DOING AWAY WITH POLICE SURVEILLANCE?

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Short history of the use of design speed

In the 1973 edition of the American Association of State Highway Officials' Red Book [1] and the earliest editions of the AASHTO Green Book [2], which replaced it, design speed was defined as "the maximum safe speed that can be maintained over a specified section of highway when conditions are so favorable that the design features of the highway govern." The advice given was that "Every effort should be made to provide above-maximum values…" then "Except for local streets where speed controls are frequently included intentionally, every effort should be made to use as high a design speed as practicable to attain a desired degree of safety, mobility, and efficiency while under constraints…"

For example, in BC, in the mid-90's, the choice of design speed for rehabilitation of highways is that "it should be as high as practical and not less than the posted speed. After the completion of the project, the maximum posted speed is the maximum safe speed that can be maintained over that section of highway when conditions are so favourable that the design features of the highway govern." [3]

The TAC Standards, up until the 1999 edition of the Geometric Design Guide for Canadian Roads, stated the advice somewhat differently: "Every effort should be made to use as high a design speed as practicable to attain a desired degree of safety, mobility, and efficiency" without any exceptions for any road category. [4] The situation was the same in Ontario. [5]

Alone among the official documents in North America, the TAC Urban Supplement to the Geometric Design Guide for Canadian Roads took the position that: "In urban design, (providing as high a design speed as practicable) is not always the case and in fact the opposite may apply for the lower end of the street classification system. Choosing too high a design speed for a local or collector street in an urban environment can induce drivers to travel beyond the safe speed for their surroundings." [6] The committee that produced the document was hesitant to expand this advice for arterial streets.

Concern arose in the U.S. about situations where the posted speed was established above the design speed. According to established procedures, the posted speed was based on the observed 85th percentile of operating speeds. It occurred that drivers were taking curves at speed higher that the design speed. So the agency was posting speed limits above the design speed indicated in documents. The concern was that the agency could be subject to liability issues and litigation. The solution was to change the wording of the design speed definition, [7] to "a selected speed used to determine the various geometric design features of the roadway," without changing anything to the underlying reality and without changing the advice on using high design speeds. This was done in the 2001 Edition of the Green Book

The 1999 edition of the TAC Guidelines endorses this position by stating "Design speed is a speed selected as a basis to establish appropriate geometric design elements for a particular section of road." The advice to use the highest design speed was restricted to "Roads intended to provide high mobility, such as freeways and expressways, should be designed with the highest practical design speed to promote traffic mobility, efficiency and safety." [8] No specific advice is given for other road classes. In general then, up until recently, North American guidance favoured the use of high design speeds for most types of roads (see H. Shaheen, Évolution des approches de conception de routes urbaines, 2014 TAC Conference).

Until Canada's conversion to the metric system, typical practice was to use a design speed 10 mph over the expected speed limit. After metric conversion, the practice was modified to be 10 kph over the expected speed limit.

Critique of the use of design speed

The assumption that justified this use of design speed was that "a design speed greater than the intended operating speed follows the concept of a "forgiving roadway" (a margin of safety) where an intentional or unintentional error on the part of the driver doesn't make the driver 'pay' with his life". (reviewer of my chapter in the Institute of Transportation Engineers' Urban Street Geometric Design Handbook)

This assumption does not bear out under normal conditions; rather, the driver is led to use an operating speed that is close to the design speed. Although the definition of design speed is now changed, its previous definition as the "safe and comfortable speed for drivers" indicated well that drivers would tend to travel at its level. "It is not surprising therefore that motorists tend to drive near that speed nor that they have difficulty driving at a lower speed." [9]

A sign that the approach is starting to change is provided by the Design Manual produced for Alachua County: "The corridor design, as a whole, should reinforce the desired operating speed… Traditionally, the design speed sets the minimum geometric design. Many, or most, features of a corridor are designed to be safely negotiable at higher speeds to provide a level of 'safety'. Yet, over design invariably leads to higher operating speeds." For collector streets, the policy established is that design speed should equal posted speed, and not any amount higher." [10]

More experience is needed to verify whether a design speed set equal to the posted speed will in fact lead to operating speeds in conformance with the posted speed. Design speed already incorporates a number of conservative factors that do not necessarily reflect the evolution of vehicle design. As a first step, though, setting design speed equal to anticipated posted speed would be proper procedure.

