



UMD RSOP

Ski Trail Grooming Guidelines

Bagley Nature Area

Duluth, MN



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Goal:

The goal of grooming the trails in Bagley Nature Area is to provide a high quality, safe trail for all types of users.

Expectations:

It is expected that groomers:

- Operate the machinery in a safe manner
- Follow through on their scheduled grooming times or get someone else on the team to do their grooming.
- Wear hearing protection while operating the snowmobile (RSOP will provide if you do not have any).

Standards:

Grooming Schedule for Spring Semester (during ski class season):

- Monday evenings or Tuesday mornings
- Thursday evenings or Friday mornings
- Whenever snowfall exceeds 2 inches
- Special events (races, fun skis,...) – at least 2 hours prior to being skied on
- Times when grooming is acceptable: 5- 11pm or 6- 8:30am

All other times (winter break, spring break):

- Trails will be groomed on an as needed basis:
 - Whenever snowfall exceeds 2 inches
 - When tracks are skied out, destroyed by walkers, or melt warrants conditioning and tracking.

Each time the trail is groomed:

- Notice will be posted on www.skinnyski.com by whomever grooms the trail
- Go to skinnyski.com
 - Click on the “Trail Reports” link
 - Select Bagley Nature Area
 - Provide information on the quality/conditions of the trail

Grooming schedule:

- Will be posted on the kiosk near Rock Pond by Lead Groomer.

If snowmobile is broken down:

- Groomer will post information on the kiosk and make sure supervisor knows of the breakdown.

Ski Trail Grooming Training

Topics to cover:

- Storage shed – organization and cleanliness
 - Ice on the floor and grit
- Snowmobile
 - Fuel
 - Electrical/switches
 - Starting – elec./pull
 - Accessories to always have – shovel, tools, nails
 - Ski weight for icy base
 - Clutch issues
- Tidd Tech.
 - Adjustment
 - Weights
- Roller
 - Use it to take the air out of the snow when we get more than about 3 inches
 - Drive slow to avoid “bouncing”
 - Doesn’t level the trail
 - Watch for ice chunks frozen to the metal – knock them off
- Grooming
 - When you have nice fresh snow
 - When the snow is super deep (more than 12”)
 - Proper speed
 - When it is icy
 - Adjusting teeth for different conditions – churning up crusted snow
 - Dealing with entrance and exit
 - Off-set track
 - Walking loop
 - Making sharp turns
 - Holes/divots
 - Getting stuck and unstuck
 - Lacross Field class grooming
- Trail Maintenance
 - Signage
 - Branches/sticks, leaves, grass, weeds

TIDD-TECH: OPERATION OF THE TRAIL TENDERIZER

SAFETY

Normal and prudent care should be taken when operating the Trail Tenderizer. The Terrain Tenderizer Teeth are very sharp, and should be treated with respect. Never reach under the front edge to move the groomer.

Be careful lifting the groomer. Its weight is often increased by snow piled on top. Deep or icy snow makes moving the groomer even more hazardous. Be sure you have secure footing, bend your knees, and keep your back straight. By pivoting the unit on one and then the other rear corners (tracking fins) you should be able to zig zag the machine to the location you want.

Do not run over skiers on the trail. It's very bad for repeat business. Seriously, if you groom during the day, stop and make sure that skiers are completely out of your way before passing them.

The tow hitch of the groomer is supplied with a shear pin mechanism. You should use eight penny coated or galvanized nails for the shear pins. The pin should break upon serious impact with rocks, stumps or trees. It is far better to go back and get the groomer than to go over or through the windshield. If the pin breaks constantly in rough terrain, you can increase the size of the nail slightly.

ALWAYS CARRY A SUPPLY OF SHEAR PINS IN THE SNOWMOBILE.

It is actually fairly rare that you break the shear pin, except during low snow times, like at the beginning of the season, or by hitting trees.

USE OF THE LIFT LEVER

The lift lever is designed to allow you to eliminate the track without getting off the snowmobile. There is a trick to getting the slotted hook to engage and disengage without touching it. If you pull the lever up and slightly toward the center of the machine, the slotted hook will drop down on the bolt and remain in the hooked position. To release the hook, pull the lever back and slightly to the side, away from the center of the machine. When you release it, the bolt should slide back in the long end of the slot, thus lowering the track setter. You might need to tighten or loosen the bolt just a little. A bit of practice helps. Once you see how this works, the action is very quick and efficient. You may need to adjust the tightness of the bolt that slides through the slotted plate. Flip the track setter up onto the compactor bed for long distances where you aren't setting tracks (see below).

PACKING NEW SNOW

The easiest way to pack new snow is to keep the angle of the compactor bed as low as possible so that the snow doesn't build up under and in front of the compactor. Use the handcrank to raise the front edge of the compactor bed about half way up to the drawbar. Drive a few yards at grooming speed and see if the snow is rolling easily under the bed. If it is billowing up over the front edge, raise the front a bit more. If snow is being dragged along by the back edge, lower

the front. Remember that as you gain speed, the compactor will tend to plane up to the surface. If you raise the track setter with the Lift Lever (for skate lane packing with no tracks), the track setter will hang out in a cantilevered position. This puts a lot of downward pressure on the flexible yellow comb, pushing it hard into the snow. The result is an excellent combing action in firm snow conditions. In soft powder, the comb may be pushed so hard downward that snow is carried along and a significant drag is put on the snowmobile. To avoid this situation, flip the track setter up onto the compactor bed. The weight is now off the yellow comb, and drag is reduced.

