



Ulteig

**Grand Forks School
Traffic Control Device
Strategy Study**

Submitted to:
Grand Forks/East Grand Forks
Metropolitan
Planning Organization

Submitted by:
Ulteig Engineers, Inc.

**Traffic Control Strategy Report
Grand Forks School Traffic Control Device Strategy Study
Grand Forks, North Dakota
UEI Project No. 107.0667**

I hereby certify that the attached plan, specification, and report was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of North Dakota.



ULTEIG ENGINEERS
FARGO BISMARCK MINNEAPOLIS DETROIT LAKES SIOUX FALLS

April 2008

School Traffic Control Device Strategy Report

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Traffic Control Device Strategy Report

Grand Forks, North Dakota

UEI Project No. 107.0667

April 28, 2008

I. Project Purpose and Need

The Grand Forks/East Grand Forks Metropolitan Planning Organization (MPO) has identified the need to develop traffic control strategies for school areas to create a more uniform approach to traffic control. A uniform approach for school traffic control devices promotes consistent behavior on the part of the motorists, pedestrians and bicyclists. Inconsistent school traffic control throughout the City of Grand Forks can cause confusion, possibly prompting wrong decisions and contributing to crashes.

The existing traffic control devices currently in place were installed in compliance with the version of the Manual on Uniform Traffic Control Devices (MUTCD) current at that time. Since then, modifications may have been made to the MUTCD changing the regulations regarding school traffic control devices. Updates to the MUTCD will also continue in the future as new technologies are discovered and devices/methods are improved. Costs due to keeping the traffic control current will be incurred.

The Grand Forks Public School District currently serves around 8,000 students. The School District does not provide transportation, except for special education students; therefore students are responsible for their own transportation to and from school. Safe Route to School maps are available for each of the elementary schools. These maps illustrate which routes are supposed to be used, and more importantly, where school crossings should be located and used.

This report provides a review of the issues and impacts related to the proposed school traffic control strategies for the Grand Forks School District. The Study focused on school related crossings located within the City of Grand Forks. Existing crossings which have been marked or signed for non-school related reasons are not affected by this Study.

A. Study Area and Project Scope

The Study Area included the entire City of Grand Forks and addresses conditions for all public and private school related pedestrian crossing activity. Given the size of the study area and the large number of crossings that are addressed, it was not feasible within the scope of the Study to examine individual crossing locations to any level of detail. Rather, this Study considered how school traffic control is generally applied within the City and provided analysis and recommendations intended to correct observed inconsistencies and provide needed uniformity.

II. TAC & Ad Hoc Committee

Ulteig Engineers, Inc. was contracted by the Grand Forks/East Grand Forks MPO to complete the Traffic Control Device Strategy Report. The MPO’s Technical Advisory Committee (TAC) was used as a steering committee throughout the project. Members of the TAC included Grand Forks and East Grand Forks City and County representatives, as well as State DOT and FHWA representatives.

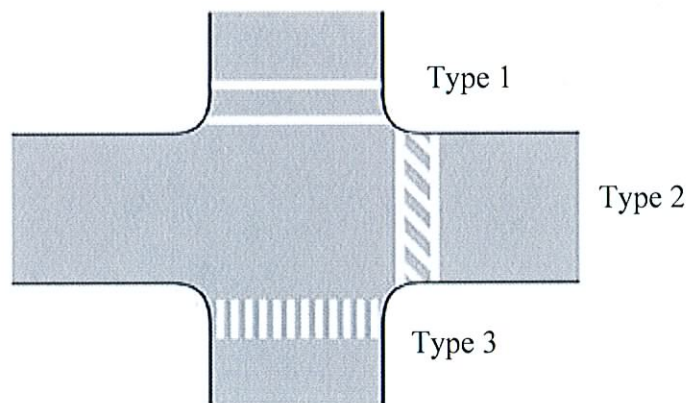
An Ad Hoc Committee was also formed to provide input on the strategies. Members of the Ad Hoc Committee included representatives from the City of Grand Forks, the Grand Forks School District, SAFE KIDS, Grand Forks Police Department, and MPO staff.

III. Existing Conditions

A. Pavement Markings

Aerial photography and Grand Forks GIS maps were provided to determine where the school crossings are currently marked. This information was supplemented by MPO staff. While the data and maps provide an incomplete picture of existing pavement marking conditions, they did assist in identifying pavement markings at many existing school crossing locations.

