Winter Tyre
Test Report

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Mt Hotham Road Patrol
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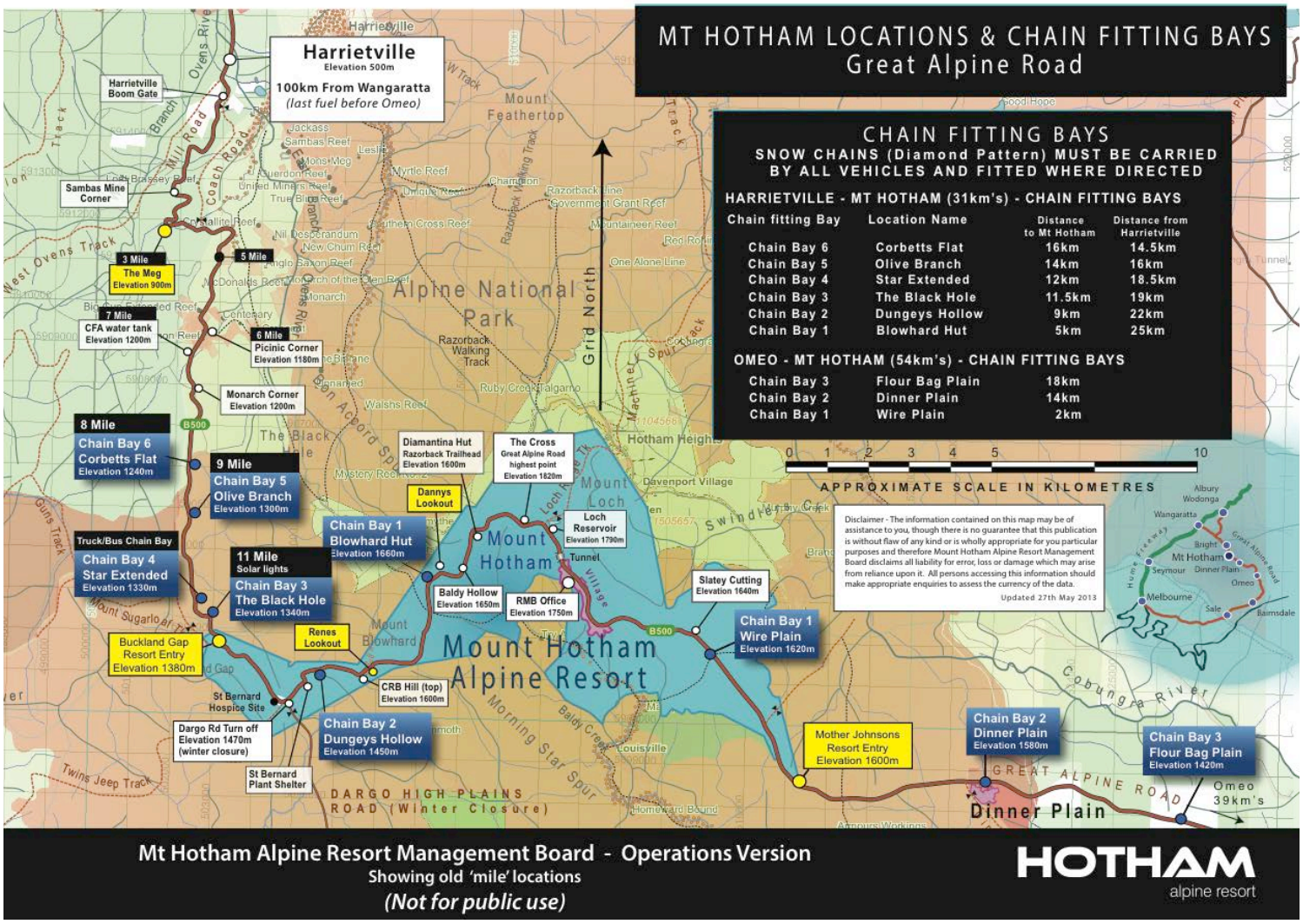
Refer page (2) & (7) **Mt Hotham locations & chain fitting bays** on Great Alpine Road showing road elevation and distances to Mt Hotham



