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LITERATURE REVIEW

Studded Tires in Oregon

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This literature review covers the conclusions and findings of previous research on the effects of studded tires in Oregon, as well as studies done since Shippen, Kennedy and Pennington published *Review of Studded Tires* in Oregon in 2015.

The damage caused to road surfaces by studded tires has been studied and well documented in research projects over several decades, including a number done in Oregon. While studded tires improve the braking, traction and cornering performance of vehicles in icy conditions, the studs themselves dislodge small amounts of pavement material as they travel on dry surfaces. The resulting ruts can fill with water and ice, creating excessive road spray, hydroplaning and damage to pavement markings (Scheibe 2002). The Oregon Department of Transportation has a threshold of 0.75 in. for ruts on state highways. At that point, the highway section earns a "Poor" rating condition, triggering a resurfacing project (ODOT 2010).

Alaska DOT, 2019

Additionally, studded tires lose much of their benefit over time as the studs wear. Once the studs are reduced to 0.024 in., the frictional effect becomes insignificant (Scheibe 2002). Studies have also shown that studded tires release 60-100 times more hazardous inhalable particulates into the air than their non-studded equivalents. In urban environments, this can contribute significantly to air pollution; in 2010, the most polluted street in Stockholm, Sweden introduced a ban on studded tires, leading to a 20% drop of PM_{10}, inhalable particulate matter with a diameter of 10 micrometers (Elmgren, Norman et al. 2018). Studies following a studded tire ban in Japan also found a decrease in particulates (Brown, Vanlaar et al. 2012).

SAFETY AND PERFORMANCE OF STUDDED AND NON-STUDDED TIRES

Since the early 1990s, the development and continued improvement of studless, or non-studded winter tires has offered a viable alternative to studded tires. While studded tires perform better under a very narrow range of

conditions – clear ice, near the freezing mark (Scheibe 2002) – non-studded tires function as well, if not better, under almost all other winter situations.

Winter tires are identified by the 3-peak mountain snowflake (3PMSF) symbol on the sidewall. This symbol indicates that the tire has met the traction standards of the American Society of Testing and Materials (ASTM) test F1805: Standard Test Method for Single Wheel Driving Traction in a Straight Line on Snow- and Ice-Covered Surfaces (ASTM International 2020). This standard has been updated a few times in recent years – the current version being ratified in 2020 – but the minor changes did not alter the testing procedures or parameters. The standard also uses the definition of winter tires developed by the US Tire Manufacturers Association (USTMA 2019).

The rubber compounds used in winter non-studded winter tires are softer and remain pliable in cold conditions, improving the grip. Their aggressive tread and siping add to their ability to handle well in snow and ice. Manufacturers have also introduced microscopic voids in the tires that introduce a capillary action on the film of liquid water on the surface of road ice, reducing the slipperiness (Okel and Rueby 2016); according to Monticello (2017), the non-studded winter tires work like a squeegee on ice. While the tire industry continues to introduce new models of winter tires, Okel and Rueby (2016) maintain that advances from this point will come more from the tread compound than tread design.

Figure 6 - illustration of ice traction of a rubber tread block; although a tread block may be macroscopically smooth, it contains microscopic asperities; friction on ice comes from viscous drag of these asperities on the ice/water film as shown; the thickness of this film is a function of temperature and can further be increased upon pressure and friction melting generated by vehicle tires

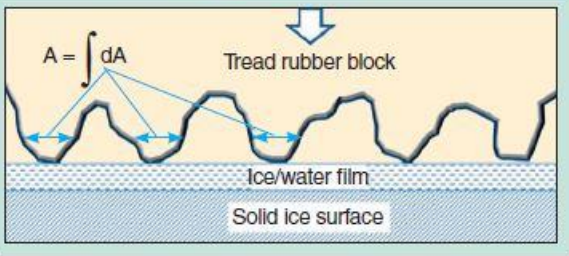
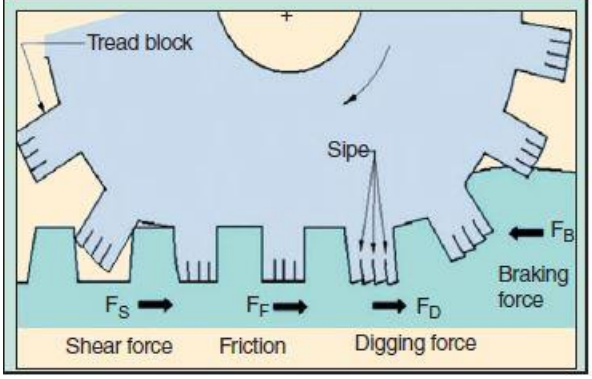


