

WINTER ACCIDENT EXPERIENCE IN ONTARIO WITH AND WITHOUT STUDED TIRES

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Total collision and personal injury accidents on the highways of Ontario during the winter of 1971-72 (without studded tires) are compared with those during the previous winter (with studded tires). Analysis is made, both overall and on a regional basis, of the specific road condition reported at the accident site and the condition generally prevailing. In spite of the general upward trend, summer and winter, in highway accidents, the proportion of accidents on icy, snowpacked, snowy, or slushy roads declined following discontinuance of the use of studded tires.

●THE evidence that led to the prohibition of the further use of studded tires in the province of Ontario after April 30, 1971, has already been documented (1-6). In brief, the literature indicates that studs not only cause serious pavement wear that is difficult and costly to prevent or repair, but also cause loss of traffic markings, reduction of skid resistance of certain types of surfacings, and ruts in the wheel tracks. Although performance tests indicated that use of studded tires might be expected to be of benefit when driving on icy surfaces, it was found in fact that icy road conditions only prevailed to a very limited extent. Most importantly, there were no data (though there were lots of claims) that any performance advantages, such as increased traction and maneuverability on ice near the freezing point, equated with actual safety benefits when driving under winter conditions.

In North America, two investigations found that the use of studded tires had no significant effect on winter accidents (2, 7). A third and fourth study were by no means conclusive, though a slightly lower involvement of cars with studded tires is indicated after appropriate treatment of the data (8, 9). One of these studies (8) has been extended as NCHRP Project 1-13(1) utilizing data from Michigan as well as Minnesota. Another NCHRP project, 1-13(2), has been addressed to effects of studded tires on highway safety, nonwinter conditions. Neither of these studies has been reported at the time of writing. In Europe, little beyond subjective claims of the type "with studded tires on all 4 wheels, winter accident rates have not increased in spite of the increase in traffic volume" appear to have been reported.

As succinctly stated by Professor E. Nakkel in his general report for the International Research Symposium on Pavement Wear in Oslo, Norway, in June 1972:

One fact is indeed remarkable. Nowhere, as yet, has sufficient evidence been established to prove that studded tires in winter road conditions really reduce the risk of accidents. This might be explained by the "risk running behavior", i.e., a general over-estimation of the degree of safety expected from the use of studded tires, an opinion which, at least in the years before, was strengthened by the tire industry itself through advertising methods motivated by self-interest rather than objectivity.

Against this background the purpose of this paper is to provide a simple comparison of the immediate before-and-after winter accident record to determine if the highways of Ontario are in fact generally safer without the use of studded tires.

The accident data are those published by Ministry of Transportation and Communications in the annual report, Highway Traffic Collisions in Ontario, as compiled from a uniform style of police report used throughout the province for all property damage incidents estimated at \$200 or more (\$100 prior to January 1, 1970) and all personal in-

jury or fatal accidents. In addition, the accidents occurring during the winter months (October to March) of 1970-71 and 1971-72 were abstracted from the general statistics so that each occurrence could be analyzed against the road condition reported by the police at the time of investigation. The data presented on the prevalence of various road conditions over the two winters were obtained in the same manner as for an earlier report (2), from the daily reports (November to April) of the Ministry's highway maintenance patrols.

GENERAL ACCIDENT TREND

Figure 1 shows the general trend of total collisions in Ontario for each calendar year from 1966 to the end of 1971. Even though the increases in vehicle registration and miles of vehicle travel mean that accident rates may actually be lower at the end of the period on certain classes of highways, the fact remains that there is, unfortunately, an increase each year in total collisions. The rate of increase varies only slightly from year to year, though it should be noted that, within this annual variation, 1970 was a low year and 1971 was a high year.

Table 1, covering the same period (1966-71), gives the distribution of the total collisions in each calendar year in relation to the condition of the road surface on which they occurred. The pattern is strikingly consistent, and, specific to this enquiry, it should be noted that, over the years in which studded tires came into increasing use, there was no corresponding reduction in the proportion of accidents on icy or snow-packed roads where studded tires were claimed to be of some advantage.

The information given in Table 2, which covers the summer, fall, and early winter months of 1970 and 1971 in greater detail, indicates that the increase in total collisions and personal injury accidents from the fourth quarter of 1970 to the fourth quarter of 1971 (which was the first winter period when the use of studded tires was not permitted) was of the same order as that between the immediately preceding three summer month periods. Preliminary examination of the accident statistics for the spring and summer of 1972 shows that this trend continues unabated.