The MPO went out to each of the school locations and took an inventory of pavement markings at all of the signed crossings. Of the crosswalks that were marked, the majority of them were type 3 markings (transverse lines), and some were type 1 (longitudinal lines). There were no crosswalks identified that had type 2 markings (diagonal lines).



Pavement markings within the City of Grand Forks were applied over the course of years for a variety of reasons:

- Wherever crossing activity was observed
- In response to a request
- On the basis of an identified or perceived need

As a result, placement of pavement markings at many locations was in reaction to conditions. This method of application is in contrast to the desired method of application which is based on an analytical effort to determine the most desirable and safe locations for crossings to occur.

It has also been observed that while some schools have few marked crossings, some schools have an abundance of them. This Study provides recommendations that focus on adherence to the Safe Routes to School Maps, which were prepared to promote crossings at the most desirable and safe locations available.

B. Traffic Control Signs

The Grand Forks traffic control inventory identifies which signs are currently being used for school crossings. The existing traffic control devices currently in place were installed in compliance with the version of the Manual on Uniform Traffic Control Devices (MUTCD) current at that time. Since then, modifications may have been made to the MUTCD changing the regulations regarding school traffic control devices.

There are existing school speed limit zones at most, if not all, of the elementary schools in Grand Forks. The speed limit for residential areas in Grand Forks is 25 mph. School speed zones reduce the speed limit to 20 mph in designated areas.

Existing sign conditions that do not follow current MUTCD standards include the following:

- Crossings that have only the School Crosswalk Warning assembly, and don't have the School Advance Warning assembly.
- Stop controlled approaches which don't have the School Crosswalk Warning assembly (which is correct), but do have a School Advance Warning assembly.
- Out-of-date School Crosswalk Warning signs. These older signs look similar to the current School Crosswalk Warning sign, except that the older signs have crosswalk lines shown on the sign. The out-of-date signs may remain in place until 2011, at which time they must be removed and replaced.
- Pedestrian Warning signs being used instead of School Crosswalk Warning signs. These signs are not recommended for school crossings because they do not identify the crossing as being school related.
- Crossings adjacent to schools that have a reduced speed limit of 15 mph, just for the crossing. Often the 15 mph speed limit for the crossing is within a 20 mph school speed limit, which means that there are multiple speed limit changes in a very short distance.
- No sign indicating the end of the school speed limit zones.

C. Flashing Beacons

The traffic control inventory and visual observation were used to determine where flashing beacons were currently being applied at school crossings. Currently, flashing beacons are being used at all of the elementary schools. Some are applied for additional awareness at heavily used crossings and some are applied for school speed limits. There is a mix of both overhead and roadside flashing beacons.

According to the City Traffic Engineer most of the flashing beacons are timed, and not actuated. The City has realized that the current controllers cannot be timed for early dismissal days, and they cannot be remotely turned on or off for snow days. The City has applied for Safe Route to School funding to purchase radio controlled beacons.

IV. Best Practices

In order to develop an appropriate strategy for application of school traffic control devices, it is important to understand what the best practices are based on applicable Federal and State regulations and guidance, as well as the current State of Traffic Engineering Practice. The best practices for traffic control devices at school related crossings were determined from the MUTCD, Institute of Transportation Engineers (ITE) documents and other related research.

Regulatory traffic control at intersections, such as 4 way stop signs or traffic signals, is addressed according to the MUTCD.

A. Pavement Markings

Crosswalk markings should be placed along identified safe routes to school as shown on the Safe Route to School maps. Therefore, it is rarely desirable to install crosswalk markings at all four legs of an intersection. Similarly, every intersection along the safe routes to school does not necessarily require crosswalk markings. In fact, national statistics have shown that marked crosswalks at uncontrolled locations may be more dangerous than unmarked crossings. This is because some pedestrians proceed into the crosswalk as though they were protected, while in reality they are not.

The MUTCD does not prescribe specific warrants or conditions mandating the installation of a crosswalk, but it does state that crosswalk lines should not be used indiscriminately. It recommends that an engineering study be performed before crosswalks are installed at locations away from highway traffic signals or stop signs.

Crosswalks provide positive guidance to pedestrians as to where they should cross a road. When crosswalks are confined to high pedestrian locations, motorists are more apt to be alert when approaching them. If crosswalks are installed at locations with low pedestrian volumes, drivers become oblivious to them, and the effectiveness of the crosswalk is significantly reduced.