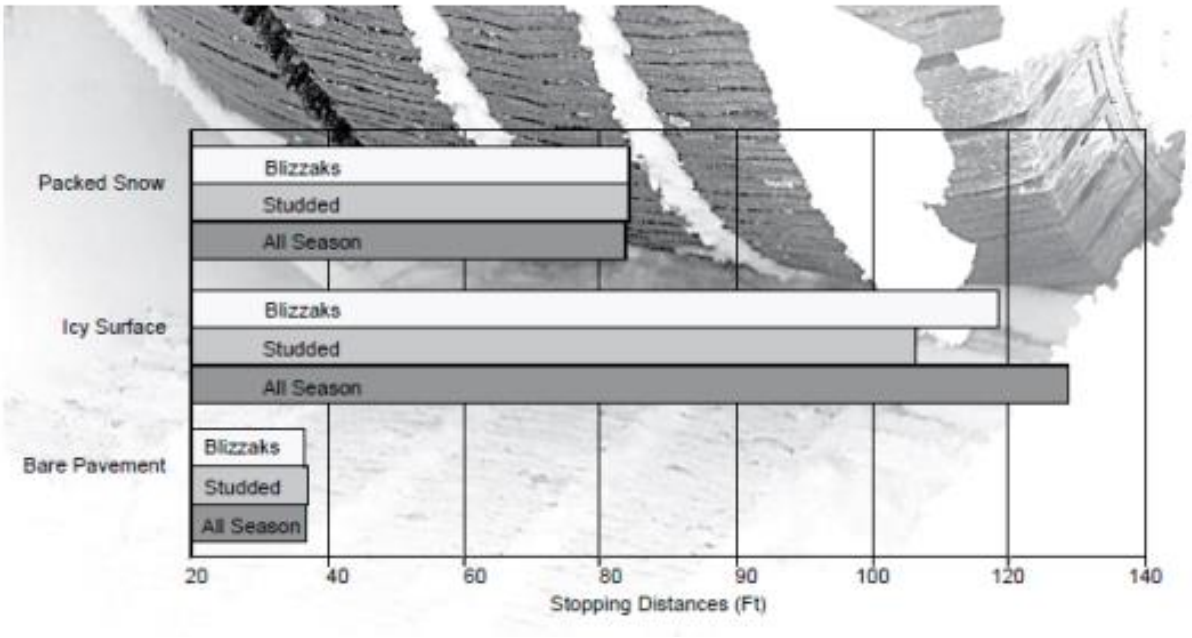
Figure 7 - illustration of snow traction mechanisms (ref. 19)



(Okel and Rueby 2016)

When tested against studded and all-season tires, dedicated winter tires perform very well. Early studies from the 1990s comparing Blizzaks (a winter non-studded tire from Bridgestone), studded tires and all-season tires showed that the Blizzaks offered the best overall performance on packed snow and ice. Both studded tires and the Blizzaks performed better than all-season tires in these conditions (Scheibe 2002). A Lithuanian study found vehicles equipped with non-studded tires decelerated 3.6% faster than those with studded tires on wet surfaces and 15.6% faster on wet snowy surfaces (Brown, Vanlaar et al. 2012).

These authors also cited a study that found that both studded and non-studded tires took 10-20% less time to reach speeds of 40 km/hr. (25 mph) than all-season tires on packed snow. On icy surfaces, studded tires took 29% less time to accelerate, and non-studded tires took 13% less time than all-season tires.



Alaska, 2019

Stopping distance for winter tires on packed snow is typically about 35% shorter than for all-season tires, and even on dry pavement during cold weather, stopping distances with winter tires were as much as 30% shorter than with all-season ones (Woodrooffe 2016). In acceleration tests, a vehicle with dedicated winter tires reached a distance of 60 meters (65.6 yards) in 8 seconds, as compared to 11 seconds for a vehicle with all-season tires (Brown, Vanlaar et al. 2012).

A 1995 Norwegian study questioned drivers reporting car damage during the winter of 1994/1995 to assess the impact of studded tires on accident rates. The study found no significant difference in accident rates of drivers with studded tires and those with non-studded winter tires (Abaza, Arafat et al. 2019). A more recent study examined data from road accidents in Finland during winter months from 1997 to 2012. This study found no statistical differences between accidents with studded compared to non-studded winter tires, except in the case of bald ice, where studded tires performed significantly better (Malmivuo, Luoma et al. 2017).

Four-wheel drive vehicles accelerate faster than two-wheel drive ones under low road-friction conditions, giving many four-wheel drive owners the perception that winter tires are not needed for their vehicles. However, tests have shown that four-wheel drive vehicles and two-wheel drive vehicles fitted with the same tires performed similarly while braking and cornering on icy roads since the number of driven wheels becomes irrelevant during braking. Two-wheel drive vehicles outfitted with winter tires significantly out-performed

four-wheel drive vehicles with all-season tires, the former having approximately 35% shorter braking distance, and similar results while cornering and encountering curves (Woodrooffe 2016).

The use of winter tires also enhances the ability of the vehicle's crash avoidance technology to work. Electronic stability control (ESC), for example, requires tire adhesion to function optimally (Woodrooffe 2016).

