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Faculty FORUM

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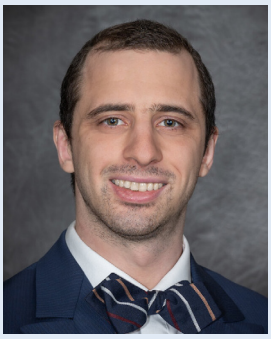

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ARTICLE SYNOPSIS

• Everyone who lives in a northern climate should purchase winter tires, or at least all-weather tires

• Winter tires are more expensive, not because of the tires themselves, but because of the extra wheels and tire pressure sensors. By contrast, all-weather tires are not much more expensive than conventional all-season tires

• Like all-season tires, all-weather tires can be used year-round. So next time your tires need replacing, at least consider all-weather tires.

TIRES MATTER

'Tis the season to equip your vehicle for optimum safety

When I graduated from Texas Tech University in 2020 and accepted an economics professorship at Northwood University, I knew I would soon have to deal with snow and ice. So one of the first things I did was research what kind of tires I would need to install on my automobile.

As an academic devoted to research, I have made it my mission to share my findings with friends, family and all who can benefit — particularly those who live in northern climates.

All-wheel drive is not enough

Many people believe that all-wheel drive or four-wheel drive is enough. But in fact, AWD and 4WD mostly help only with acceleration. AWD will put power down on the tires with the most traction – and 4WD, on all four tires. But this only helps with acceleration, not with braking and cornering. If anything, this might create a sense of false confidence. AWD will help you get your car moving, and you might believe that your car has enough traction. But then, when you reach an icy intersection, you suddenly discover that you can't stop or turn. Now you've just T-boned another car or run over a pedestrian, and you would have been better off stuck at home with two-wheel drive.

AWD and 4WD might certainly help, especially on a snowy or icy incline. By all means, buy an AWD or 4WD vehicle if you can afford it. But ultimately, your traction is limited by the quality of your tires. AWD and 4WD send power to all four tires, but if your tires have zero traction, then four times zero equals zero. To drive anywhere with snow and ice, you need proper tires. It is better to have the best traction on only two powered tires than have zero traction on all four.

All-season tires are not enough

Meanwhile, many people believe that all-season tires are suitable for winter. After all, it's right there in the name: all seasons! But in fact, all-season tires really only have traction compared to summer tires. In temperatures below 40 degrees Fahrenheit, summer tires harden and even crack and splinter. By comparison, all-season tires at least remain pliable and soft enough in the winter to be technically usable. And their tread pattern is designed to have at least some traction in the snow. That's all. All-season tires are technically usable in the winter because they technically have some traction, whereas summer tires have zero traction. That's like saying a family of four can technically live on an income that is one dollar above the poverty line. All-season tires might be enough for

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someone who lives in the south, where maybe they occasionally see a sprinkling of snow, but that's it.

Source of top photo: https://en.wikipedia.org/wiki/Snow_tire#/media/File:Winter_tires_with_North_American_symbol.jpg. Left, the 3PMSF and Mountain Ice symbols. Source: https://commons.wikimedia.org/wiki/File:Tire_tread.jpg.

Winter tires with the Three Peak Mountain Snowflake

Here in the north, drivers need winter tires with the Three Peak Mountain Snowflake (3PMSF) symbol. This symbol certifies that the tire has at least minimal traction for acceleration in snow. However, this symbol does not certify any traction for braking and cornering, so it is still important to choose a tire from a reputable brand, preferably one that has been independently reviewed and tested. In the EU, many tires also receive the Mountain Ice symbol, certifying ice traction as well. The new Nokian Hakkapeliitta R5 studless Nordic winter tire is the first tire in the US market to receive this Mountain Ice symbol.

Winter tires have two major advantages over all-season tires. First, they have a softer rubber compound which remains grippy and pliable at lower temperatures, when all-season tires begin to become hard hockey pucks. This softer rubber compound is technically safe at warmer temperatures too, but it will tend to wear faster. Therefore, while it is not advisable to use winter tires year-round, it would still be safe to use winter tires in early November and late March, when snow and ice are unlikely but still possible. The second advantage of winter tires is that they have small squiggly grooves in the tread called "sipes."

