

TORONTO STAFF REPORT

August 22, 2006

To: Works Committee

From: Gary Welsh, General Manager, Transportation Services

Subject: Proposed Zebra Crosswalk Policy
(All Wards)

Purpose:

The purpose of this report is to obtain Council approval to adopt zebra crosswalk markings as the standard crosswalk marking treatment for all signalized intersections and pedestrian crossovers in the City of Toronto.

Financial Implications and Impact Statement:

Funds to implement the zebra crosswalk markings as part of road reconstruction and resurfacing projects and for new traffic control signals can be accommodated within the existing Transportation Services Division's Annual Capital Works Program. The incremental increased cost of installing zebra crosswalk markings as the standard crosswalk treatment for signalized intersections will be offset by a reduction in the number of concrete crosswalks installed.

Recommendations:

It is recommended that:

- (1) zebra crosswalk markings be adopted as the standard crosswalk marking treatment for signalized intersections and pedestrian crossovers;
- (2) Transportation Services Division staff be directed to install zebra crosswalk markings at all signalized intersections and pedestrian crossovers in conjunction with road reconstruction and resurfacing projects within the Division's Annual Capital Works Program and in conjunction with all new traffic control signal and pedestrian crossover installations;
- (3) this report be forwarded to the Pedestrian Committee for their information; and

- (4) the appropriate City Officials be authorized and directed to take the necessary action to give effect to the foregoing, including the introduction of any Bills that may be required.

Background:

In 2003, Transportation Services initiated the “We’re All Pedestrians Program” to address pedestrian safety concerns and improve pedestrian security. The “We’re All Pedestrians Program” is a combination of public awareness campaigns and pilot projects to evaluate technologies and designs to improve pedestrian safety. One of the first pedestrian safety pilot projects evaluated the potential for zebra crosswalk markings to reduce motor vehicle-pedestrian conflicts and collisions at signalized intersections. In consultation with the Pedestrian Committee at the outset of the program, the Committee selected the zebra crosswalk study as their top priority among the study proposals being considered. This report presents a brief summary of the results of the evaluation study and proposes a new standard for crosswalk markings in the City of Toronto.

Comments:

The Transportation Services Division recognizes that safely accommodating pedestrians is an important element of a balanced transportation system. Pedestrians are the most vulnerable users of the transportation system and therefore it is vital that we incorporate their special need for protection from motor vehicles in the design of intersections.

In the five year period 2001-2005, there was an average of 2,432 pedestrian-motor vehicle collisions and 36 pedestrian fatalities per year in the City of Toronto. In 2005 there were 911 pedestrians injured and six pedestrians killed in collisions at signalized intersections.

1. Current Crosswalk Designs

Transportation Services is responsible for providing a safe pedestrian environment at signalized intersections and pedestrian crossovers by designing effective pedestrian crossings. The City’s standard crosswalk design is based on the guidelines set out in the Ontario Manual of Uniform Traffic Control Devices and the Ontario Traffic Manual, which define a pedestrian crosswalk as having two solid parallel white lines marking both edges of the crosswalk. Pedestrian crosswalks are typically 3.0 metres wide and the solid crosswalk lines are 10 cm wide.

Over the years, Transportation Services has marked crosswalk lines with a variety of materials, including oil-based and water-soluble paints, cold and thermal plastic products and various tape products in an ongoing effort to provide the most effective crosswalk markings for pedestrians. While crosswalk lines are typically applied on standard asphalt pavements, Transportation Services has also used several different types of paving materials to accentuate the pedestrian crossing area, including concrete, impressed asphalt and decorative brick and pavers. In the past several years there has been increased pressure to include concrete crosswalks in road reconstruction projects, resulting in significantly increased project construction costs and, over the life of the roadway, increased maintenance costs.

Concrete crosswalks and other decorative treatments are more costly to install and maintain than standard asphalt pavements and have a greater impact on road users during construction. For example, when installing a concrete crosswalk, the intersection must be closed for 24 hours or more to allow the concrete to set properly, resulting in inconvenience to pedestrians, cyclists, transit service and drivers. The increased cost to install and maintain these decorative crosswalks has been rationalized because it was felt they provided a more attractive design and an enhanced crossing area for pedestrians. However, there is no evidence that these treatments have resulted in enhanced safety for pedestrians.