Winter non-studded tires function optimally at temperatures of 45 degrees and below; use in warmer temperatures causes excessive tread wear. This requires owners to maintain two sets of tires so they can be changed out. To overcome this drawback, all-weather tires began to appear on the scene in the early 2000s. These tires meet the standards of ASTM F1805, so are considered winter tires and carry the snowflake symbol. However, they use a hybrid tread and are made from a unique compound somewhat similar to all-season tires, allowing owners to use the tires year-round. Beginning in 2011, these tires were widely promoted in Canada, offering those citizens an option for winter tires that didn't require being changed (Brown, Vanlaar et al. 2012). Given the cold and snowy winter weather in much of Canada, and the fact that winter tires are required in Quebec during the winter months, it was offered as an option for those who felt unable to afford and/or maintain two sets of tires. However, the Tire and Rubber Association of Canada recommended the use of dedicated winter tires for extreme winter conditions (TRAC 2019).

Another designation used by the tire industry is the Mud/Snow identification. It is marked on tire sidewalls with the letters "M" and "S" (MS, M/S, M&S, M+S). Developed in the 1970s, this was a way of identifying tires with a more aggressive tread that should exhibit better stopping, starting and driving performance under snowy or muddy conditions. However, this is a visual standard, and does not represent a performance standard. While often appearing with the mountain snowflake symbol, the Mud/Snow designation by itself does not represent a dedicated winter tire (Ulrich 2019).

AVAILABILITY AND COST

Non-studded tires are widely available in Northwest markets. In his 2002 report for Washington State, Sheibe noted a nearly 50% higher cost for non-studded varieties over comparable studded tires. However, costs appear to have equalized over time; a November, 2020 quote from Les Schwab Tires for a set of four non-studded winter tires for a Honda CRV was $767.88, as compared to studded tires for the same vehicle at $745.88, a difference of only $22.00, or 3%. See appendix for further information on winter tire brands and prices.

Sales of non-studded winter tires have increased in Oregon in recent years. Information supplied by Les Schwab Tire Stores show increasing sales of non-studded winter tires in Oregon between 2016 and 2020 (Les Schwab Tire Centers, personal correspondence, November 24, 2020).

Winter tire sales make up a small percentage of overall US tire sales. This is in contrast to sales in Canada, where the number of drivers using winter tires grew from 35% in 1998 to 75% in 2017. Even excluding Quebec, where the use of winter tires are mandatory, 70% of Canadians currently use them (TRAC 2019). The following table shows the percentage of winter tires shipped in the US between 2004 and 2018:

U.S. PASSENGER TIRE UNITS SHIPPED

2004-2018 (in millions)

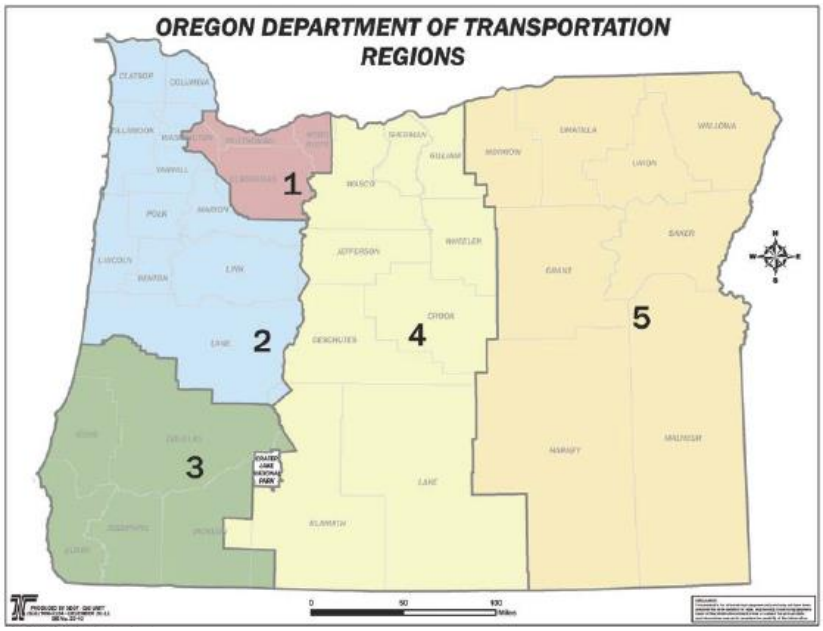
Year	Overall	Winter	%winter
2018	216.1	5.2	2.4%
2017	209.3	5.3	2.5%
2016	207.7	5.9	2.8%
2015	205.9	7.0	3.4%
2014	206.6	6.9	3.3%
2013	201.6	4.9	2.4%
2012	192.0	5.6	2.9%
2011	196.5	6.8	3.4%
2010	198.7	5.8	2.9%
2009	184.0	5.1	2.9%
2008	195.0	5.3	2.7%
2007	205.0	4.5	2.2%
2006	199.1	4.2	2.1%
2005	205.8	4.5	2.1%
2004	199.4	4.2	2.1%

SOURCES: U.S. TIRE MANUFACTURERS ASSOCIATION, MODERN TIRE DEALER

Ulrich, 2019

PREVALENCE OF STUDDED TIRE USE IN OREGON

Research has shown that usage of studded tires has been steadily declining over the years. In the 2015 report, Shippen, Kennedy and Pennington found that studded tire use declined from approximately 16 percent of registered vehicles in 1995 to about 4 percent in the 2013-14 winter season. This study conducted a survey based on studded tire use in the state by ODOT regions, and compared it to a similar study conducted in 1995.



