Through Road/Main Street Interventions: Towards a More Balanced Coexistence Between Road Traffic and Life in Small Municipalities

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Briefing Note

For up-to-date knowledge relating to healthy public policy

The term "through roads/main streets"[1] refers to sections of public roadways that have a dual purpose, serving both as the main streets of small or medium-sized communities and as through-routes for motor vehicles. Due to a design that generally favours motorized through traffic, through roads/main streets negatively influence many health determinants. They increase the frequency and the severity of collisions, create noise pollution, decrease the use of active modes of travel, discourage social links (communities are "cut in half"), and so on.

The aim of this brief document is twofold. First, we want to familiarize public health actors with the interventions that can be made on through roads/main streets so as to mitigate their impacts on health. To this end, we will provide an overview of certain dimensions of practices and policies related to through roads/main streets, as well as evaluations of such actions. Secondly, we wish to suggest ways that those who are interested may strategically promote such interventions.

What is a through road/main street intervention and why implement one?

The concept of through road/main street interventions refers to interventions affecting the design of public roadways and the land adjacent to them. The purpose of this type of intervention is to ensure a more balanced coexistence between, on the one hand, motorized through traffic and, on the other hand, other users of public roadways and the functional uses of adjacent land, where there may be businesses or housing, for example. The motto used by the directorate of public works, transportation and energy in the Canton of Bern (Switzerland) to promote its interventions affecting through roads/main streets illustrates this idea well: "Trafic routier : oui à la cohabitation, non à la domination" (road traffic: yes to coexistence, no to domination).[2]

The objectives associated with these interventions are multiple, and vary from one intervention to another. The priority assigned to each objective also varies. Nevertheless, the aims almost always include improving road safety and reducing feelings of insecurity generated by motorized traffic flow. In many cases, aims also include reducing noise or vibrations, encouraging safe active transportation, and creating a more coherent urban environment, for example. Often, these interventions are also integral to strategies for revitalizing the social and economic core of the municipalities concerned.

In what contexts are such interventions carried out?

The years 1930-1940 marked the beginning of a dynamic of expansion of both the population and of territorial occupation, and the large-scale use of motor vehicles. The synergy of these trends led to an increase in distances travelled and in regional and supraregional motorized traffic. In response to these trends, the main streets of many municipalities were redesigned using a "road" design approach. That is, one focused on ensuring the fluid flow of motor vehicles crossing through towns at relatively high speeds. Other modes of active travel (walking, cycling) as well as the uses of land bordering these public roadways (residences, businesses, civic and social functions, etc.) were thus reduced to secondary concerns in terms of design decisions. Since these practices were initiated, there has been an almost continuous increase in the modal share and in the size of trucks transporting merchandise on such roads. This likely has

[1] In Switzerland, the term usually used instead is "traversée de localité" (a highway through a municipal centre such as a town or village).

[2] Retrieved on December 5, 2014 at: http://www.bve.be.ch/bve/fr/index/strassen/strassen/berner_modell.html

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bearing on the fact that these sections of public roadway are often seen today as sources of significant health nuisances, despite the benefits of motorization. These changes have, indeed, provided rural populations with access to a range of health-promoting care and services (education, health services, food, recreation, etc.).

Mitigation option: the bypass

Historically, the first way that road network authorities responded to these nuisances was to create bypass routes to circumvent the municipalities crossed. However, for various reasons, a bypass route is not always the option chosen. Firstly, they entail significant financial costs. Moreover, sometimes the planning of bypass routes does not, ultimately, prove a satisfactory solution to the problem at hand. Indeed, either the synergy referred to above or the relative proportions of through traffic and local traffic in a given region sometimes allow planners to foresee that problems related to safety or traffic flow on the bypass route or on the through road/main street will not be permanently resolved.[3] Concerns may also be expressed about the commercial vitality of the central core of the municipalities which would be thus circumvented. Such fear concerning the consequences of establishing bypasses is not totally unfounded: while the phenomenon does not generally seem to greatly affect the overall volume of trade in a given municipality, bypasses have resulted in diminished revenues for certain types of businesses located in the urban centre and have altered the existing distribution of trade between the urban core and the periphery (Leong & Weisbord, 2000; Yeh, Gannon, & Leong, 1998).

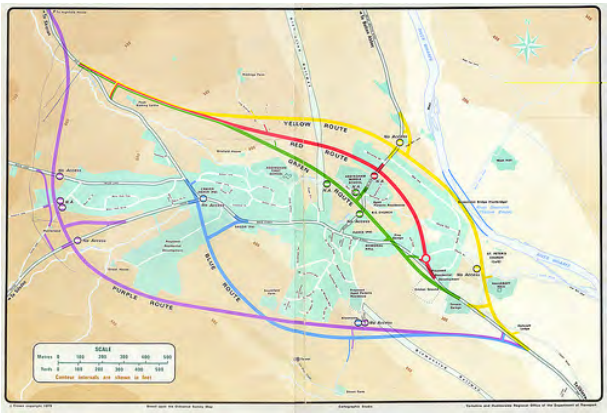

Figure 1 **The bypass route, a mitigation option that is not always desirable**

In Addingham (United Kingdom), various routes are envisioned for an urban bypass route, here represented in pale blue.
Source: www.flickr.com
Image: Don Barrett.