For the past three years, Transportation Services has been experimenting with zebra crosswalk markings to determine if they can provide a higher level of safety and comfort for pedestrians while at the same time offering a more cost-effective installation and maintenance option. Zebra crosswalk markings are longitudinal lines installed across the pedestrian crosswalk, parallel to the driver's direction of travel. The white bands are 60 cm wide and spaced 60 cm apart, as illustrated on the attached Drawing No. 421F-8474

Zebra crosswalks have several advantages over traditional crosswalks marked only with two parallel lines. The zebra design increases the crosswalk marking from seven percent of the crosswalk area using conventional parallel crosswalk line markings to forty percent of the crosswalk area. The increased coverage of the reflective pavement marking material increases the conspicuity of the pedestrian crosswalk area for drivers and pedestrians during both day time and night time.

In addition to making the crossing area more visible to drivers, zebra markings are less expensive to install and repair than concrete or decorative crosswalks. Unlike concrete crosswalk construction, zebra markings can be walked on and driven over very shortly after application, resulting in less disruption to the travelling public. Because the zebra markings are applied to the road surface, zebra crosswalks can be installed during road resurfacing as well as reconstruction, and can be retro-fitted to existing pavements. Concrete crosswalks can only be effectively installed when a road is being reconstructed.

2. Evaluation of Zebra Crossings

Zebra markings have been widely used in Europe for several decades, and more recently in North American cities; however, there is little current research on their effectiveness in enhancing pedestrian safety. In order to measure the potential safety benefits of zebra crosswalks on Toronto streets, Transportation Services undertook the "Evaluation of Zebra Crossings" study (completed in August, 2005). The study evaluated the effectiveness of zebra crossings in reducing the frequency of motor vehicle-pedestrian conflicts and collisions through field-testing and on-site evaluations.

Zebra crosswalk markings were installed at seven consecutive signalized intersections on both Mt. Pleasant Road and Bathurst Street, including the intersections with Eglinton Avenue and three intersections to the north and three intersections to the south. The study's evaluation focussed on the intersections of Mt. Pleasant Road/Eglinton Avenue East and Bathurst Street/Eglinton Avenue West. To determine the effectiveness of the zebra crossings, before and

after studies were undertaken to measure any changes in the frequency of motor vehicle-pedestrian conflicts and non-yield behaviour at the study intersections. There were three observation conditions: Before Implementation, After Implementation (one to two weeks after installation of zebra crosswalk markings) and Follow-up (three to six months after installation of zebra crosswalk markings).

At the Mt. Pleasant Road/Eglinton Avenue East intersection, the results show an 82 percent decrease in the rate of motor vehicle-pedestrian conflicts between the “before” and “after” conditions. Six months following implementation, the conflicts decreased by 88 percent. These results are statistically significant at the 95 percent confidence level. At the Bathurst Street/Eglinton Avenue West intersection, the very low occurrence of conflicts in the “before” condition did not allow for a measurable change in the number of conflicts after the installation of the zebra crosswalk markings. The percentage of non-yield driver behaviour did not change significantly at either of the monitored intersections between the “before” and “after” conditions.

The significant decrease in conflicts at the Mt. Pleasant Road/Eglinton Avenue East intersection demonstrates the potential for enhanced pedestrian safety and comfort at signalized intersections. However, the study indicates that measurable safety benefits attributed to zebra crosswalk markings will vary from intersection to intersection, with the greatest potential benefits derived at locations with existing high levels of motor vehicle-pedestrian conflicts.

In order to gauge pedestrians’ perception of the zebra crosswalk markings a pedestrian survey was conducted at the Mt. Pleasant Rd/Eglinton Avenue East zebra crossing. The objectives of the survey were to assess:

- how the zebra markings affected pedestrians’ feeling of security and visibility; and
- how the zebra markings affected pedestrians’ behaviour when crossing.