Introduction

The Great Alpine Road between Harrietville and Omeo would arguably be the most hazardous winter road in Australia and is subjected to considerable snowfalls, blizzards and high winds due to the its altitude, exposed position and mountainous terrain. However in the Australian snow fields we also experience a common occurrence known as thaw and freeze and this is due to snow melting during the day and refreezing at night leaving a thin layer of ice a couple of millimetres thick on the surface of the road giving the appearance of a wet road and this is known as Black Ice. Black Ice can also be re-covered by fresh falling snow giving the appearances of dry virgin snow but will offer little traction to the standard highway tyres that are fitted to most vehicles today.
Factors such as driving quickly, rapid acceleration, abrupt braking, turning, driver inattention and fatigue also contribute to issues involving loss of traction with the road surface resulting in loss of control of the vehicle with the possibility of the all too common, collision.

Black Ice can easily look like a wet road.

It is evident from information gathered from in excess of 350 serious vehicle incidents during the winter seasons over the past 15 years that driver inattention to the conditions, drivers not distinguishing or understanding signage, drivers inadequate understanding of their vehicle and its limitations and drivers overconfidence in their abilities all contribute to road incidents. But the one common factor in 95% of all vehicle incidents on this section of road, is loss of traction with the road surface due to the icy conditions.

Winter Driving Strategies

All-Wheel Drive and Four-Wheel Drive

Two Wheel Drive vehicles are not overly represented in collision statistics due to the regular fitting of diamond pattern wheel chains but they are not without issues usually involving low clearance issues in snow or being hit by a sliding All Wheel or Four Wheel Drive vehicle.

Two wheel drive vehicles only have front or rear wheels receiving power to provide drive. Vehicles that have All-Wheel Drive or Four-Wheel Drive capabilities can power all four wheels.

Example: If the rear wheels are slipping, the front wheel can pull the vehicle through or vice versa if the vehicles wheels have traction. All-Wheel Drive vehicles are usually fine for driving in moderate snow but can have difficulty in heaver snow or in icy conditions. This can be contributed to the various methods of torque distribution systems employed by different All-Wheel Drive vehicle manufactures and this has proved to be problematic to many drivers over the years. For some time now the classification of All-Wheel Drive and Four-Wheel Drive have been used interchangeably but true Four-Wheel Drive vehicles provide low-range gearing and direct torque to both front and rear wheels when engaged. But this is all theoretical unless the vehicle has traction with the surface it is travelling on.

All-Wheel Drive and Four-Wheel Drive vehicles can offer improved drive capabilities, but many drivers get in to trouble because they are under the impression that All-Wheel or Four-Wheel Drives are invincible when travelling on snow covered roads. This is an erroneous belief and one that needs to be dispelled. All-Wheel Drive and Four-Wheel Drive vehicles provide maximum traction when travelling straight ahead but traction is reduced when cornering and provide no added benefit when braking. They generally carry extra weight due to the vehicles mechanical components and luggage and this can add to the difficulty in slowing down or stopping when braking. The vehicle can begin to slide uncontrollably until the driver regains control, the vehicle hits an object or slides off the road completely. It should also be noted at this point that vehicles with chains fitted to the rear wheel will receive little if any advantage from the chains when using the foot brake of the vehicle. Therefore good quality suitable tyres are highly recommended.

Highway Tyres

The modern highway tyres manufactured today are designed to be used specifically on Australian dry or wet paved roads to improve handling, safety and comfort. This type of tyre is made of a hardwearing rubber compound that is designed to withstand the higher temperatures experienced on Australian roads, while improving longevity of the tyre.

It is the most common tyre type fitted to vehicles and this includes many All-Wheel and Four-Wheel Drive vehicles on the road today. The majority of All-Wheel and Four-Wheel Drive vehicles on the road today are driven on suburban roads and are rarely driven in snow or off road conditions allowing for standard highway tyres to be fitted and they service the vehicle adequately.

However if a All Wheel or Four Wheel Drive vehicle fitted with highway tyres is required to travel in snow and icy conditions the tyres traction and safety capabilities can be severely limited and this will contribute to poor vehicle handling. This type of tyre when cold can become hard and it lacks ample cross grooves or sipes and this in turn compromises the tyres ability to perform well in frigid conditions or retain traction on a mud or snow covered road.

