

Safety Benefits of Traffic Calming

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This study was conducted to determine whether there are quantifiable collision-reduction benefits that result from traffic calming. Traffic calming is typically implemented to address speeding and external traffic concerns. It is intuitively recognized that successful traffic calming would therefore result in safety benefits. This research attempted to determine whether these safety benefits are measurable and significant. Four local traffic-calming projects in the Greater Vancouver area were reviewed as part of the research. All four of the projects achieved reductions in collision frequency, severity, and the annual collision claim costs. The magnitude of these benefits varied among the projects, with an average 40 percent reduction in collision frequency and 38 percent reduction in the annual claims costs. A total of 85 case studies from Europe, Australia, and North America were reviewed to determine the safety benefits of traffic calming as measured by other jurisdictions. The international case studies in which more than five precalming collisions per year occurred were analyzed separately. In this group of 15 studies, the decrease in collision frequency ranged from 8 percent to 95 percent. The implementation of traffic calming involves participation on the part of the general public, local municipalities, and emergency response organizations. The planning, engineering, and public consultation process are all a necessary part of the process to improving neighborhood livability. The results of this research provide evidence that the safety benefits of traffic calming are both quantifiable and significant.

Traffic calming, also known as neighborhood traffic control, traffic restraint, local-area traffic management, and environmental traffic management, is being employed extensively in Europe, Australia, and increasingly in North America. Traffic calming originated as a method to physically and visually impede speeding and the use of local roads by nonresidents avoiding congested arterial routes. In the past two to three decades an increasingly common response to residential complaints of high traffic volumes and speeds has been for municipalities to institute a program of traffic calming. This technique involves the provision of innovative traffic control devices, which when properly designed and situated can achieve reductions in traffic speed and nonlocal traffic volumes. The purpose of this study was to determine whether there are quantifiable collision-reduction benefits that result from traffic calming; and if so, to determine whether the magnitude of these benefits is significant.

The primary focus of the quantitative portion of this study were neighborhoods within the Greater Vancouver and Victoria areas that had introduced traffic-calming measures. These neighborhoods were chosen to provide the most relevant data to this study. A literature review was also conducted, and international experience was researched to provide background information as well as quantification of the long-term results of traffic calming. Interviews were conducted with transportation personnel at municipalities in the Greater

Vancouver area and on Vancouver Island that are actively involved in the provision of traffic calming. From the information gained in these interviews, four local sites were selected for an in depth review of pre- and postcalming collision characteristics. Personnel from Portland, Bellevue, and Seattle were also contacted. The literature review included documents from Europe, Australia, Japan, and North America. Particular emphasis was placed on documents quantifying the safety benefits of traffic calming.

EXPERIENCE IN GREATER VANCOUVER AREA

Site Selection

The sites that were reviewed were selected based on the availability of collision records at least one year before and after the traffic-calming measures were installed. The information collected for each site included internal reports on the implementation process, the types of traffic-calming measures installed, the exact timing of implementation, and the cost of implementation. The following four sites were reviewed:

1. City of Vancouver, West End.
2. City of Vancouver, Mount Pleasant.
3. City of Burnaby, Willingdon Parker.
4. City of New Westminster, Kelvin North.

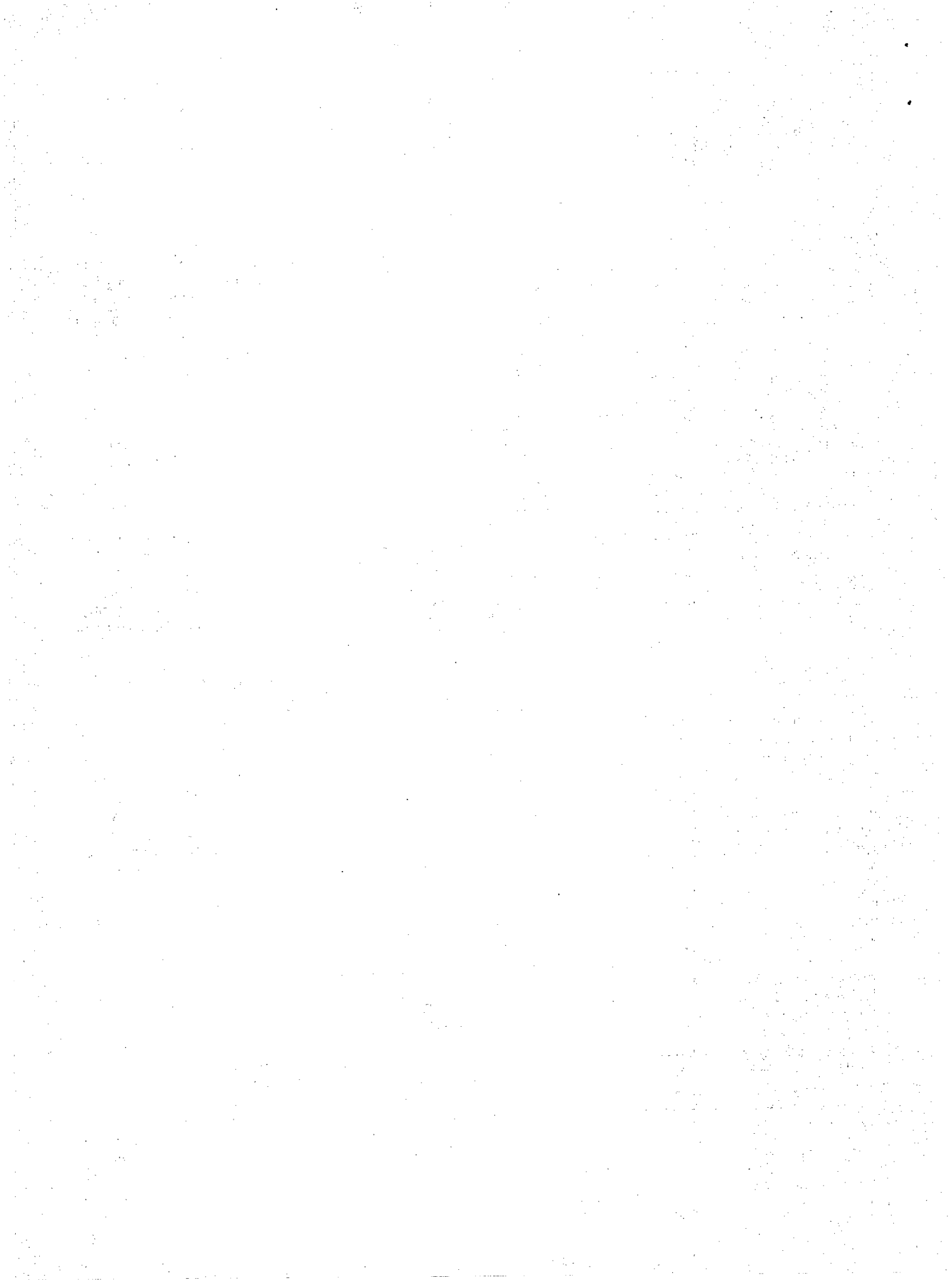
In each neighborhood, an extensive public consultation process had been undertaken prior to the implementation of traffic calming. Comments by the Police, fire department, and residents were given full consideration in the implementation schemes. Temporary facilities were put in place and monitored for success or failure based on the individual neighborhood's traffic-calming goals.