According to the MUTCD, crosswalks should be marked at all intersections where there is substantial conflict between vehicular and pedestrian movements. Marked crosswalks should also be provided at appropriate points of pedestrian concentration, such as at loading islands, mid-block or uncontrolled crossings or where pedestrians could not otherwise recognize the proper place to cross.

There are three different types of crosswalk markings: two longitudinal lines, transverse lines and diagonal lines. The transverse lines, which are more visible and can be spaced to avoid the wheel path, are recommended according to the Grand Forks/East Grand Forks School Crossing Study.

Yield lines may be used to indicate the point behind which vehicles are required to yield, in compliance with a Yield sign or a Yield Here to Pedestrians sign. Stop lines may be used to indicate the point behind which vehicles are required stop, in compliance with a Stop sign, traffic control signal. Yield lines and set-back stop lines in advance of crosswalks improve a driver's view of the pedestrian in the crosswalk, reduce the number of motor vehicles encroaching on the crosswalk, and indicate that drivers should yield to pedestrians in advance of crosswalks.

Markings can be used to supplement the regulations or warnings provided by other devices, or they can be used alone and produce results that cannot be obtained by the use of any other device. They have the advantage of conveying warnings or information to the road user without diverting attention from the road.

B. Traffic Control Signs

Marked crosswalks are just one option in a progression of other devices and design treatments. For some school crossings, marked crosswalks are best used in combination with other devices such as the School Crosswalk Warning signs.

The School Crosswalk Warning assembly shall be installed at marked crosswalks, or as close to them as possible, used by students going to and from school as determined by an engineering study. The School Crosswalk Warning assembly shall not be used at marked crosswalks other than those on established safe routes to school. It consists of a School Advance Warning sign supplemented with a diagonal downward pointing arrow plaque to show the location of the crossing.

The School Advance Warning assembly shall be used in advance of a School Crosswalk Warning assembly or in advance of the first installation of the School Speed Limit assembly. It consists of a School Advance Warning sign supplemented with a plaque with the legend AHEAD or XXX FEET.

School Crosswalk Warning Assembly



School Advance Warning Assembly



All school warning signs shall have a fluorescent yellow-green background, with a black legend and border. The fluorescent yellow-green signs are much more conspicuous than standard yellow signs, especially at dawn and dusk, as well as during inclement weather.

If yield lines are used in advance of an unsignalized marked mid-block crossing, they should be placed adjacent to the Yield Here to Pedestrian sign located in advance of the nearest crosswalk line, and parking should be prohibited in the area between the yield line and the crosswalk. A Stop Here for Pedestrians sign may be installed along with a stop line.

A School Speed Limit sign or assembly shall be used to indicate the speed limit where a reduced speed zone for a school area has been established or where a speed limit is specified for such areas by statute. The school speed limit assembly shall consist of a top plaque with the legend SCHOOL, a speed limit sign, and a bottom plaque indicating the specific periods of the day and/or days of the week that the special school speed limit is in effect. The end of an authorized and posted school speed zone shall be marked with a standard Speed Limit sign showing the speed limit for the section of highway that follows or with an End School Zone sign. If there is an existing school speed limit zone, a second speed zone shall not be placed within it.

In-street school crossing signs may be used to remind road users of laws regarding right of way at an unsignalized crossing. The legend STATE LAW may be shown at the top of the sign if applicable.

The in-street school crossing sign shall not be used at signalized intersections. This sign may be used seasonally to prevent damage from plowing operations and may be removed at night if the pedestrian activity at night is minimal.



C. Flashing Beacons

Flashing beacons are used to draw driver attention to unexpected conditions, such as school speed zones or upcoming crossings. By alerting drivers to situations that require a speed reduction or special caution, flashing beacons improve the safety of the surrounding area.

Single flashing beacons are most commonly used (a single beacon mounted above a sign). They may include solar power and can be installed on a 2" or 4 1/2" post. The concern with single flashing beacons is that if the beacon is not working for some reason, it would appear as though the school speed limit, or other regulatory/warning sign that the beacon is enforcing, is not in affect.

Dual flashing beacons are also available (a beacon mounted above and below a sign), but they are more expensive, take more energy to operate and can only be installed on a 4 1/2" post. The benefit with the dual flashing beacons is that if one of the beacons is not working, the other beacon will still flash.