Through road/main street interventions: a new mitigation option

It was within the context of these conflicting concerns that through road/main street interventions were developed. In several European countries and in Australia, they have been firmly established for many years, even decades. Indeed, it was in the mid 1980s that the first interventions took place in France (within the context of the "Ville plus sûre, quartier sans accidents" program [safer town, accident-free neighbourhood]), in Denmark (as Environmentally-adapted through roads), in the United Kingdom (under the Village Speed Control Working Group) and in Australia (as Environmental adaptation of the Main Street in Rural Towns) (Mackey, 2004).

In North America, the specific development of such interventions and practice guides is more recent and less widespread.[4] In Canada, although some initiatives exist at the regional level, the province-wide development of through road/main street interventions is not common, except in Québec. We can point to a series of interventions carried out by

[3] Structural trends and contingencies aside, it is believed that the construction of bypass routes may sometimes produce an "induction effect" on motorized traffic which can be a factor in preventing resolution of the problems being addressed. The argument, although greatly simplified, is that adding road capacity to address traffic congestion, by improving fluidity, immediately modifies motor vehicle use (resulting in more and longer trips) and, in the longer term, leads to a reorganization of land use (e.g., (re)location of commercial and residential functions). These phenomena in turn contribute to increases in the volume of vehicle-kilometres travelled and in travel demand, which lie at the source of the problems being addressed. This effect was documented in contexts where capacity was increased through the construction of highways in major cities as early as the mid-1990s (SACTRA, 1994). It was also reported in the wake of a number of bypass projects. It must be said that this induction effect is the subject of debate among experts in transportation planning and that it is not possible to resolve these disputes here or in general. Regardless, some jurisdictions take this factor into account during the planning of bypass routes (Australian Transport Council, 2006, p. 60).

[4] In Québec, in particular, a series of through road/main street interventions was implemented by the ministry of transportation.

the Ministère des transport du Québec (MTQ – Québec's ministry of transportation). The MTQ also produced several documents focused, in whole or in part, on through road/main street interventions[5] and collaborated on the preparation of fact sheets (Fondation Rues principales, 2011).

These contain some examples of interventions carried out as well as some evaluation results that were presented at the annual conference of the Canadian Public Health Association (Berthod, 2012).

It was during the 1990s that context sensitive design practices and expertise developed in the United States. This concept is most frequently used in Canada, outside of Québec, and in the United States; it refers to an approach to road design which incorporates, among other things, through road/main street interventions. The Federal Highway Administration (FHWA) published a guide entitled Flexibility in Highway Design (FHWA, 1997), allowing road construction standards to be modified to reflect objectives other than motorized traffic flow and capacity. The following year, five pilot projects were implemented in various US states. In 2004, the FHWA developed an internet platform enabling the development of expertise (*Context sensitive solutions*[6]) and funded the publication of a "best practices" guide (National Cooperative Highway Research Program, 2002).

How can design practices be modified to achieve desired goals and objectives?

Interventions take varying forms depending on the desired objectives and goals and on the "contextual zones" of through roads/main streets. Indeed, design specifics will vary according to whether "gateways" marking entrances and exits to a municipality or its urban core are being considered, and according to whether speeds of 60 km/h or 30 km/h are preferred in the urban core. The layout and parameters of the design will be determined by the relative importance given to the transit function versus other uses of public roadways and the land adjacent to them.

Figure 2 The through road/main street intervention: a public road for everyone

In Köniz, Switzerland, a roundabout that marks the entrance to the urban core.
Source and photographer: Commune de Köniz.

Regardless of the layout and the preferred speed, it is common to see devices that mark the transition into and out of the municipality, such as roundabouts, deflector islands, chicanes or other devices that break up the linearity of a route and signal a change of zone.

For road sections that run between entrances and exits, there are numerous measures for changing or stabilizing speeds and making other modes of transportation safer. These include, for example, narrowing lanes using pavement markings or introducing wider sidewalks, cycle paths, curb extensions, protective islands, bollards or other devices. Revegetation (planting trees, vegetation islands) serves the same purpose, in addition to beautifying the landscape and enhancing the experience of being in an urban environment. Readers can find numerous examples in many of the documents listed as references.

What are the results of evaluations of such interventions?

The evaluations identified[7] provided informative results about the effects of such interventions on: the

[5] An informative document raising awareness about the subject was published as early as 1997 (MTQ, 1997). The MTQ also funded a study of the relationship between the design of through-routes and vehicle speeds (Bellalite & D'Amours, 2002). More recently, it published technical data sheets on traffic-calming measures which focus, in particular, on through road/main street interventions (MTQ, 2011). Finally, it collaborated on a "tip sheet" identifying certain parameters (such as collaboration between actors) or principles (such as the observance of certain steps) — which should, according to the author, guide the process of defining a through road/main street intervention (Fondation Rues principales, 2011).

[6] Retrieved on February 26, 2015 at: http://contextsensitivesolutions.org/

[7] The search for evaluations was performed using the following key words: traversée d'agglomération; traversée de localité;

speed of motorized traffic; the flow and volume of motorized traffic; collisions and injuries; noise; and the use made of public roadways and the land adjacent to them.[8] With the exception of the last category, all the results are presented in detail in the table on pages 5 and 6. The last category of results did not lend itself well to synthesis in table format, and is therefore presented in the body of the text.