Description of Sites

Vancouver, West End Area

In the early 1980s, the city of Vancouver undertook the traffic calming of an area located in the downtown part of Vancouver, with primarily medium-to high-density residential land use and streets developed to local road standards. The traffic calming was carried out in response to residents' demands that measures be taken to reduce nonlocal traffic volume and speed, and to improve the safety and livability of the neighborhood. As shown in Figure 1, 22 traffic-calming devices were installed. These consisted of forced-turn islands (to restrict intersection turning movements to right-in-right out), street closures, diagonal diverters, traffic circles, build outs, and one-way streets. The Vancouver West End program was one of the earliest and

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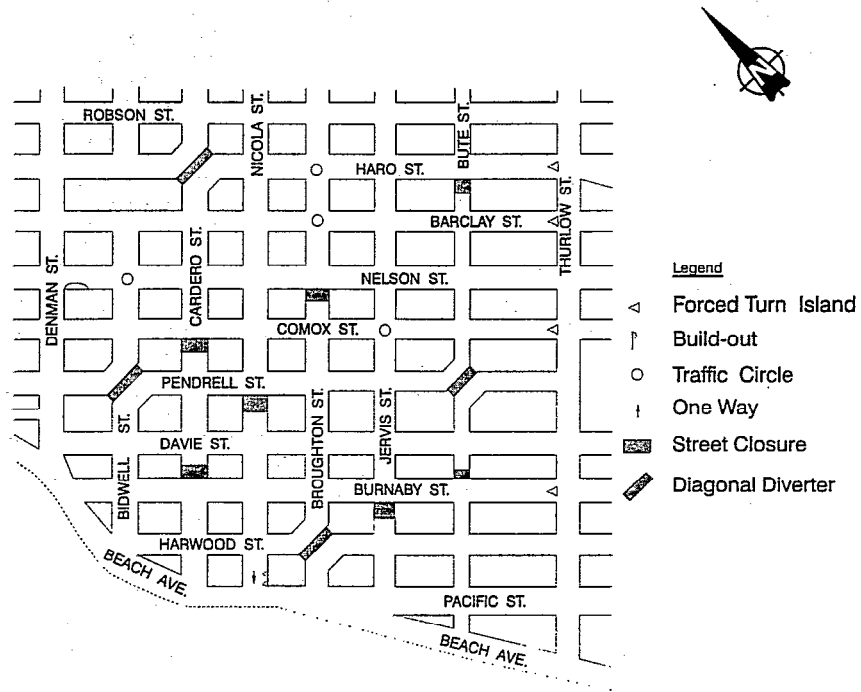


FIGURE 1 City of Vancouver, West End traffic calming plan.

largest neighborhood traffic-calming projects implemented in North America, and is considered to be one of the most successful. The cost of construction is estimated at \$7.5 million in 1996 dollars.

Vancouver, Mount Pleasant Area

The Mount Pleasant area consists primarily of low-density residential housing. The cost of construction for the permanently implemented calming plan was estimated at \$69,000 in 1991 dollars (\$90,000 in 1996 dollars). The goals of the traffic calming carried out in Mount Pleasant were to improve safety and to reduce commuter shortcutting. As shown in Figure 2, the traffic calming plan included the installation of stop signs, two forced-turn islands, nine build-outs, four traffic circles, and two one-way streets.

Burnaby, Willingdon-Parker Area

In early 1993, the city of Burnaby undertook traffic calming in the Willingdon-Parker area. The area consists primarily of medium-density single-family residential housing. Due to congestion on the arterial streets, the area was subjected to a considerable volume of shortcutting traffic, especially during the peak hours. There was also significant residential concern regarding safety at the uncontrolled "courtesy corner" intersections in this area. As shown in Figure 3, the method of traffic calming selected for this area was the installation of alternating Stop-sign control at all intersections, making it less convenient for motorists to traverse the area. The estimated cost for the installation of the Stop signs was \$15,000 in 1993 dollars, equivalent to \$20,000 in 1996 dollars. The Stop signs were installed in May 1993.