Single flashing beacons can become a safety concern if the single beacon is not operational. Therefore, it is recommended that all flashing beacon locations in the City of Grand Forks are transitioned to dual flashing beacons in the future.

Flashing beacons should be operated only during those hours when pedestrians are using the crossing. Beacons can be programmed to operate at certain hours of the day or they can be pedestrian actuated. Either timed or actuated work well depending on the situation on the crossing and the capabilities of the controller.

Grand Forks typically mounts flashing beacons along the side of the road on a post. Flashing beacons shall be mounted overhead on a mast arm when side mounted beacons will not be visible according to the prescribed cone of vision in the MUTCD.

V. Traffic Control Device Strategy

The Grand Forks school traffic control device strategy has been developed as a three step process. The rationale used for this strategy included a combination of related research and realistic objectives for the City of Grand Forks. The intent was to create a strategy which could be easily implemented, resulting in a consistent application of traffic control devices for school crossings.

The first step (see Figure 1) of the strategy is a flow chart which provides guidelines for determining whether a school crossing is viable or not. It takes into account the pedestrian usage, the location of the crossing, and the visibility of the crossing.

The second step (see Figure 2) is a chart used to measure the extent of conflict between vehicular and pedestrian movements. The higher the level of vehicular/pedestrian conflict, the greater the level of traffic control recommended for the crossing. The pedestrian volume used for this chart is during the peak school hour, probably the hour school starts or the hour school is let out. The vehicular volume used is the Average Daily Traffic (ADT). If only a peak hour traffic volume is known, the peak hour volume can be divided by 0.09 to get the ADT.

If the ADT and pedestrian volumes are high enough, flashing beacons or other innovative devices may be warranted. The third step (see Figure 3) is a table that helps to decide which innovative devices may be appropriate.