NOTE: It is a good idea to leave the rubber tie-down strap connected between the crank handle and some other part of the compactor bed to prevent the crank from spinning as a result of vibration. In this way, the height of the cutting teeth from the snow will remain constant.

BACKING UP

It is difficult to back up very far with the groomer attached. It tends to jack-knife at the hitch. Some backing is possible provided that you raise the yellow comb off the snow surface. This is done by flipping the track setter up onto the compactor bed and pulling it forward toward the raise/lowering crank. You can secure the track setter in this forward position with the rubber tie-down strap provided. Stretch it between the crank handle and the track setter's plastic base (between the hinges). You will notice the comb bending upward as you slide the track setter forward.

SPECIAL SITUATIONS

Deep new snow (over 10-12") may require two passes to get sufficient air out of the powder to make a skiable surface. If the snow is very deep, you will probably have to run the snowmobile alone without dragging the Trail Tenderizer (this is also the perfect application for a Tidd Tech Roller). You can usually set good tracks on the second pass. If the groomer bogs down, remove the track setter(s) and put it/them on the back of the snowmachine or leave them off at the base lodge. This gives you less drag from the groomer and more traction on the Grading uneven surfaces is done in one of two ways. With soft, powder snow, you can raise the compactor to the highest angle so that you drag snow along, filling in the low spots automatically. With settled, or crusty snow, drop the teeth to a fairly low angle, and cut off the high spots. Snow will be dragged into low spots to level the surface. Don't be concerned if some snow piles up on top of the compactor, you can pull it along until you find a deep hole, then dump or shovel it into the hole.

FIRM OR CRUSTY SNOW

The Terrain Tenderizer Teeth do a lot of surface renovation as long as the snow is reasonably workable, i.e. you can kick your heel into it. Adjust the depth of the teeth so that snow is just rolling under the front edge of the compactor. A couple of turns of the crank make a big difference in how successful your renovation

works. Generally you should keep the compactor bed horizontal, so that the weight of the whole unit is on the teeth. If the teeth are too low, they will create a lot of drag on the snowmobile and may bounce, creating a washboard effect. Raise them up enough to not overwork or overheat your snow machine. On steep uphill, it is sometimes advisable to raise the teeth a bit to make pulling easier, then groom that trail in the opposite direction on the next pass with the teeth fully down on the downhill.

The Trail Tenderizer has difficulty grooming extremely hard-frozen granular or solid ice. Nothing you put behind a snowmobile short of plastic explosives will affect rock solid ice. However, the teeth will texture the top surface and make it smoother and flatter so that skis slide easily (and quickly!) over it. Our motto is: IF IT'S WHITE, IT'S ALL RIGHT; IF IT'S GRAY, IT'S O.K.; IF IT'S BLUE, SO ARE YOU; AND IF IT'S BROWN, IT'S TIME TO SHUT THE PLACE DOWN.

Setting track in hard snow sometimes requires one or two concrete blocks in the compartments of the track setter(see below). Another way to set better tracks in hard snow is to remove the sidewall tracking fins on the track setter, or move them up using the extra pair of bolt holes. By doing this, only the track cutters are hitting the snow. With the sidewall fins off or in the higher position, ***you must raise the track setter(s) to cross roads.*** Otherwise, you will scuff the molding blocks and dull the cutters.

WEIGHTING THE TRACK SETTER

The blocks fit into the hinged cage of the track setter. You can set tracks in powder with no weight on the track setter. One block in the rear compartment will create more packing on the track molds. One block in the front compartment will put more pressure on the track cutting teeth for harder snow. With both blocks on the track setter, you will have increased the weight of the track setter to at least 112 pounds. This should set a good track in very hard conditions. However, it is a lot of weight to pull up hills. After some experimentation, you will discover the best arrangements of weight to set ideal tracks in various snow situations.

OBSTACLES

Hitting rocks, roots, trees and other obstacles is not recommended. But, of course, you will do this, so just slow down when you do. The groomer is designed to ride over rocks etc. even with the teeth down. However, high speed impacts may dull, bend and/or break the teeth, and distort other parts of the groomer. Be nice to the machine and it will serve you for a long time. The teeth on the cutting bar can be resharpened with a four inch angle grinder when they get dull. It's a quick, easy maintenance task and will improve the performance of the teeth. This is necessary usually only once or twice a year, or after extended use in low snow.

CROSSING ROADS OR BARE SPOTS

You must raise the cutting teeth and flip the track setter(s) up onto the compactor bed before crossing plowed roads or snowless sections. The groomer will ride on the tracking fins at the back corners of the compactor and not harm the urethane comb. These tracking fins will eventually wear down. They can be repositioned in four directions, and eventually replaced.

