

Arterial Speed Calming

Mohawk Road Case Study

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ABSTRACT

Mohawk Road was an undivided two lane arterial with a 50-km/h speed limit, 85th percentile speeds of up to 70 km/h, and in need of rehabilitation. The adjacent land uses are low-density residential and open space. During the design phase, it was decided that additional lanes were not required, but that one of the design goals should be to effectively reduce travel speeds to 50 km/h without diverting traffic. An innovative design using a series of wide, short landscaped median islands (speed control medians) was employed, which reduced mean speeds and the percentage of drivers exceeding the speed limit in the treated section.

INTRODUCTION

One of the biggest challenges facing the road transportation professional is operation and control of traffic on an arterial street abutted by low- and medium-density residential land use. The function of the arterial is primarily to provide mobility. However, the adjacent residents and property owners generally want to reduce travel volumes, speeds, and noise. The transportation professional is faced with a balancing act of reducing travel speeds without diverting traffic or significantly affecting the mobility function of the road.

Historically, the road authority's desire to provide mobility has often eclipsed the residents' concerns with speed, and roads were built to high standards that encourage speeding. Recently, the transportation profession has modified its stance on motor vehicle mobility, attempting to provide essentially the same mobility while also addressing residents' concerns.

This article examines the Region of Hamilton-Wentworth's public involvement process and ultimate road design to address mobility and speed concerns on Mohawk

Road in the Town of Ancaster. The paper is divided into five sections: a description of the study area, the public involvement process, the road design, the results of speed testing, and conclusions.

STUDY AREA

Mohawk Road is a two-lane arterial roadway connecting the Town of Ancaster to Highway 403 (a controlled-access freeway), and to the City of Hamilton. The road traverses a section of Ancaster that is primarily residential with some open space. The speed limit of the road is 50 km/h. The design classification is UAU60 with a rural cross-section. The road, in relation to the broader street network, is shown in Figure 1. The section of Mohawk Road from Wilson Street to McNiven Drive (the test section) was redesigned, and the section of Mohawk Road from McNiven Drive to Highway 403 (the control section) was untouched.

Traffic signals control the movement of traffic at either end of the study section. The remaining intersections have Stop controls facing the side streets. Driveways are

