

SUMMARY: AN OVERVIEW OF STUDED AND STUDLESS TIRE TRACTION AND SAFETY

BY ROBERTY R. SCHEIBE – RESEARCH PROJECT AGREEMENT T2695, TASK 21 – 10/2002

Abstract: Studded tires have generated much controversy over the years; a number of states have banned them, while others have restricted their use and passed legislation to require lighter-weight studs. This report reviews recent studies that have addressed the performance and safety of the current generation of studded tires as well as the new “studless” winter tires on late-model vehicles. The well-documented correlation between studded tires and pavement wear was not the focus of this work.

The issues surrounding studded tire performance and safety are complex. From the standpoint of traction alone, studded tires, when new, often provide some benefit over other tire types on ice-covered roads when the temperature is near freezing. However, the advent of the new studless tires has diminished the marginal benefit, and recent studies suggest that the infrequent, narrow range of conditions necessary for benefit from studded tires may not outweigh their detrimental effect on traction in dry or wet conditions on certain pavement types. In addition, a host of primary and secondary safety factors are related to studded tire use, many of which are very difficult to quantify, including facets of driver behavior and safety perception.

Conclusions: 1. Studded tires produces their best traction on snow or ice near the freezing mark and lose proportionately more of their tractive ability at lower temperatures than do studless or all-season tires.

2. The traction of studded tires is slightly superior to studless tires only under an ever-narrowing set of circumstances, being clear ice near the freezing mark, a condition whose occurrence is limited. For the majority of test results reviewed for snow, and for ice at lower temperatures, studded tires performed as well as or worse than the Blizzak tire. For those conditions in which studded tires provided better traction than studless tires, the increment usually was small.

3. The precise environmental conditions under which studded tires provide a traction benefit are relatively rare. The maximum frictional gain (in comparison to non-studded (not studless) tires) is found for new studded tires on smooth ice, where they have been shown to provide up to 100% gain in certain tests. However, the relative frictional gain

of studded tires diminishes or becomes negative on roughened ice, as temperatures drop, as the studs wear, or if the comparison is made with studless tires.

4. The single best indicator of tire performance is braking distance and deceleration.

5. Studded tires may reduce the risk of drivers misjudging the necessary braking distance they need and may improve the braking potential for anti-lock brakes.

6. In one set of tests in Alaska studded, studless and all-season tires performed nearly equally on snow. On ice, stopping distances for studded tires were 15% shorter than for Blizzaks, which in turn were 8% shorter than for all-season tires.

7. In another set of tests in Alaska, studless Blizzak tires offered the best traction performance, especially for braking on both packed snow and ice in comparison to studded tires and all-season tires.

8. On bare pavement, studded tires tend to have poorer traction performance than other tire types.

9. Tractive performance of studded tires is sensitive to stud wear.

10. A Norwegian study concluded that the use of studded tires tends to reduce the accident rate by a small amount, being somewhere from 1% to 10%.

11. Drivers tend to behave differently when they use studded tires which affect their effectiveness. They either driver safer or more dangerous.

12. Pavement rutting caused by studded tires can cause the dangerous conditions of tramlining, hydroplaning, excessive road spray, and premature damage to pavement markings.

13. The use of studded tires by the public roughens ice and provides a net safety benefit for all vehicles (with or without studs) by helping to prevent the formation of smooth, glare ice.

14. The cost of studless tires is 50% higher than studded ones.

15. Studded tires increase fuel consumption by 1.2%, while unevenness, snow and ice increase fuel consumption by 15%

16. Suspended particulate matter from pavement dust created by studded tires and noise from studded tires are health concerns.