Against this background of more accidents every year, a situation that is of course not peculiar to Ontario, the accident statistics for the period October 1, 1971, to March 31, 1972 (the first complete winter without studded tires), may be compared with those for the corresponding period of the previous winter and account taken of differences in the prevailing road conditions from one winter to the next.

WINTER ACCIDENT EXPERIENCE OF 1971-72 AND 1970-71

Two main accident indicators were selected for analysis against the road condition reported at the site of each accident. Total collisions and nonfatal personal injury accidents are used in the analysis, covering the whole of the province as one unit. In view of the similarity in trends found between the two, only total collisions are analyzed in the regional breakdown when comparing conditions on provincial highways with those on all roads. Fatal accidents are not included in the analysis because, fortunately, the small number of these does not provide a statistically valid basis on which to work.

Province-Wide Winter Accident Experience

Table 3 gives total collision and personal injury accidents for the winter of 1971-72 (without studded tires) with those occurring over the same period in 1970-71 (with studded tires) for all highways in Ontario. In addition, that fraction of the total collisions that occurred on provincial highways is shown separately.

In terms of actual numbers (although there was an increase from 85,099 to 99,279 from the winter of 1970-71 to that of 1971-72 in total collisions in the province), the number of collisions that occurred on icy or snowpacked roads remained almost the same, 22,348 and 22,324 respectively. Similarly, for personal injury accidents (although the total increase in these was from 25,845 to 30,727), those that occurred on icy or snowpacked roads only increased from 5,297 to 5,502.

With the magnitude of the overall numbers in mind, it is simpler to talk in terms of

percentage of increase or decrease in order to place the accidents occurring in various road conditions in perspective. Considering all highways in the province, total collisions in icy and packed snow and in snowy or slushy road conditions show a reduction of 0.1 percent and 2.0 percent respectively. These reductions assume greater significance when viewed in light of the 16.7 percent overall increase in total collisions because of the substantial increase in dry and wet road accidents of 21.4 percent and 40.0 percent respectively. The trend is similar with personal injury accidents. Though there was a slight increase in those that occurred in icy and snowpacked road conditions (3.9 percent) and in snowy or slushy conditions (3.7 percent), these increases vary much less than those occurring in dry (19.7 percent) or wet (35.8 percent) conditions, which accounted for almost all of the 18.9 percent overall increase recorded in personal injury accidents.

Thus, provided the winter of 1971-72 was no less severe than its predecessor, especially with respect to the prevalence of icy roads, it appears that the relative incidence of accidents occurring in road conditions where studded tires have been claimed to provide greater safety in fact declined once studded tires were no longer used.

Regional Winter Accident Experience

Because of the size of Ontario, the province-wide experience may be of little solace to a motorist sliding on ice toward an impact at Red Lake. Accordingly, the total collision experience was examined on a regional basis. For this purpose, the province was divided into seven areas (following county or other administrative boundaries, which permitted segregation of the accident data from the available records) within each of which generally similar climatic, physiological, economic, and road-use characteristics occurred. Obviously, different splits could be made, but most people who know the province will recognize those chosen as representative of regions, alike within themselves, yet different from each other.

Tables 4 and 5 give these regional data, and for ease of display the percentage of increase or decrease in total collisions for each road condition of interest is indexed against the applicable region shown in Figure 2. This figure also shows a ranking against each road condition on a scale of 1 to 4 where 1 represents the largest decrease (or smallest increase) and 4 represents the greatest increase in the percentage of accidents occurring on a particular road condition. This ranking system permits a quick grasp of what otherwise would be a lengthy explanation of the differences that occurred in accidents between the winter in which studded tires were not permitted and the previous winter.

In three areas, southwestern, snowbelt, and urban counties, bordering on Lake Ontario, there was a significant reduction last winter (without studded tires) in accidents on icy or snowy roads, which ranks these and 1 or 2 (best) on the 1 to 4 scale. This ranking applies also to south central and eastern Ontario, though in these areas there was an increase in accidents on icy or snowy roads. In north central and northern Ontario the ranking changes, however, so that in both of these areas dry roads become 1 (showing the smallest increase) and ice and snow become 2 and 4 in north central and 3 and 2 in northern Ontario respectively.

Therefore, in spite of the general increase in collisions, in no case (north or south) did collisions on icy roads show the largest increase. In most cases, accidents in these conditions showed the greatest decrease or smallest increase. The icy road condition, of course, is the one in which studded snow tires are claimed to provide a safety advantage.