OFF SEASON STORAGE

Clean your Trail Tenderizer at the end of the season. A good wash with a garden hose will do. Inspect the tooth bar for worn or missing teeth. Sharpen the teeth with an angle grinder. Straighten any bent pieces. Paint any exposed steel parts of the groomer. A spray can of rust resistant paint is adequate. Use a piece of cardboard to mask the plastic parts.

NOTE: Store the groomer on a couple of boards up off the ground and cover it with a tarp. UV sunlight can degrade the plastic and make it more brittle.

With proper maintenance and care in its use, the Trail Tenderizer will last for many years.

Ultimate Best Line - Be a Track Setting Hero

By David Zink

Back in the days before skating, setting technical cross-country ski trails was an art. Good track setters not only knew when to lay the tracks and when to pull them, they also knew how to follow the “best line” around curves.

Today, most classic tracks share the trail with a wide skating lane. There are plenty folks who enjoy arguing the pros and cons of the new wide trails vs. the “good old days”. What I find interesting is that most of this discussion centers on the width of the trail and it’s feeling of “intimacy”. We often forget another reason why the old trails had a different “feel”.

In the old days if you were setting track on an 8’ logging road, for example, you got to “define the curve”. You would start at the outside of an approaching corner, cut across to the inside and finally end on the outside again – we know this as “taking the best line”.

Today, as we set our tracks on one side of the skating lane, we are completely at the mercy of the trail itself. Curves are defined now by

the trail cutter, not the track setter.

Next time you set tracks for that “classic only” race course, or if you would just like to try something fun on a section of trail, try setting a best line course. But before you fire up the snowmobile, do some research and training:

First go ski the section of trail. My recommendation is to ski it on skating skis, taking the curves and corners as aggressively as you can. Pay attention to the line you take through the curves. If you don't feel proficient, park yourself at the edge of the trail and watch a good skier's line. Take lots of notes with sketches, because it will all look very different through the windshield of the snowmobile.

Now go set some tracks. Follow the line you picked while on skis, even if it doesn't look right from the snowmobile. Ski the tracks and feel the difference. It is amazing how much more fun it is to ski a best line track. Were you a little overzealous on some of the down hill corners? It is very important when setting best line to “pull” the tracks when the curve becomes too fast.

More so than ever, skiers must trust a best line track setter's judgment – if the tracks are there, they will use them, often because they don't have a choice (the tracks cut across their path). And when they do successfully ski through that downhill curve in a tuck you will be their track-setting hero. But if you set tracks around a corner that is too tight for the average skier, you are the goat, so learn your trade well.

If you have the option of using a snowmobile track setter in combination with snow cat equipment on a wide trail, here is an idea for the ultimate best line course: Send the snow cat (with the tiller running if you have one) out just ahead of the snowmobile/tracksetter. Run the snow cat slow enough that your snowmobile track setter can follow right behind, so that you are setting tracks before the tilled snow has a chance to set up. Set your best line with the snowmobile, using the full width of the trail through the curves. You will end up with a wonderful product that not only looks great but will stand up to some pretty hard use. If you are grooming exclusively with a snowmobile, make enough initial passes to cover the full width, then

follow with your best line track-setting pass.

Don't be afraid to experiment a little with track placement. Sometimes we get in a habit of doing things a certain way and forget that it can be a thrill for skiers to experience something new and different. Another trap to avoid is the thinking that tracks and skating are incompatible. It is just as fun for the skaters to hop into a best line track down and around a curve as it is for your classic skiers. If you have a wide, one way trail over some rolling terrain that is normally groomed as a skating lane with classic track on the side, try setting the APPROPRIATE downhill sections best line (you can still leave a skating lane everywhere else). I think you will enjoy the response you get from your skiers.

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A Technical Manual for the Organization of Cross Country Ski Events

Jim Thomson, Editor

Course Preparation & Tracksetting 6-1

Snow Physics

The key to setting good tracks and fast smooth skating lanes lies in the snow grooming which is done before tracksetting. Grooming is the working or reworking of snow using special vehicles and attached equipment in order to provide consistent skiing conditions.

The objective in grooming is to create a smooth level trail bed that is firm enough to support the skiers and their poling and at the same time to have enough loose workable snow to mould tracks and shape skating surfaces.

Why Groom Your Ski Trails

- Grooming helps to make a skier's visit or race fun from start to end
- Grooming helps make a ski race fairer

- Grooming demonstrates that cross country skiing is not only good exercise but also fun and exciting.
- Grooming puts more glide in cross country skiing.

There is an ongoing debate as to whether grooming is an art or a science. The fact is that the basic medium, snow, comes in a bewildering variety of states, and groomers, in their attempts to define scientifically what is still a very inexact art, have come up with as many definitions of snow types as have the Inuit. For this manual the basic snow terminology, snow conditions, grooming and tracksetting processes will be presented. For a more detailed discussion of snow physics, grooming and tracksetting please refer to the Cross Country Canada Trail Grooming and Tracksetting Manual.