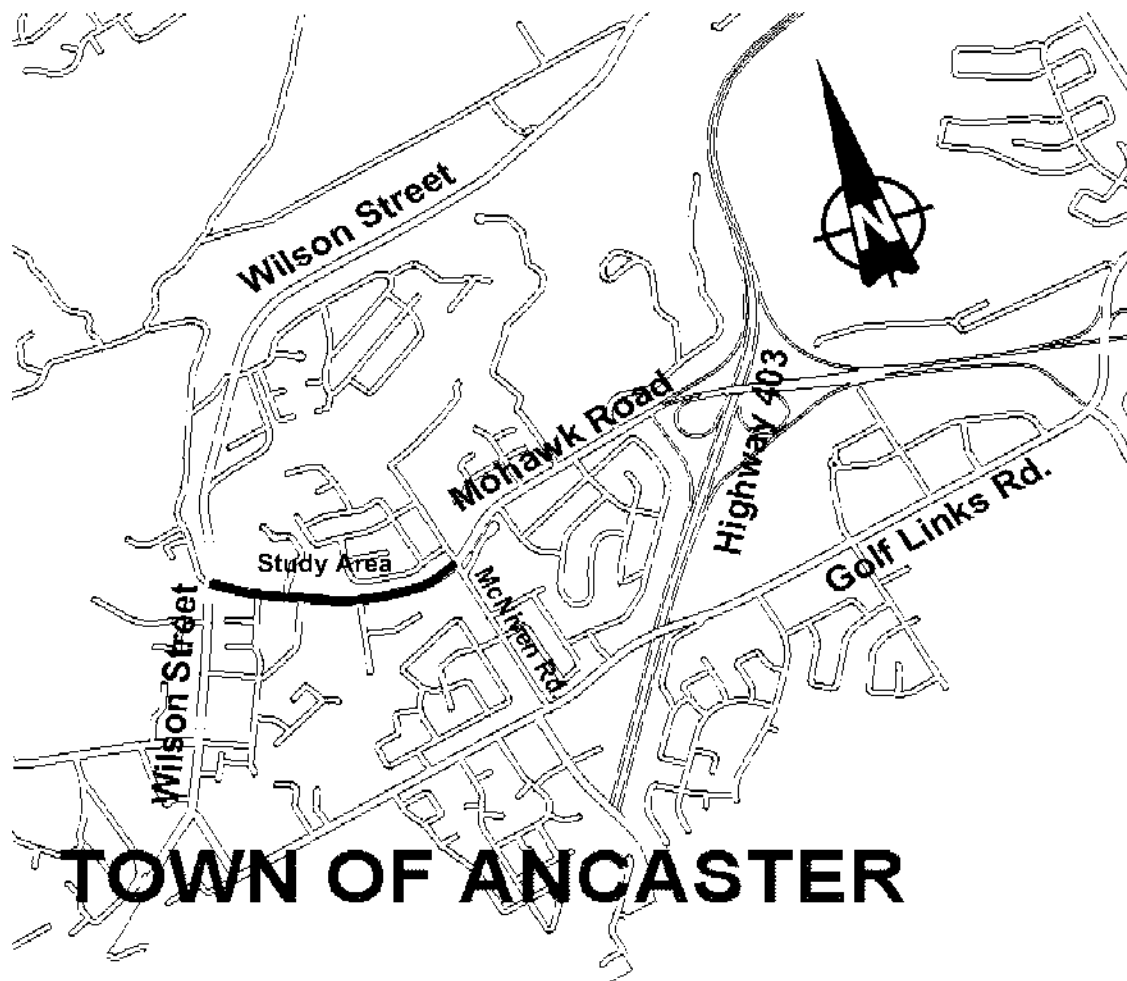


FIGURE 1 Mohawk Road and the surrounding street network.

present on both sides of the road. Prior to reconstruction, speed studies indicated that the mean and 85th percentile speeds in the test section were 54 km/h and 63 km/h respectively. Sixty-seven percent of the vehicles in the test section were exceeding the speed limit, and speeding was identified by residents as the biggest problem with the road.

Recent traffic counts indicated that Mohawk Road was busiest during the afternoon peak hour, with approximately 1,500 vehicles per hour. Field observations showed that periodic queuing occurred on Mohawk Road at both Academy Street and Wilson Street during this period. Due to a continued increase in employment and population in the region, it is expected that the traffic volumes will increase to 1,900 vehicles per hour in the year 2021. The existing capacity of the road was about 2,400 vehicles per hour.

The road's alignment had several horizontal and vertical curves, and the lane widths were as narrow as 3.0 metres. The shoulder widths were generally deficient along the entire study section. Shallow ditches were provided on both sides of the road to accommodate surface runoff from the road.

The crash frequency in the test section was 6.2 crashes per year. Normalizing for length and volume of traffic, 6.2 crashes was well below the average frequency for this type of road. There was a minor trend in rear-end crashes on Mohawk Road at Academy Street where left-turning vehicles had to wait in the through lane for a gap in opposing traffic.

PUBLIC INVOLVEMENT PROCESS

Since the public was deeply concerned about proposed changes to the road, it was decided that an intensive public involvement strategy needed to be a cornerstone of the roadway planning and design process. In retrospect, the well-thought-out and executed public involvement strategy was pivotal in the success of this project.

The objective of the public involvement process was to provide a forum for public input, and gather public opinion on proposed changes to the road. Staff assumed the roles of information provider and opinion collector. It was staff's responsibility to help residents define their objectives and reach informed decisions on preferred solutions. Staff did not implement the traditional decide (on a solution), announce (the staff solution to the public), and defend (the staff position) approach. Designs recommended by staff were not presented. This overall approach to public involvement created an advisory relationship rather than an adversarial relationship between the transportation professionals and the public.

The bulk of the public involvement process involved three meetings held with area residents. The purpose of the first meeting was to identify the residents' problems with the road, their ideas for solving the problems, and important features/elements of the community that they would like to preserve. The first meeting was an opportunity for staff to listen to the residents. Staff did not present factual data; analyse or respond to residents' perceived problems; or quote policies, guidelines or standards in an attempt to inhibit "unacceptable" solutions. Requests for Stop signs and lower speed limits on the arterial road were recorded without prejudice or comment. The residents identified speeding as their biggest concern with the road.

At the end of the first meeting, residents were informed that the process would be for staff to evaluate each of the proposed solutions by analysing how effective it would

be in addressing the identified problem, and by identifying the impacts each solution would have on the important community features identified by the community. The public was also informed that staff would include and analyse reasonable proposals for other solutions that may not have been put forth by the residents, and would also include an evaluation of conformance with broad municipal policies and objectives.

The results of the evaluation were presented at the second meeting. The identified solutions to the speeding problem were: do nothing; erect Stop signs; erect traffic signals; reduce the speed limit; police enforcement; speed humps; and speed control medians (SCMs). Staff proposed the last solution; the public suggested all other treatments. A description of an SCM is provided in the next section.

Each of the proposed solutions was evaluated and presented to the public, even if it was ineffective or did not conform to policy. Upon reviewing the effectiveness and impacts associated with each alternative, the public overwhelmingly abandoned the pursuit of Stop signs, traffic signals, speed humps and lower speed limits in favour of the SCMs and police enforcement (in that order of preference).