Standard Highway tyres in use today

All Terrain Tyres

The standard All Terrain Tyre is designed to be used in general road conditions and in certain off road situations and it works well in both application but due to its rugged tread pattern and tougher rubber compound it is not necessarily the best tyre for snow and ice conditions. All Terrain Tyres may sometimes be marked with “M+S” this indicates that they are mud and snow tyres. While they can provide good all weather performance they may not always be suitable or the best tyre for harsh snow and ice conditions. While its tread pattern can be adequate to offer traction in virgin snow on a dry road and in certain other snow situations it can easily lose traction and spin rendering a vehicle immobile in heaver snow conditions or if too much torque is applied to the wheels. The rubber compound often becomes harder in cold conditions and lacks flexibility to conform well to the road surface and due to the lack of suitable sipes offers little traction in snow and ice conditions.

Standard All Terrain Tyres

Winter Tyres

Winter Tyres (also known as Snow Tyres) have deeper tread patterns specifically design to dig in to provide traction on snow and ice covered roads. They are made from softer rubber compounds compared to other types of tyres that allow the winter tyre to retain flexibility in cold conditions and in conjunction with the many sipes and sipe activators provide extra traction in snow and ice conditions.

This is achieved by the small serrated grooves known as sipes and sipe activators in the tread of the tyre being able to open up and compact any loose snow due to the flexibility of the rubber allowing the tyre to grip the snow or icy road surface and provide improved traction compared to standard Highway or All Terrain Tyres.

Winter Tyre

Winter tyres are often confused with All Terrain M+S tyres however there is a considerable difference between the two.

Winter tyres are designed and manufactured specifically for snow and ice and can provide enhanced braking performance in snow and icy conditions compared to other types of tyres. They perform well in all types of winter conditions including snow, ice, sleet, slush, wet and cold dry roads as well as roads covered with loose snow churned up by vehicles fitted with snow chains. The aggressive tread reduces snow build up and most drivers' experience an improved vehicle control and handling due to the aggressive tread and softer rudder compound used to manufacture the winter tyre, snow chains also work more effectively when fitted.

However while snow tyres are an excellent option for winter snow driving they should be removed from the vehicle at the end of each winter and replaced with suitable summer tyres. If stored correctly they can be refitted to your vehicle at the start of the following winter and you should be able to achieve a good few winter seasons from a set of good quality winter tyres.

Wheel Chains

Wheel Chains or Snow Chains are traction devices that are fitted to the drive wheels of vehicles that are required to traverse over snow covered roads. Wheel Chains have been used on vehicles for well over 100 years and have had many changes in design in that time but the principle has remained the same, to provide traction to rubber tyres in slippery conditions. It should also be remembered that when wheel chains first came in to the market place vehicles had narrow wheels and a majority of roads where still greatly unpaved and chains therefore gained traction from the compacted snow as well as the surface of the road. In order for wheel chains to work effectively they must penetrate in to a compacted surface, unlike a winter tyre that relies on snow to enter the tread of the tyre, but over the years with changes to vehicle and tyre design, chains are not an all round solution as they once were.

Good quality Wheel Chains should be constructed from high quality steel and in a diamond pattern configuration across the entire tread width of the tyre. Wheel chains provide traction by being fitted around the tyre of the drive wheels of a vehicle to act as an aggressive tread that is able to gain leverage in snow and ice and be able to clear its self of snow as the wheel turns. However in Australia due to the lack of regulations and standards a multitude of inferior and inappropriate products are on the market and these products can and do cause problems for motorists. Wheel chain should only be purchased or hired from a reputable dealer that's expertly fits and demonstrates fitting to the vehicle in question.

All countries that experience snow use wheel chains in one form or another but most of these countries have extremely stringent regulations on the use of winter tyres. It is mandatory that all vehicles travelling on snow covered roads or in certain areas must have approved winter tyres fitted and these vehicles may still be required to fit chains.

For wheel chains to work effectively they must be able to rely on the tread of the tyre for grip to help prevent the wheel from spinning inside the chain and it is for this reason why wheel chains are normally fitted to winter tyres in other countries. Wheel chains do not work efficiently on bald highway tyres.

Vehicles with traction control systems and wheels chains fitted can have control issues due to the chained up wheels circumference being increased and the differential between the chained up wheels and the unchained wheels. This has a tendency to confuse the traction control system and this in turn can become detrimental to the handling of the vehicle.