INFLUENCE OF ROAD CONDITIONS

The road conditions likely to be met by a motorist driving on a main highway in Ontario during the winter of 1969-70 were assessed in an earlier report (2) on the basis of the number of day-miles where a particular condition prevailed in each of three main areas (when the data from each of the individual districts grouped therein indicated that there were characteristics in common). Table 6 gives similar data but in summary form for the two succeeding winters of 1970-71 and 1971-72. The Appendix discusses data for the winter of 1972-73.

Figure 1. Trend in total collisions.

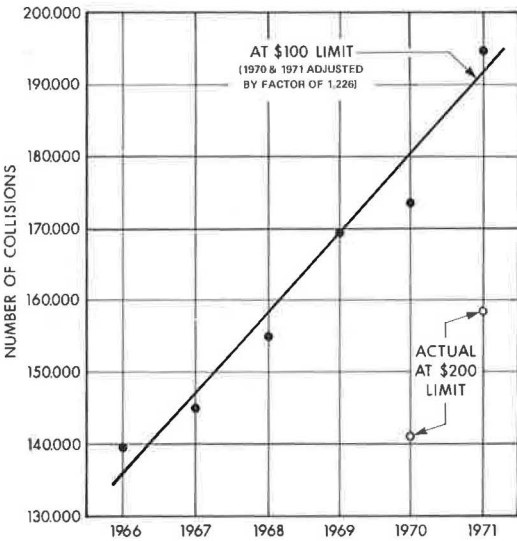


Table 1. Annual distribution of total collisions by road condition, 1966-71.

Road Surface Condition	Calendar Year by Percentage					
	1966	1967	1968	1969	1970	1971
Dry	56.5	55.0	57.8	60.4	55.5	53.8
Wet	25.6	25.5	22.1	22.1	24.0	22.2
Snow and slush	6.2	6.7	6.2	5.6	8.3	8.2
Ice and packed snow	10.4	11.5	12.6	10.8	11.1	14.4
Other*	1.3	1.3	1.3	1.2	1.1	1.4

*Includes mud, loose sand, gravel, etc.

Table 2. Total collisions and personal-injury accidents.

Month	Total Collisions		Percentage of Increase, 1971 Over 1970	Personal-Injury Accidents		Percentage of Increase, 1971 Over 1970
	1970	1971		1970	1971	
July	11,704	13,105	11.97	4,670	5,513	18.05
August	10,985	12,936	17.76	4,574	5,340	16.75
September	11,388	12,281	7.84	4,538	5,077	11.88
October	12,853	14,699	14.36	4,827	5,703	18.15
November	12,545	16,347	30.31	4,409	5,409	22.68
December	17,585	18,126	3.08	5,014	5,681	13.30

Table 3. Total collisions and personal-injury accidents by road surface condition, 1970-72.

Road Surface Condition	All Highways in Ontario						Provincial Highways Only*		
	Total Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71	Personal-Injury Accidents, Winter		Percentage of Increase, 1971-72 Over 1970-71	Total Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71
	1970-71	1971-72		1970-71	1971-72		1970-71	1971-72	
Dry	26,948	32,716	21.4	9,757	11,677	19.7	5,287	5,948	12.5
Wet	20,950	29,339	40.0	7,157	9,718	35.8	3,289	3,902	18.6
Snow and slush	14,245	13,958	-2.0	3,427	3,554	3.7	2,942	3,395	15.4
Ice and packed snow	22,348	22,324	-0.1	5,297	5,502	3.9	5,998	5,732	-4.4
Other*	608	942	55.0	207	276	33.3	46	56	21.7
Total	85,099	99,279	16.7	25,845	30,727	18.9	17,562	19,035	8.4

*Provincial highways are those maintained by the province of Ontario and exclude roads and streets under municipal jurisdiction.

*Includes mud, loose sand, gravel, etc.

Table 4. Total collisions in Ontario by region.

Road Surface Condition	Southwestern*			Snow Belt ^b			Urban Counties Bordering Lake Ontario ^c			South Central ^d		
	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71
	1970-71	1971-72		1970-71	1971-72		1970-71	1971-72		1970-71	1971-72	
Dry	4,382	5,350	22.1	1,679	2,222	32.3	14,032	17,522	24.9	1,893	2,295	21.2
Wet	3,024	3,935	30.1	1,437	2,036	41.7	11,414	16,175	41.7	1,513	1,965	29.9
Snow and slush	1,561	1,442	-7.6	1,625	1,343	-17.4	5,646	5,591	-1.0	1,199	1,343	12.0
Ice and packed snow	3,117	2,428	-22.1	2,888	2,508	-13.2	7,256	6,714	-7.5	2,724	2,834	4.0
Other*	126	190	50.8	62	98	58.1	232	355	53.0	61	82	34.4
Total	12,210	13,345	9.3	7,691	8,207	6.7	38,580	46,357	20.2	7,390	8,519	15.3

*Includes the following counties: Brant, Elgin, Essex, Haldimand, Kent, Lambton, Middlesex, Norfolk, and Oxford.