A word of warning: when interpreting the results, the wide variability of the interventions should be kept in mind. The evaluations synthesized examined interventions that can be placed on a continuum ranging from minimalist interventions, aimed at slightly altering driving speeds with a small deflection placed at the entrance to municipalities, to more comprehensive interventions, such as the case where speed was limited to 30 km/h and the central section of the through road/main street was set up as a *Zone 30*.[9] A more satisfactory review of the evaluations would have required fully detailing each intervention, which was inconsistent with the purpose and format of this document. However, readers are encouraged to consult the complete studies found synthesized here. Many of the studies provide detailed descriptions of the interventions, which allow the evaluation results to be better understood.

It can, however, be stated that the magnitude of effects seems to be closely related to the extent of speed management interventions. The most significant results are, in general, linked to the most substantial efforts to reduce traffic speeds. Although speed variations are known to have effects on collisions, injuries, noise and other determinants of health, the current body of knowledge does not yet include an assessment of the effects of through road/main street interventions on this factor.

When considering the results of evaluations, the methodological quality of the studies identified must be taken into account, so as to assess their strengths and weaknesses. The evaluations usually allow for comparisons between pre- and post-intervention periods, without, however, allowing for comparison with "untouched" through roads/main streets. The validity and reliability of results would have been improved by the inclusion of such comparisons. Nevertheless, several evaluations carried out before and after interventions analyzed data over several years, partially offsetting the tendency for regression towards the mean, which can favourably bias results. Other weaknesses are attributable to the way the effects observed were reported in some evaluations or to their methodology. For example, one evaluation specifies that an intervention resulted in a decrease "of about 10 to 15 km/h," but it does so without even specifying the average speed before or after the intervention. In some evaluations, the number of survey respondents is not specified, nor do they indicate when or how speeds were measured. Yet all these factors can have a significant impact on results; for example, measurements may or may not have been taken during periods of heavy traffic. On the other hand, it should also be noted that the results, despite these differences, are generally convergent, and when this is not the case, it is fairly easy to explain why. The results presented are also convergent overall with evaluations of other interventions whose central mechanism of action is speed management, such as traffic-calming measures introduced on local city streets (Bellefleur & Gagnon, 2011) and road diets (Bowman, 2013).

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context sensitive design; environment* AND adapt* AND road OR street; traffic calming AND road. These keywords were used in Google, Google Scholar and 360, the Institut national de santé publique du Québec 's (INSPQ) documentary search tool. This Serials Solutions search engine covers the following databases: BioMedCentral, Cambridge Journals Online, CINAHL, EMBASE (from 1980 to today), Environmental Sciences & Pollution Management, Érudit, HighWire Press, ipl2 – Internet Public Library, Journals@Ovid LWW Total Access Collection, MEDLINE (Ovid), MEDLINE Plus Health Information, MEDLINE with Full Text (EBSCO), MetaPress Complete, Nature Journals Online, OAIster, PILOTS, Political Science Complete, Psychology & Behavioral Sciences Collection, PsycINFO 1887-Current, Public Affairs Index, PubMed, PubMed Central, ScienceDirect, ScienceDirect Journals, Scirus, Social Services Abstracts, SocINDEX with Full Text (EBSCO), Sociological Abstracts, Wikipedia. The bibliographic references of the evaluations were systematically reviewed to identify other evaluations referenced there.

8 Some evaluations considered other effects of these interventions, such as the "cognitive load" of drivers or the behaviours of users of cross streets. These results are interesting, but a decision was made to not include here dimensions that were examined in only one evaluation, for reasons of space.

9 The through road/main street intervention in Köniz is exceptional, because it affects a significant portion of the streets in the municipality's road network. The documentation concerning its implementation and evaluation place it in the category of a global urban reorientation. Considering traffic arteries alone, notable features of the intervention include, in addition to the installation of a pedestrian priority zone where speed is limited to 30 km/h, a bypass route open during peak hours and dynamic management of motorized traffic in the urban centre. Moreover, the intervention is also exceptional in that the pre-existing situation on a significant portion of the road network in question was characterized by a problem of compatibility between the environment and its usability for other public road users that was tied to traffic volumes and congestion, rather than to speed.

Table 1 **The effects of interventions on health determinants** (for abbreviations, see the key at the end of the table)

