

Snowgrooming in Australian Ski Resorts

7 May 2005

Introduction

This booklet is intended to provide skiers and snowboarders with a brief overview of snow grooming operations in Australian ski resorts and how changing snow conditions can affect a skier and snowboarder's day.

Snow and it's changing nature

Snow falls in various forms. Temperature and atmospheric conditions combine to form anything from dry powder to soft hail, each presenting different problems for slope preparation. Fresh snow contains ice crystals, linked together, and containing a great deal of air. By compressing or packing the fresh snow, some of the air is removed, and a load bearing surface is created. Beginners, especially, need this load bearing surface to be able to turn.

Fresh, powdery conditions can last for weeks without any further snowfalls, if the temperature remains well below freezing. In Australia this is not usually the case. Within a day or two, the passage of skiers, snowboarders and temperature fluctuations begin to melt the snow crystals. Water forms in the crystals, and with an overnight temperature drop, a binding effect is created and the slope can become hard and icy. This process of thawing and refreezing may take place hundreds of times in just a few weeks and, eventually, the crystal structure deteriorates to become a collection of small balls of ice surrounded by water. This "loose or deteriorated snow" has very little binding between the grains, and is common in high traffic areas and on village roads. "Spring slush" and "sugar" are two types of this loose, deteriorated snow. This type of snow is easily moved by skiers and snowboarders, and huge bumps can form within hours. It also offers very little traction for grooming machines.

Spring snow also accumulates dirt, and this darker colour combined with the poorer reflective power of its structure, results in rapid solar deterioration. Not only does it melt, but it can also sublime directly from a solid to a vapour, during a warm north wind. These effects can cause a rapid end to a good ski season if the weather is not favourable in Spring.

Conservation of snow reserves

There is always a limited amount of snow required to cover the slopes. Some years there is more and in other years there is less.

Skiers and snowboarders push snow downhill every time they turn and, if a snow groomer operator can't get it back uphill again, the slope begins to deteriorate through this mechanical loss of snow.

Snow fences, snow farming and good grooming techniques are as important as snowmaking when it comes to making a slope last the whole season.

Each of these snow conservation management techniques are adopted in Australian resorts. High traffic areas and sun affected slopes require constant maintenance to make them last. Summer works are often specifically designed to improve and increase snow retention.

Terrain Influences

Australian resorts have a wide variety of terrain and some areas have been summer groomed to a high standard. This means these areas can be easily snow groomed during the season and safely opened on a minimum depth of snow. Other areas have had very limited summer grooming and require a much greater depth of snow before they can be snow groomed and safely opened to the public. In these areas, the type of snow as well as the direction it comes from, also influences when snow grooming can commence. These areas generally require heavy moisture laden snow to pack down the underlying vegetation.

Snow Grooming

The main objective of snow grooming is to produce a high quality skiing and snowboarding surface for our guests.

It is a combination of high quality groomed slopes, as well as ungroomed, off-piste slopes, that provide our guests with the best possible skiing and snowboarding experience.

Snow grooming, in conjunction with associated summer works programs, also aims to provide a safe environment for snow sports enthusiasts. On-piste slopes with high grooming standards are balanced against off-piste slopes that are inherently more difficult and challenging.

The work snow groomers perform is vital in maintaining the quality of the skiing and snowboarding terrain. Skiers and snowboarders not only seek out the groomed slopes, they demand them. The corduroy finish formed by the groomer's tiller is the end product of many tasks mostly performed during the night. These tasks include:

- smoothing out bumps and moguls
- maintaining snow depth in high traffic areas
- reshaping and rebuilding trails
- pushing out snow from snow fences and snow drifts
- removing excess snow from around lift stations
- covering creeks, rocks and other obstacles
- spreading man-made snow
- packing fresh snow
- making interesting and challenging features in the Terrain Parks and grooming Half Pipes.

All ski lifts must have level load and unload stations. The level of these stations must be maintained every day by either pushing fresh snow in or removing excess snow.

Some types of snow offer very poor skiing and snowboarding conditions if they are not groomed.

Wind

Wind is both our friend and our enemy. Ski Resorts actively farm snow by using snow fences to collect snow. Snow fences create a low pressure area on the leeward side into which snow falls and collects. The snow that

accumulates ("farmed") is then spread out so that the fences can again catch snow in the next storm.