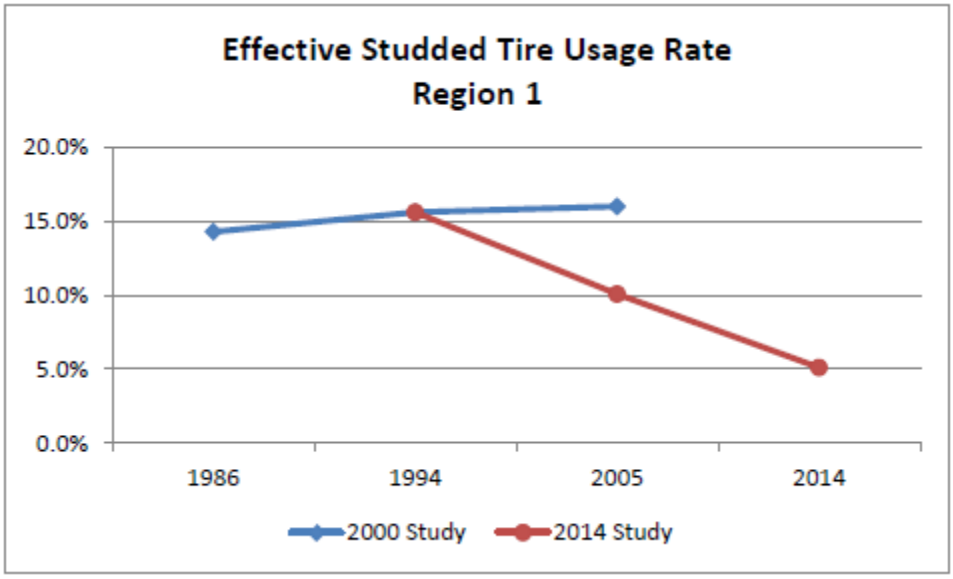
Regional Map of Oregon

ODOT Region	2013 Registered Passenger Vehicles (DMV)	Nominal Vehicle		Effective Use
1	1,295,426	2.6%		5.1%
2	837,994	2.0%		4.0%
3	423,189	1.3%		2.7%
4	368,935	13.3%		26.6%
5	159,533	10.9%		21.8%
Weighted State Average	3,085,077	4.0%		7.9%

Results from the PSU phone survey for studded tire use in Oregon for the 2013-14 winter driving season (Shippen, Kenneday et al. 2015)

ODOT Region	ODOT 1995 Telephone Survey	ODOT 2014 Telephone Survey
1	15.6%	5.1%
2	12.4%	4.0%
3	5.4%	2.7%
4	40.1%	26.6%
5	30.2%	21.8%
Weighted State Average	16.0%	7.9%

Comparison of studded tire effective use by region from 1995 survey vs. 2014 survey (Shippen, Kennedy et al. 2015)



Studded Tire Usage Rate in Region 1 (Portland Area) (Shippen, Kennedy et al. 2015)

Sales of studded tires have continued to decline in the intervening years. Les Schwab Tire Centers are major tire distributors in the Northwest, with stores throughout the state. Information from the chain showed a decline in Oregon sales between 2016 and 2019. This trend is reflected in other parts of the US with severe winter conditions; research has shown that studded tire usage in Alaska has declined from approximately 49% in 1990 to 35% in 2018 (Abaza, Arafat et al. 2019).

COST OF STUDDED TIRES TO OREGON HIGHWAYS


I-5 SB segment near Wilsonville showing wheel rut wear caused by studded tires (Shippen, Kennedy et al. 2015)

Rut depth is a function of studded tire passes. It was suggested that asphalt surfaces are most susceptible to rutting in the first two years because of secondary compaction. Concrete is considered to get stronger as it ages, making it less vulnerable to rutting over time.

Rut repair for asphalt assumes a 2" overlay with 12 foot lanes, at an estimated overall cost of $98,300 per lane mile (2014 USD). Concrete (PCC) overlays must be done over the entire section of the roadway, including the shoulders (Shippen, Kenneday et al. 2015). Alaska DOT found that studded tires reduced the asphalt life by 6-8 years, with an average of 7 years, representing about 47% loss of pavement life annually (Abaza, Arafat et al. 2019).

The 2015 Oregon report found the effective damage cost estimates of studded tire use in 2012 to be just over $8.5 million (2012 USD). The effective damage costs includes studded tire damage that is expected to reduce the useful life of pavement surfaces.