Country and reference	Interventions	Speed	Collisions and injuries	Noise	Traffic flow and volumes	Remarks
Denmark **(Herrstedt, 1992)**	Synthesis of 3 evaluated interventions. Objective: reduction from 60 km/h to 50 km/h in 1 case, and from 60 km/h to 40 km/h in the other two.	Reduction at all control points, of between 1 and 10 km/h. Variations in speed reduction.	No effect on C for the intervention where speed was reduced to 50 km/h, but reduction for the 2 where speed was reduced to 40 km/h (reduction not qualified or quantified).	Ambient noise "unchanged" in one case, "slightly" reduced in the other two. Increase in ambient noise of 9 dB(A) in one case, of 8 dB(A) in the other two, near the rumble strips at the gateway marking the transition into the municipality.	Travel time "slightly" increased in all three cases. Level of service not affected.	Noise: absolute measurements not specified.
United Kingdom **(Wheeler & Taylor, 1999)**	Synthesis of 9 evaluations of as many interventions.	Gateway: Reduction of between 5 and 21 km/h (a bit greater for V85 reductions) after one year. In municipality: reduction of between 3 and 19 km/h (greater for V85 reductions). Exits: 5 reductions, 3 neutral, and 1 increase.	"Small" reduction in CMD (3.4 to 3.0/yr). Reduction in C from 4.3 to 3.2/yr where devices apart from surface markings were used and from 2.9 to 2.8/yr where only markings or signals were used. Reduction in CSI from 0.8 to 0.06/yr and in CD from 0.2 to 0/yr.	Reduction in emissions of between 1 and 5 dB(A). Daytime ambient noise: LA10, 6 p.m., from 0 to -8.6 dB(A); LA90, 6 p.m., from -0.6 to -9.4 dB(A). Night time ambient noise: LA10, 6 a.m. from +0.9 to -12.9 dB(A); LA90, 6 p.m., from -2.3 to -2.5 dB(A).	Increase in travel times in cases where this was measured. AADT unaffected.	Speed: greater reductions where there were more intense interventions and where objective was more ambitious (from 90 to 60 km/h). Collisions and injuries: the three interventions with a significant number of devices off the pavement surface had a 25% greater reduction. Collisions and injuries: the post intervention follow-up period was not specified.
France **(SETRA, 1994; 1995; 1997a; 1997b; CERTU, 2004; 2007; 2010)** **Results reported here start with the oldest (1) to the most recent (7)**	7 case analyses of as many interventions. Highly variable, from a simple deflection at the entrance to a full application of the "road diet" approach (from 2 lanes in each direction to 1 + 1 left-turn lane).	1. Average speed in both directions from 72 to 57 km/h (61 km/h in one, 52 km/h in the other). 2. Average speed reduction of between "10 and 15 km/h" (average speed before unknown, but V85 before = 81 km/h). 3. Reduction of V85 of "over 10 km/h in both directions." 4. Speed reduced "by about 10 km/h" after 3	1. Reduction in CID (4.25 to 0.51/yr); CD (1 to 0.25/yr); CSI (3.5 to 0/yr); CMI (3.75 to 0.51/yr). 2. Reduction in CID (2.4 to 0.75/yr); CD (0.6 to 0/yr); CSI (1.4 to 0/yr); CMI (1.4 to 1.2/yr). 3. Reduction in CID (3.6 to 0/yr); CD (1 to 0/yr); CSI (1.2 to 0/yr). 4. Reduction in CD (1.2 to 0/yr); CSI (1.6 to 0.6/yr). 5. Reduction in			1. Calculations before and every 3 years after. 2. Intervention extended over several years. Collisions and injuries: measured 5 years before, 5 years after. 3. Collisions and injuries: measured 5 years before, 2 years after. 4. Injuries measured 5 years before, 3 years 4 months after. 5. Intervention extended over

Country and reference	Interventions	Speed	Collisions and injuries	Noise	Traffic flow and volumes	Remarks
		years. 5. Reduction of 5 km/h after 1st phase and V85 of 43 km/h after 2nd phase. 6. Reduction from 72 km/h to 61 km/h in the direction that was problematic. 7. Reductions of from 36 to 21 km/h (V85 from 46 to 36) and of from 50 to15 km/h (V85 from 59 to 26) at two points which were problematic.	CSI (1.4 to 0/yr); CMI (0.4 to 0/yr). 6. Reduction in CMI (0.4 to 0/yr). 7. 0.1 CMD after, "many" CMDs before.			2 years. Injuries: 5 years before and right after up until the writing of the report. 6. The data on injuries are those of 5 years prior to the intervention, and immediately after the intervention, up until the writing of the report. 7. The period "before" the intervention is not specified, whereas the follow-up period after the intervention extended over 10 years.
Switzerland **(Commune de Köniz, 2010)**	The data presented concern exclusively the section transformed into a *Zone 30*; that is, the section crossing through the municipality's central core.	Average speed reduced by 2.5 km/h. V85 of 30 km/h.	Reduction of CID (8.25 to 5.5/yr); CMD (2.5 to 0.5/yr).		Reduction of travel time by 20% when pedestrian crossings were eliminated (from 2.5 to 2 minutes). AADT: About -10% between 2002 and 2006.	Average speed already below the speed limit of 50 km/h before the intervention.
Canada **(MTQ, 1997)**	1 intervention including, in particular, rumble strips to mark entry into the municipality and recovery of a portion of the public roadway to create a safety corridor for pedestrians and cyclists in the village using surface markings and bollards.	Average speed reduced by 6.5 km/h (62.5 to 56 km/h). V85 reduced by 7 km/h. Measurement taken of southbound traffic, whose lane is adjacent to the cycle lane and pedestrians.				Speed: Measurement taken 9 months after the intervention.