It is worthy to note that the public was informed that:

- SCMs, particularly on arterial roadways, had never been implemented or tested in the Region of Hamilton-Wentworth;
- The effectiveness of this measure in reducing speeds was uncertain;
- SCMs would essentially be obstacles placed in the middle of the traveled way and would almost certainly be involved in some crashes; and
- Staff's expectations were that a speed reduction was achievable, and that the change in the crash rate would be nominal.

The third meeting with residents was to establish the location of the SCMs along the length of the road. Providing a full range of movements at all intersecting streets and driveways limited the opportunities for placing the SCMs. However, staff and the residents worked together to establish desirable locations for four SCMs, and the final locations were fairly evenly spaced along the test section.

DESIGN OF THE SCMS

In general, the treatments that transportation professionals undertake on roadways to make them more safe also tend to increase the operating speed. Straight, flat alignments with ample clear zones are safe but promote speed. Since the control of speeding was the biggest concern of residents, it was necessary to strike a balance in design to accommodate both safety and speed control.

In terms of the roadway alignment, it was decided that the current horizontal and vertical alignments would be maintained as much as possible. For the most part, driveway grades, a creek crossing, and underground utilities limited the flexibility of the vertical alignment.

Existing development, property constraints and a creek crossing structure limited opportunities for changes in horizontal alignment. The existing alignment was curvilinear and helped to control speeds, to a degree, while maintaining an adequate safety record (as evidenced by the satisfactory crash record).

The main changes to the conventional design features were the provision of a uniform lane width of 3.3 metres, 1.0-metre paved shoulders, and a left-turn lane at Academy Street. The wider lanes were necessary given the relatively large volume of traffic; the left-turn lane was constructed to address a “rear-end” safety concern. All of these features and their dimensions were selected to provide a good balance between safety and speed control.

The SCMs have a primary purpose of limiting travel speeds, but have a real potential to adversely affect safety. Design of these devices was carefully considered. The speed control to be provided by the SCMs is achieved in two ways:

1. The SCMs were initially designed to be 4.0 metres wide and placed directly on the centreline of the traveled way. This would effectively create a 2.0-metre deflection in the path of travel. This deflection combined with short approach tapers (10:1) would create a transition that is smooth if traversed at 50 km/h, but uncomfortable if traversed at higher speeds. The design width for some of the SCMs had to be modified before construction because of property constraints, and ultimately the SCMs were constructed at 4.0 m, 3.5 m, 3.0 m, and 3.0 m respectively.

2. The SCMs break the pavement width from 8.6 metres (two 3.3-metre lanes and two 1.0-metre paved shoulders) into two 4.3-metre pieces. This reduction in width is intended to have a psychological effect causing the driver to slow down. This effect is heightened by the placing of several trees in the median and on the side of the road adjacent to the median.

The SCM design is shown in Figure 2.

The SCMs are essentially obstacles that have been placed in the middle of the travel path of an arterial road. They are, by definition, a hazard in the road, and as such,

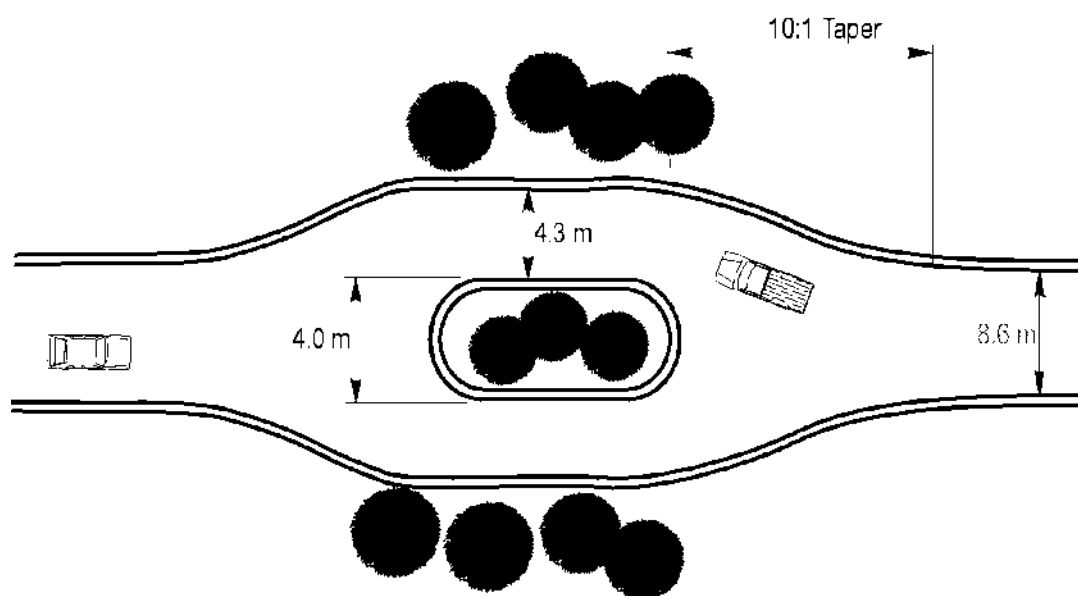


FIGURE 2 Speed control median (SCM).