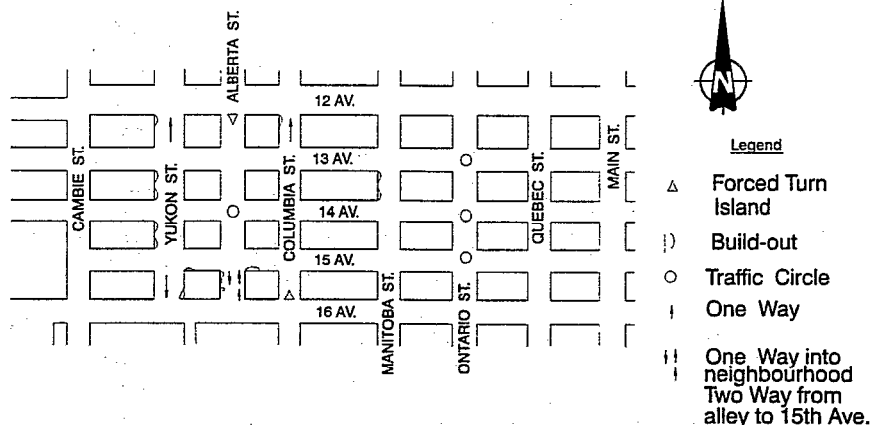


FIGURE 2 City of Vancouver, Mount Pleasant traffic calming plan.

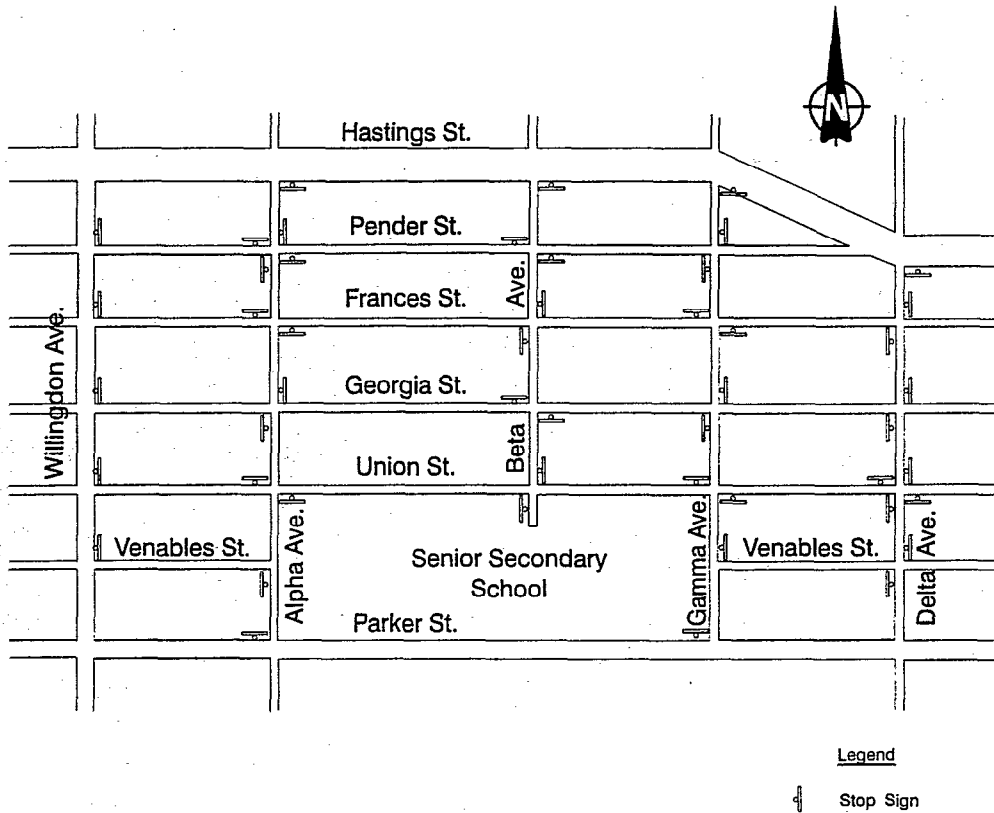


FIGURE 3 City of Burnaby, Willingdon-Parker traffic calming plan.

New Westminster, Kelvin North Area

In September 1993, the city of New Westminster implemented traffic-calming measures in the neighborhood of Kelvin North. The neighborhood consists primarily of single-family residential housing. The primary goal of this traffic calming project was to deter nonresidents from shortcutting through the residential streets. To accomplish this goal the city of New Westminster

installed a total of 17 speed humps and imposed parking and turning restrictions during peak hours, as shown in Figure 4. The cost of the signs and humps is estimated at \$25,000 in 1996 dollars.