Key: C = collisions; CID = collisions with injuries or death; CMI = collisions with minor injuries; CSI = collisions with serious injuries; CD = collisions with death; CMD = collisions with material damage; AADT = annual average daily traffic; LA10 = noise level exceeded 10% of the time during a given period; LA90 = noise level exceeded 90% of the time during a given period; V85 = speed at or below which 85% of motor vehicles are observed to travel.

Speed of motorized traffic

Because it is the main mechanism of action, speed management is the most studied subject in the evaluations available. The 85th percentile (expressed as V85) designates the speed at or below which 85% of motor vehicles are observed to travel. Average speeds are sometimes also measured. Speed variations are also examined, these being linked to collisions and injuries, noise, and other health determinants.

As shown in Table 1, above, all of the evaluations revealed speed reductions, regardless of the measures chosen. At the times speed variations were measured, these were also reduced. That said, the table also shows that the effects of interventions on speed varied greatly. As mentioned previously, it is very likely that an intervention's effect on speed is related to the intensity of its speed-related measures.

Today, the use of interventions that modify road design to manage speed is fairly well mastered. For this purpose, physical devices and pavement markings are often used, although devices other than markings are considered to be particularly effective and relevant by urban planners. That said, one intervention managed to significantly reduce travelling speeds solely through the use of pavement markings (Service d'études sur les transports, les routes et les aménagements [SETRA], 1995); another managed this using markings, new traffic signs and on-road parking spaces (Centre d'études sur les réseaux, les transports, l'urbanisme et les constructions publiques [CERTU], 2004). Similarly, another intervention also managed to reduce speeds by combining the installation of rumble strips at the gateway to the municipality, the addition of new traffic signage and the narrowing of lanes through the use of pavement markings and bollards (Gagné, 1999).

Flow and volume of motorized traffic

Traffic flow is usually evaluated in terms of travel time and level of service. Travel time refers to the average time needed to travel over a particular section of the public road network.

Level of service, for its part, measures the estimated difference between the flow of motor vehicles under ideal conditions (minimal waiting time at intersections, for example) and when delays are incurred due to the presence of other vehicles. The level of service is often referred to, in everyday speech, as the level of congestion. Traffic volumes are frequently measured in terms of average annual daily traffic (AADT). This constitutes an estimate of the average number of vehicles circulating daily on a given section of a public road, calculated on an annual basis.

The results of the evaluations indicate that by reducing speed, these through road/main street interventions often led to an increase in travel time. In the evaluations discussed below, travel times increased in all cases except one, namely that of Köniz (Switzerland).

It is interesting to consider for a moment the anomaly of Köniz, which experienced a 20% decrease in travel time in the *Zone 30* section. This zone had a very poor level of service before the intervention, being frequently congested. The reduction in travel time occurred when the pedestrian crossings were removed. The authors explain that eliminating pedestrian crossings and allowing pedestrians to cross anywhere reduced the number of stops and starts for motor vehicles. In addition, the global intervention included the addition of a bypass route with flexible hours and dynamic traffic lights. These two devices were managed so as to prevent motorized traffic from saturating the capacity of the *Zone 30* section. Thus, the number of motor vehicles crossing through the urban centre decreased slightly (from 24,300 to 22,100 in one direction, and from 25,100 to 24,100 in the other) between 2000 and 2006 (Commune de Köniz, 2010, p. 15). This improvement in travel time is probably also partly related to the management of traffic volumes in the *Zone 30* section.[10]

It is not desired, nor is it generally expected, for a through road/main street intervention to provoke a decrease in the level of service, by increasing traffic congestion. In the three Danish cases, the level of service was not affected (Herrstedt, 1992, p. 7).

Finally, it is not desired, nor is it generally expected, for a through road/main street intervention to modify traffic volumes. The anomaly of Köniz has already been discussed and partially explained. The United

[10] Moreover, bus use increased significantly on this route, in conjunction with an increase in the frequency of bus service and the establishment of bus priority at certain intersections (Commune de Köniz, 2010, p. 16).

Kingdom evaluation for its part shows no change in motorized traffic volumes (Wheeler & Taylor, 1999, p. 19).

Collisions and injuries

With regard to road safety, the concept of a collision (C) refers to an impact between a motor vehicle and another entity or object, be this another motor vehicle, a cyclist, a pedestrian or a fixed object. A collision with material damage (CMD) can be defined as an event that has only caused damage to vehicles. The concepts of collisions with injuries (CI), with minor injuries (CMI), with serious injuries or death (CSID), with serious injuries (CSI), or with death (CD) are used to describe all types of collisions causing injuries of varying severity.

Overall, Table 1 reveals either neutral effects or a reduction in the rate of collisions, with or without injuries. It also appears that the interventions that produced the greatest reductions in speed also produced the greatest reductions in the rate of collisions, with or without injuries, and in the severity of injuries.

In addition, the evaluation conducted in the United Kingdom reveals that the three interventions which included a large number of design changes involving more than just pavement markings produced a 25% higher reduction in the number of collisions (Wheeler & Taylor, 1999, pp. 19-20).

Furthermore, in Switzerland, the effects on safety were also congruent with those concerning the perception of safety, with a sample set of the municipality's population finding that the *Zone 30* section had improved pedestrian safety (Commune de Köniz, 2010, p. 19).

