

A RECOMMENDATION TO THE VIRGINIA DEPARTMENT OF HIGHWAYS
CONCERNING THE USE OF STUDED TIRES IN VIRGINIA

by

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Virginia Highway Research Council
(A Cooperative Organization Sponsored Jointly by the Virginia
Department of Highways and the University of Virginia)

Charlottesville, Virginia

January 1972
VHRC 71-R17

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RECOMMENDATION

At the request of the Highway Department, the writer has stayed abreast of the available information on the usage of studded tires and their effects on highway safety and pavement wear since their introduction into this country; and has prepared several reports(1,2,3,4) to transmit current findings to the Department. The writer's service on the Highway Research Board Task Force on Studded Tires (chairman), NCHRP Panel 1-13 on the Effects of Studded Tires on Highway Safety, and the HRB Ad Hoc Evaluation Panel on Pavement Wear Study — the last of which evaluated the Minnesota experiments with studded tires — made the task of staying abreast of current information a much easier one than it otherwise would have been.

As a member of the above NCHRP and HRB panels, the writer has made several trips to Minnesota to view firsthand the pavement damage inflicted by studded tires. Also, in conjunction with one of these trips, he visited the American Oil Company Laboratories in Whiting, Indiana to witness the laboratory wear tests that the Company was performing for the Minnesota study.

Based on the knowledge gained from the above assignments, supplemented by findings from extensive literature reviews and simple yearly experiments in Northern Virginia in which the numbers of cars using studded tires have been estimated by monitoring vehicles in the Pentagon parking lot and pavement wear has been monitored through periodic measurements of selected pavements, the writer submits the following recommendation:

The Highway Department should concur in the extension of the legalization of studded tires for another two-year period. However, the Department should request that the winter use period be reduced from October 15-April 15 to November 1-April 1.

This recommendation is supported by the following observations.

Trend in Use of Studded Tires in State

While it is true, as has been demonstrated in the Northern States, the Canadian Provinces and several European countries, that extensive pavement damage can result from the widespread use of studded tires, the state of Virginia has not experienced any such damage. Studded tires constitute a relatively small percentage of the winter tires used in Virginia. Based on the surveys made in the Pentagon parking lot there was an increase in usage for several years. Originally, the number of such tires in use seemed to double each year, which was quite alarming because this same phenomenon had occurred in Europe, Canada, and the Northern States, and had progressed to the point that pavements in these areas had incurred extensive damage. However, the most recent Pentagon lot survey, made on December 3, 1971, indicates that the usage this year will be about 8 to 10%. Table 1 gives a breakdown of the use of studded tires, winter mud and snow tires, and conventional tires for the past four years.

TABLE 1
Pentagon Parking Lot Survey For Studded Tire Usage

	Snow Tread With Studs		Snow Tread Without Studs		Plain Tread With Studs		Plain Tread Without Studs	
	Front	Rear	Front	Rear	Front	Rear	Front	Rear
Feb. 24-25, 1969	2(.03%)	123(2.8%)	21(.47%)	3173(71%)	0		4443(99.5%)	1170(26.2%)
Feb. 17-18, 1970	0	182(4.2%)	20(.5%)	3156(72.8%)	0		4317(99.5%)	999(23%)
Feb. 16, 1971	4(.1%)	354(7.7%)	13(.3%)	2986(61.1%)	0		4568(99.6%)	1245(27.2%)
Dec. 15, 1971	0	288(6.7%)		2103(48.7%)	0		4315(100%)	1924(44.6%)

It will be noted that this winter's survey was made in December whereas in the past the surveys were made in February. This difference in survey dates naturally makes a difference in studded tire usage. However, by comparing this year's snow tread usage with that of past years it appears that about 70% of the people who use winter tires had made the change when this year's survey was made. Based on this estimate, the usage for this winter would be 9.5% rather than the 6.7% as shown in the table.

Several other things are worthy of note from Table 1. First, the number of people who use studs in the front tires is negligible, and second, about 25% of the drivers don't use winter tires at all.