Results from Greater Vancouver Area

For each of the four neighborhoods collision data from police reports were provided by the municipalities. Only the internal local

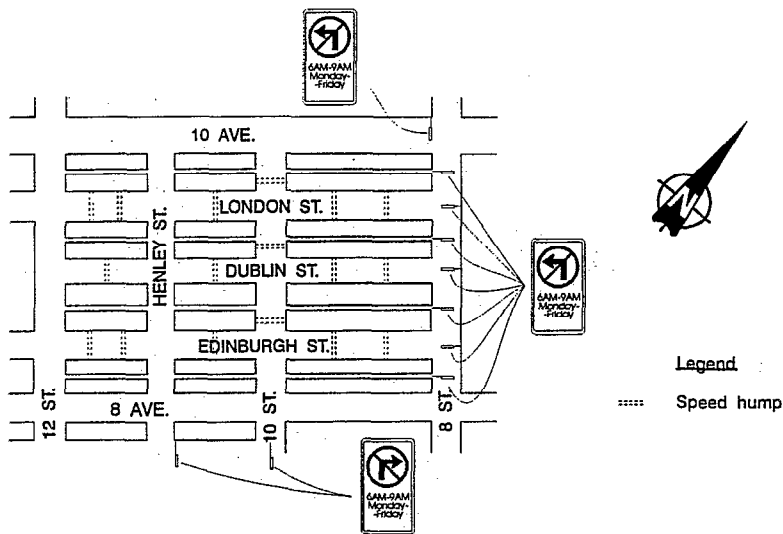


FIGURE 4 City of New Westminster, Kelvin North traffic calming plan.

streets were analyzed in detail, but a brief review of the available volume and collision data from the surrounding arterials indicated no significant change in trends between the pre- and postcalming periods. In all the neighbourhoods, the traffic calming resulted in a reduction of the traffic volume on the local streets. However, this research was sponsored by the provincial insurance agency which is interested in the net collision frequency and severity (and resultant claim costs). The focus was therefore on the number and severity of collisions within the neighborhood rather than the rate given that the accident frequency on the surrounding arterials had not recorded a noticeable change due to the traffic calming on the local streets.

Collision types were compiled for each neighborhood from the provided collision data. As can be expected, the neighborhoods displayed characteristically different collision-type increases and decreases. Figure 5 indicates the change in the collision-type characteristics for the four neighborhoods. The change in average collision frequency and severity between the pre- and postcalming years was reviewed in detail for the local streets within each neighborhood. Severity was measured using the latest available average claim costs from the Insurance Corporation of British Columbia

(ICBC) for the severity categories of property damage only, injury, and fatality to calculate the annual collision cost. This cost reflects the insurance cost to settle claims; it excludes external societal costs such as the value of life and lost income.

The safety benefits of the local traffic-calming initiatives are summarized in Table 1. The traffic-calming projects all achieved reductions in collision frequency, severity, and the annual collision claim costs. The magnitude of these benefits varied among the projects, with an average 40 percent reduction in collision frequency and 38 percent reduction in the annual claim costs. The results are individually presented in Figures 6 to 9 for each neighborhood. From these results, it is concluded that safety benefits have been consistently achieved from these traffic calming projects. It can be further concluded that when proper implementation procedures, including engineering and public consultation, are followed, safety and the associated cost benefits can be expected from traffic-calming schemes. Due to data constraints, and the timing of the projects, the long-term effects of traffic calming on the four neighborhoods could not be analyzed. A broader spectrum of experience with traffic-calming projects was gained through the literature review.


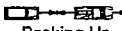


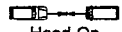
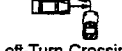
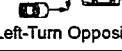




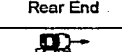

COLLISION TYPE	NEIGHBOURHOOD			
	Vancouver - West End	Vancouver - Mount Pleasant	Burnaby - Willingdon Parker	New Westminster - Kelvin North
 Angle	↓ Decrease	↓ Decrease	↓ Decrease	Increase ↑
 Backing Up	↓ Decrease	↓ Decrease	NO CHANGE	NO CHANGE
 Bicycle	Increase ↑	↓ Decrease	NO CHANGE	↓ Decrease
 Fixed Object	Increase ↑	↓ Decrease	NO CHANGE	NO CHANGE
 Head On	↓ Decrease	Increase ↑	NO CHANGE	↓ Decrease
 Left-Turn Crossing	NO CHANGE	NO CHANGE	NO CHANGE	Increase ↑
 Left-Turn Opposing	↓ Decrease	↓ Decrease	NO CHANGE	Increase ↑
 Off Road	NO CHANGE	NO CHANGE	↓ Decrease	NO CHANGE
 Overtaking	NO CHANGE	NO CHANGE	NO CHANGE	↓ Decrease
 Parked Vehicle	↓ Decrease	↓ Decrease	NO CHANGE	NO CHANGE
 Pedestrian	Increase ↑	NO CHANGE	NO CHANGE	NO CHANGE
 Rear End	↓ Decrease	↓ Decrease	↓ Decrease	Increase ↑
 Side Swipe	NO CHANGE	↓ Decrease	NO CHANGE	NO CHANGE

FIGURE 5 Change in collision-type characteristics.

TABLE 1 Summary of Safety Benefits from Traffic Calming Projects in the Greater Vancouver Area

Neighbourhood	Change in Collision Frequency (%)	Change in Annual Collision Claim Cost (%)
Vancouver - West End	-18	-10
Vancouver - Mount Pleasant	-46	-37
Burnaby - Willingdon Parker	-60	-48
New Westminster - Kelvin North	-34	-57
AVERAGE	-40	-38

INTERNATIONAL EXPERIENCE

Europe

Traffic calming has been practiced in Europe for many years. British studies demonstrate that the utilization of traffic-calming techniques is an effective way to reduce casualty collisions. A report on accident investigation and prevention (1) states that there can be a reduction of between 60 and 70 percent in casualty collisions through the use of traffic-calming measures. This study indicates that these techniques are the most cost-effective way of saving lives, and if all local authorities vigorously implemented them the resulting savings could include 200 to 300 lives and 15,000 injuries per year. Most schemes pay for themselves in less than 2 years, and many within 1 year. Of the numerous British case studies examined, all resulted in significant reductions in the frequency of personal-injury accidents. The reductions typically ranged between 65 and 100 percent.