Whereas larger grooves — possessed by both all-season and winter tires — are designed to channel water and slush out of the tire, to prevent hydroplaning, sipes are designed to hold onto snow. This is because — as anyone who has ever made a snowball knows — nothing sticks to snow better than snow. By holding onto the snow in its sipes rather than channeling the snow away as all-season tires do, the winter tire can use the power of snow to stick to snow. If you have ever tried to accelerate in snow with all-season tires, you might have noticed that your tires

FACULTY FORUM

Faculty Forum is a new initiative by the Northwood University of Office of Communications to highlight the expertise of faculty members. Northwod recently launched a new podcast series, Faculty Forum, hosted by Dr. Kristin Stehouwer, provost and academic vice president. The podcast can be viewed on YouTube and heard on Apple and Spotify. The first episode features Professor Jim Hop, who talks about the entrepreneurial mindset and how Northwood's programs develop future business leaders. Northwood plans to feature other faculty members in future podcasts and digital and print supplements such as today's Faculty Forum featuring Dr. Michael Makovi. Send your feedback to Kate Hessling, executive director of communications and public relations, at hesslink@northwood.edu.

simply spin, with all the snow simply passing through the tread grooves. A winter tire's softer rubber compound plus its sipes allow the winter tire to actually grip the snow rather than impotently spinning through the snow.

To demonstrate why drivers in cold climates need winter tires, Tire Rack tested winter vs. all-season vs. summer tires on an ice skating rink with a 2WD sedan, in a YouTube video titled, "Tested: Winter vs. All-Season vs. Summer Tires on Ice." As Tire Rack shows, all-season tires are unable to complete a 90 degree turn at 11 mph on ice. By contrast, the winter tires had no difficulty in this test, successfully completing the corner. Lest one believe that AWD would have made winter tires unnecessary, Tire Rack duplicated this comparison with an AWD-equipped SUV, in a YouTube video titled "All-Season vs. Winter Tires: The All-Wheel Drive/Tire Connection." Once again, only the vehicle equipped with winter tires was able to complete the 90 degree turn on ice. Moreover, braking from only 12 mph, the SUV with all-season tires required 57 feet to brake, while its counterpart with winter tires needed only 33.7 feet. Of course, an ice skating rink is a more extreme scenario than most people will encounter in real life, but then again, most people drive faster than 12 mph.

Many people eschew winter tires because they believe they cannot afford them. But in fact, using winter tires does not cost very much. For the most part, the cost of tires depends on how many miles one drives, not how many tires one owns. Owning two sets of tires that are each driven for half the year does not cost any more than owning one set of tires that is driven all year long. Suppose one drives on all-season tires for eight months and winter tires for four months. Then the all-season tires are only being used eight twelfths (0.666) as much, and they will last twelve eighths (1.5) times longer. The real cost comes from purchasing a second set of wheels and a second set of TPMS (Tire Pressure Monitoring System) sensors. By mounting the winter tires on their own set of wheels with their own sensors, seasonal swaps are much simpler.

Often, people choose to buy black steel wheels that are cheaper than their OEM aluminum alloy wheels. They also buy steel wheels that are smaller and cheaper. For example, my car's factory wheels are 17" aluminum, but my winter tires are mounted on 15" steel. Smaller steel wheels are not only cheaper, but they are easier to pound back into shape after a curb strike. And smaller wheels allow the use of a tire with a larger rubber sidewall (to maintain the overall size of the tire), which protects against pothole damage and improves ride quality. In fact, for my all-season tires too, I replaced my 17" factory wheels with 15" aluminum to improve the ride and reduce the risk of damage from a pothole. Ask your tire shop for a "downsize" to fit the smallest wheels that are compatible with your vehicle.

Many people complain that they do not have the space in their garage to store mounted tires in the off-season. Fortunately, many tire shops will store your tires for you. For example, I pay Belle Tire about $100 every 6 months to store my tires in their climate-controlled warehouse. When the time comes for a seasonal tire swap, I simply call and make an appointment. They ship my tires from their warehouse to the store, and on the appointed day, they swap my tires and ship the other set to their warehouse.