Table 5.6: Summary of Effective Cost estimates, Base case*

	Asphalt	PCC	Total Cost
Region 1	$4,312,163	$103,462	$4,415,625
Region 2	$43,286	$0	$43,286
Region 3	$0	$0	$0
Region 4	$3,918,429	$74,777	$3,993,206
Region 5	$86,927	$0	$86,927
Statewide	$8,360,805	$178,239	$8,539,044

Asphalt design life and wear rate: 16 years, 0.0295
PCC design life and wear rate: 40 years, 0.0091

Estimates shown in 2012 USD (Shippen, Kennedy et al.2015)

The higher costs for Region 1 is indicative of the high traffic volume and the high proportion of PCC highway sections in that area. Region 4 has lower traffic volumes, but higher studded tire usage. This figure compares to the annual cost of pavement damage due to studded tires in Alaska of $13.7 million. (2019 USD) (Abaza, Arafat et al. 2019).

The Oregon study also estimated the total damage cost, which effectively "accumulated" all the rut depth into sections that are at the threshold of 0.75" deep (the point at which a resurfacing project would be planned), then calculated the cost for an equivalent number of lane miles
(Shippen, Kennedy et al. 2015).

That estimate, by region:

Studded Tire Pavement Damage Estimator For 2012

Region	Pavement Type	Gross VMT	% lt Veh	Seasonal Factor	% stud use	VMT season	IN/LN/MI Damage
1	Concrete	791,309,422	91.1%	57.0%	6.21%	25,498,612	2.32
1	Asphalt	5,501,079,552	91.1%	57.0%	6.21%	177,263,015	52.29
2	Concrete	644,487,497	84.9%	55.5%	4.88%	14,834,546	1.35
2	Asphalt	6,014,883,455	84.9%	55.5%	4.88%	138,448,090	40.84
3	Concrete	322,498,448	79.9%	54.3%	2.97%	4,157,651	0.38
3	Asphalt	2,419,580,250	79.9%	54.3%	2.97%	31,193,238	9.20
4	Concrete	43,818,581	75.7%	52.3%	28.06%	4,860,698	0.44
4	Asphalt	2,009,086,545	75.7%	52.3%	28.06%	222,863,498	65.74
5	Concrete	330,055,909	68.6%	52.6%	22.68%	26,994,379	2.46
5	Asphalt	1,342,391,632	68.6%	52.7%	22.68%	109,978,573	32.44

			Wear rates			
Damage Factors	Per Million VMT	Concrete	0.091	Inch/LANE/MILES Damages	Concrete	6.95
		Asphalt	0.295		Asphalt	200.53

Mitigating Strategy	Replacement Costs LN/MI	Threshold (inches)	Pavement Type	Cost
2" AC Overlay (PCC)	98,300	0.75	Concrete	$ 910,582
2" AC Overlay	98,300	0.75	Asphalt	$ 26,282,169
				$ 27,192,751

The recent research in Alaska (Abaza, Arafat et al. 2019) found that the decrease in studded tire usage in that state has seen the pavement damage wear rate decline by approximately 22% since 1996. It might be assumed that Oregon will continue to see a similar decrease as studded tires are used by fewer drivers.

Studies have also shown that studded tires create more wear on the pavement than do heavy trucks. Most recently, Abaza, Arafat et al. (2019) showed differences in wear along highway sections, with the following findings:

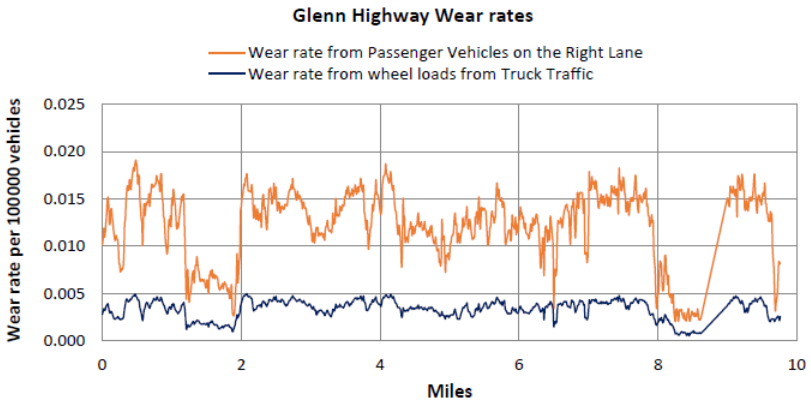
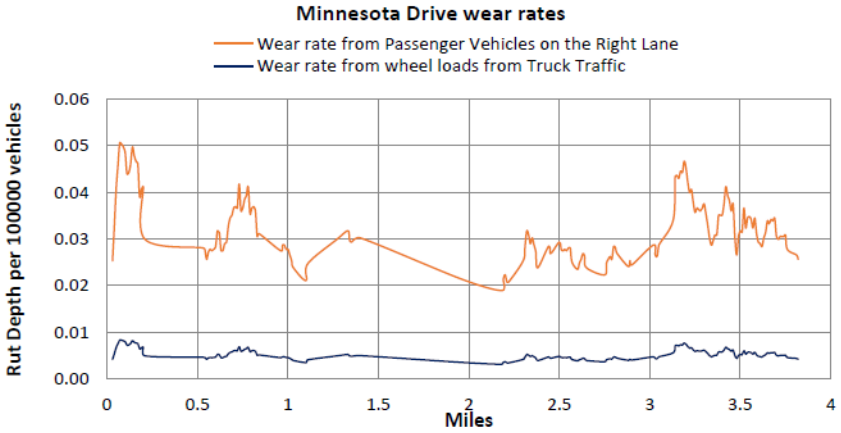