Noise[11]

Noise is often measured in terms of decibels weighted with a type A filter (dB(A)). When measuring dB(A) at the source, the concept of noise emissions is used. When measurements are taken at a distance from the source, the concept of ambient noise is used. To estimate continuous noise levels, average dB(A) can be calculated over a shorter or longer period, such as one day, during the night or during the day (respectively LAeq T, LAnight, LAday). A more or less equivalent measurement, less frequently used today, is one that measures the noise level exceeded 90% of the time for a given period, referred to as LA90. However, we can also measure noise "peaks," in which case maximum noise levels are estimated (LAmax).[1] A more or less equivalent measurement, also less frequently used today, is one that measures the noise level exceeded 10% of the time for a given period, referred to as LA10. As a frame of reference, negative health effects have been documented as occurring over the threshold of 40 dB(A), and this is the standard level suggested by the World Health Organization (WHO) for continuous (or "background") noise at night. For daytime, the WHO's suggested standard for continuous noise is 55 dB(A).

Overall, it can be seen from the table that interventions generally reduced or had a neutral effect on ambient noise or noise emissions. On the other hand, the installation of rumble strips to mark the transition into a municipality significantly increased ambient noise levels (Herrstedt, 1992, p. 12).

Despite these generalized neutral or positive effects, the surveys conducted among residents following the interventions in the United Kingdom reported a neutral or negative assessment of ambient noise. The results vary from one village to another: in one village, respondents said they perceived little change; in another, a slight deterioration; and in a third, a significant deterioration. The authors believe that the responses of respondents in one village may have been negatively coloured by their unsuccessful attempt to have a bypass installed. In addition, it must be observed that perceptions of noise also vary significantly depending on the device installed. For example, speed cushions probably produced negative perceptions, according to the authors, because some trucks strike them when crossing over (Wheeler & Taylor, 1999, pp. 17-19).

[11] The evaluation carried out in the United Kingdom measured vibration levels. The problem is that vibrations generated by heavy vehicles (in the ground or through the air) can directly disrupt sleep or social relations or can amplify noise effects (Hunaidi, 2000).

Uses and perceptions of roadways and adjacent land[12]

The Danish evaluation examined how many users of active transportation crossed the public roadway and how many travelled in parallel, by bicycle on the public roadway or by foot on its sidewalks. The number of people crossing the roadway increased by 20% in two municipalities and by 60% in the other. The number of people travelling in parallel on foot increased, but in one case the number of cyclists decreased. The authors note that the intervention included the installation of a cycling path elsewhere in the municipality. In the two other municipalities, the number of people travelling in parallel increased by 15% and 45% respectively. According to the authors, these variations are not explained by the reduction in crossing wait times, which were small, but by the net reduction in insecurity linked to motorized traffic. The proportion of cyclists who reported feeling unsafe decreased from 70% to 30% and from 56% to 17% in two of the three municipalities. In these same municipalities, the proportion of 'insecure' pedestrians dropped from 63% to 25% and from 43% to 14%. For the third municipality, the data on pedestrians and cyclists were combined, with the proportion of 'insecure' users of active transportation dropping from 73% to 45%. The authors note that elderly people benefited the most from the rise in feelings of safety (Herrstedt, 1992, p. 11).

In the same evaluation, a net increase was observed in "voluntary or necessary" activities alongside the road/street. This translates into increased numbers of people using the land adjacent to the roadway, with specific increases of 16%, 47% and 50%. On the other hand, commercial activity did not apparently increase, even though business owners reported being pleased with the roadway's new design (Herrstedt, 1992, p. 11). Finally, in two of the three municipalities, the residents found that the interventions made the surroundings more agreeable, and the volume and speed of vehicles more acceptable. In one case, however, the level of satisfaction was much lower due to a mini-roundabout that did not reduce speeds or properly control traffic (Herrstedt 1992, pp. 12-13).

In the case of the evaluation carried out in the United Kingdom, police reported that their intervention times were not affected. On the other hand, firefighters and ambulance drivers expressed some concerns, in particular, about delays due to congestion at some roundabouts and about the discomfort of their patients when travelling over speed cushions (Wheeler & Taylor, 1999, p. 19). However, perceptions of speed seem incongruous with the reductions observed, even the greatest reductions. It seems that results did not always meet expectations, for example, because they failed to reduce speeds to the desired level of 32 km/h in one case, and in another case, because residents had campaigned for a bypass route (Wheeler & Taylor, 1999, p. 21). Finally, the numerous distinct measures implemented (speed cushions, roundabouts, etc.) drew different responses from the various categories of residents or public roadway users, which could prove a valuable source of information for those interested in planning such interventions.

The Swiss evaluation revealed that the number of pedestrian crossings of the public roadway in the *Zone 30* section of the intervention quintupled after the intervention (Commune de Köniz, 2010, p. 19). Waiting time increased somewhat, even though it remained relatively low, at 10 seconds. Despite this, more than 60% of pedestrians reported that they were satisfied with being able to cross at any point and that this new way of circulating posed no problem for them. The evaluation reported a stable amount of travel by cyclists (Commune de Köniz, 2010, p. 16). The redesign proved not to be an obstacle for the elderly or for children.