Traffic-calming methods in Denmark have also been successful in improving road safety. Many Danish studies (2) have been conducted on the three towns of Vinderup, Skaerbaek, and Ugerlose. Physical measures were implemented to restrict 95th percentile speeds to 30 km/hr. Within these towns, injury accidents have been reduced by 60 percent. In 1984, France initiated the *Ville plus sure, quartiers sans accidents* program (Safer city, accident-free districts) with concurrent goals of reducing traffic speeds and collisions. Traffic-calming measures utilized included traffic circles, landscaping, and horizontal alignment variations. The program resulted in a 60 percent decrease in annual accident frequency within districts where traffic calming was applied. Germany's experience with traffic calming has been similar to the other European countries. The German term for traffic calming is *Verkehrsberuhigung*, which means traffic tranquilizing. A detailed analysis of the effects of traffic calming on safety was conducted for the German experience. The study (3) concluded that although the total number of collisions has remained stable, there has

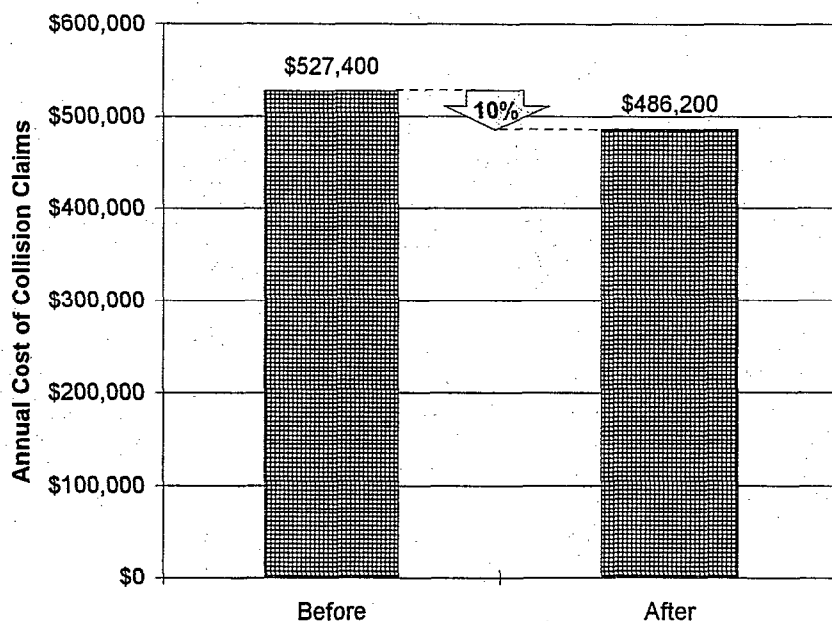
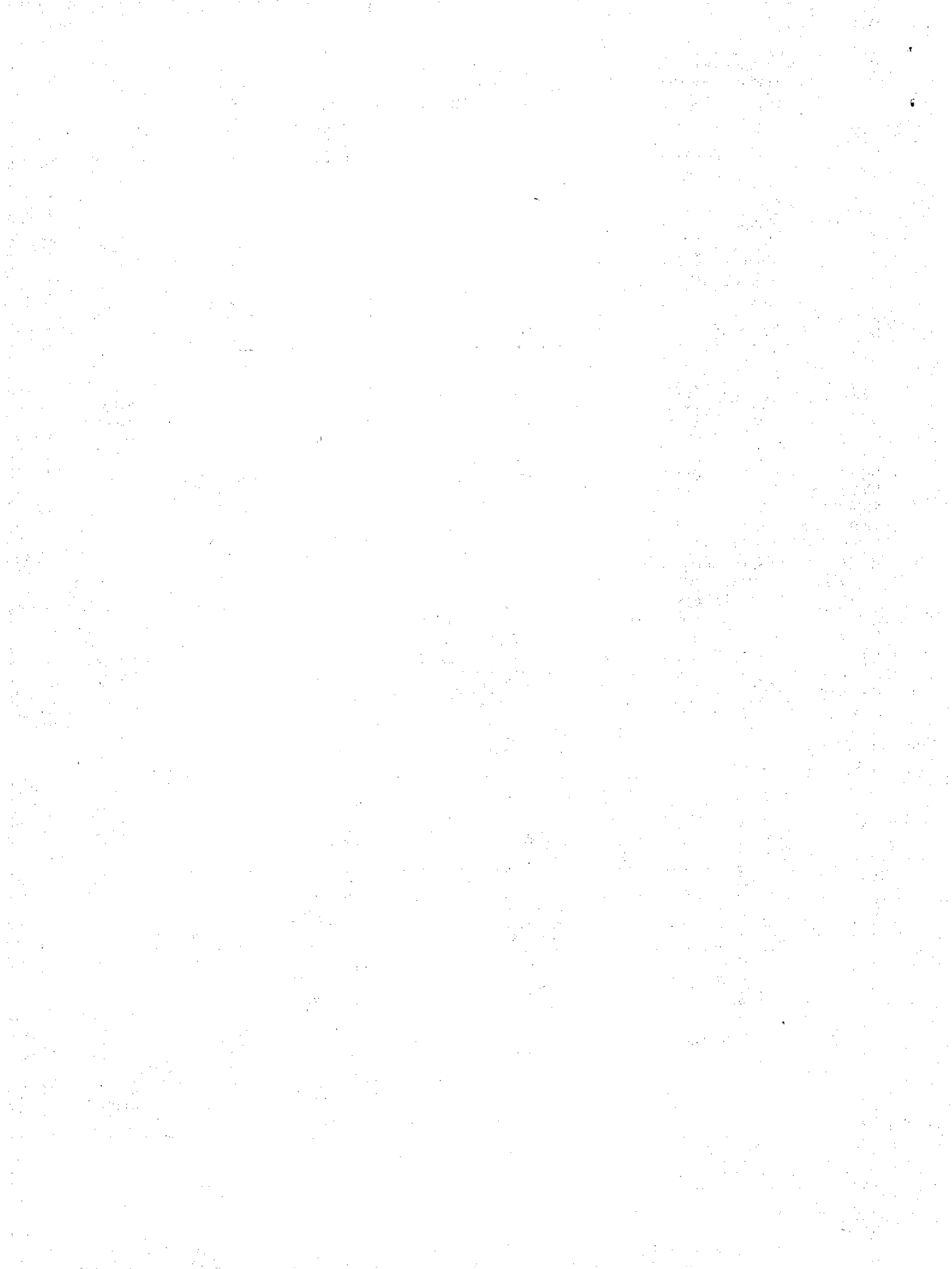