European practices may be instructive in this regard: "Good infrastructure design can induce drivers to reduce speed "instinctively" – i.e. independently of speed limit signs or rules of the road. Design is even more crucial where the function of a road changes. A break in the continuity of design is needed to draw attention to the change, make road-users more alert and encourage them to adjust their speed of their own accord, when, for example, they enter a built-up area." [11]

In contrast, "In the United States, design guidance for high- to low-speed transition zones for rural highways is in its infancy…. Clearly, more work needs to be done to achieve such a goal. One of the areas in which more work needs to be accomplished is the obtaining of more accurate and reliable information on the effectiveness of transition zone treatments on reducing speeds and improving safety." [12] For example, this report was not able to document a speed-reduction effect of roundabouts.

Now, the concept of target speeds (where the objective is to obtain a chosen operating speed) is gaining greater acceptance. Research is underway to find ways of designing for lower speed roadways. NCHRP Project 15-48 is looking at Guidelines for Designing Low- and Intermediate-Speed Roadways that Serve all Users. The results should be published in 2016.

The Example of Angers

We were involved in the redesign of a 1,6 kilometre section of Highway 148 in Angers (now part of Gatineau, QC) in 2001-2002. The project was undertaken in response to an accident to a young girl crossing the highway to get to school. To our knowledge, this was the first project by the Ministère des transports du Québec whose avowed purpose was to alter driver behaviour and lower speeds. The town had experienced rapid growth, since it was located at the temporary end of Autoroute 50. The residential growth had been located mostly north of the highway, and most commercial development had been south of the highway. The highway had retained a rural cross-section with shoulders 3 meters wide. The speed limit within the center of the town was 70 km/h, with operating speeds in the range 76 to 84 km/h. There was one important intersection on the highway, with Montée des Laurentides, the road that led to the Autoroute. It was located towards the western edge of the town, though not quite at its beginning.

Our proposal involved providing an urban cross-section, with curbing and a shoulder reduced to 1 meter, a roundabout (a first in the region) at Montée des Laurentides, two speed reduction islands at the edges of the built-up area (Figure 1) and suggested zoning changes to make sure that future urban growth would remain between these two islands. Since the highway section was destined to be part of the provincial cycling network, the Route verte, a off-street cycle track was planned, with contrasting materials at driveways to alert drivers to the possible presence of cyclists.

Figure 1. Speed reduction island at the western entrance to Angers

The road construction work was done in two phases, in 2003 and 2005. The Ministry presented the results of before / after speed measurements (Figure 2) [13].

The average reduction of the 85th percentile speeds is indicated at 23 km/h. This reduction in speed reflects a change in drivers' speed choice. Over the time period of 4 years, the vast majority of drivers are the same in the before and after categories. Virtually the only change has been to the geometric characteristics of the road. This example clearly demonstrates that geometric design has a powerful influence on speeds.