Figure 1: Step 1 – Viability of School Crossing

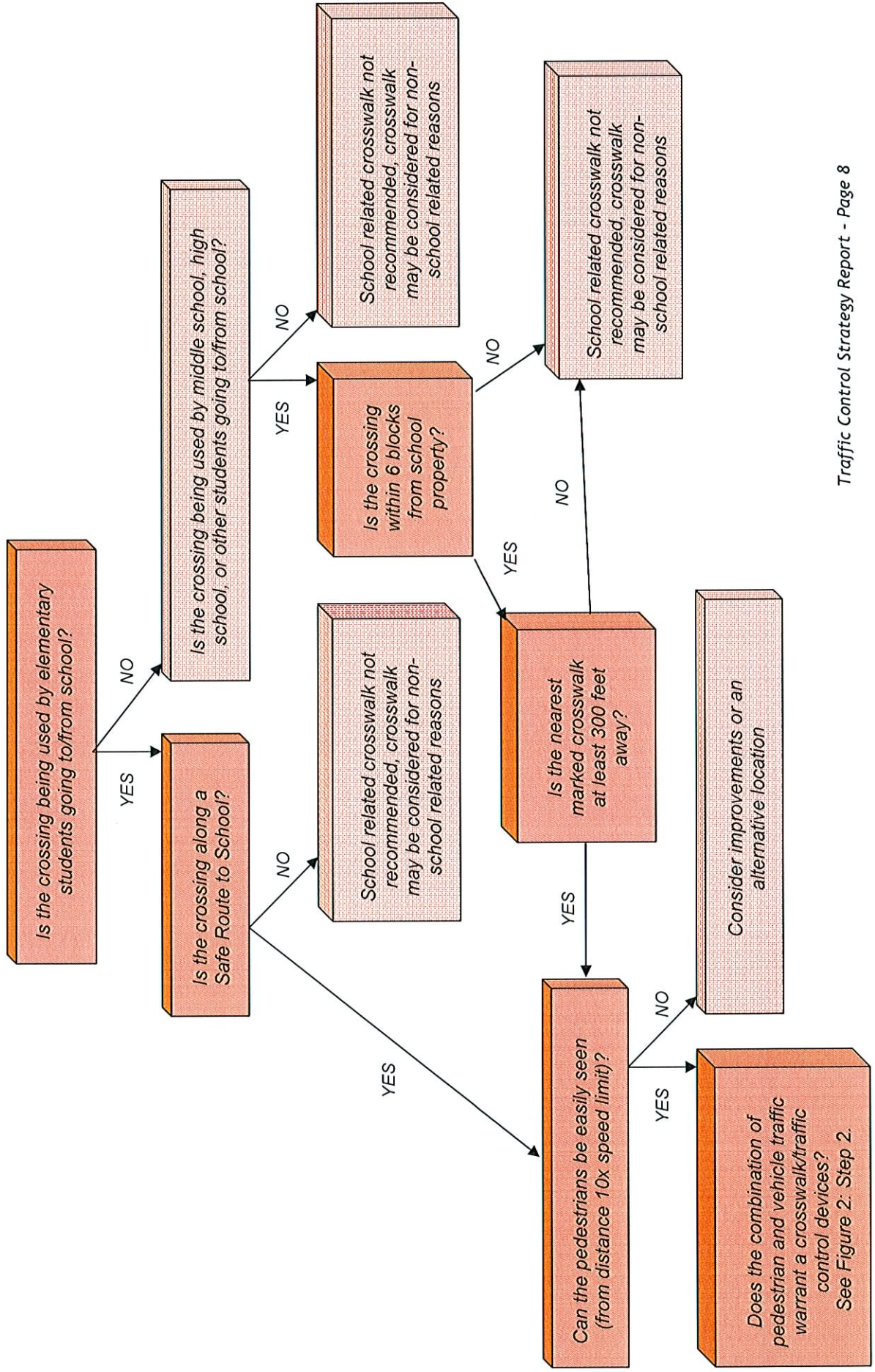
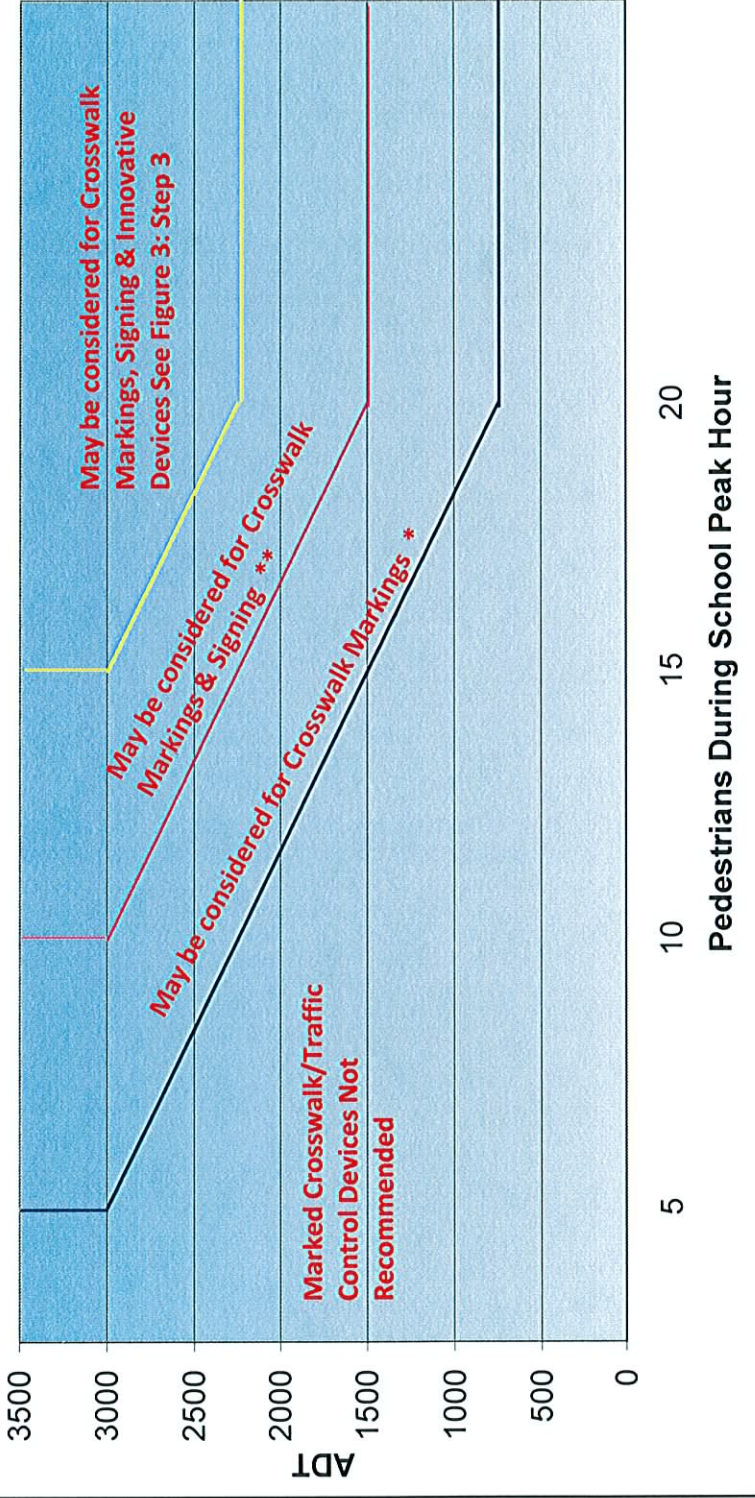