Snow

A knowledge of how snow is altered due to changes in temperature will allow you to better understand what happens when you groom trails in different conditions. It will help you to:

- _ pack the snow to achieve suitable density for a variety of different users
- _ provide the same track conditions for all skiers in a competitive event
- _ extend your skiing season by working the snow the right amount.

Heat Gain and Loss In The Snow Layer

Temperature Gradient - The temperature gradient is the difference in temperature between the snow surface and the ground expressed in terms of degrees Celsius per meter of depth. For example, consider one meter of snow lying on a ground surface the temperature of which is zero degrees Celsius. If the air temperature drops to minus 20 degrees Celsius there is a difference of 20 degree Celsius in one meter of snow depth, or 20 degree Celsius per meter. Because the temperature gradient influences the movement of water molecules within the snow pack, it has a significant effect on changes in snow structure within the snow pack. The physical processes which cause changes at and beneath the surface of the snow are driven by temperature gradient or the lack thereof and by transfer of heat to the snowpack.

For the purpose of grooming, the interfaces which most concern us are:

- _ the ground and snow surface
- _ the air just above the snow surface and the snow surface
- _ the snow surface and the snow one to two centimeters below the snow surface

Factors which affect the above interfaces are:

Incoming Ultra-violet Radiation (sunlight)

This process will heat up the snow and cause melting within the top few centimeters of the snowpack. The amount of warming depends upon the albedo (reflectivity) of the snow, the amount of impurities (dirt) mixed with the snow, and the granular structure of the surface layers.

Machine groomed snow is not highly reflective and therefore a large percentage of the incoming solar radiation is absorbed which may create a significant temperature gradient within the top two to three centimeters or may cause melting of the surface layers.

Outgoing Infra-red Radiation

This cools the snow surface. In clear conditions, in midwinter, outgoing infra-red radiation may cool the snow surface at the same time as incoming radiation warms the snow beneath the surface, creating or enhancing a significant temperature gradient. During a clear cold night, a crystalline deposit of surface hoar may form on the snow surface.

Rain

Rain transfers heat directly to the snow. It may remain as liquid water in the snowpack.

Wind

A warm moist wind results in heat being transferred to the snowpack. A dry wind, while causing the snow to evaporate at a high rate, transfers little heat into the snowpack.

Metamorphism - Process of Rounding

Snow begins to change as soon as it reaches the ground (or at higher temperatures, in the air before it reaches the ground). The rate at which it changes depends upon the temperature. Close to zero degrees Celsius the change is rapid. Below about -20 degrees Celsius there is little discernable change from day to day.

When outside temperatures are moderate or when the snowpack is deep, the temperature gradients within the snowpack will be small. Snow will then change by a process known as "rounding". The natural process of minimizing surface area breaks down the intricate crystalline snow structure of the ice crystals into smaller, more rounded ice grains.

At the same time, because of the reduction in volume of the snow particles, the snowpack consolidates and settles. When snow is first deposited it is light and fluffy, the crystal branches interlocking to form a cohesive mass. After a period of time, water molecules are transferred by vapour movement from the extremities to the body of the crystal. Eventually, the ice grains lose all sign of their previous crystalline structure and become more and more rounded. The larger ice grains grow at the expense of the smaller particles resulting in a uniformity of size within each snow layer.

How Snow Gains Strength and Density

You have probably noticed that soft new snow, when packed, will harden overnight. The process where snow gains strength by the joining together of ice grains, is called Sintering.

In the case of the ski trail, the snow crystals or ice grains are forced close together by the mechanical compaction of grooming equipment, at which time energy is introduced into the snow by the mechanical action, resulting in a partial melt, and thus increasing the density of the snow. As a result a transfer of water molecules, necks of ice form between adjacent grains, strengthening the snowpack. On re-warming, the necks between the ice grains will be reduced thereby weakening or destroying the bond between grains.

Importance of Density

If your trails are to withstand their intended use, you should pay attention to the density of the groomed snowpack.

The following table gives typical snow densities and indicates suitable densities for various levels of use. Kilograms/cubic

metre (Kg/m^3) is the usual measure of density.

- New Snow 150 - 200 Kg/m^3
- Wind packed snow 250 - 300 Kg/m^3
- Packed with snowmobile alone 300 - 350 Kg/m^3
- Support required for racing basket >350 Kg/m^3
- Recreation trails (moderate use) 450 Kg/m^3
- Racing trails 500 Kg/m^3 or greater
- World Cup and higher events 540 - 560 Kg/m^3

The Melt-Freeze Process

When the sun is sufficiently strong to melt the top layers of the snowpack during the day, and when night-time temperatures fall below zero degrees Celsius, cycles of freezing and thawing will occur. In this process smaller grains will melt before larger ones. During the course of a number of melt-freeze cycles, larger grains will grow at the expense of smaller ones. The meltwater wetting the surface of these larger grains eventually re-freezes and firmly cements the grains together. Melt-freeze grains have a tendency to freeze together in clusters, leaving large pore spaces unless packing is done.

Types Of Snow

Falling or Newly Fallen Snow

In cold conditions (-One degree Celsius and lower): The snow will be low density, highly crystalline, possibly interlocking crystals, matting and building up on trees. The snow will be hard to pack if the new snow is allowed to get too deep. It packs well in 10-15 centimeters (four - six inches), layers at temperatures close to zero degrees Celsius, and becomes more difficult to pack as temperature decreases.