FIGURE 6 City of Vancouver, West End change in annual average collision cost.



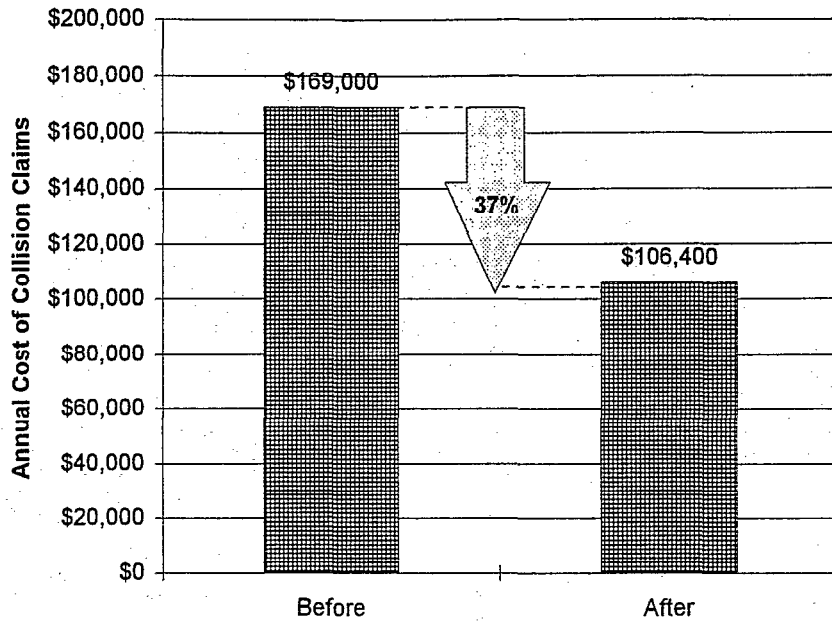


FIGURE 7 City of Vancouver, Mount Pleasant change in annual average collision cost.

been a 60 percent reduction in injury accidents within the more than 200 communities calmed in the country.

Australia

In the 1970's, Australian authorities began to implement traffic-calming schemes such as narrowed streets, speed humps, and circuitous routings to reduce speed and volumes in residential areas. Austroads (4), Australia's national association of state, territory, and federal road authorities, publishes a guide to traffic engineering and practice for local area traffic management that states that inexpen-

sive environmental improvement schemes, aimed at reducing traffic volumes or speeds or both have often resulted in the reduction of accidents. However, the available literature did not quantify the safety benefits of the Australian traffic-calming experience.

North America

Since the early 1980s, the utilization of traffic calming in North America has been steadily gaining in popularity. In the United States, various cities have experimented with traffic-calming techniques to reduce traffic volumes and speeds in residential areas. The