The same evaluation revealed that the sales figures of merchants in the urban core rose significantly after the intervention, and that this area was seen as a more agreeable place for meetings and social activities. However, this commercial success seems to have been achieved to some degree at the expense of businesses located further away from the urban core (Commune de Köniz, 2010, pp. 9-10).

To summarize, the results of evaluations concerning the uses and the perception of public roadways and their adjacent land demonstrates that, under certain conditions, through road/main street interventions can improve the urban environment in general, and enhance active transportation, in particular. At the same time, certain specific measures may have undesired effects. It is therefore important to

[12] As these are discussed in other sections, perceptions of noise and of road safety are not addressed in this section.

carefully plan interventions, so as to maximize the potential benefits and limit undesired effects wherever possible.

How can public health actors promote through road/main street interventions?

Generally, provincial transportation departments are responsible for through roads/main streets. Some routes, however, are also under the control of regional municipalities, some of which began developing through road/main street interventions as far back as the early 2000s, as was the case in the Ottawa region (City of Ottawa, 2000). Identifying who is responsible for one or another through road/main street and verifying whether this authority has already developed practices to address concerns is perhaps the first step to take. Moreover, the existence or non-existence of intervention practices targeting through roads/main streets can be an early indication of the openness and flexibility of road network managers if faced with a proposal for redesigning the link. This openness and flexibility will likely vary from one jurisdiction to another.

In any case, proposals for minor corrective interventions, i.e., those that do not call into question existing speed limits, would be the most likely to be favourably received, regardless of context. This is especially true if they are carried out with a view to improving road safety, which is one of the priority mandates of road network managers. However, promoting through road/main street interventions that call into question traffic speeds and target other health determinants, such as noise or active transportation, will likely prove a greater challenge. This type of intervention is generally considered when the importance of impacts on other users of the public roadway and of the adjacent land is acknowledged.

Concern for these impacts can develop, in particular, when attention is drawn to noise and to other environmental determinants of health generated by through roads/main streets. The field of public health can contribute unique expertise and can illustrate the scope of these phenomena when such discussions are on the agenda and issues related to public road design are being addressed. Discussing the impacts of these other determinants on human health at various forums for exchange and planning may serve to raise awareness among elected officials and engineers and encourage elected officials and road network managers to expand promising or conclusive experiments so that they become widespread practices.

Many elected officials and professionals are already aware of the problems engendered by the current configurations of through roads/main streets. Actions are already underway or in development, and public health resources can contribute to these efforts by working cooperatively with those already involved.

References

Australian Transport Council. (2006). *National guidelines for transport system management in Australia*. Canberra: Commonwealth of Australia. Retrieved from: http://www.transportinfrastructurecouncil.gov.au/publications/files/national_guidelines_volume_1.pdf

Bellalite, L. & D'Amours, M. (2002). *Évaluation de l'impact du profil en travers sur les vitesses pratiquées au sein des traversées des petites agglomérations.* Sherbrooke: Université de Sherbrooke. Retrieved from: http://www.saaq.gouv.qc.ca/rdsr/node/190

Bellefleur, O. & Gagnon, F. (2011). *Urban traffic calming and health: Literature review.* Montréal: National Collaborating Centre for Healthy Public Policy. Retrieved from: http://www.ncchpp.ca/docs/ReviewLiteratureTrafficCalming_En.pdf

Berthod, C. (2012). *Highways through urban areas*. Presentation given at the Annual Conference of the Canadian Public Health Association (CPHA), June 11, 2012, as part of the workshop on "Motorized Traffic and Health: Interventions to Mitigate its Impacts." [PowerPoint presentation]. Retrieved from: http://www.ncchpp.ca/docs/CPHA2012_4Highways_en.pdf

Bowman, S. (2013). *Road diets: Fitter, healthier public ways*. Montréal: National Collaborating Centre for Healthy Public Policy. Retrieved from: http://www.ncchpp.ca/docs/RegRoutiersRoadDiets_EN.pdf

Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques (CERTU). (2004). *Traversée d'agglomération — Requalification dans le cadre d'une démarche concertée*. Lyon: CERTU. Retrieved from: http://www.aude.gouv.fr/IMG/pdf/requalification_demarche_No6_cle5e2128.pdf

Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques (CERTU). (2007). *Traversée d'agglomération ou de quartier — Réalisation d'une bande médiane en résine*. Lyon: CERTU. Retrieved from: http://www.aude.gouv.fr/IMG/pdf/bande_resine_No8_cle1116e1.pdf

Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques (CERTU). (2010). *Traversée d'agglomération — Modération de la vitesse.* Lyon: CERTU. Retrieved from: http://www.aude.gouv.fr/IMG/pdf/moderation_vitesse_No10_cle06e685.pdf

City of Ottawa. (2000). *Regional road corridor design guidelines*. Ottawa, Ontario. Retrieved from: http://documents.ottawa.ca/sites/documents.ottawa.ca/files/documents/con027786.pdf