In warmer conditions (zero degrees Celsius and above): The snow will be wet and heavy with little remaining crystalline form. If accompanied by wind, the snow is plastered on trees, signs, buildings, etc. It packs easily into a hard, dense layer at temperatures close to freezing and may turn to slush at higher temperatures.

Partially settled Snow (Fresh Powder)

This type of snow has begun the rounding process and, if left alone, will settle and strengthen naturally over a period of time as pore spaces are reduced and sintering occurs. Mechanical disturbances such as blading, tilling or packing will reduce the air spaces by pushing the ice grains closer together allowing better sintering. The snow, now "Machine Groomed Powder" becomes both denser and stronger.

Settled Snow

When snow is settled, the grain size becomes smaller and more uniform. Pore space decreases, sintering increases, and density increases. The ability of the snow to re-crystallize due to large temperature gradients, and hence loosen-up,

is reduced due to small pore spaces. In continental snow climates such as Alberta and the Rockies, Saskatchewan, Manitoba, Yukon, and North West Territories, a well packed trail system will not present re-crystallization problems. The snow should be packed early and well.

Dry Granular Snow

This type of snow may present itself in three ways:

_ faceted surface grains. This is unlikely to occur at low elevations of most Cross Country ski areas.

_ faceted grains in bottom of snowpack. This is common in continental snow climates, but will not be a problem if trails are well packed.

_ re-frozen melt-freeze grains. These are enlarged grains produced by several cycles of melting and freezing, often a function of over-grooming the same snow pack. They may present as a loose surface layer, but more likely will be frozen clusters which will break up as temperature rises and skier traffic increases. When partial melting has occurred (free water content less than eight percent) it is known as "Corn Snow". Excessive grooming will tend to loosen and enlarge these grains.

Surface layers of refrozen melt-freeze grains (or sugar snow) can be reconstituted (strengthened) in two ways:

_ It can be mixed with fresh snow, either new snowfall or old dry snow from layers beneath the granular layer.

_ A power tiller or, for snowmobile groomers, a compaction drag may be used to mill the snow. This reduces the size of the particles, allowing partial melting and sintering to take place. If melt-freeze cycles continue, the snow will eventually become sloppier, and renovation will be needed. There is little you can do at this stage to alter the physical characteristics of the snow grains. Tilling will help to dry out the snow by exposing more surface area to evaporation. Wind will speed up this process.

Wet Snow

There is an old field “squeeze” test for the definition of snow moisture levels. A handful of snow is scooped up and squeezed in a gloved hand. Dry snow will crumble when released. Moist snow will compact to form a snowball, and water can be squeezed out of a handful of wet snow. Wet snow creates special problems for groomers. It should never be packed or groomed if there is any chance that temperatures will drop later in the day or night. Wet snow which is compacted and later frozen can become a “bullet proof” groomer’s nightmare.

Wet snow can sometimes be broken up into coarse chunks with a front renovator or rotary hoe or tiller and left loose to aerate for several hours before further grooming. This will allow water to percolate downward and encourage evaporation through the increased surface area. Later, when temperatures have started to drop below freezing point, further renovation and tilling can refine the surface layers. In wet conditions where there is no chance of freezing prior to a race, snow can again be coarsely renovated or tilled to promote drainage and aeration, but final grooming and tracksetting should be left until just before the race. It is normally difficult to till wet snow as it “balls up” in the tiller.

Basic Grooming

Although the discussion of Snow Physics indicates that snow grooming has a science base, it would be far too simple to describe it as a purely scientific activity. One could argue that there is as much art as there is science in the practice. It is certainly true that much can be learned by studying snow crystals and their change processes under a magnifying glass, but for most experienced groomers a few boot kicks in the trail snow and the weather report will often give them all the information they need for a good grooming job. So much of the work relies on the groomer’s practical experience with their area, their knowledge of the local climate, and the site’s microclimates. With this comes a sense of intuition that can’t be described in any formal manual. This makes it very difficult for any individual to be a true grooming

guru, or for any manual to be considered as The Bible. The following discussion is intended as a brief overview of basic grooming processes for race officials and others who are new to the field.

Grooming can be relatively simple or very complex depending on conditions, the desired end product and the time and equipment available. For simplicity, the whole grooming program can be broken down into several basic processes.

Packing

This is a season long process. Ideally, packing should be done with at least every six inches of new snow (with the understanding that this is not always possible when big dumps come). In low snow areas groomers will carefully pack every time more than 2 cm of snow accumulates to gradually build up a base.

Early season packing usually involves running over trail surfaces with light equipment meaning snowmobiles alone initially, followed by snowmobiles towing rollers or other compaction devices. Even high snow regions which normally groom trails with snowcats will find that snowmobile packing is essential until the initial base is set (this can range from 15 to 30 cm or 6 to 12 inches of packed snow depending on the smoothness of the ground surface). End Result – An Increase in Snow Density

Snowmobile groomers may have to fall back on track packing with snowmobile only at later times in the season for big dumps of snow which would make towing any implements impossible, and even cat groomers will occasionally find track packing useful with unusually heavy snowfalls. But, normally packing will be done with implements.