^bIncludes the following counties: Bruce, Dufferin, Grey, Huron, Perth, Waterloo, and Wellington.

^cIncludes the following counties: Halton, Lincoln, Ontario, Peel, Welland, Wentworth, and York.

^dIncludes the following counties: Durham, Frontenac, Hastings, Lennox and Addington, Northumberland, Peterborough, Prince Edward, Simcoe, and Victoria.

*Includes mud, loose sand, gravel, etc.

Table 5. Total collisions by region.

Road Surface Condition	Eastern ^a			North Central ^b			Northern ^c		
	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71	Collisions, Winter		Percentage of Increase, 1971-72 Over 1970-71
	1970-71	1971-72		1970-71	1971-72		1970-71	1971-72	
Dry	2,252	2,813	24.9	1,969	1,707	-13.3	741	807	8.9
Wet	1,991	2,940	47.7	1,242	1,675	34.9	329	613	86.3
Snow and slush	2,772	2,371	-14.5	908	1,259	38.7	534	611	14.4
Ice and packed snow	2,849	3,510	23.2	2,310	2,485	7.6	1,204	1,843	53.1
Other ^d	56	74	32.1	55	104	89.1	16	39	143.8
Total	9,920	11,708	18.0	6,484	7,230	11.5	2,824	3,913	38.6

^aIncludes the following counties: Carleton, Dundas, Glengarry, Grenville, Lanark, Leeds, Prescott, Renfrew, Russell, and Stormont.

^bIncludes the following districts: Haliburton, Manitoulin, Muskoka, Nipissing, Parry Sound, Sudbury, and Timiskaming.

^cIncludes the following districts: Cochrans, Kenora, Rainy River, and Thunder Bay.

^dIncludes mud, loose sand, gravel, etc.

Figure 2. Percentage of increase or decrease in collisions, 1970-72.