Based on the survey results, pedestrians indicated they felt safer, more comfortable and more visible to the drivers when they used the zebra crossings. They also reported that they were more likely to use a zebra marked pedestrian crosswalk, instead of walking outside of the marked crosswalk area. Therefore, the survey suggests that there is a higher pedestrian level of comfort and sense of security with zebra marked pedestrian crosswalks.

The report, “Designing Sidewalks and Trails for Access - Part II: Best Practices Design Guide” sponsored by the U.S. Department of Transportation, Federal Highway Administration (September 2001), recommends the continental crosswalk (also known as the zebra crosswalk) because “...research indicates that it is the most visible to drivers” and it “...improves crosswalk detection for people with low vision and cognitive impairments.” The report also recommends “that the continental design be used consistently to mark all crosswalks; otherwise the impact of less visible markings may be weakened by comparison.”

3. Adopting the Zebra Design as the Standard Crosswalk Treatment

Based on the results of the pilot project, Transportation Services recommends adopting zebra crosswalk markings as the standard treatment for all signalized intersections and for all

pedestrian crossovers. Zebra crosswalk markings have already been recommended as one of the “visibility enhancements” for pedestrian crossovers on major arterial roadways in the City of Toronto (Works Committee Report No. 3, Clause No. 2, adopted by City Council on May 23, 24 and 25, 2006). A separate report, entitled “Pedestrian Crossover Review – Minor Arterial Roads”, will be considered by the Works Committee at its meeting on September 11, 2006. This report recommends a five-year implementation strategy to install zebra markings at 270 pedestrian crossovers on arterial roads. Funds to install zebra markings at existing pedestrian crossovers on arterial roads have already been requested as part of the Transportation Services’ 2007 Capital Budget submission, as a program enhancement.

It is most cost effective to install new zebra crosswalk markings when a roadway is being resurfaced or reconstructed. Applying durable marking materials on fresh asphalt will increase the longevity of the markings, resulting in lower life cycle costs, including maintenance costs. Therefore, Transportation Services recommends that zebra crosswalk markings be installed at all signalized intersections and pedestrian crossovers as part of the Transportation Services Annual Capital Works Program for road resurfacing and reconstruction projects.

The cost to implement zebra crosswalks using durable marking material at a typical signalized intersection will be approximately \$7,500.00. This estimate is based on our experience tendering small quantities of work. The costs for zebra crosswalks may be significantly reduced when tendered in larger quantities as part of the road reconstruction and resurfacing projects. It is anticipated that zebra crosswalks will be installed at approximately 100 signalized intersections each year in conjunction with the annual Capital Works Program. The incremental increased cost of installing zebra crosswalk markings as the standard crosswalk treatment for signalized intersections will be offset by reducing the number of concrete crosswalks installed as part of the Capital Works Program.

Zebra crosswalk markings should also be installed as part of all new traffic control signal installations. To achieve the most cost effective installation, durable markings will be used unless the existing pavement condition is in poor condition and/or the location is scheduled to be resurfaced or reconstructed within six years. The incremental cost to include zebra crosswalk markings in the installation of new traffic control signals can be accommodated within the existing budget for the Traffic Control Signal Program.

There are approximately 2,000 existing traffic control signals in the City of Toronto. It will take 20 years to install zebra crosswalk markings at all existing signalized intersections, in conjunction with the annual Capital Works Program, at a rate of 100 intersections per year. The completion rate could be accelerated by establishing a new program to begin converting signalized intersections which are not scheduled for resurfacing or reconstruction in the next ten years. If Council wishes to complete the installation of zebra crosswalks in less than 20 years, Transportation Services staff should be directed to report further on options and funding requirements to establish a new program for converting signalized intersections which will not be reconstructed or resurfaced within the next ten years.

Conclusions:

As part of its ongoing effort to improve pedestrian safety, Transportation Services has been evaluating the potential benefits of zebra crosswalks. Based on the results of the evaluation, Transportation Services recommends that the zebra crosswalk design be adopted as the standard crosswalk treatment for all signalized intersections and pedestrian crossovers in the City of Toronto. Zebra crosswalks could be installed most cost-effectively in conjunction with road reconstruction and resurfacing projects. Zebra crosswalks should also be installed in conjunction with all new traffic control signals and pedestrian crossovers.