Snowmobile groomers can pack with two basic types of equipment – rollers, or compaction pans/bars. Rollers offer the advantage of packing snow without dragging or displacement. They can, however, ice up in warm conditions, and working speed needs to be kept low to keep them from bouncing (creating washboard surfaces). Homebuilt rollers can be produced quite easily using various types of pipe, steel culvert, etc, but some of the most efficient units are produced by grooming suppliers such as YELLOWSTONE TRACKSETTING SYSTEMS, and TIDD TECH.

There are several compaction bar/pan devices available from equipment suppliers. The TIDD TECH Trail Tenderizer which has been around for more than a decade is a good example of a useful compaction pan when run with the front cutter teeth cranked up. Many groomers prefer compaction bars and pans to rollers for season long packing because they level and smooth the surfaces as they compact and they don't tend to ice up as readily in warm wet conditions.

Working speeds still have to be kept low enough to prevent washboarding.

Compactor bars (“C-Bars”) are available for larger snow vehicles. These bladelike bars mount at the rear of snowcats. Down pressure and blade trim (vertical angle) are all hydraulically controlled. “C-Bars” are particularly useful for early season packing (assuming a sub-base packed by smaller vehicles) where rocks, stumps, and other obstructions might still be hazards to power tillers, and they may be handy for later season mega –dumps which would clog tillers.

Generally though, most cat groomers will routinely pack recurring snowfalls with tiller passes. If compactor bars aren’t available particularly heavy snow dumps may have to be track packed before tilling.

Groomers often have little choice about timing for packing. Normally snow will pack and groom best in a relatively narrow temperature range between -10 and 0 degrees Celsius. Extremely cold dry snow (below -20 C) does not pack well, and as a general rule, all grooming of extremely warm snow (above 0 C) should be avoided.

Warm wet snow can be a sticky frustrating mess and if followed by a cold spell the resulting icy surface can be dangerous. But, the pressures applied by an impatient skiing public or an upcoming race may force groomers to pack and groom in less than ideal conditions.

Surface Shaping

Most of the time, careful packing will leave trail surfaces smooth enough for tracksetting and skiing, but this isn’t always the case. Packing can leave bumps and dips which should be flattened out. Skier traffic and repeated grooming passes can also gradually push snow to trail sides leaving a concave or dished surface.

Periodically all of these irregularities should be flattened out, and snow may have to be moved back from trail sides to the middle. In the past, there has been a grooming theory that the ideal trail surface should be crowned (a convex surface higher in the middle than the sides). This would provide better snow depth in the middle where traffic would be highest. It would also make for more efficient ski skating (every skating thrust from the top of the crown results in a downhill glide) and it would make herringboning steep uphill easier for classical skiers since ski tips would not dig into higher side surfaces. A nice theory on paper - but in practice it has proven to be impractical. The excavation required to shave snow from trail sides to move it to the centre is very difficult to do with snowmobile equipment and in low snow regions the risk of digging up dirt and debris is much too high even if snowcats with skilled blade operators are available. The most practical aim for the majority of groomers is to maintain surfaces as flat and as smooth as possible.

For snowmobile groomers drag graders are the basic tool for surface shaping. These can range from home built devices like the old bed-spring drag to commercial units such as YELLOWSTONE TRACKSETTING SYSTEMS Compaction Drag or ADVANCE TRACKSETTING SYSTEMS Renovating Leveller. They can be used throughout the

season to plane and flatten trails. Both the YELLOWSTONE Compaction drag and the ADVANCE Leveller are approx seven feet long (excluding the hitch). This seems to be a reasonable length for most snowmobile drag grader work. A number of ski and snowmobile clubs have been using longer bed graders (10-12 ft) originally built by BOMBARDIER and other makers for maintaining snowmobile trails. The extra length makes these very effective surface planers, but they can be brutes to tow in steep terrain and they will scrape high spots bare very quickly. In low snow country they have to be used with caution.

The most efficient tools for surface shaping are snowcat multidirectional front U-blades. U-blades can move massive amounts of snow and skilled operators can shape trails with near surgical precision. Again – as with long bed graders – the limiting factor is snow quantity. In most nordic trail systems outside of the heavy snow belts, operators will have relatively little chance to use the blades during regular grooming. Unless there is more than a foot of compacted snow on the trail surface, anything but the most conservative blade use will scrape snow down to the dirt, and dirt in trail snow packs is a nasty problem. Dirt and debris worked into a trail snowpack early in the winter can turn into a season long headache. Unless it is completely buried by a large dump (50 cm or more) regular grooming will continually work dirt up into the trail surface. Gravel and rock chips can foul expensive race waxes, or damage ski bases. More important to the groomer, the discoloration of the snow will cause rapid melt out patches in warm periods. In spite of this cautionary note, the front U-blade is an indispensable tool. It can flatten out and redistribute drifted snow; it can wing in snow from beside trails to fatten up thin spots (assuming that trail sides are relatively smooth and free from stumps, rocks, etc.).