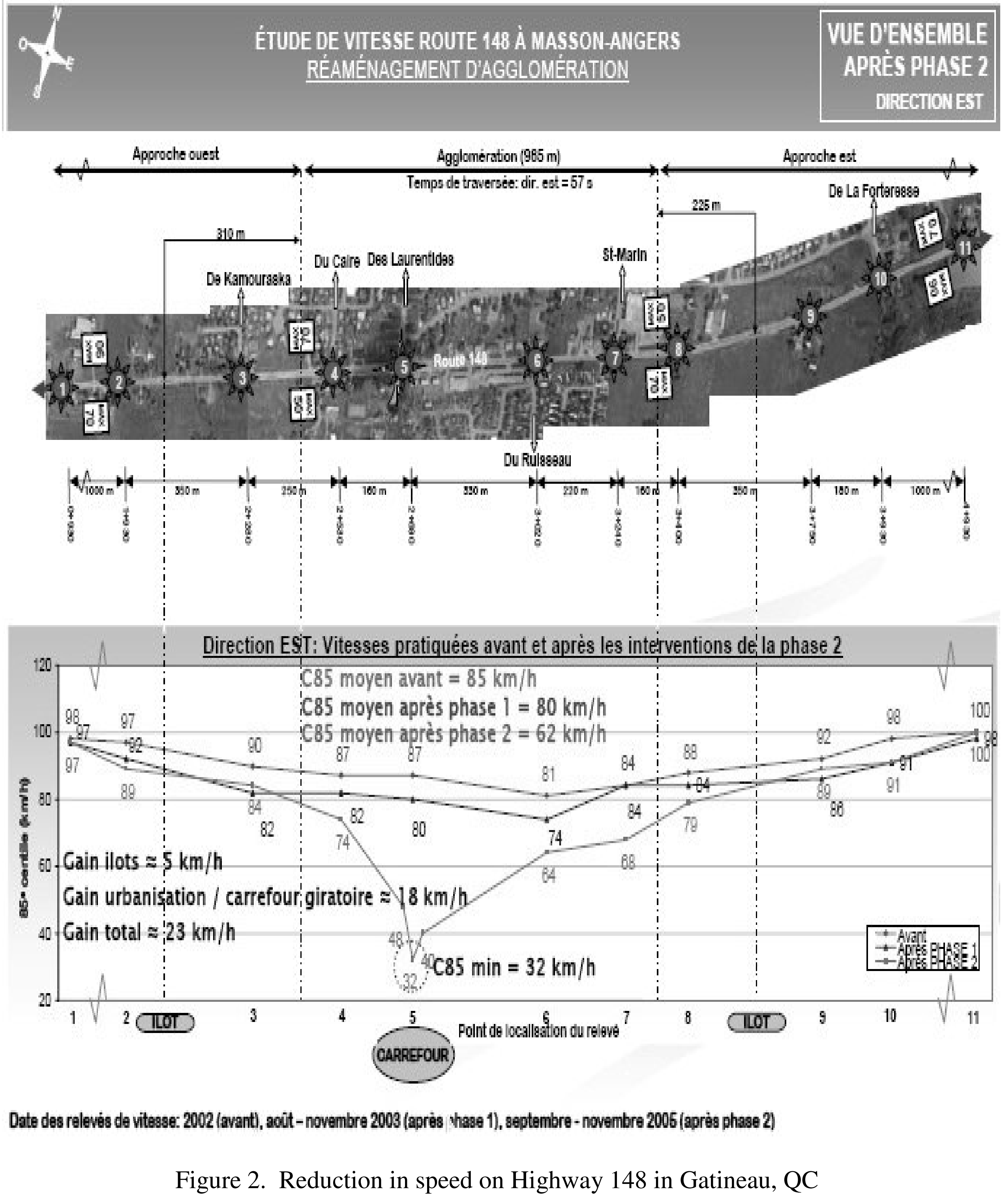

Figure 2. Reduction in speed on Highway 148 in Gatineau, QC

The Example of Val-d'Or

We have redesigned 3rd Avenue West in Val-d'Or, Quebec, in stages since 2010, to fit the different commercial contexts on a 1,5 kilometer stretch. The City had first thought of widening a section of the street from 2 lanes to 4 lanes to accommodate growth, due to the then-booming mine exploration industry. After we had conducted a road safety audit on their proposal, the City asked us to come up with an alternate plan.

Our proposal involved a single through-traffic lane in each direction with a blend of TWLTL (Two-way Left Turn Lane) for lower traffic volume adjacent businesses and medians with left- and right-turn lanes for the higher traffic volume businesses (Figures 3, 4 and 5).

Figure 3. Two-way left turn lane on 3rd Avenue West at the western entrance to Val-d'Or, QC (looking west)

Figure 4. Left turn lanes on 3rd Avenue West near Barrette Blvd. in Val-d'Or (looking west)

Figure 5. Two-way left turn lane and protected left-turn bays on 3rd Avenue West in Val-d'Or (looking east)

After the western section was finished, the local police chief stated that, after the redesign, they no longer need to do surveillance. Speed measurements were made from Tuesday, August 13 to 27, 2013 in the TWLTL section to back up that statement. Average speed was 50,4 km/h and the 85th percentile speed was 58,9 km/h. Considering the 24 hour nature of the counts, which include the late evening and very early morning, and the inclusion of weekend traffic, the results were very satisfying. More recently, City staff have anecdotally mentioned that there are no longer any reported accidents in this section.