Contact:

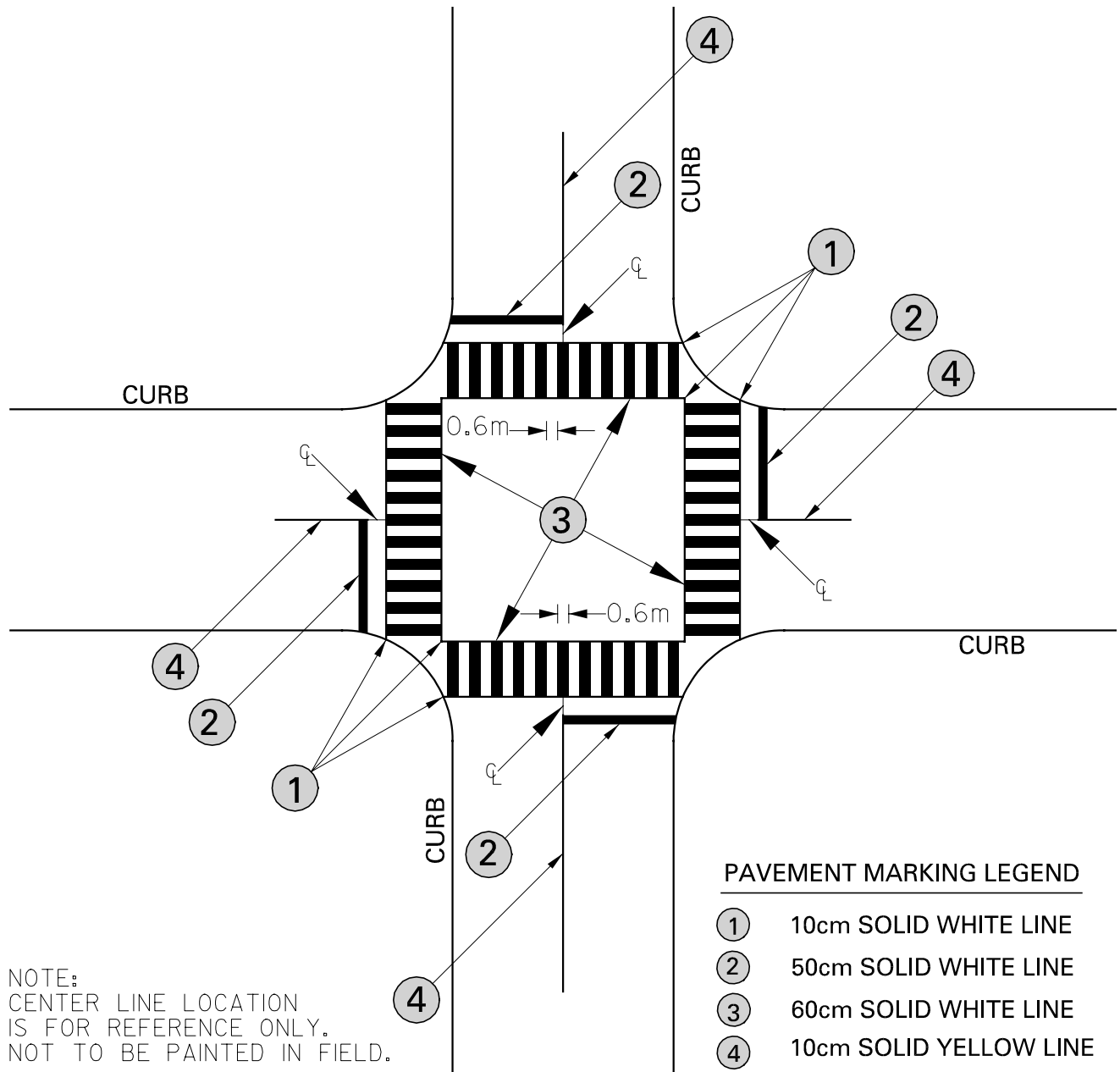
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List of Attachments:

Drawing No. 421F-8474 – Zebra Pavement Marking Detail



ZEBRA PAVEMENT MARKING DETAIL

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