Unfortunately, as noted above, many groomers in low snow areas never have the opportunity to become skilful blade operators. For those who may wish to learn more about the art of blading, the best approach would be to arrange to ride along with an alpine groomer on a few shifts. Alpine groomers are the true masters of blade work.

Conditioning

Further snow conditioning processes will be required during a ski season. The following process definitions are somewhat arbitrary, and - obviously - there is considerable crossover between them.

Aging

This is a term used for a complex set of processes touched on in this chapter's earlier section on Snow Physics. Most types of fresh fallen snow require mechanical aging to turn them into suitable building materials for a ski trail surface.

Cold dry snow is light and fluffy; it flows easily and resists compaction. Snow aging is a natural process, but mechanical action can speed it up to produce a consistent snow mass which can be shaped into firm tracks and skating surfaces.

The process is started by packing which reduces air spaces, forces snow crystals together, and promotes sintering. It is continued with the surface shaping which will further mill snow depending on the exact implements used. For most grooming operations packing and shaping will provide all of the aging necessary for good skiing. Groomers in low snow areas will rarely want to go further, because skiing traffic and subsequent grooming passes will harden trail surfaces surprisingly fast when regular snowfalls are a rare commodity. And re-grooming hardened old snow becomes increasingly difficult with each successive grooming shift.

There will be situations requiring additional aging passes. High level ski races require firm surfaces, and in deep snow country where snow comes every week, extra work will be necessary to produce hard fast skating surfaces. In addition to shaping surfaces, simple drag graders such as the YELLOWSTONE Compaction Drag mill snow quite effectively as the cutting blades move it inwards and then back out, creating high-speed snow crystal collisions. The friction of these collisions produces heat which promotes sintering and speeds up natural aging. Additional drag passes will gradually harden trail surfaces. Cat groomers have the most efficient aging implement, the power tiller, with its cutting teeth mounted on a shaft spinning at 1000 rpm or more.

Mixing

This is another part of the conditioning process which can be considered separately, but which is obviously involved in several of the other conditioning stages (surface shaping, aging, renovation). New snow from surface layers can be mixed with older lower snow to produce an “aged” trail surface which will set up and withstand skier traffic much more readily than fresh snow alone. For an opposite effect - trail surfaces which have been turned to boiler plate or otherwise worn out by skier traffic, natural freeze-thaw cycles, or repeated grooming can be rejuvenated by being mixed with lower layers which have not been overused. Mixing is done with the same deep-cutting implements used in heavy renovation.

Renovation

This is a term for a series of processes whose objective is really the opposite to that of packing and aging. Snow which has been hardened excessively through a combination of skier traffic, grooming, and weather conditions must be loosened and converted back into a more powdery form before it can be reshaped into new tracks or a smoother more forgiving skate surface. Renovation may be required at different levels. End Result – A Reduction in Snow Density

Surface Scarification

Skier traffic and weather conditions will scar up and glaze rail surfaces, but it may not always be necessary to do a deep renovation to buff them up enough for enjoyable skiing. This is true as long as tracks are still sound and icing is not too deep. Light surface scarification by snowmobile drags will touch up lightly glazed, rutted skate lanes. In low snow country especially, groomers can do much to save their snow packs by minimal use of more aggressive renovation.

Many homebuilt drags such as the “Magic Carpet” (a piece of chain-link fence with 2 by 4’s nailed across the top) or the “Step Tread” (three or four 4-6 ft wide expanded metal stair treads chained together) can scratch up and re-smooth surfaces enough to bring back pleasant skiing. A number of commercial implements will do the job much more efficiently.

The levelling graders (YELLOWSTONE Compaction Drag, ADVANCE Renovating Leveller) can handle light surface scarification if weighted sufficiently. Another old standby for light surface scarification is the TIDD TECH Trail Tenderizer with its double front rows of cutting teeth.

In the past few years, the Swedish JACA skate surface Renovator, and –more recently- Yellowstone Track Systems Ginzugroomer’ and Tidd Tech’s G-2 have added a whole new dimension to light equipment trail grooming. The JACA

Renovator uses a horizontal cutter bar, while the Ginzugroomer and G-2 feature vertical knives . All use electric rams controlled by switches on the snowmobile to raise or lower cutter units. This means that the days of having to stop and get off the snowmobile to adjust depths are no more (being able to control cutting depths on the go reduces the risk of one of the snowmobile groomer’s nastiest old bugbears - getting stuck on steep uphill). They allow snowmobile groomers to produce results as professional in appearance as those of any cat operator, but they do so without having to tear up surfaces to any depth. This can be particularly useful whenever quick touchup grooming is required during events (i.e., cleaning up a sprint course between rounds, or removing classical tracks before a following free technique race). In these situations using a cat would leave trail surfaces hopelessly soft.

Deep Renovation

Sooner or later deep renovation will be required. Old tracks which have become worn and icy, and trail surfaces turned hard and glazed by traffic and weather will need to be broken up and refined into snow soft enough to be moulded into new tracks and skate surfaces which allow ski edges to bite.