Winter Road Trial

The Road

This section of road is fully sealed and transverses through Mt Hotham and Dinner Plain, it rises to an altitude of 1,840 metres and is subjected to considerable snowfalls, blizzards and high winds. This section of road is also regularly subjected to the formation of Black Ice due to the snow melting and then re-freezing. The road has a numerous number of sharp corners and steep hills that can be covered with different types of snow and ice at any time of the day and night. Extreme weather and road conditions sometimes result in the road being closed between Harrietville and Omeo.

The Trial Vehicle

The vehicle used for the trial was a 2006 4x4 Toyota Land Cruiser cab chassis with a steel tray. Approximate weight of this vehicle is 2.8 tonne. This vehicle is the Mt Hotham Road Patrol Vehicle. The tyres tested were Nokian Hakkapeliitta LT2 (Non-Studded)

The Trial Operative

This trial has been conducted by the Mt Hotham Road Patrol. The Mt Hotham road patrol is a 24/7 service that has been in operation patrolling the great alpine road during the winter months for 15 years and travelled in excess of 250,000km on it during the winter months. The duties of the road patrol are to render assistance to any motorist that has any type of issue on the great alpine road and to attend to all road incidents and accidents regardless of the time of day or night, regardless of weather conditions and investigate and report the cause and outcome.

The type of circumstances the road patrol is required to attend to are, but not limited to, pulling stranded vehicles on to the road after slipping off, pulling disabled vehicles to safety, patrolling the road to render assistance, pull vehicles out of deep snow and generally keep the road as safe as possible.

The Trial

The winter tyre trial has been conducted on The Great Alpine Road between Harrietville and Omeo during the winter snow season of 2015, over a period of ten weeks. The trial and assessments have been made from observations, investigations and experimentations and has been conducted during normal road patrol operational procedures.

Due to the conditions and traffic flow it is imperative that all issues are conducted quickly, efficiently and safely, with minimal disruption to the public. To achieve this, the trial vehicle is required to travel quickly and safely to the scene of vehicle incidents on snow and ice covered roads. To do this it is essential that the vehicle has the maximum possible traction with the surface of the road.

Please Note: It is assumed that all motorists will be driving to the requirements of the law or the conditions, which ever is the safer. However certain parameters, with authorisation have been exceeded when safe to do so for the benefit of this trial and under no circumstance should any member of the public attempt any type of driving procedure outside the requirements of the law or conditions. Also for the benefit of this trial is should be assumed that all roads are covered with snow and ice unless mention in the contrary.

Travelling

Travelling on a relatively flat section of snow covered road the vehicle has a remarkable holding ability. The rear of the vehicle has minimal to no indication of sideways slippage when power is applied when the vehicle is in two wheel drive mode. When engaged into four wheel drive mode the vehicle has excellent handling abilities with no indication of any slippage.

During this period several skid test were conducted on varying road conditions. A skid test is conducted by travelling at near the legal speed limit and applying the foot brake rapidly when safe to do so to encourage the vehicle to slide. A skid is normally achieved quite effortlessly but using the Nokian tyres it was quite difficult to achieve any form of slide or skid. When the brake was applied the vehicle would pull up with little to no slippage. The only time any slippage was experienced was when the test was conducted on smooth glazed ice.

Up Hill

Driving up hill in two wheel drive mode is exceedingly improved compared to standard Highway tyres and a mark improvement over standard All Terrain tyres. However if acceleration is applied rapidly the rear wheels can spin and traction is lost. When four wheel drive mode is engaged traction is regained and the vehicle drives as normal.

One particular incident required a disabled 12 seat bus with 9 adult male occupants to be towed approximately 700m up a rise to safety. The road was covered with snow and ice and the temperature was in the vicinity of -10. The Road Patrol vehicle was placed in low 4x4, 1st gear and once the tow line was connected and the slack was taken up the bus was placed in neutral. When the Road Patrol vehicle moved off a constant amount of acceleration was applied and at no stage was any amount of wheel slippage detected during the operation.

In the past, this type of operation would require wheel chains to be fitted to the Road Patrol vehicle and this would usually result in a certain amount of wheel spin as the chains try and get purchase in the ice and when the chains dig through to the surface of the road.

It must be remembered that a vehicle travelling uphill at a moderate speed can maintain traction but once the vehicle stops, traction can be lost and the vehicle will have difficulty regaining traction and moving off.