Figure 2.1 Distribution of wear rates for the Glenn Highway



POLICIES, REVENUE, AND FINANCIAL INCENTIVES

In 2004, the state of Alaska imposed a $5.00 per tire charge for the purchase of studded tires. This fee is collected by the seller and remitted to the Alaska Dept. of Revenue (Alaska 2006). However, Abaza, Arafat et al. (2019) pointed out that resurfacing costs from the effect of studded tires is 42 times higher than the annualized studded tire fees of $318,000. In 2017, a bill was introduced that would raise the fee on studded tires to $50/tire (2017); the bill was apparently not popular, and did not make it out of Committee.

Washington State also imposed a $5 per tire fee on sales of studded tires in 2016 (Washington, 2015). In 2019, HB 1309 was introduced in the Washington State Legislature; this bill would increase the fee to $100 per tire and phase out studded tire usage in the state by 2025. It was reintroduced and retained in Committee by resolution during the 2020 regular session (Washington, 2019).

ORS 815.167 prohibits the sale of heavy metal studs in Oregon, allowing only for the more modern, lightweight variety, which does less damage to road surfaces. Scandinavian countries have continued to work to reduce stud protrusion and weight, showing less wear effects on pavement (Abaza, Arafat et al. 2019). This research may provide less damaging options for those desiring options with studded tires.

Canadian provinces have promoted efforts to increase the use of winter tires. Quebec joined a number of European counties by mandating the use of winter tires in 2008, and data has shown a significant decrease in accidents and injuries during the winter months since that move. In 2014, Manitoba initiated a program administered by Manitoba Public Insurance, offering low-interest loans for the purchase and installation of qualified winter tires. As of the fall of 2019, more than 71,000 applications had been processed. The government of Ontario passed legislation in 2016 requiring all insurance providers to reduce auto insurance premiums for drivers who have four winter tires installed on their personal passenger vehicles. (TRAC 2019). These programs are aimed at increasing winter driving safety and do not distinguish between studded and non-studded tires, but they are examples of popular incentive programs. A public education program has also been launched with the Be Tire Smart website.

In their 2019 study from Alaska, Abaza, Arafat et al. gave policy suggestions to reduce highway damage from studded tires, including phasing out the allowed use of studded tires and shortening the season allowed for their use. They also proposed subsidizing the sale of non-studded tires, suggesting that a $6 million investment by the state, resulting in a subsidy of $80 per non-studded winter tire for the 75,000 studded tires currently purchased annually by Alaskans, could reduce annualized damages to $6 million and potentially eliminate studded tire use by 2034. They also encouraged an educational program to promote the switch to non-studded tires, a method that could also be adopted in Oregon.

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Appendix A
Models and Costs of Winter Tires

Brands/Models and Price of Winter Snow Tires Tested By Consumer Reports
November, 2017

Brand/Model	Price
Michelin X-Ice X13	$117
Nokian Hakkapeliitta R2	$135
Bridgestone Blizzak WS80	$112
Cooper Weather-Master WSC	$92
Dunlop Winter Maxx	$103
Toyo Observe G3-ICE	$173
Continental WinterContact SI	$136
General Altimax Arctic	$90
Nokian WR G3	$116
Toyo Celsius	$108
Vredestein WinTrac Xtreme S	$149
Hankook Winter i*Pike RS	$120

Comparison of Tire Costs at Major Alaskan Tire Distributed
Prepared for Alaska SB 50, 2017

TIRE COST COMPARISION			
AMOUNT BASED ON COSTS FOR 2015 DODGE RAM 1500 17" TIRES 265-70-17			
	Studded	**Non-Stud (Blizzaks)**	***Difference***
COSTCO	NO STUDS	$895	XXXXXXXXXXX
SAM'S CLUB	$700	$832	Stud $132
LES SCHWAB (Juneau Only)	$1,155.56	$1,356.02	Stud $200.46
ANCHORAGE TIRE FACTORY	$1,050	$830	Non-Stud $220
ALASKA TIRE & RIM	$829	$809	Non-Stud $20
MIDAS - (Artic Claw)	$1,044.96	$891.96	Non-Stud $153
AIASKA TIRE SERVICE	$717.80	$883.80	Stud $166
SEARS	NO STUDS	$1,013.76	XXXXXXXXXXX
AMERICAN TIRE	$1,010	$1,020	Stud $10
ALYESKA TIRE	$1,009.80	$971.80	Non-Stud $38
AMAZON.COM	$756.00 (no install)	$852.92 (no install)	Stud $96.92
TIRE RACK	$1,129.80	$927.08	Non-Stud $202.72
AVERAGE COST:	$940.29	$940.27	

The Tire and Rubber Association of Canada (TRAC) publishes a listing of available winter tires. The association does not separate the listing between studded and non-studded tires, so the following 2020 list likely contains some models that are studdable or studded – but this shows the variety of winter tires currently on the market.