When it is windy in exposed areas, especially in high traffic areas, every time a skier, snowboarder or grooming machine disturbs the snow, it can blow away. This can sometimes be seen on wind exposed break-overs where the base (an icy hard layer) has been exposed.

After snow storms, the grooming machines spend most of their time pushing snow from the "level sensitive" lift stations, removing snow drifts and making sure the lifts will open on time. The amount of grooming can often be restricted to the priority beginner and intermediate areas, as the machines struggle to keep up with the storm's effects. It can take up to at least 24 hours to get the grooming back up to the normal area standard after a storm. Poor visibility can also hamper grooming operations during storms.

Types of snow and different grooming requirements

Temperature, relative humidity, wind and other elements of the weather all combine to produce different types of snow that, in turn, give rise to different grooming requirements.

The following tables outline some of the different types of snow that you may experience and some examples of the grooming requirements that are needed as a result.

Powder

Description

Light and fluffy easy to kick away. Consistency can remain the same throughout a 24 hour period if the temperature remains well below freezing point.

Grooming Requirements

A groomers delight unless it is too deep then it can be hard to climb.

Finish

Easy to ride corduroy finish.

Hard Packed

Description

When natural or man-made snow becomes firmly packed. The snow has not melted and re-crystallised, but has been compressed through grooming, constant skiing or snowboarding, or continuous wind compaction.

Grooming Requirements

Easy to groom.

Finish

Finish can be excellent providing a corduroy finish, although, this corduroy surface will generally revert again to hard packed as skiing and snowboarding activity increases or if there is a strong wind.

Types of Snow and different grooming requirements continued

Spring snow

Description

In a 24 hour period spring snow will generally have 3 characteristics:

1. Early morning – frozen hard packed.
2. During the day – softening to wet slush or dry loose granular snow.
3. Any time during the day and night depending on the temperature - breakable crust.

Grooming Requirements

Spring snow can be very hard to groom especially on steeper runs because of the limited traction available. Grooming can push the snow out either side causing ridges or berms to form between passes. Grooming uphill can help solve this but the limited traction and the downhill pass that follows can result in an unsatisfactory standard of grooming. This type of snow may also set in a thin layer on the surface (breakable crust). When the snow does this, it will feel like ice early in the morning, but will thaw fairly quickly. Grooming this type of snow can be difficult as the machines may break through the crust. Spring snow can lead to reduced grooming, an unsatisfactory finish, shortened slope life and snow loss. In order to conserve this type of snow, it is often preferable not to groom it at all until conditions improve.

Finish

It can be difficult to get a good finish, for example machines can bog climbing uphill, leaving depressions in the slope and, when grooming downhill, the snow can roll away from the machine leaving large soft balls of snow laying on the slope that can later freeze. These can be a hazard to skiers/boarders. If slushy spring snow has not had a good overnight freeze, even a groomed slope can form moguls by 10 am. If groomed after it has frozen, the finish can be good but can also be difficult.

Rain / fog affected snow

Description

Wet and soft to a deep depth, sinking underfoot.

Grooming Requirements

Behaves much like spring snow with the extra problem that grooming this snow can cause it to deteriorate at a much faster rate. If the snow melts after it has been groomed, the machines track marks can be left imbedded in the snow resulting in a hazard to skiers and boarders. As a result of these problems grooming is generally not carried out on rain and fog affected snow.

Finish

Usually not good and has a similar finish to spring snow. (See above.) As a general rule, rain packed snow offers better skiing and boarding than trying to groom it with a machine.

Types of Snow and different grooming requirements continued

Ice

Description

Not to be confused with hard packed. Ice has a hard, glazed surface created either by freezing rain, ground water seeping up into the snow and freezing, or by the rapid freezing of snow saturated with water from rain or from solar induced melting. It is important to note that, generally, hard packed snow is opaque whereas ice is translucent.

Grooming Requirements

Ice can be very difficult to groom especially if it is windy as the fine particles that are created by the machine can blow away very quickly. This leaves only the marks left by the blade or tiller. May require double or triple grooming passes. If multiple passes are required, this can dramatically reduce the areas able to be groomed overnight.