Regaining traction after stopping on an uphill section of the road was improved due to the many Sipes and Sipe Activators incorporated in to the tyres. This allows the tyres to grip and compress the smallest amount of snow on the surface of the road to regain traction to allow the vehicle to move off when acceleration is applied slowly and gradually, once momentum is achieved the vehicle travels as normal.

In the same situation all terrain tyres require a lot more soft dry snow to regain traction. This often requires the driver to roll the vehicle backwards into soft dry snow and use the same procedure to move off. However this is no guarantee that the vehicle will move off and wheel chains may be required to be fitted. As for vehicles fitted with Highway tyres, regardless of what type of vehicle it is (Four or All Wheel Drive) this procedure will most likely fail and wheel chains will need to be fitted to the drive wheels to assist the vehicle to move off.

However the only time during the trial that the tyres had difficulty in gaining traction was on a steep, sharp uphill corner of the road and this was due to the road being covered in this one spot by smooth ice with the absents of any snow. Traction was soon regained once a few hand full's of grit were applied to the surface of the ice.

Down Hill

Travelling downhill and remaining in control of a vehicle on any type of tyre in icy conditions can be difficult. Regardless of whether the vehicle is a Four Wheel Drive or All Wheel drive, this will not assist in the braking process and may worsen the situation due to the increased weight of the vehicle.

When travelling downhill in a straight line braking was applied by applying pressure to the brake pedal with the foot just long enough to slow the vehicle down and then released. This was repeated until the desired speed was achieved. This method helps prevent the vehicle from sliding and if the vehicle does slide the foot brake is released, the wheels begin to turn and the sliding stops.

The Nokian Hakkapeliitta LT2 tyre handled this situation with ease, the vehicle remained in the tracking line of the front wheels at all times with no indication of slippage. Slippage was only achieved for testing purposes when speed was increased and the brake applied abruptly. Once the brake was released slippage stopped and control was regained.

When negotiating a corner the on / off braking method was applied before entering the corner to slow the vehicle down to the desired speed. Once in the corner the vehicle tracked perfectly the braking method was employed while turning and no control was lost at anytime.

A simular test was performed on the same corner 10 minutes later at an increased speed and using abrupt braking methods. The vehicle slid in a straight line but as soon as the brake was released the slide stopped. When travelling around the corner the rear of the vehicle slid out slightly but regained traction as soon as the brake was released.

It should be noted that in this situation braking should be applied slowly and carefully to help prevent sliding. However it was noted that the smallest amount of snow on an ice covered road greatly assisted with traction but this can be dependent on several factors, the type of ice under the snow, the steepness of the road and the weight and speed of the vehicle.

Many vehicle accidents on snow and ice covered roads are due to vehicles not being able to stop when required and this is particularly true on downhill sections of the road.

Conclusion

In the past the best and sometimes the only alternative to improve vehicle traction on snow covered roads in Australia was the fitting of wheel chains but they have not been without their issues. Wheel chains are generally only fitted to the front or rear drive wheels of a vehicle and while this will offer drive to a vehicle, it will do little to improve the handling of the vehicle. It should also be highlighted that wheel chain performance is greatly improved if fitted to a winter tyre as is the custom overseas.

The modern vehicles of today are often designed with many different types of sensory systems to aid in the control and handling of the vehicle, often known as a traction control system. But for the traction control system of a vehicle to work, the vehicle must have a certain amount of traction with the surface of the road. This is often greatly reduced or sometimes unachievable on ice covered roads and is only exacerbated by the addition of the vehicle being fitted with highway tyres. Without a certain amount of traction with the road surface these systems can be rendered useless and sometimes dangerous.

But after trialling the Nokian Hakkapeliitta LT2 tyres in the icy conditions at Mt Hotham I have been greatly impressed on the handling and the gripping capabilities of these particular tyres in situations where traction would normally be lost using a standard All Terrain tyre.

The tyres allow the vehicle to be driven in a more responsive fashion than previously experienced and the control of the vehicle was greatly enhanced.

Cornering, braking and accelerating were all achieved with minimal to no slippage at all. No matter how low the temperature the Nokian tyres remained soft and pliable, allowing the sipe activators to provide maximum traction in the snow and icy conditions. The smallest amount of snow on an icy section of road surface would help provide traction enabling the vehicle to remain under the driver's control.