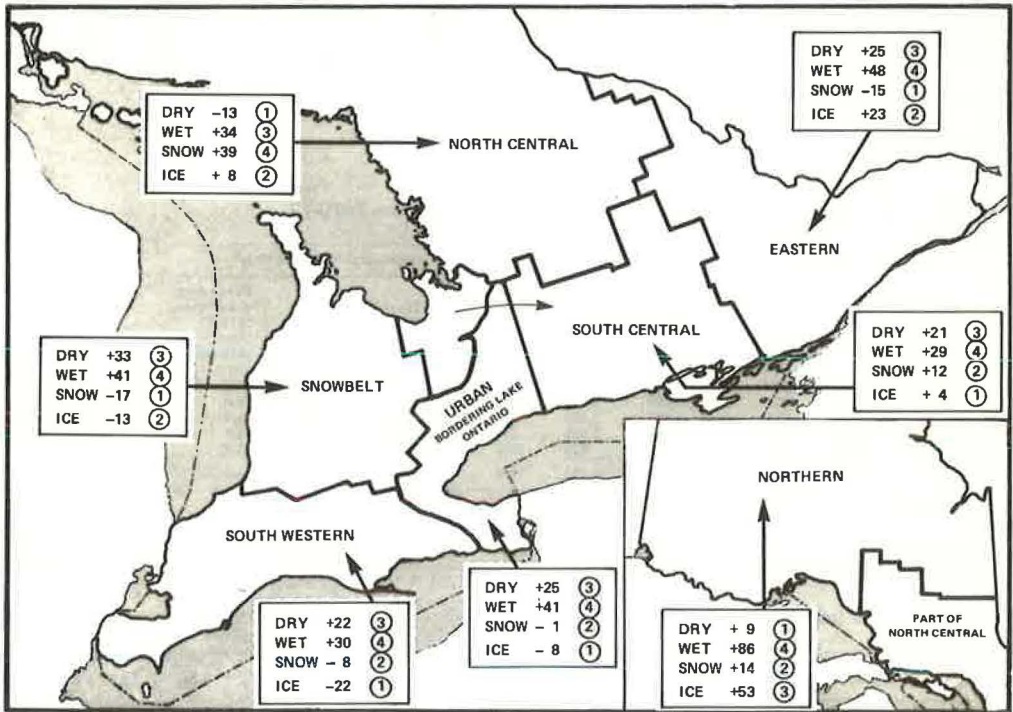


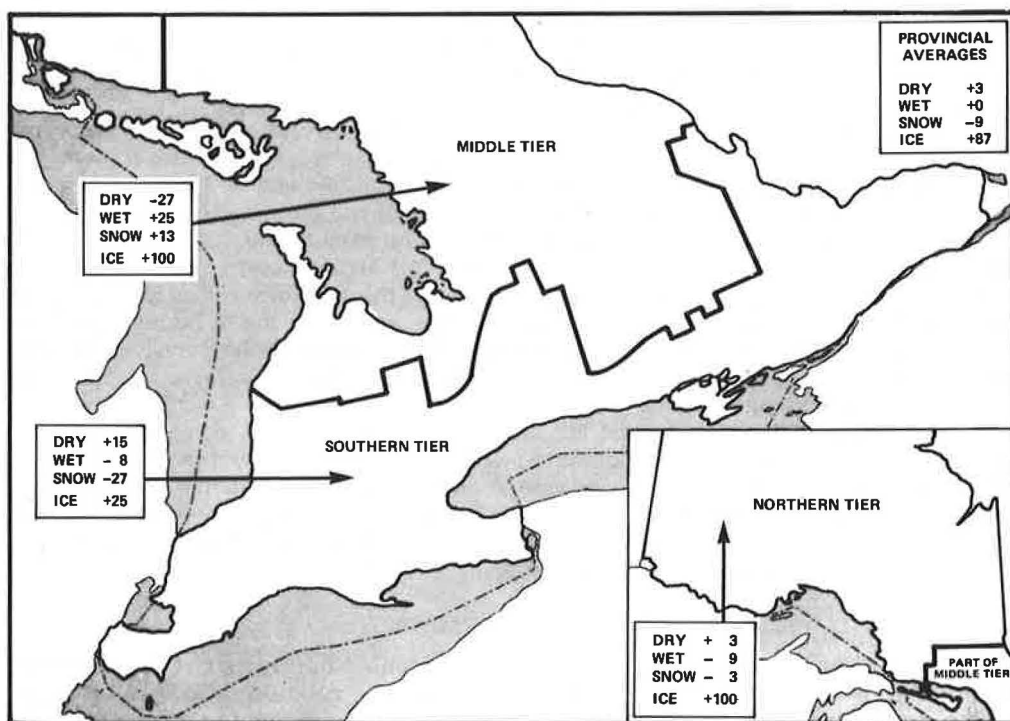
Table 6. Winter road conditions in Ontario.

Area	Provincial Highways Total Miles ^b	Winter Road Conditions (percent)							
		Bare Dry		Bare Wet		Snow or Slush		Icy	
		1970-71	1971-72	1970-71	1971-72	1970-71	1971-72	1970-71	1971-72
Southern tier	6,547	48.9	56.1	33.1	30.3	17.2	12.6	0.8	1.0
Middle tier	3,563	42.3	31.0	26.7	33.4	30.2	34.0	0.8	1.6
Northern tier	4,882	27.0	27.7	30.0	27.3	40.0	39.0	3.0	6.0
Total	14,992	39.4	40.6	29.9	30.0	29.2	26.6	1.5	2.8

^aSouthern tier includes Chatham, London, Stratford, Hamilton, Toronto, Port Hope, Kingston, Ottawa, M.T.C. Districts; middle tier includes Owen Sound, Bancroft, Huntsville, North Bay, Sudbury, M.T.C. Districts; and northern tier includes New Liskeard, Cochrane, Sault Ste. Marie, Thunder Bay, Kenora, M.T.C. Districts.

^bProvincial highways include those highways maintained by province of Ontario and exclude roads and streets under municipal jurisdiction. Mileages shown are in the following order: 10,536; 5,734; 7,857; and 24,127 km.

Figure 3. Percentage of increase or decrease in road conditions.



First, it should be noted that, on a province-wide and regional basis, there was an increase in icy road conditions recorded each winter. For example, there was an increase province-wide from 1.1 percent in 1969-70 (2) to 1.5 percent in 1970-71 to 2.8 percent in 1971-72.

