	C	17	26.9	C
	T + R	35	34.8	C	22	21.0	C	26	26.0	C
WB	L	6	35.2	D	7	21.4	C	33	29.1	C
	T + R	115	43.7	D	70	21.4	C	70	26.6	C
NB	L	12	4.8	A	12	7.4	A	23	10.7	B
	T	924	22.8	C	399	7.3	A	471	7.9	A
	R	24	5.2	A	16	5.4	A	27	5.8	A
SB	L	61	22.4	C	22	5.1	A	78	4.2	A
	T	390	5.6	A	716	12.9	B	705	16.7	B
	R	9	4.2	A	17	5.4	A	23	4.9	A

¹ Synchro printouts for future traffic with stop signs can be found in Appendix C.