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So if you can afford these modest expenses, there is simply no substitute for dedicated winter tires. According to most reviews, the best winter tires include the Nokian Hakkapeliitta R5, Michelin X-Ice Snow, Bridgestone Blizzak WS90, and Continental VikingContact 7. But if those are too expensive, then any winter tire at all from a reputable brand will be leaps and bounds better than any all-season tire. Even a budget winter tire — as long as it is made by a reputable brand — will vastly outperform the best all-season tires. Budget winter tires such as the Firestone Winterforce 2 and General AltiMax Arctic 12 are perfectly sensible choices. Other reputable brands include — but are not limited to — Goodyear, Pirelli, Yokohama, Toyo, Cooper, Falken, Hankook, Kumho, Sumitomo, and BFGoodrich.

All-weather tires: A substitute for winter tires

But some people cannot afford even these relatively modest expenses. Luckily, there is a solution: so-called "all-weather" tires. These tires are not to be confused with all-season tires. Unlike all-season tires, all-weather tires have the 3PMSF, so they are rated for severe winter weather. Although they are not as capable in snow and ice as dedicated winter tires, they at least possess enough traction to be safe. But like all-season tires, they can be run year-round, eliminating the need for extra wheels or tire storage. In a YouTube video entitled, "New All-Weather Tires Outperform Some Snow Tires," Consumer Reports says that the previous-generation Nokian WR G3 and Toyo Celsius

(which have since been replaced by the Nokian WR G4 and Toyo Celsius II) even outperform some winter tires. We all need to replace our all-season tires eventually when they do wear out, so anyone who cannot afford winter tires should replace their all-season tires with all-weather tires.

To illustrate how all-weather tires compare to winter tires and all-season tires, Nokian Tyres compared braking on ice at 25 mph in a YouTube video titled "Comparison Video: Full ABS Braking on Ice with Nokian Tyres." Their two all-season tires — one a standard tire, the other an ultra-high-performance tire — required 174 feet and 203 feet respectively, while their Hakkapeliitta R3 winter tires needed only 118 feet. Their all-weather tire, the WR G4, came in between at 148 feet. Clearly, the WR G4 is not as capable as the dedicated winter tire, but it is far better in severe winter conditions than the all-season tires.

In a review for MotorTrend ("Nokian WR G4 Tire: It's All-Weather, Not All-Season"), Marc Noordeloos tested the Nokian WR G4 in a West Michigan blizzard. He had this to say:

"The Nokian WR G4 performed like a performance winter tire [a milder type of winter tire often used on sports cars] in 2-3 inches of snow. Acceleration, braking, and overall cornering grip was impressive. . . . Later that week, we received a larger dump of snow overnight totaling over six inches. I went for a drive early in the morning, before the plows did their duty. The all-weather WR G4 showed its limitations in these conditions. The ABS worked overtime under braking and the confidence I felt in lighter to medium snow was diminished. On the other hand, the [2017 Toyota] 86 never got stuck and there were other cars on all-season tires incapacitated all around me. . . . [But] icy intersections reminded me that all-weather tire doesn't offer the ice grip of 'arctic-spec' products like Nokian's Hakkapeliitta line of winter rubber."

In other words, the all-weather tire will not perform miracles, and it cannot compete with the dedicated winter tire. At the same time, it is at least safe and drivable in conditions that all-season tires are not. And unlike winter tires, the WR G4 is usable year-round. Although the Nokian WR G4 is not sold by Tire Rack, nor by Belle Tire, it is sold by Discount Tire, Tire Factory, and online by Simple Tire.

Another premium option is the Michelin CrossClimate 2. It has excellent dry and wet traction rivaling the best all-season tires, while also having very good snow and ice traction. Compared to the Nokian WR G4, the Michelin CrossClimate 2 is likely to be superior in dry and wet weather, while the Nokian out-compete the Michelin in snow and ice. But both tires are superior to the average all-season tire in all types of weather.

Several other models of all-weather tire are available as well, including the Bridgestone WeatherPeak, Toyo Celsius II, General AltiMax 365AW, Firestone WeatherGrip, and Hankook Kinergy 4S2. Nokian makes a budget all-weather tire too, the Encompass AW01, which is exclusive to Tire Rack and Discount Tire. A few new all-weather tires have been released, but I have not yet read reviews of their winter performance. These new entries include the Pirelli WeatherActive, the Kumho Solus HA32, and the Falken Aklimate. The all-weather tire category continues to expand, and we should look forward to professional reviews of these new releases.