The regional road condition data are shown in Figure 3 in terms of the nearest whole percentage of increase or decrease in each condition. This shows that, in the southern tier, the increase in icy road conditions was of the order of 25 percent, whereas in both the middle and northern tiers the increase was 100 percent. A rough comparison can be made (Fig. 2) against the increase or decrease in icy road accidents even though the "accident" regional areas do not follow the same boundaries. Generally in the south, the 25 percent increase in icy road conditions was not matched by a corresponding increase in icy road accidents among the vehicles exposed to traveling in these conditions. Indeed, in three of the southern accident areas there was actually a decrease in icy road accidents. Turning to the middle and northern tier road conditions, which cover the north central and northern accident areas, the increase in icy road accidents in these areas of +8 percent and +53 percent respectively is much less than the 100 percent increase in icy road conditions that prevailed in both.

The other significant differences between the two winters appear to be that, in the south, there was less snowy, slushy, and wet pavements, whereas in the middle tier there was an increase in these conditions.

The data for the analysis of road conditions were gathered only from roads maintained by the province, and the corresponding data are not available for roads under municipal jurisdiction, which may have lower standards of winter maintenance. Province-wide, about one-third of the total collisions on icy roads occurred on provincial highways, and the decrease in the case of the 1971-72 winter compared to the 1970-71 winter was 4.4 percent as compared with only 0.1 percent when all highways were taken into account.

This observation [and findings such as the report of the dramatic reductions in stopping distances that occur irrespective of the type of tire in use once ice at higher temperatures is sanded (5)] suggests that a more detailed examination of the relative influence of weather conditions, maintenance practices, natural clearing, and resulting road conditions would be worth undertaking.

This possibility is being examined, but at present there is a lack of detailed and comparable data that appears to preclude a full rationalization of winter maintenance standards on the basis of accident or economic considerations. Pending this, caution must be exercised to ensure that the level of service achieved by present standards of winter road maintenance is not allowed to decline in face of increasing costs and because of pressures to reduce pollution from spent road salting.

CONCLUDING REMARKS

The analysis of accidents and road conditions presented in this report of necessity paints a broad picture. In so doing, although this may not relate to a particular community, rural or urban, or to a particular freeway or back road or to the experiences of an individual driver, it does appear to answer beyond reasonable doubt the question, "Are the highways of Ontario in general safer in winter without the use of studded tires?"

In the face of the continuing trend of increasing highway accidents, summer and winter alike, the proportion of winter accidents occurring on icy roads declined in the first winter following prohibition of the use of studded tires. Considering the prevalence of icy road conditions, this relative decline occurred in all regions of the province, north and south.

Naturally, there is cause for grave concern in the number and continuing increase in accidents where cessation of the use of studded tires cannot have a direct influence. Research and countermeasure efforts are being addressed to this problem. Studies of the circumstances of winter (and summer) accidents on particular highways in specific localized areas and time periods might throw light on a common cause. Equally, past experience of accident causation studies indicated that the results might well be inconclusive because of the nature of the data available, the number of unknowns, and the vast

range of interacting variables. Such an investigation would have to take into account not only local variations in road and weather conditions, traffic volumes, and driver-vehicle operating characteristics, but also continuing highway serviceability deficiencies such as the reduction in skid resistance of certain types of pavement surface and the consequences of wheel-track wear rutting caused during the period when studded tires were in use (2, 6).

It would be of interest to know why the physical performance promise of studded tires in reducing stopping distances and improving traction and maneuverability on icy surfaces at temperatures above 0 F is not apparently translated into tangible improvements in safety in actual driving circumstances on icy highways. Although there are physical differences between tests on smooth ice and actual driving in traffic on road ice, seemingly other, nonphysical factors govern. It may prove both difficult and pointless to try to determine these factors.

Whatever the answer on these points may be, there is a real need for winter driving aids that provide both the convenience of increased traction and the assurance of better vehicle control in adverse conditions. If the present level of mobility and favorable accident experience is to be maintained, it would be imprudent to reduce levels of winter maintenance in response to financial or pollution constraints at least until such winter driving aids are available and proved effective.

As pointed out as the final conclusion of the very first report on the studded tire investigation in Ontario, research and development work on alternative winter driving aids is the one of most potential benefit (1). Since then, a promising start has been reported in devising and performance testing alternatives to the conventional studded snow tire (5, 10). Many other ideas and products are in the initial stages of development or evaluation by their manufacturers, and an NCHRP project for evaluation of winter driving traction aids is being developed. It is hoped that the findings of this report will spur such efforts rather than the continuance of postmortems on conventional studded-tire performance or the mitigation of the adverse effects of their use.