Figure 2: Step 2 - Vehicle/Pedestrian Conflict



***Eligible for signing if crossing is mid-block or uncontrolled.**

****Eligible for flashing beacons if crossing is mid-block or uncontrolled.**

NOTE: Midblock crossings should be avoided, unless other reasonable options are not available.

Figure 3: Step 3 - Innovative Devices

	Mid-block or Uncontrolled Crossing	Crossing Located in School Speed Zone	Crossing at Signalized Intersection w/ Actuation	High Speed Crossing (≥40 mph)	High Crash Location (≥3 ped crashes in 5 yrs)	Crossing w/ Limited Visibility	Non-adherence to Posted Speed	High Volume of Children with Disabilities
Flashing Beacons*	X	X	X	X	X			
In-pavement LED Markers**	X		X	X				
Radar Speed Display Sign		X				X		
Pedestrian Countdown Signals								X
Accessible Pedestrian Signals***								X
In-Street Crossing Sign	X	X						

*Flashing beacons shall only be used to supplement an appropriate warning or regulatory sign or marker.

**In-pavement LED markers shall only be installed at marked crosswalks with applicable warning signs. They shall not be used at crosswalks controlled by yield signs, stop signs or traffic control signals, per MUTCD.

***Includes any future devices recognized by the MUTCD.

A. Pavement Marking Strategy

All new crosswalks shall be Type 3, as per the 2000 School Crossing Study report. As shown on the Safe Route to School Maps, the major street should only be crossed once and the minor street may be crossed once or twice as practicable.

If there are existing marked crossings within the City of Grand Forks which do not meet the criteria of Figures 1 and 2, the markings may be left as is or removed. They should not be remarked unless they do meet the criteria.

B. Signing Strategy

The School Crosswalk Warning assembly shall not be installed on approaches controlled by a stop sign.

The School Advance Warning assembly shall be used in advance of any installation of the School Crosswalk Warning assembly, or in advance of the first installation of the School Speed Limit assembly.

If there are existing signed crossings which do not meet the criteria of the attached flow chart and table, the signs should be removed. If the removed signs meet current regulations and are in good condition, they may be relocated to a crossing which does meet the criteria.

As mentioned before, there are some 15 mph school speed limit signs for certain crossings within 20 mph school speed limit zones. The 15 mph school speed limit signs shall be removed (if there are flashing beacons, the beacons may be left in place). The 20 mph school speed zone may be left as is. The end of the school speed zone shall be signed with a speed limit sign.

Any existing Pedestrian Crossing Signs located at school crossings shall be removed. If the crossing location meets the signing criteria, School Advance Warning signs and School Crosswalk Warning signs shall be installed.

C. Flashing Beacon Strategy

If there are existing flashing beacons which do not meet the criteria, the flashing beacons may be removed or left as is. Flashing beacons that do not meet the criteria should be reviewed for removal.

D. Innovative Device Strategy

The four types of innovative devices that were researched include in-pavement LED markers, radar speed display signs, accessible pedestrian signals and pedestrian countdown timers. All cost estimates are based on the material costs only.

1. In-Pavement LED Markers

In-pavement LED markers consist of flashing LED lights embedded in the roadway along the width of the crosswalk to indicate an active crosswalk location. Some systems also have optional centerline chase lights that increase the visibility and advance warning of crosswalks. They can be solar powered and can be used with most pedestrian activation devices including pushbuttons.

According to the MUTCD, in-pavement lights shall only be installed at marked crosswalks with applicable warning signs. They shall not be used at crosswalks controlled by yield signs, stop signs, or traffic control signals. The lights shall be installed along both sides of the crosswalk and shall span its entire length. The lights shall initiate operation based on pedestrian actuation and shall cease operation at a predetermined time after the pedestrian actuation, or with passive detection, after the pedestrian clears the crosswalk.