It's important to note that the all-weather tire will not perform miracles — and it cannot compete with the dedicated winter tire. At the same time, it is at least safe and drivable in conditions that all-season tires are not. That needs consideration.

While all-weather tires are slightly more expensive than conventional all-season tires, they are not very much more expensive. Let me give some examples of prices for my car with 195/65R15 tires. One of the most affordable conventional all-season tires from a reputable brand is the Sumitomo HTR A/S P03 for $92.99/tire. Personally, my all-season tire is the Yokohama Avid Ascend GT for $112.99. For comparison, consider one budget all-weather tires, the Toyo Celsius II for $109.94, which is even cheaper than my Yokohama tires. The Nokian Encompass AW01 and General AltiMax 365AW are only slightly more expensive, at $117 and $118.99. What is probably the best tire, the Nokian WR G4, is still more expensive at $130, but it is still reasonably priced.

One warning: the Goodyear Assurance WeatherReady unfortunately appears to have poor wet traction. According to Tire Rack ("Testing Firestone's Newest Entry in Grand Touring All-Season"), "The Goodyear is noticeably slippery in the wet, and it has some tricky handling traits, as well. With the limited traction, our drivers were best served by slowing down and driving conservatively. Those who did attempt to hustle the tire found the quick steering response typically leads to terminal understeer, though the rear end

will quickly step out under certain situations, as well."

For those who drive large trucks or cargo vans, there are two all-weather options: the Michelin Agilis CrossClimate and the Toyo Celsius Cargo. One day, I happened to see my electrician had the Agilis CrossClimate on his Ford Transit cargo van. I asked him how it was, and he replied, "It's great. On the stock tires, my van used to get stuck on even the thinnest veneer of snow and ice, but now, with these new tires, it never gets stuck."

I cannot find any professional reviews of the Toyo Celsius Cargo, but the manufacturer's website mentions "ice" several times, saying things like, "improved snow and ice performance," "[o]ptimizes snow, slush and ice traction," "[g]rip the snow and ice," and "[e]vacuate snow and ice." At the bottom of the page, Toyo ranks the Celsius Cargo by comparing it to their own H08+ commercial van all-season tire. The Celsius Cargo receives 4.5/5 in ice traction, while the H08+ receives only 3/5. Considering that Toyo specifically mentions ice while Michelin does not, my suspicion is that the Toyo Celsius Cargo is even more capable in severe winter weather than the Michelin Agilis CrossClimate, but I cannot be sure.

New all-weather tires are continually being introduced and withdrawn from the market.

To find the latest all-weather tires available for your vehicle, there are a few websites that can help.

New all-weather tires are continually being introduced and withdrawn from the market. To find the latest all-weather tires available for your vehicle, there are a few options:

• At TireRack.com, search for either your vehicle (year, make, model, trim) or else your tire size (pay attention to the load rating). In the search results, look at the sidebar and scroll down. Under "Severe Snow Service Rated," choose "All-Season w/Severe Snow Service Rating."

• At SimpleTire.com, search for your vehicle or tire size. In the search results, look at the top bar. Under "Tire type," choose "All Weather."

• At BelleTire.com, search for your vehicle or tire size. In the search results, look at the sidebar and scroll down. Under "Tire Type," choose "All-Weather."

• At DiscountTire.com / DiscountTireDirect.com, search for your vehicle or tire size. In the search results, look at the sidebar under "Quick Filters" and choose "Three-Peak Mountain Snowflake." This will include both all-weather and winter tires. Unfortunately, there seems to be no way to search only for all-weather tires.

Tire Rack and Simple Tire will both ship to either your house or the local tire shop of your choice. Belle Tire is a brick-and-mortar store in Michigan, Indiana, Ohio and Illinois. DiscountTire.com will ship your tires to your local brick-and-mortar Discount Tire shop, while DiscountTireDirect.com will ship to your house. In some parts of the USA, Discount Tire is known as America's Tire.

Interestingly, both Discount Tire and Tire Rack sell the budget Nokian Encompass AW01, but only Discount Tire and Simple Tire sell the premium Nokian WR G4. A local Michigan chain, Tire Factory, sells the Nokian WR G4 at its locations in Mount Pleasant, Alma, Owosso, and Traverse City. Belle Tire does not sell Nokian tires, but they do sell Michelin, Bridgestone, Toyo, Firestone, General, etc. It is worth noting that Belle Tire can perform alignment checks as well. At one point or another, I have bought tires and/or tire-related services from every single one of these companies, and I have had an excellent experience with all of them.