ACKNOWLEDGMENTS

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APPENDIX

WINTER ACCIDENT EXPERIENCE IN ONTARIO, 1972-1973

The winter of 1972-73 has been the second since the use of studded tires was prohibited in the province of Ontario. Before-and-after winter accident experience in relation to the prevailing road conditions has already been presented up to the end of the 1971-72 winter, and this brief addition to that report is intended to update the data.

Briefly and generally, the new data appear to amply confirm and extend the earlier conclusion that the proportion of winter accidents occurring on icy or snowpacked and on snowy or slushy roads declined in Ontario following discontinuance of the use of studded tires.

Looking at the accident picture in terms of total collisions and personal injury accidents for the whole province (Table 7), there was an increase in both wet- and dry-road accidents. For example, though the amount of wet road increased by only 1.8 percent from 30 to 31.8 percent, there was an increase in total collisions of 17.7 percent and in personal injuries of 12.1 percent. With regard to snow and slush or icy road conditions, dramatic decreases in collisions and personal injury accidents were experienced ranging from 13.3 to 28.9 percent. In the case of snow and slush conditions, these reductions were of the same order as the reduction in the prevalence of these conditions. However, on icy roads—considering that in the southern and middle tiers icy road conditions increased 50 percent over the previous year—the reduction in accidents is much greater than would have been expected from the prevailing road conditions.

Updated accident information for the winter of 1972-73 on a regional basis is given in Tables 8 and 9 and is shown in Figure 4. Increases in dry- and wet-road accidents occurred in all regions except the north central area where all accidents were down. The decrease in accidents on icy and snowpacked roads prevailed in all regions. On snowy or slushy roads there was a decrease in all regions except the northern area where a minor increase of 5.6 percent, corresponding to 34 additional collisions, occurred.

Road condition data (Table 10) generally confirm the common experience that last winter was a kind one for driving. In the province as a whole there was less snowy or slushy and less icy road conditions than the winter before. Correspondingly, there was an increase in both bare dry and bare wet pavements. These differences prevailed on a regional basis except in the southern and middle tiers of Ontario where there was a significant increase in icy roads.

It is, of course, in these icy circumstances that studded tires have been claimed to provide additional safety. The experiences in Ontario over the past two winters show this is simply not true. Without studded tires, the proportion of winter accidents occurring on icy or snowpacked roads has declined.

In light of the foregoing evidence, no change in policy toward use of studded tires would appear warranted; however, in recognition of the need for winter traction aids, a close watch on new developments is being maintained.

Table 7. Total collisions and personal-injury accidents by road surface condition, 1971-73.

Road Surface Condition	All Highways in Ontario						Provincial Highways Only		
	Total Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72	Personal-Injury Accidents, Winter		Percentage of Increase, 1972-73 Over 1971-72	Total Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72
	1971-72	1972-73	1971-72	1971-72	1972-73	1971-72	1972-73	1971-72	
Dry	32,716	35,857	9.6	11,677	11,806	1.1	5,948	6,674	12.2
Wet	29,339	34,532	17.7	9,718	10,898	12.1	3,902	5,312	36.1
Snow and slush	13,958	12,098	-13.3	3,554	2,913	-18.0	3,395	2,923	-13.9
Ice and packed snow	22,324	16,254	-27.2	5,502	3,910	-28.9	5,732	4,457	-22.2
Other	942	734	-22.1	276	241	-12.7	56	54	-3.6
Total	99,279	99,475	0.20	30,727	29,768	-3.1	19,035	19,420	2.0

Figure 4. Percentage of increase or decrease in collisions, 1970-73.