The tyres perform equally as well on dry and wet road surfaces allowing the transition between all to take place without any loss of control. This was particularly noticeable when the road was not covered with ice suitable enough to warrant the fitting of wheel chains but icy enough to be problematic for the driver.

At this point it must be remembered that wheel chains need to have firm compacted snow or ice to penetrate to provide the maximum amount of traction. Traction is often lost when the snow and /or ice begins to break up or melts and wheel spin is experienced or in certain situations the vehicle can slide on the wheel chains.

The test vehicle did not have a traction control systems and this allowed for a straightforward testing procedure to be undertaking. But a vehicle with a traction control system could benefit greatly with all four wheels fitted with Nokian winter tyres. This would help allow all wheels to have an equal amount of traction with the road surface, allowing the vehicle to operate as the manufacture had intended and allowing the driver to remain in control or regain control if control is lost.

The Nokian Hakkapeliitta LT2 tyres out performed wheel chains in most situations but approved winter tyres will not and should not ever be considered as a total replacement for wheel chains but used in conjunction with each other.

The alpine regions of Australia experiences too many variants in the ever changing road conditions to allow just one method of traction control system to be relied upon. At the present, wheel chains are the only recognized approved method of traction for all vehicles travelling in the alpine regions of Australia during winter. However the time has possibly come to open up discussion on the attributes of winter tyres and their benefits with government authorities for recognition and inclusion in to legislation.

This would involve the legislation in regard to All Wheel and Four Wheel Drive vehicles and when the requirement to fit chains comes in to operation.

But it all comes down to one thing and that is, a vehicle fitted with approved winter tyres, carrying good quality approved wheel chains that fit the vehicle and driven to the conditions is a safer vehicle on the road than one that has bald tyres, wheel chains from a supermarket and a driver with no regard to the conditions. Every motorist has the responsibility to maintain control of their vehicle for the safety of every other road user.

Refer Page (7) **The Road**

This section of the Great Alpine Road is fully sealed and transverses through Mt Hotham and Dinner Plain, it rises to an altitude of 1,840 metres and is subjected to considerable snowfalls, blizzards and high winds.

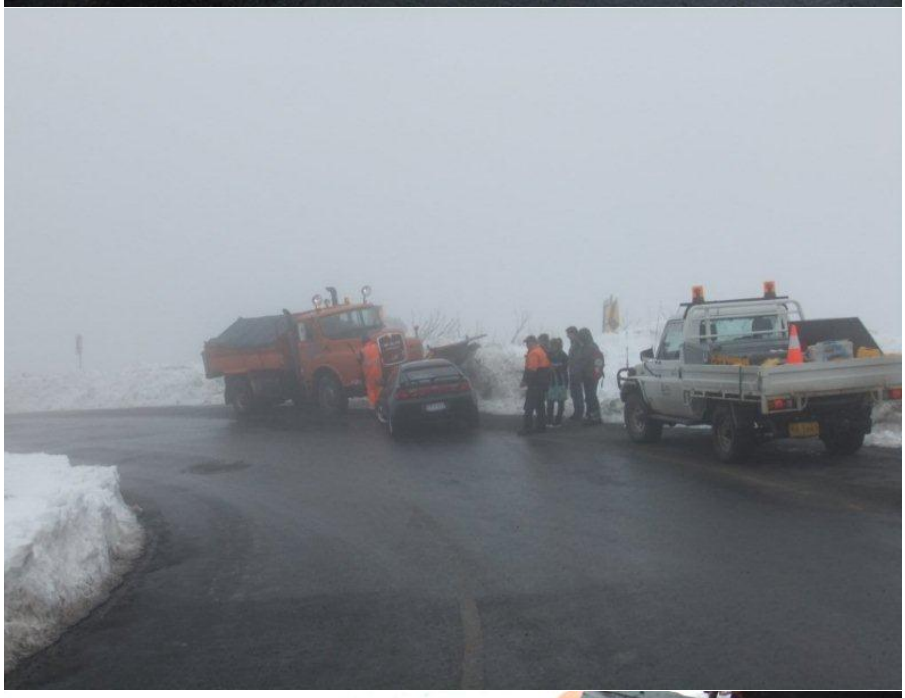
This section of road is also regularly subjected to the formation of Black Ice due to the snow melting and then re-freezing.