It should be remembered that the estimates of studded tire use in the state are based on surveys of the Pentagon parking lot only, and thus they might be in error. However, the writer believes that because of the geographic location of the lot in the northern part of the state and the socioeconomic backgrounds of the people who work in the Pentagon, the estimates of usage are higher than the average for the state.

Tire Performance

It has been demonstrated on numerous occasions that studded tires provide better traction and shorter stopping distances on ice than do conventional or winter mud and snow tires. The writer feels that the extreme reduction in stopping distance, which has been demonstrated on ice pads at high speeds, would provide little if any added safety under actual driving conditions. While studs greatly reduce stopping distances on ice at relatively high speeds (at 50 mph, from about 780 ft. with conventional tires to about 670 ft. with studs on the rear, and about 520 ft. with studs on all four wheels⁽⁵⁾), the reduced distances, even with studs on all four wheels, are still so long that a vehicle most likely would either leave the roadway or become involved in a collision prior to stopping. However, at the locations where ice is most likely to be encountered — driveways, both urban and rural, residential city streets, and rural low traffic secondary roads, especially in the mountains — the average driving speed is low enough to render the added traction and reduced stopping distance a real safety advantage, as well as a convenience. While the use of studded tires at these locations is not likely to appreciably reduce fatalities or serious injury it could greatly reduce minor property damage and minor injury accidents.

The Cornell Aeronautical Laboratory reported in a study⁽⁶⁾ they conducted for Minnesota that studded tires showed a mild advantage over snow tires and that both types showed a clear advantage over conventional tires in reducing sliding accidents. They further reported that on ice the studs reduced preimpact rotation, whereas on snow regular snow tires showed an advantage. However, it should be noted that on dry surfaces conventional tires performed best in preventing preimpact rotation, and that they were followed by snow and then studded tires. Cornell also reported "...the drivers of studded tire automobiles which triggered accidents due to sliding were less likely to incur injury."

Improvements in Stud Design

While historically studs have caused damaging wear to pavements, the stud manufacturers have been working to improve the stud-tire system in order to reduce wear and, in fact, it appears that they have made some progress recently. They claim a 40 to 50% reduction in pavement wear.⁽⁷⁾ This claim was corroborated by laboratory tests conducted recently by the American Oil Company⁽⁸⁾ for the state of Minnesota, in which a reduction in wear of from 30 to 50% was found. This reduction in wear is accredited to a reduced stud protrusion.⁽⁷⁾ There are possibly other means of reducing wear, such as attaching a soft, spring-like rubber cushion underneath the stud flanges,⁽⁷⁾ and use of a plastic coated stud being developed by a firm in Ludenschied, Germany. The last two ideas have not been successfully field tested but they do remind one that there is a potential for reduced wear through improvements to studded tires.

Recommended Reduced Period of Use

The writer's recommendation to renew the legalization of studded tires for an additional two years stipulates that the usage season be reduced from October 15-April 15 to November 1-April 1. This reduction in usage has a potential of reducing pavement wear a maximum of 16%. In Virginia there is not much likelihood of significantly icy road conditions prior to November 1 nor after April 1, even when the state experiences unseasonal snows.

The Maintenance Division advised the writer that Virginia has experienced the following early and late snow falls for the past few years:

Year	Date of First Snow	Date of Last Snow
1968-69	November 10	March 12
1969-70	November 14	March 18
1970-71	November 4	April 7
1971-72	November 22	

The recommended shorter season would be more in line with those of some of the northern states which experience much colder weather than Virginia. For instance Iowa and Michigan's season is from November 1 to April 1, and Wisconsin, who's present season is from November 10 to March 15, desires a reduction of from December 1 to March 1. Pennsylvania's season dates are from October 15 to April 1. New York's present dates are from October 15 to May 1, but they are contemplating changing to November 15 to April 15. New Jersey's season is from November 15 to April 1. It is interesting to note that while the northernmost states have shorter seasons than Virginia the two states to the immediate north have as long or longer seasons than does Virginia. Delaware's season is from October 15 to April 15 and Maryland's season is from October 15 to April 30. The writer attributes this fact to Delaware and Maryland's experiencing less pavement damage because of less usage than the states further north. However, both Maryland and Delaware are now becoming quite concerned about wear.