Tire and Rubber Association of Canada | L'Association canadienne du pneu et du caoutchouc

Winter Tire Listing – November, 2020: *Many tires can be suitable for winter driving, some of which may not be included on this list. This list shows Tire and Rubber Association of Canada's (TRAC) member brands of tires with the "mountain/snowflake symbol" that are* ***marketed for winter use only****.*

BF Goodrich

- Winter Slalom KSI
- Winter T/A KSI
- Commercial T/A Traction

Bridgestone

- Blizzak DM-V2
- Blizzak LM001
- Blizzak LM001 RFT
- Blizzak LM-500
- Blizzak LM-25 RFT
- Blizzak LM-25 4X4 RFT
- Blizzak LM-25 4X4 MOE
- Blizzak LM-25-1 RFT
- Blizzak LM-32
- Blizzak LM-32 EXT
- Blizzak LM-32 MOE
- Blizzak LM-50 RFT
- Blizzak LM-60 RFT
- Blizzak LM-80
- Blizzak LM-80 EVO
- Blizzak LM-80 RFT
- Blizzak LT
- Blizzak MZ03 RFT
- Blizzak W965
- Blizzak WS-70
- Blizzak WS- 80
- Blizzak WS- 90

Continental

- ContiIceContact
- ContiWinterContact TS760
- ContiWinterContact TS790
- ContiWinterContact TS800
- ContiWinterContact TS810
- ContiWinterContact TS810S
- ContiWinterContact TS830P
- ContiWinterContact TS860S
- Conti4X4WinterContact
- Conti4X4IceContact
- ContiExtremeWinterContact
- ContiCrossContactWinter
- ContiVancoWinterContact
- ContiVancoViking
- ContiVikingContact3
- ContiWinterViking
- WinterContact SI
- WinterContact SI Plus
- WinterContact TS850P
- VancoWinter 2
- Vancontact Winter
- VikingContact 7

Cooper

- Artic Claw Winter TXI
- Artic Claw Winter XSI
- Avalanche RT
- Avalanche X-Treme
- Evolution Winter
- Motomaster Total Terrain W/T
- Motomaster Winter Edge
- Dean Wintercat SST
- Dean Wintercat XT
- Discoverer True North
- Discoverer M&S
- Starfire RS-W 5.0
- Starfire RS-W 7.0

A19 - 260 Holiday Inn Dr.
Cambridge, ON, L5N 1W1
Phone: (519) 249-0366
www.tracanada.ca; Email: info@tracanada.ca

Tire and Rubber Association of Canada | L'Association canadienne du pneu et du caoutchouc

Winter Tire Listing – November, 2020: *Many tires can be suitable for winter driving, some of which may not be included on this list. This list shows Tire and Rubber Association of Canada's (TRAC) member brands of tires with the "mountain/snowflake symbol" that are* ***marketed for winter use only****.*

Dunlop

- Grandtrek SJ5 (P)
- Grandtrek SJ6
- Grandtrek WTM3 (P)
- Grdtrek WTM3 DSSTROF
- SP Winter Sport 3D
- SP Winter Sport 4D
- SP Winter Spt 3D ROF
- SP Winter Spt 4D NST
- SP Winter Spt 4D ROF
- Winter Maxx
- Winter Maxx 2
- Winter Maxx ROF
- Winter Maxx SJ8
- Winter Sport 5 SUV
- Winter Sport M3
- Winter Sport M3 DSST
- DUN SP LT 60
- DSX DSST ROF

Duraturn

- Duraturn Mozzo Winter
- Duraturn Mozzo Winter Ice
- Duraturn Travia Winter
- Duraturn Mozzo Winter Van C Load

Falken

- Espia EPZ II
- Espia EPZ II SUV
- EuroWinter HS449
- Winterpeak F-ICE 1

Firestone

- Firehawk PVS
- Winterforce 2
- Winterforce 2 UV
- Winterforce CV
- Winterforce LT

General

- Altimax Arctic
- Altimax Arctic 12
- Grabber Arctic
- Grabber Arctic LT

Gislaved

- NordFrost C
- NordFrost 5
- NordFrost 100
- NordFrost 200

GT Radial

- Champiro IcePro
- Champiro IcePro SUV
- Champiro IcePro2
- IcePro3
- IcePro SUV3
- Champiro WinterPro HP
- Champiro WinterPro2
- Savero WT
- Maxmiler WT-1000

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Goodyear

- Cargo Ultra Grip 2
- Eagle Enforcer Winter
- Eagle Ultra Grip GW2
- Eagle Ultra Grip GW3
- Eagle Ultra Grip GW3 ROF
- Ultra Grip Ice
- Ultra Grip Ice +
- Ultra Grip Performance 2
- Ultra Grip SUV ROF
- Ultra Grip+ SUV 4x4
- Ultra Grip Winter
- Ultra Grip 8 Performance
- Ultra Grip Perf ROF
- Ultra Grip Ice WRT
- Ultra Grip Ice WRT LT
- Ultra Grip Performance Gen
- Winter Command