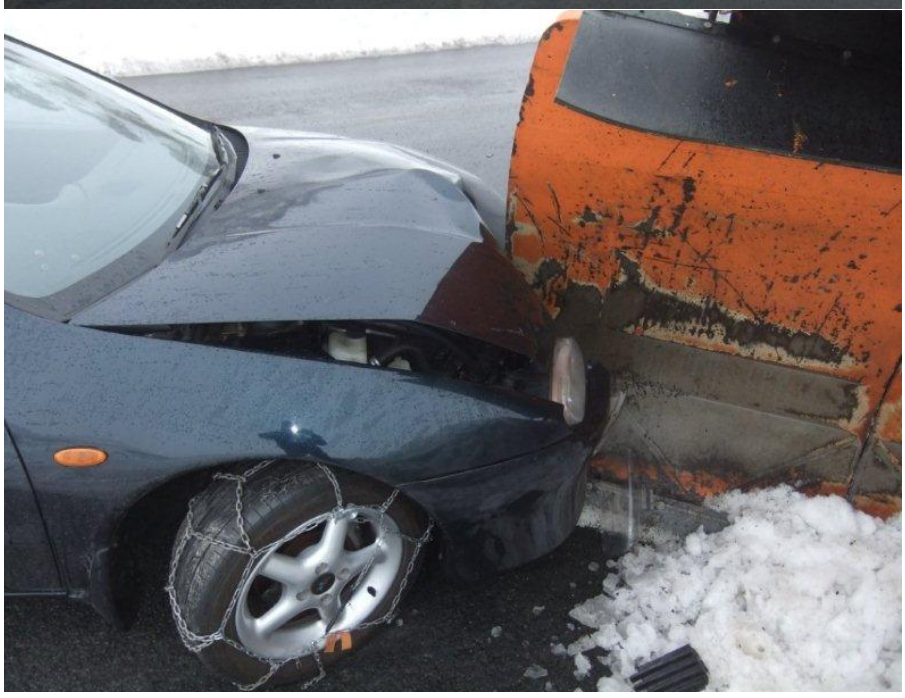
The road has a numerous number of sharp corners and steep sections that can be covered with different types of snow and ice at any time of the day and night.

Extreme weather and road conditions sometimes result in the Great Alpine Road being closed between Harrietville and Omeo.