Finish

Can be good if the wind does not blow the groomed surface away. Skiing and boarding can be hard and fast first thing in the morning. Spring skiing and boarding on the groomed slopes can be excellent provided the overnight freeze is strong enough to create a firm base.

Man-made Snow

Description

Generally the same as hard packed snow.

Grooming Requirements

The grooming team must ensure that this man-made snow is flattened into a skiable slope before we open each morning. On very cold nights (-10c or colder), it can be quite a job because of the amount of snow that can be produced.

Finish

Generally good, but by the time the skiers and boarders get onto the surface, it is usually the same as hard packed.

What is a grooming machine?

Grooming machine manufacturers worldwide recognise the need for resorts to provide an ever increasing high standard of snow grooming to resort guests. The competition to create the ultimate grooming machine has culminated in machines that can climb steep slopes, push heavily compacted snow and leave a seamless trail of corduroy in their wake. Not to mention the speciality machines for winching on extremely steep terrain and attachments for carving perfect half pipes and other features.

For example, Perisher Blue Ski Resort in NSW has a total of 19 machines, 16 fitted with tri-flex tillers, 4 with winches, 1 half-pipe grinder and 1 cross-country machine (fitted with tracksetters).

There are a number of grooming machine manufacturers and individual resorts choose between these manufacturers based on a number of factors and preferences in deciding the best machines for that resort.

The blades, which are mounted on the front of the machine, have twelve movement capability: Up/Down; Tilt left/right; Curl or Crowd forward/back; Swing or Windrow left/right; Left wing forward/back; and Right wing forward/back.

The rear implement on most of the machines is a Tri-Flex Tiller. This state-of-the-art piece of equipment ensures an outstanding finish to the snow. The Tillers have hydraulically driven cutting bars (like a drive shaft fitted with teeth) to grind the snow followed by plastic combing "finishers" which leave the corduroy finish. Tillers from other manufacturers either don't flex or some only flex in the centre (Bi-Flex tillers).

The Tri-Flex, as its name suggests, is a three-piece design allowing far greater flexibility. This is especially important when working on a thin layer of snow, as it allows the operator to keep the cover more uniform in depth. A non-flexing tiller can only leave a good finish on a very flat surface. This may leave large amounts of snow in some areas and very little snow in others.

Winch Cats

There are two different types of winch cat arrangements. There are front mounted winches that, when hitched to another grooming machine, pulls the hitched machine up the hill. The other more common and efficient type has the winch mounted as a turret winch mounted over the top of the cab with the cable anchored to a secure point at the top of the run. This arrangement is more efficient as it generally only involves one cat, except where one is used as an anchor. Winch cats allow the operator to rebuild runs in high traffic areas including the capability of pushing snow uphill to preserve the ski slope.

Because the winch cat is the anchor point, this means that you can winch nearly anywhere including very steep slopes.

Half Pipe Grinder (HPG)

The Half Pipe Grinder (HPG) or Pipe Dragon or other Half Pipe cutting device is an attachment specifically designed to cut half pipes at the optimum shape, carrying the snow from the transition up the wall to the top. The HPG mounts via quick connection to the front of one of the machines.

The Operators

Most Australian resorts employ Australian operators as well as operators from some of the best-known resorts in the world. Australian operators are amongst the best in the world in this highly specialised field. North American resorts actively seek out our operators because of their skills and work culture.

Grooming is predominantly a night operation generally consisting of two shifts - 4 p.m. to 12 midnight and 12 midnight to about 9 a.m. In special circumstances, resorts may also groom during the day, but this is generally kept to a minimum for safety reasons.

Usually a daily grooming report is available to the public each morning that details the runs and terrain features groomed the previous night.

Snow groomer operators will tell of hair-raising experiences in whiteout conditions, in the dead of night when it was difficult to determine up from down, never mind the exact location. They will also speak of stars and moonlit nights, and inspiring sunrises from the top of Australia that make the night shift a privileged crew. Many also enjoy sampling their product first thing in the morning.

We hope this information helps you understand more about the challenges of grooming in Australia as well as the goals that are strived for. The groomer operators will be out there working all night seeking to provide the best surface for the best experience.

Enjoy.