I got in touch with the police lieutenant responsible for traffic on May 27 of this year. He confirmed that, "generally, there were no problems and that the road was working extremely well. With only one traffic lane, there is no room to speed, traffic is fluid and at a reasonable speed. The only exception is at the eastern end of the redesigned street, because of the road configuration at a Tim Horton's, with congestion and fender benders." The restaurant is on a small corner lot, with the parking aisle serving as one of the drive-through waiting areas, the other being just off the sidestreet (see Figure 6).

Road design does play then an essential role in driver behaviour. Drivers read the road and the roadside, and that means the road itself with its geometric characteristics. It is not principally the signing which influences drivers; signing must be read in a rational mode of thought, whereas the road is read instinctively. Signing should play the role of reemphasizing proper geometric design.

Figure 6. Location of the Tim Horton's very near the intersection

Advice that could be improved

NCHRP Report 600, **Human Factors Guidelines for Road Systems** has a section on "Methods to Reduce Driver Speeds in School Zones", which it says "refers to traffic control devices and pavement markings that are used to encourage drivers to drive at lower speeds in school zones." [14] As such it does not consider geometric design. The example it provides (see Figure 7) is a four-lane arterial, with speed limits of 35 mph in the school zone. As we have seen in the Val-d'Or example, consideration should first be given to reducing the number of lanes.

Does That Mean No Police Surveillance?

What role can police surveillance have in traffic safety? They remain indispensable for a minority of delinquent drivers, for DUI offenders…. These drivers will not be greatly influenced by road design – other factors are at play. There will also be drivers who want to experience the risk of driving and, for them, "the thrill of speed". It would not be cost effective to design a street that would make it impossible for such behaviours. Yet, despite their lower numbers, these drivers have a major impact on the quality of life of residents. In such cases, police surveillance is the appropriate solution.

But, if in fact, it is the geometric design that is leading to driver behaviour by the majority of drivers that is deemed not acceptable, dealing with the situation by having police enforce a speed limit, for example, will result in driver frustration and a decrease in support for police surveillance.

Other categories of drivers that require police surveillance are "normal" drivers that increasingly are becoming distracted by the use of cell phones, either handheld or hands-free, or drivers that need to adjust to new highway conditions, geometric or weather-wise. And police are especially useful in patrolling accident-prone locations, in order to gather data to improve the situation.

Road designers can help police concentrate on their specific mission by producing optimal geometric designs for urban streets that will operate at appropriate speeds to allow urban life to flourish.