Finally, it is important to note that some all-terrain tires do have the 3PMSF, but they are generally not intended to be used on ice. Those who own trucks or large vans who search for tires with the 3PMSF are likely to find many all-terrain tires, so make sure you pay attention to whether the tire is all-terrain or all-season. An all-season tire with the 3PMSF is an all-weather tire, while an all-terrain tire with the 3PMSF is intended to be used off-road, not on ice. I am not aware of any all-terrain tires that can be used on both ice and off-road. This is probably because off-roading generally requires a harder, more durable rubber that can withstand rocks and stones, while ice traction requires a softer, more pliable rubber that can compress and expand to fill microscopic rough spots in the ice.

In conclusion, I encourage everyone who lives in a northern climate to purchase winter tires, or at least all-weather tires. Winter tires are more expensive, not because of the tires themselves, but because of the extra

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wheels and tire pressure sensors. By contrast, all-weather tires are not much more expensive than conventional all-season tires. Like all-season tires, all-weather tires can be used year-round. So next time your tires need replacing, at least consider all-weather tires.

Basic tire safety

Speaking of replacing tires: it is important to note that many people do not replace their tires as frequently as they should. The common wisdom is to replace tires when their tread reaches 2/32", or when President Lincoln's head cannot be seen on a penny that has been inserted into a tire's tread.

However, 2/32" tread is only enough for dry weather, not wet. For rainy weather, one needs at least 4/32" tread, when President Washington's head cannot be seen on a quarter. And for snow, one needs even more tread than that, 6/32". According to two articles by Discount Tire, entitled "Tire Tread and Stopping Distance" and "Tire Safety Practices," a new tire with 11/32" of tread will require 160 feet to stop on a wet road, while a car with 4/32" requires 205 feet. A tire with only 2/32" tread needs 250 feet to stop. (Discount Tire does not specify the speed at which these tests were done.) Moreover, they say, hydroplaning is much more likely with lower tread.

Therefore, Discount Tire recommends replacing tires at 4/32," and they refuse to service tires at 2/32." In their article, "How to Check Tire Tread Depth," Discount Tire shows how to use the penny test to measure 2/32" and the quarter test to measure 4/32." I will add that one may buy a precise tire tread depth gauge for only a few dollars.

Moreover, tires must also be replaced when they get too old. As they age, some of the oils in the tire evaporate, and tires gradually lose their pliability. Eventually, the rubber becomes too hard and brittle to grip the road effectively, and the tires can even suffer a risk of catastrophic blowout. In their article "Tire Safety Practices," Discount Tire recommends replacing tires at six years of age, and they refuse to service tires older than 10 years. A tire's age can be determined from its DOT (Department of Transportation) code. The last four digits of the DOT code give the week and year of manufacture. For example, "3422" would mean a tire was manufactured in the 34th week of 2022.

Finally, it is important to maintain your tire's air pressure. Check your tire's recommended pressure by looking at the placard on the driver's size door jamb. Do not use the tire pressure printed on the tire's sidewall, which is the tire's maximum safe pressure, not the tire pressure recommended for your vehicle. Tire pressure gauges are inexpensive.

The vehicle's TPMS sensors generally only light the warning light on the dashboard when the tire loses 25% of its pressure, so it is best to periodically use a tire pressure gauge to catch loss of tire pressure sooner. In particular, tires lose pressure in the winter because cold air exerts less pressure than hot air. The rule of thumb is that a tire loses 1 psi for every drop of 10 degrees Fahrenheit. Some newer cars are able to precisely measure the exact psi on the dashboard. Low tire pressure causes the tire's sidewall to rub against the road, creating a risk of blowout. High tire pressure causes the tire's compact patch with the road to be too narrow, worsening traction. High tire pressure also worsens ride quality and comfort. Extremely high tire pressure creates a risk of blowout as well.

But slightly high tire pressure — just a few psi — is not a safety risk, so it is better to slightly over-inflate a tire than to under-inflate. Therefore, most vehicle manuals recommend slightly over-inflating the tire in winter so that especially cold days will not cause the tire to be under-inflated.