Commune de Köniz. (2010). *Êtes-vous satisfaits du nouveau centre? Contrôle des résultats du réaménagement du centre de Köniz et du réaménagement de la Schwarzenburgstrasse*. Bern: Office des ponts et chaussées du canton de Berne – Arrondissement d'ingénieur en chef II. Retrieved from: http://www.bve.be.ch/bve/fr/index/strassen/strassen/kantonsstrassen/realisierte_strassenbauprojekte.assetref/dam/documents/BVE/TBA/fr/TBA_ST_BM_Schwarzenburgstrasse_Erfolgskontrolle_f.pdf

Federal Highway Administration (FHWA). (1997). *Flexibility in highway design.* Washington, District of Columbia: U.S. Department of Transportation. Retrieved from: www.fhwa.dot.gov/environment/pulications/flexibility/flexibility.pdf

Fondation Rues principales. (2011). *Aménager les traversées d'agglomérations en milieu de vie.* Québec: Fondation Rues principales. Retrieved from: http://www.rues-principales.co/wp-content/uploads/2014/11/Ficheconseil19.pdf

Gagné, J. (1999). *La traversée de l'agglomération de Bolton-Centre.* Case study presented at the seminar "Routes et paysages villageois" organized by the Conseil du paysage québécois, March 16, 2000 [pdf document]. Retrieved from: http://www.paysage.qc.ca/activ/routes/rp_pdf/rp8.pdf

Herrstedt, L. (1992). Traffic calming design - a speed management method. Danish experiences on environmentally adapted through roads. *Accident Analysis and Prevention*, *24*(1), 3-16.

Hunaidi, O. (2000). Construction technology update No. 39*:* Traffic vibration in buildings. Ottawa: Institute for Research in Construction.

Leong, D. & Weisbord, G. (2000). *Summary of highway bypass studies*. Boston, MA: Economic Development Research Group. Retrieved from: http://www.edrgroup.com/pdf/Town-Bypass-Case-Studies.pdf

Mackey, P. (2004). *Context-sensitive design for rural speed management.* Presentation prepared for the session on "Geometric Design and Vulnerable Road Users" at the 2004 Annual Conference of the Transportation Association of Canada, in Québec [pdf document]. Retrieved from: http://conf.tac-atc.ca/english/resourcecentre/readingroom/conference/conf2004/docs/s20/mackey.pdf

Ministère des Transports du Québec (MTQ). (1997). *Aménagements routiers dans la traversée des agglomérations : Document d'information et de sensibilisation*. Québec, ministère des Transports. Retrieved from: http://aapq.org/sites/aapq.org/files/bibliotheque/GestionCorridorsRoutiers.pdf

Ministère des Transports du Québec (MTQ). (2011). *Fiche technique. Modération de la circulation. Dos d'âne allongés et coussins*. Québec, ministère des Transport. Retrieved from: http://www.mtq.gouv.qc.ca/centredocumentation/Documents/Securite-transport/moderation-transport/dos-dane-allonges-coussins.pdf

National Cooperative Highway Research Program. (2002). *A guide to best practices for achieving context sensitive solutions, Report 480*. Washington, DC: Transportation Research Board. Retrieved from: http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_480.pdf

The Standing Advisory Committee on Truck Road Assessment (SACTRA). (1994). *Trunk roads and the generation of traffic.* London: HMSO. Retrieved from: http://webarchive.nationalarchives.gov.uk/+/http:/www.dft.gov.uk/pgr/economics/rdg/nataarchivedocs/trunkroadstraffic.pdf

Service d'études sur les transports, les routes et leurs aménagements (SETRA). (1994). *Traversée d'agglomération — Réduction du nombre de voies et aménagement central de la chaussée.* Lyon: SETRA. Retrieved from: http://dtrf.setra.fr/notice.html?id=Dtrf-0000083

Service d'études sur les transports, les routes et leurs aménagements (SETRA) & Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques (CERTU). (1995). *Traversée d'agglomération — Traitement par déhanchements successifs*. Lyon: SETRA & CERTU. Retrieved from: http://dtrf.setra.fr/notice.html?id=Dtrf-0000096

Service d'études sur les transports, les routes et leurs aménagements (SETRA) & Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques (CERTU). (1997a). *Traversée d'agglomération — Réduction de la largeur de voie avec effet de porte d'entrée*. Lyon: SETRA & CERTU. Retrieved from: http://dtrf.setra.fr/notice.html?id=Dtrf-0000102

Service d'études sur les transports, les routes et leurs aménagements (SETRA) & Centre d'Études sur les Réseaux, les Transports, l'Urbanisme et les Constructions Publiques (CERTU). (1997 b). *Traversée d'agglomération — Renforcement du caractère urbain par coloration du revêtement et neutralisation d'une bande centrale*. Lyon: SETRA & CERTU. Retrieved from: http://www.aude.gouv.fr/IMG/pdf/coloration_No4_cle53184b.pdf

Wheeler, A. H. & Taylor, M.C. (1999). *Traffic calming in villages on major roads: Final report*. London: Transport Research Laboratory. Retrieved from: http://www.trl.co.uk/reports-publications/trl-reports/traffic-management/report/?reportid=2545

Yeh, D., Gannon, M., & Leong, D. (1998). *The economic impacts of highway bypasses on communities. Summary.* Madison: Wisconsin Department of Transportation. Retrieved from: http://www.dot.wisconsin.gov/library/publications/topic/plans/bypass.pdf

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