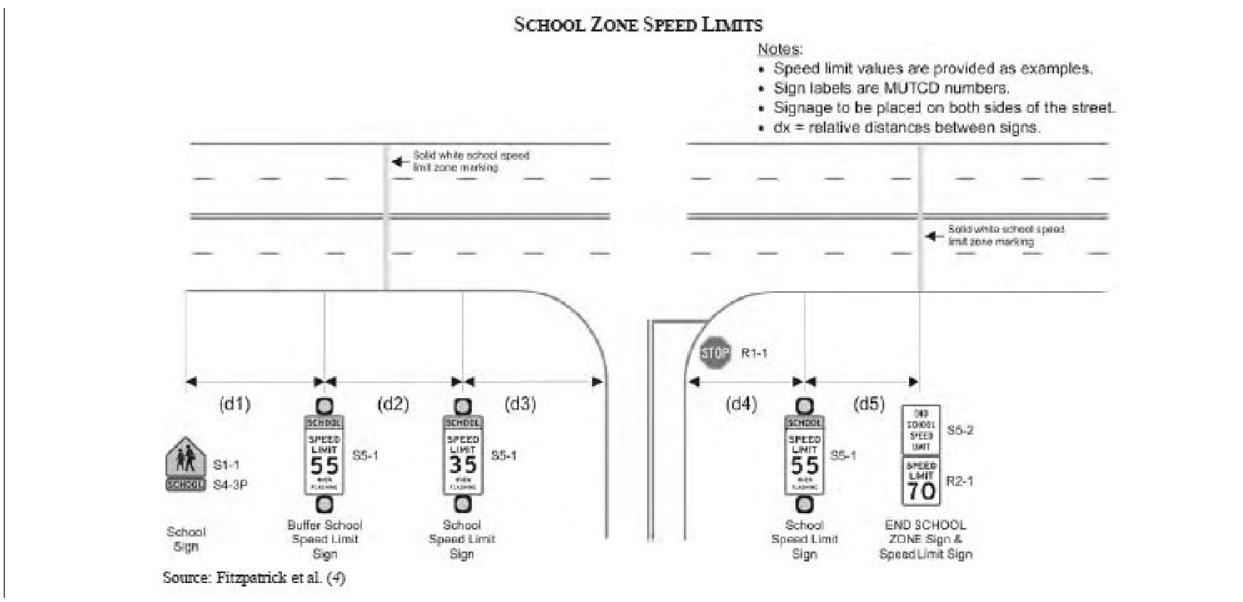

Figure 7. Example provided for reducing speeds in school zones

1. American Association of State Highway Officials. 1973. *A Policy on Design of Urban Highways and Arterial Streets* , Washington, DC, p.283 (which replaced the 1957 publication *A Policy on Arterial Highways in Urban Areas*)

2. American Association of State Highway and Transportation Officials. 1984. *A Policy on Geometric Design of Highways and Streets* , Washington, DC, p.60

3. Voyer, Richard J. and Bonser, Patrick J.. 1995. "Geometric Design Guidelines for Highway Rehabilitation Works in British Columbia" in *Paper presented at the 1995 TAC Annual Conference*. Ottawa, ON: Transportation Association of Canada, P. D12

4. Transportation Association of Canada. 1976. *Geometric Design Standards for Canadian Roads and Streets*. Ottawa, ON, p. A 16

5. Ministry of Transportation and Communications.1984. *Geometric Design Standards for Ontario Highways*. Toronto, ON, p. A-3; see also Department of Highways. 1965. *Geometric Design Standards for Ontario Highways and Streets*, Toronto, ON p. 40

6. Transportation Association of Canada. 1995. *Urban Supplement to the Geometric Design Guide for Canadian Roads*. Ottawa, ON, p. U.A – 18

7. Fitzpatrick, Kay, Carlson, P.J., Brewer, M.B, Woolridge, M.D. and Miaou, S.P.. 2003. *Design Speed, Operating Speed, and Posted Speed Practices.* NCHRP Report 504, Washington, DC: Transportation Research Board

8. Transportation Association of Canada. 1999. *Geometric Design Guide for Canadian Roads*. Ottawa, ON, p. 1.2.3.2

9. Fildes, B.N and Lee, S.J., 1993, *The Speed Review*, Federal Office of Road Safety, Canberra, Australia, as quoted in the *Manual for Setting Speed Limits on Municipal Road Networks*, Ministère des transports du Québec, 2002

10. Hurd, Patricia S. 2003. "Alachua County Corridor Design Manual"in *Proceedings of the ITE 2003 Technical Conference*, Institute of Transportation Engineers, Washington, DC.

11. European Conference of Ministers of Transport.1996. *Speed Moderation*, Paris, FR, p.25

12. D.J. Torbic et al. 2012, *Design Guidance for High-Speed to Low-Speed Transition Zones for Rural Highways*, NCHRP Report 737, Washington, DC: Transportation Research Board, p. 84

13. J. Henry and Chevalier, N.,. 2006, *Les bénéfices escomptés par la mise en oeuvre d'infrastructures novatrices* 41st Annual Meeting, AQTR (Quebec Road and Transportation Association), Quebec City

14. Campbell, J.L. et al., 2012, *Human Factors Guidelines for Road Systems*, NCHRP Report 600, Washington, DC: Transportation Research Board