In-pavement LED markers are very effective at mid-block crossings because they minimize traffic flow disruption and increase the visibility of the crosswalk during the day and at night. The estimated construction cost for one crossing at a two lane road is \$75,000. This cost includes automatic pedestrian detection, traffic control and three LED lights on each side of the crossing.

East Grand Forks is currently using in-pavement markers for two crossings. One system was installed in 2007 and the other system is scheduled to be completed in 2008. They used brick pavers the entire width of the roadway on both sides of the crosswalk. The in-pavement markers were then embedded into the brick pavers.

2. Radar Speed Display Signs

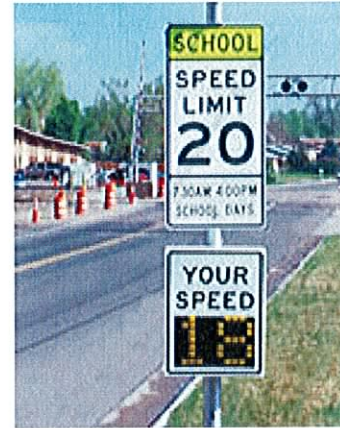
Radar speed display signs are signs that utilize radar to measure and record the speed of an approaching vehicle. The measured speed is then displayed to the approaching driver. Radar speed display signs are typically used in conjunction with a school zone speed limit sign.

There are a couple different ways that the radar speed display signs can be used. If there are multiple locations throughout the school district where vehicular speed is a concern, a portable radar speed display sign can be used. This device can be used at one location for a period of time, and then moved to another location. If there are one or two locations where vehicular speed is an ongoing hazard, pole mounted radar speed display signs can be used. The sign is attached to a pole, usually directly below a speed limit sign.

There are also different display sizes depending on the speed of the roadway where it will be used. An 18" display should be used if the sign is used on a roadway with a speed limit higher

than 40 mph. A smaller display can be used if the sign is used on a roadway with a speed limit of 35 mph or less.

The Grand Forks Safe Kids Coalition recently received funding to purchase 4 portable SpeedMinder Radar Speed Signs. The signs have a 10.5” LED display which flashes red for speeders and turns green for legal speeds. The cost for each portable radar speed sign was just over \$1,700. They plan on installing the signs at Century, Ben Franklin, Kelly and Viking elementary schools. These schools were chosen because they were active in communicating their traffic control concerns and in finding solutions. The goal is to get at least one radar speed sign for every school.



Safe Kids also applied for additional funding to purchase more speed signs and at the request of the GF/EGF MPO they applied for funding to purchase portable radar recorders. The recorders are mounted on the side of the road and record speed data without drivers knowing. The speed is not displayed to drivers, it is recorded and typical speed profile reports can be created. The cost for each recorder is approximately \$5,150.

3. Pedestrian Countdown Signals

A pedestrian countdown signal contains a timer display that counts down and shows the number of seconds left to finish crossing the street. This device is intended to aid pedestrians in getting out of the street before they would be exposed to the danger of oncoming motor vehicles.



Pedestrian countdown signals can easily be incorporated into existing signal systems. Normally the pedestrian signal face is the only thing that gets replaced. The wiring stays in place and nothing in the cabinet has to be modified because the countdown signals are compatible with all controllers.

The cost for installing a pedestrian countdown signal into an existing signalized intersection does depend on the number of pedestrian countdown signals that are to be installed and the existing bracketing. A 12” bracket is needed to install a pedestrian countdown signal. The estimated cost for one 16”x18” pedestrian countdown signal with hand/man is \$550-\$600. If an intersection has 8 pedestrian signals (4 crosswalks with one pedestrian signal at each end), the cost to install countdown signals at the intersection would be \$4,400-\$4,800.

Pedestrian countdown timers are becoming mandatory in Grand Forks for signalized intersections by 2013. The City of Grand Forks currently has some located around the UND area. They are pleased with the results of the countdown timers.

4. Accessible Pedestrian Signals

Accessible pedestrian signals include devices that communicate information about pedestrian timing in a non-visual format such as audible tones, verbal messages or vibrating surfaces. The MUTCD suggests that installation of accessible pedestrian signals at signalized intersections should be based on an engineering study, which considers the following factors:

- Potential demand or a request for accessible pedestrian signals
- Traffic volumes during times when pedestrians might be present
- The complexity of the traffic signal phasing
- The complexity of the intersection geometry

Accessible pedestrian signals can provide information to pedestrians about the existence and location of the pushbutton; the onset of the walk interval; the direction of the crosswalk and location of the destination curb; the clearance interval; intersection geometry; intersection street names; and intersection signalization.