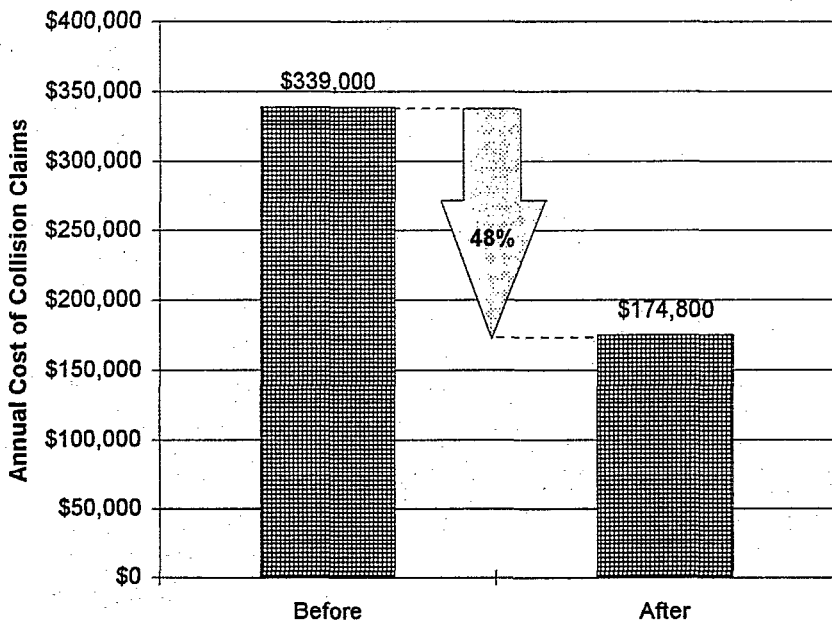
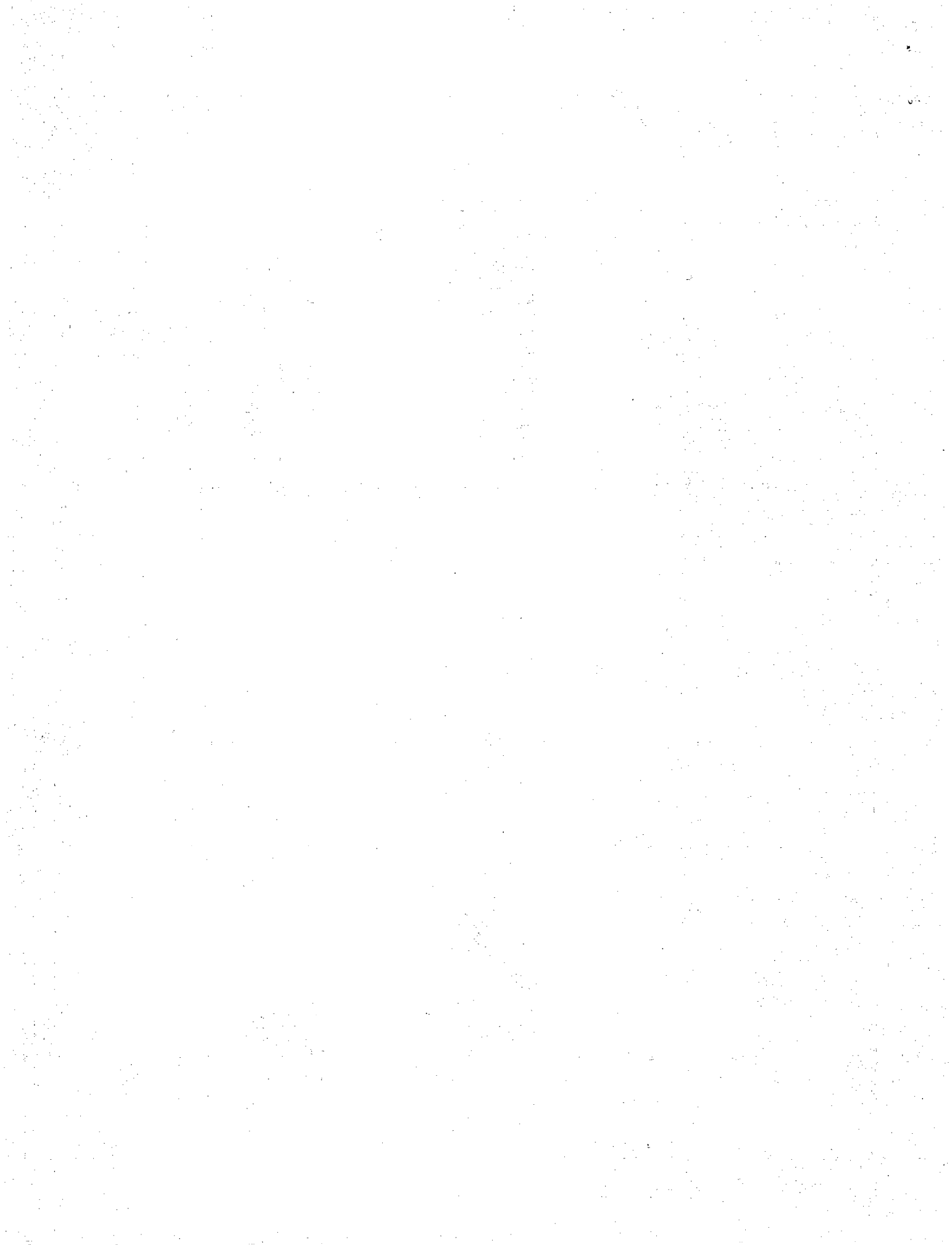
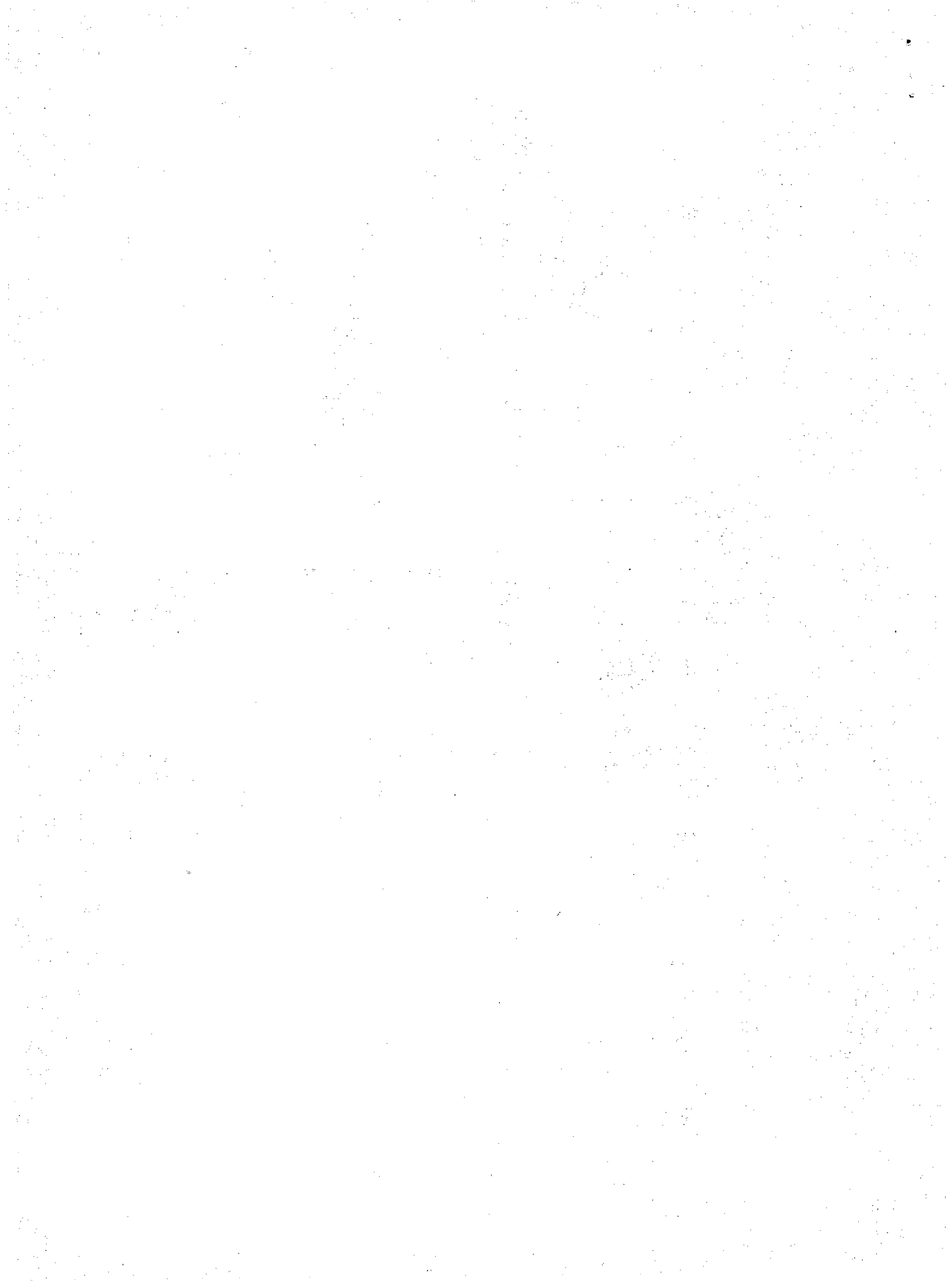