It is the writer's opinion that this reduction is warranted and should receive serious consideration by the Department.

Option to Change Recommendation on Use

The fact that the recommendation stipulates a two-year extension of the legalization of studded tires rather than a permanent legalization deserves some comment. First it should be remembered that the damage studded tires have done to pavements in Europe, Canada, and the Northern States is quite serious. Prior to the banning of studded tires in Ontario, it was estimated that continued usage would cost the Province an additional \$127 million for road construction and maintenance by 1980. Michigan's projection is much higher — \$28 million per year, or \$280 million of additional expenditures over the next ten years. Consequently the Michigan Highway Commission has gone on record as being in favor of banning the use of studs in the lower peninsula, while leaving them legal in the northern and sparsely populated areas of the state. Minnesota and Utah have followed Ontario and made studded tires illegal after this winter, though Minnesota still permits vehicles registered in other states to employ studded tires. The Wisconsin senate has passed a bill prohibiting the use of studded tires after the winter of 1972-73. This bill is scheduled for consideration by the Wisconsin assembly soon. The Iowa Commission has prepared a bill that would prohibit the use of studded tires as part of their legislative program. Pennsylvania, New York, New Jersey, Delaware, Maryland, and Ohio have considered banning studs but have decided to study their effects for another winter before making a final decision.

In light of the above, Virginia should not lose sight of the fact that a combination of an extremely cold and wet spell and a surge advertising campaign by stud producers could greatly increase the use of studs in the state. This would, of course, place Virginia in the same position as the northern states in regard to pavement damage.

In addition to the potential for additional expenditures for road construction and maintenance in case of a large increase in the use of studded tires, there are several potential safety disadvantages. These are:

1. The widespread use of studded tires causes an early obliteration of pavement markings, and thus a quite hazardous driving condition. (9)
2. The pavement wear caused by studs creates troughs in the wheel paths which could accumulate water that could either set the stage for hydroplaning or freeze and cause a slippery condition.
3. The stopping distance on dry and wet concrete, particularly wet concrete, pavements is extended when studs are employed. (5)
4. Preimpact rotation is more likely on dry pavements when studded tires are employed than when snow or conventional tires are used. (10)

All the safety aspects of studded tires are not understood. There have been many safety claims but little hard research on this facet of the studded tire. However, AASHO, through the NCHRP, is quite active. They presently have a \$200,000 contract with Cornell Aeronautical Laboratory for follow-up work on the project that Cornell conducted for Minnesota on the safety aspect of studs. The study conducted for Minnesota evaluated the safety aspects of studded tires during 1970-71 while they were legal in Minnesota. The follow-up study is to determine if there is any change in safety due to the banning of studs. In addition, the study is designed to evaluate the safety aspect of the use of studs in Michigan.

In addition the NCHRP has solicited and is now reviewing a proposal on the "Effects of Studded Tires on Highway Safety" by the Highway Safety Research Institute at the University of Michigan.

The objective of the study is outlined in the following excerpt from a letter to the HSRI from the NCHRP office. "...the general objective of this work is to undertake a synthesis study to relate the effects of pavement wear from studded tires to highway safety and potential accident causation. The study will consider, but not be limited to, such effects as premature loss of pavement markings, shifting of lateral placement of vehicles in traffic lanes, possible hydroplaning from water accumulating in the wheel paths, increased splash and spray from water in the wheel paths, possible reduction of skid resistance and adverse steering effects."

Therefore, until more is known about the safety aspect of studded tires, and until more is known about improvements in studs which might reduce the pavement damage they cause, it would be prudent to extend the use of studs on only a two-year basis, and even then for a reduced season of from November 1 to April 1.

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