There are four types of products available and are categorized by the location and type of indication provided.

1. Pushbutton-integrated – Audible tones, speech, or vibrating hardware integrated into the pedestrian pushbutton
2. Pedhead-mounted – Speakers mounted in, on, or near the visible pedestrian signal head
3. Vibrotactile-only – Walk information only provided by vibrotactile indication at the pushbutton location
4. Receiver-based – Infrared transmitters mounted in or on pedestrian signal heads that provide speech messages at personal receivers, or LED pedestrian signal heads that pulse to transmit a code to call up a speech or vibrotactile message at personal receivers

The pushbutton-integrated device is the most common type. They provide a speaker and a vibrating surface or arrow at the pedestrian button, and all sounds come from the pedestrian pushbutton housing, rather than the pedhead. A quiet pushbutton locator tone repeats during the flashing and steady don't walk intervals. The walk interval may be indicated by the same tone at a faster rate, or by a speech message.



Locations where accessible pedestrian signals would be effective include the following:

- Intersections with vehicular and/or pedestrian actuation
- Very wide crossings
- T-shaped intersections
- Non-rectangular or skewed crossings
- Intersections with high turning movements volumes
- Signalized intersections with split phase timing
- Intersections commonly used by people with applicable disabilities

E. School Speed Zones

The existing school speed zones within the city of Grand Forks seem to be somewhat uniform. Most schools have a speed zone on at least one roadway adjacent to school property, and the majority of the school speed limits are 20 mph. It is recommended that this consistency remain the same in the future.

One option that was mentioned previously is using radar speed display signs instead of flashing beacons at the start of a school speed zone.

Application of school speed zones at future schools can be a challenging issue. The length of the school speed zone is discussed in the MUTCD. Guidance indicates that it is desirable for the zone to extend along the entire length of school property. This can result in fairly long zones which can have a detrimental impact on traffic movement, especially for those schools located along collector or arterial roadways. In these cases, consideration should be given to shortening the zone to address the intended crossing locations and not to extend to the end of school owned property.

VI. Impacts of Strategy Implementation

As this strategy gets implemented there will be some impacts on the existing traffic control at school crossings. Some of the expected impacts include removing existing marked crosswalks and/or crosswalk warning signs. Although some resistance may be met when removing traffic control devices, the city wide goal of uniformity must be kept in mind.

It is recommended that traffic control changes be made during the summer while school is not in session. This will reduce the impact of changes on established school crossing patterns. It is advisable to coordinate traffic control changes with the appropriate school officials. Further, the Safe Routes to School Maps should be reviewed with school officials, PTA's, school parents and children to promote better observance of desired school crossing patterns.

VII. Public Involvement

A. Initial Input

The first public input meeting was held on Wednesday, December 12, 2007 to provide information concerning the project and to identify issues. Three citizens signed the attendance sheet for the input meeting. Public input was also received by mail, e-mail or fax. All of the comments received are included in Appendix A of this report.

Reporters from the Grand Forks Herald and a local television channel also attended the meeting. A copy of the article written in the Grand Forks Herald is included in Appendix A of this report.

B. Feedback on Strategies

The second public input meeting was held on Thursday, April 17, 2008 to present the draft report, including strategies, to the public and to receive comments. No citizens attended the meeting and no comments were received.

The notice for this meeting was given to the Safe Kids Coalition and to put on the back of their flyer and also in school newsletters, if permitted. The notice is included in Appendix A of this report.

VIII. Recommendations

This Study provides the City of Grand Forks with a tool and guideline to be used to examine existing and future school traffic control devices. Based on the information presented in the previous sections, the following recommendations have been made:

- Review all existing school crossings using this strategy
- Examine all future school crossing locations using this strategy
- Develop Safe Route to School Maps for post elementary schools
- Continue additional MPO studies to evaluate transportation needs and alternatives at each individual school
- Conduct future studies to address other school traffic issues which were not included in this study (parking, pick-up and drop-off areas, etc.)
- Review and update Safe Route to School Maps for elementary schools

It is anticipated that as the recommendations of this Study are implemented, it will be necessary to adjust the strategies and recommendations to account for actual field conditions. These changes will be beneficial to future uniform application of school traffic control devices within the Grand Forks area.