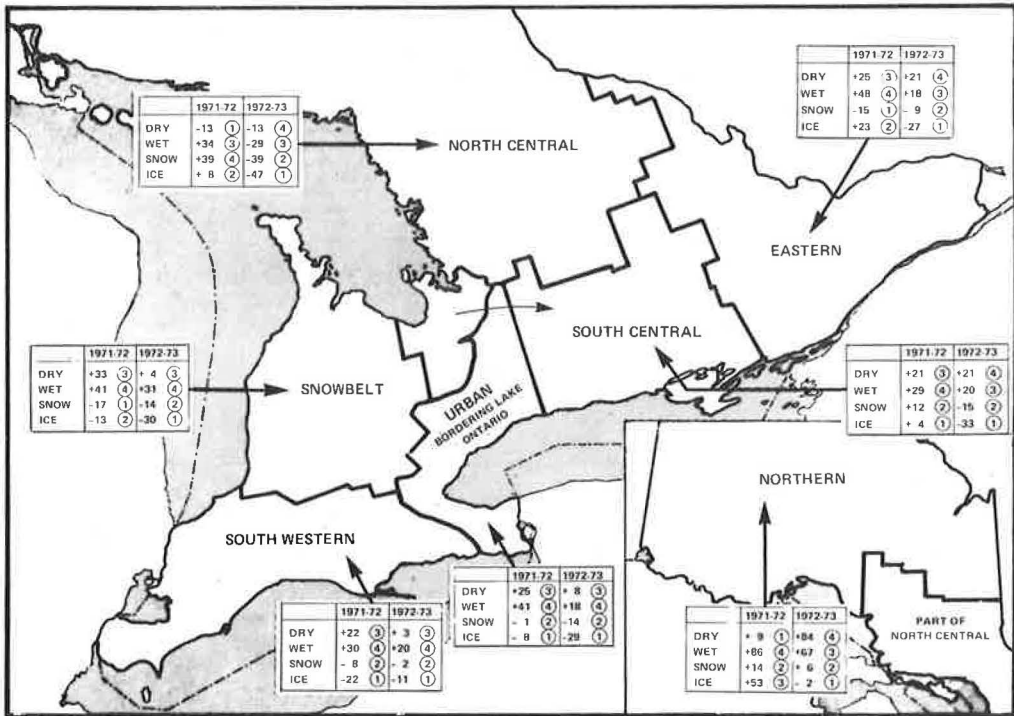


Table 8. Total collisions by road surface condition.

Road Surface Conditions	Southwestern			Snow Belt			Urban Counties Bordering Lake Ontario			South Central		
	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72
	1971-72	1972-73		1971-72	1972-73		1971-72	1972-73		1971-72	1972-73	
Dry	5,350	5,503	2.9	2,222	2,299	3.5	17,522	18,885	7.8	2,295	2,783	21.3
Wet	3,935	4,720	20.0	2,036	2,662	30.7	16,175	19,113	18.2	1,965	2,361	20.2
Snow and slush	1,442	1,410	-2.2	1,343	1,152	-14.2	5,591	4,835	-13.5	1,343	1,142	-15.0
Ice and packed snow	2,428	2,153	-11.3	2,508	1,758	-29.9	6,714	4,767	-29.0	2,834	1,891	-33.3
Other	190	151	-20.5	98	73	-25.5	355	276	-22.3	82	49	-40.2
Total	13,345	13,937	4.4	8,207	7,944	-3.2	46,357	47,876	3.3	8,519	8,226	-3.4

Table 9. Collisions by road surface condition.

Road Surface Condition	Eastern			North Central			Northern		
	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72	Collisions, Winter		Percentage of Increase, 1972-73 Over 1971-72
	1971-72	1972-73		1971-72	1972-73		1971-72	1972-73	
Dry	2,813	3,414	21.4	1,707	1,486	-12.9	807	1,487	84.3
Wet	2,940	3,457	17.6	1,675	1,191	-28.9	613	1,028	67.7
Snow and slush	2,371	2,148	-9.4	1,259	766	-39.2	611	645	5.6
Ice and packed snow	3,510	2,567	-26.9	2,485	1,320	-46.9	1,843	1,798	-2.4
Other	74	65	-12.2	104	58	-44.2	39	62	59.0
Total	11,708	11,651	-0.49	7,230	4,821	-33.3	3,913	5,020	28.3

Table 10. Winter road conditions.

Area	Provincial Highways, Total Miles	Winter Road Conditions (percent)											
		Bare Dry			Bare Wet			Snow or Slush			Icy		
		1970-71	1971-72	1972-73	1970-71	1971-72	1972-73	1970-71	1971-72	1972-73	1970-71	1971-72	1972-73
Southern tier	6,547	48.9	56.1	56.7	33.1	30.3	32.1	17.2	12.6	9.5	0.8	1.0	1.7
Middle tier	3,563	42.3	31.0	37.8	26.7	33.4	35.4	30.2	34.0	24.4	0.8	1.6	2.4
Northern tier	4,882	27.0	27.7	37.5	30.0	27.3	27.5	40.0	39.0	30.9	3.0	6.0	3.4
Total	14,992	39.4	40.6	44.1	29.9	30.0	31.8	29.2	26.6	21.6	1.5	2.8	2.5