they are increasing the crash potential for that element of the design. However, if effective, the SCMs should reduce travel speeds and thereby increase that aspect of road safety. The net effect of the SCMs (to increase, decrease or have no effect) on the safety of the road section could not be determined. There is certainly a potential for the SCMs to increase the number of crashes. This point was clearly articulated to the public. A review of the literature failed to assist in quantifying the potential disbenefit to safety. Nonetheless, staff felt that under the proposed design, safety would only be affected nominally.

In designing the SCMs the amount of deflection and the width of the pavement on either side of the SCMs are easily derived from the conventional guidelines and standards. One of the keys of effectiveness in this situation is the approach and departure tapers. Once again, the speed versus safety conundrum is faced. A gradual taper would be safer, but permit higher travel speeds; a short taper would produce the opposite effect. It was decided that a 10:1 taper would be sufficient as this ratio is considered to be the minimum acceptable practice for constricted urban conditions.

A concerted effort was also expended to ensure that the placement of the SCMs was consistent with the overall alignment of the road. Because the horizontal and vertical alignments have curves, it was imperative that these “obstacles in the road” were visible to approaching motorists so that appropriate action could be taken.

One design change that was implemented during construction was the change from a rural cross-section to an urban cross-section along the entire south side of the roadway. This change was instituted because the cross-section of the shoulder and ditch was judged to be too steep and deep by the abutting property owners, notwithstanding that they had originally requested a rural cross-section in the planning stages of the project. The edge of pavement remained in the same location, but the grass shoulder and ditch area was replaced by a 0.3-m curb and gutter.

RESULTS

Mohawk Road was reconstructed with the SCMs in the summer and early fall of 1998. In order for this speed calming effort to be considered a success, it needed to achieve an actual reduction in travel speeds, without significantly compromising safety, and produce a belief among residents that a speed reduction had occurred. Evaluation to determine the degree of success was comprised of before and after speed and crash studies, and a survey of residents.

Speed data were collected using automatic counters at several locations in the test section, and in the control section of Mohawk Road between McNiven Road and Highway 403. This permitted a before-and-after analysis with a control group. Speed data were collected for 48 hours at all locations.

The indicators that have been selected to determine whether the objective of speed control and reduction has been met are:

- a reduction in the mean speed; and
- a reduction in the proportion of vehicles exceeding the speed limit.

The mean speed for the test section of the road dropped from 54.0 to 49.3 km/h. This is a 9% drop in mean speed and is statistically significant with a 99% confidence limit. Mean

speeds on the control section of Mohawk Road dropped by only 3%. While the statistical significance of the reduction in mean speed is impressive, its practical significance must also be considered. In other words, is a 4.7-km/h reduction in the mean speed perceptible to the public and does it have any positive implications for substantive safety?

A reduction in the percentage of vehicles exceeding the speed limit is important for two reasons. Firstly, it relieves some of the burden of enforcement from the police. Secondly, it is generally the small percentage of vehicles that are moving extremely fast that cause the greatest concern for residents. The before and after speed studies indicate that the percentage of vehicles exceeding the speed limit in the test section was reduced from 67% to 47% while the control section experienced an 88% to 85% reduction. The 20% reduction in the test section is statistically significant with a 99% confidence limit. In this instance, the 20% reduction in vehicles exceeding the speed limit is large enough that it is considered practically significant as well.

Reliable crash data are not yet available for the test section of Mohawk Road after the SCMs have been installed. The safety record of the road is being carefully watched by staff to identify any unacceptable conditions.

At the time this paper was written, the survey of residents to determine speed perceptions was not complete, as it is intended to be undertaken in May or June of 1999. However, anecdotal evidence from encounters with residents during site visits indicates that there is a perception that the SCMs are successful in controlling speeds.

CONCLUSIONS

The information gathered to date is evidence that the SCMs are effective speed control devices for two-lane arterial roads. Mean speeds and the percentage of vehicles exceeding the speed limit have been reduced significantly. However, continued monitoring of the SCM installation is required to quantify other measures of effectiveness that were not available at the time. These measures include:

- The long-range effect of the SCMs on travel speeds (will travel speeds creep back to pre-SCM conditions?);
- The effect of the SCMs on the crash rate of the road section; and
- A survey of residents to determine perceived benefits or disbenefits of the SCMs.

Pending collection of the above-mentioned data, and discovering good results, it appears that the SCMs are an effective device for controlling travel speeds without materially affecting safety.