SNOW POLES (ORANGE)
MARK EDGE
NEXT 10 Km
KEEP TO RIGHT
OF POLES


KEEP
LEFT





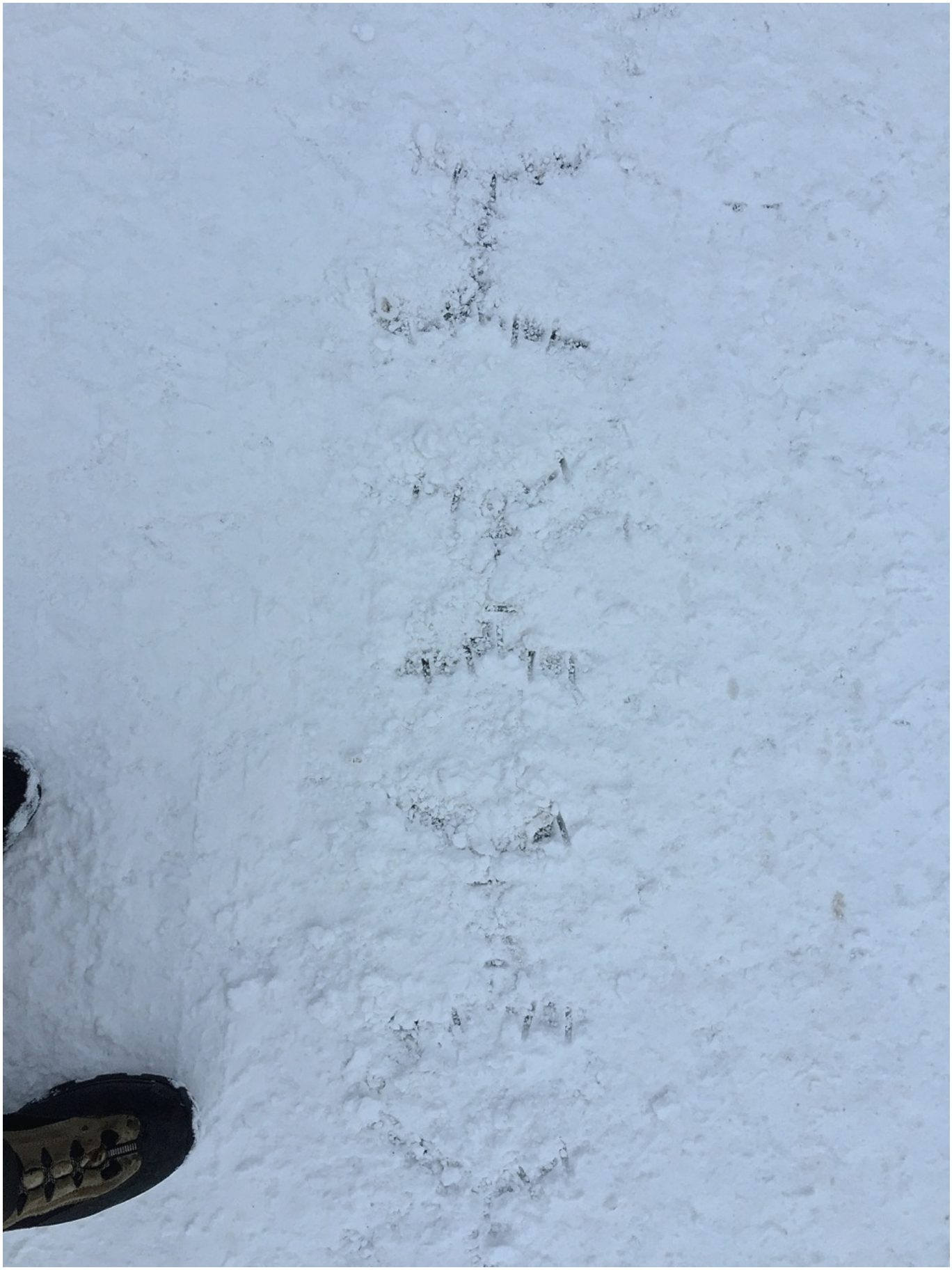
Refer Page (7) **Wheel chains** provide little grip on a 'bare' road free of compacted snow especially when cornering or trying to stop.

Extract from Mercedes Benz link.....

Snow chains should not be used on a road that is free of snow as "The vehicle's driving and braking characteristics will be adversely affected

if you drive on roads that are clear of snow with snow chains fitted to the vehicle."

Refer Page (11) Imprint of diamond pattern snow chain on compacted snow



Refer page (2) **Incidents**

Images, A-T, show various incidents on Great Alpine Road attended by Mt Hotham Road Patrol.

D. 4x4 Vehicle unable to stop on an icy road - Highway Tyres

E. Two wheel drive vehicle fitted with unsuitable wheel chains, bogged in 30cm snow drift, vehicle buried within 15 minutes

I. 4x4 slid off the road, Highway tyres fitted

J. Vehicle lost control and slid off the road, the driver did not fit chains and received an infringement from police

N. Inappropriate vehicle for snow conditions

O. Inappropriate wheel chains on an inappropriate tyre

S. Worn Highway Tyres vehicle slid off the road.

T. All Wheel Drive Vehicle with HitghwayTyres fitted, failed to remain on the road

A. Wheel Cables, Inappropriate for Mt Hotham

B. Worn Highway tyres on a vehicle involved in a four vehicle collision

C. 4x4 Vehicle failed to remain on the road

F. Worn tyres on a vehicle involved in vehicle roll over

G. All Wheel Drive Vehicle unable to stop on an icy road with snow tyres fitted. No chains fitted.

H. 4x4 lost control and slid off the road in icy conditions

K. 4x4 with ladder chains fitted to the front wheels, the ladder chains steered the vehicle over the side of the road

L. 4x4 vehicle hit by another 4x4 vehicle in photo M

M. 4x4 vehicle was unable to stop on an icy road and slid into vehicle L.

P. Worn Highway tyres vehcile left the road.

Q. 4x4 vehicle lost control on icy road, chains not fitted

R. Inappropriate ladder chains, unsafe and dangerous at Mt Hotham

For additional information relating to the Nokian 265 75 R 16 123/120 Q Hakkapeliitta LT2 winter tyres used on the Mt Hotham Road Patrol Toyota Land Cruiser for this report.

Please contact

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