Hankook

- Hankook Winter i*cept evo2 (W320)
- Hankook Winter i*cept iZ2 (W616)
- Hankook Winter i*Pike RS (W419)
- Hankook Winter i*Pike (W409)
- Hankook i*Pike RW11 (RW11)
- Hankook Winter i*Pike LT (RW09)
- Hankook iPike RSV (PW71)
- Laufenn I FIT Ice (LW71)

Kelly

- Kelly Winter Access

Kumho

- WinterCraft WP51
- WinterCraft WP71
- WinterCraft WP72
- WinterCraft SUV WS71
- WinterCraft Ice SUV WS51
- WinterCraft Ice Wi31
- I*Zen KW31
- WinterCraft SUV WS31
- I*Zen Power Grip KC11

Maxxis

- Arctic Trekker SP-02
- Arctic Trekker WP-05
- NP3
- NP5
- NS3
- NS5
- Presa SUV SS-01

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Michelin

- Alpin A4
- Agilis Alpin
- Latitude Alpin
- Latitude Alpin HP
- Latitude Alplin LA2
- Latitude X-Ice Xi2
- LTX Winter
- Pilot Alpin PA4
- Pilot Alpin 5
- Pilot Alpin 5 SUV
- X-Ice Xi3
- Primacy Alpin PA3

Nexen

- WinGuard ICE
- WinGuard ICE SUV
- WinGuard Snow'G WH2
- WinGuard Sport
- WinGuard Sport 2
- Winguard SUV
- WinGuard WinSpike
- WinGuard WinSpike SUV
- WinGuard WinSpike WH62
- WinGuard WinSpike WS62
- Winguard WT1

Nitto

- SN2
- Arctic Claw WXI
- NT90W

Nokian Tyres

- Hakkapeliitta 8
- Hakkapeliitta 8 SUV
- Hakkapeliitta 9
- Hakkapeliitta 9 SUV
- Hakkapeliitta C3
- Hakkapeliitta CR3
- Hakkapeliitta LT 2
- Hakkapeliitta R2
- Hakkapeliitta R2 SUV
- Hakkapeliitta R3
- Hakkapeliitta R3 SUV
- Nordman 7
- Nordman 7 SUV

Pirelli

- Scorpion Ice & Snow
- Scorpion Winter
- Winter Ice Zero FR
- Winter 190 Snowcontrol Serie 3
- Winter 210 Snowcontrol Serie 3
- Winter 210 Sottozero Serie II
- Winter 210 Sottozero
- Winter 240 Sottozero
- Winter 240 Sottozero Serie II
- Winter 270 Sottozero Serie II
- Winter Sottozero 3
- Winter 240 Snowsport
- Cinturato Winter

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Sumitomo

- Sumitomo Ice Edge

Toyo

- Enscribe CSi-1
- Observe Garit KX
- Observe GSi5
- Observe G3-ICE
- Observe GSi-6 HP
- Open Country WLT-1

Uniroyal

- TigerPaw Ice & Snow 3
- TigerPaw Ice & Snow II
- Laredo HD/T

Yokohama

- IceGuard G075
- IceGuard IG53
- BluEarth V905

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Appendix B

Tire Associations and Distributors

Corporate Headquarters

Associations

US Tire Manufacturers Association (USTMA)
1400 K Street NW
Suite 900
Washington, DC 20005
Info@ustires.org
202-682-4800

Tire and Rubber Association of Canada (TRAC)
A19-260 Holiday Inn Drive
Cambridge, ON, N3C 4E8
info@tracanada.ca
Contact: Barry Yutronkie, byutronkie@tracanada.ca

Major Northwest Tire Distibutors

Les Schwab Tire Centers
20900 Cooley Road
Bend, Oregon 97701
Contact: Carrie Blanchard, carrie.l.blanchard@lesschwab.com

Tire Rack
7101 Vorden Parkway
South Bend, IN 46628
888-541-1777

Discount Tire
11431 Willows Road NE
Suite 220
Redmond, WA 98052
425-424-2010

Tire Manufacturers

B.F. Goodrich/Michelin
1 Parkway S.
Greenville, SC 29615
Contact: Christian Fisher, christian.fisher@michelin.com
864-485-5309

Bridgestone/Firestone
Bridgestone Americas, Inc.
535 Marriot Drive
Nashville, TN 37214
1-800-367-3872

Cooper Tire & Rubber Company
701 Lima Avenue
Findlay, OH 45840-2315
419-423-1321

Goodyear/Dunlop Tire Corporation
200 Innovation Way
Akron, OH 44316
330-796-2121

Nokian Tyres American Headquarters
501 Union Street
Nashville, TN 37219
629-204-0702
Contact: Wes Boling, wes.boling@nokiantyres.com