FIGURE 8 City of Burnaby, Willingdon-Parker change in annual average collision cost.





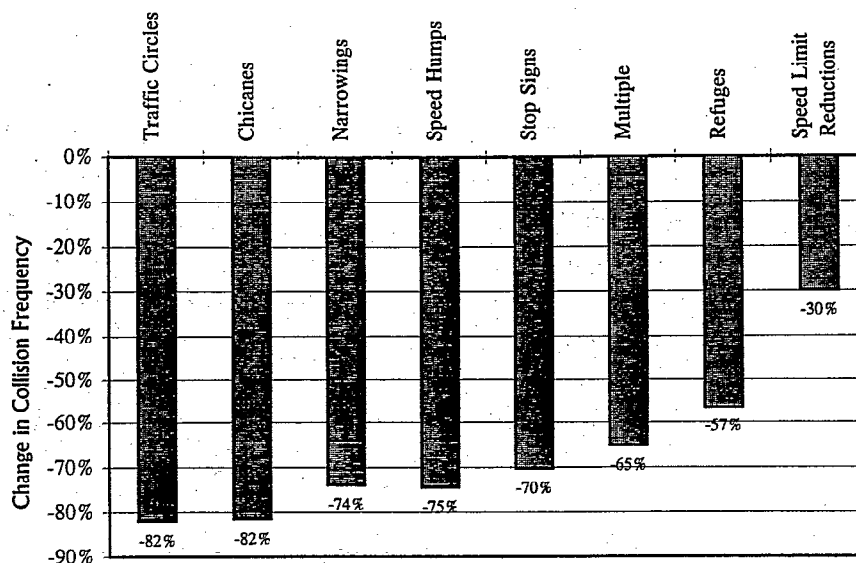


FIGURE 11 Average percent reduction in collisions per measure.

MICROLEVEL BENEFITS

From all the available international and Greater Vancouver area studies, the reduction in collisions for the different traffic-calming devices was reviewed, and the results are summarized in Figure 11. It was found that all the various measures are effective in reducing collision frequency, with the magnitude of the frequency reduction varying from 30 to 82 percent. The data is limited for some traffic-calming measures, due to the difficulty in disaggregating the benefits of individual devices when a comprehensive traffic-calming plan is implemented. The category labeled "multiple" denotes several calming devices constituting one plan. The international literature confirms that traffic-calming reduces both the collision frequency and severity. However, due to different methods of measuring severity, the overall average benefits in reduced collision severity could not be summarized from the available international data.

CONCLUSION

The focus of this study has been the review of the safety benefits of traffic calming. From the review of international and local experiences, safety benefits were consistently gained through the implementation of traffic-calming techniques. The magnitude of the safety benefits varied according to individual site characteristics. On average, a reduction of 40 percent in both the collision frequency and the annual collision claim costs was achieved. Residential traffic calming is often implemented in neighborhoods with low volumes and relatively low collision frequency. To achieve target benefit/cost ratios, low cost plans would need to be implemented. Traffic calming has been a successful method for reducing collisions around the world and locally. The success of

traffic calming depends upon achieving consensus among the residents and conducting a proper engineering analysis of the perceived problems and recommended solutions. In addition to the reductions in speed and external volume typically associated with traffic calming, the safety benefits are both quantifiable and significant.

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