This can be one of the most challenging processes for groomers –especially for snowmobile groomers in low snow areas. Tools of agricultural origin (discers, harrows, rotary hoes) have been used to break up hard pack snow with mixed

results. Most of these implement types tended to be too heavy and aggressive for dependable use behind snowmobiles.

They were usually better suited for use behind heavier vehicles like the “Bombi”, or some of the older types of snowcat. None of the old “Farmer Jones” type implements for snow grooming are currently available in the regular market.

Fortunately, the current market does offer a small range more efficient renovation implements for snowmobile groomers. Most groomers will be familiar with the old BAECHLER Pull Renovators which first appeared in the early 1970's. Many are still in use and many more sit in “bone yards” around the country. The old PL with its two and a half foot horizontal cutting bar could rip up hard snow, but it came up in big chunks and the machine was a notoriously hard pull for snowmobiles in hard conditions on hilly trails. The BAECHLER renovator is still manufactured under license by YELLOWSTONE TRACKSETTING SYSTEMS. YTS has modified it by replacing the original horizontal teeth with a set of vertical cutting knives, which leave a finer textured product and make the pulling a little easier.

The JACA skate surface renovator mentioned above also uses a horizontal cutter. It produces a beautiful fine-grained skate surface when set at shallow cutting depth, but since it is almost five feet wide it could be an extremely tough pull in hard conditions if set for deep cuts. Groomers would have to make repeated passes at increasing depth settings to renovate to track depth. The same would apply to the Tidd Tech Trail Tenderizer. The Tenderizer comes in four and six foot widths. Two rows of 2-inch long vertical cutter teeth are deployed by cranking the front of the implement pan up or down. This is normally done by hand with the attached trailer type jack, but an electrically operated depth control device which permits adjustments on the fly from the snowmobile is available as an option.

A small Canadian supplier ADVANCE TRACK SETTING SYTEMS promotes its leveling drag (Renovating Leveller) as a renovation tool, and it also sells a Renovator for deep cutting in hard and icy snow. It is similar to the old BAECHLER PL in width (2-3ft). Again, it would probably require several passes to tear up extremely hard snow to any considerable depth, and depth adjustments are manual (although an electrical control was rumoured to be on the way as of the summer of 2004). YELLOWSTONE TRACK SYSTEMS' Ginzugroomer - already noted for its shallow scarification abilities - also works for deeper renovation. The Ginzu's vertical cutter teeth are mounted on a rotatable spring-tensioned pipe which permits the teeth to pivot out of the way when rocks, stumps or other obstacles are hit. This spring tensioning also produces a cutter action which leaves behind a relatively fine textured loose snow layer quite similar to that produced by power tilling. In very hard conditions – again- multiple passes would probably be needed to get down to depths of 5 cm or more. TIDD TECH's “G-2” which appears to be close to the Ginzu in principle should produce similar results (at the time of writing the writer had not yet had a chance to test a G-2).

Power Tilling

To many skiers and for groomers in deep snow country the whole art and science of snow grooming relies on one tool – the hydraulic tiller. In the right conditions, power tillers mounted behind modern snowcats can handle the whole series of grooming processes from initial packing to light or deep renovation. In areas where fresh snowfalls can be counted on every week, nothing more is needed. Grooming in the snow-rich Okanagan (i.e. Silver Star) is done throughout the winter by sending a big cat with tiller and tracksetters out on the trails every day. In drier parts of the BC interior, and other areas not so blessed tillers have to be used with much more caution. Repeated tilling passes in snow which is not being renewed by fresh snowfalls can do a lot of damage. Tilling is an extremely aggressive process. Snow crystals are rapidly reshaped into smaller more rounded forms, resulting in a more compact denser snow pack. If carried to extremes, tilling can actually reduce snow depth on trails. Snow particles repeatedly ground down to finer size leaving a denser and thinner snow pack. Carried on further, excessive tilling can leave “dead” snow. In this case rather than being too hard trail surfaces become sugary. Snow crystals have been altered so much that they will no longer compact. The only thing that will rejuvenate “dead snow” is an infusion of fresher snow which can come from snowfalls or snowmaking from above – or by bringing up and mixing in fresher snow from lower layers.

The most efficient tool for breaking up old hard pack and mixing with sub layers is the front renovator. A wide (2.5 – 4+ m) horizontal cutting blade front mounted on a snowcat cuts and lifts hardpack, leaving a loose chunky layer which is then refined by tilling into a smooth finish surface. The original Front Renovator introduced by the Swiss firm, BAECHLER TOP TRACK, is still being manufactured and sold under license by YELLOWSTONE TRACK SYSTEMS. A front renovator variation (an attachment to the snowcat front U-blade) is available from the German Pisten Bully maker, KASSBOHRER.

When to Groom ?

There is no single answer to the question of “When to groom?” Generally grooming should be done at times when skiers aren’t around. Aside from the obvious safety issues raised by the possibility of skiers running into grooming machinery on trails, fresh groomed snow normally needs time to set up before it is ready to take skier traffic (usually 2 hours minimum - as little as 1 hour in areas with high snow humidity). This normally means grooming at night or very early in the morning.

There are also other considerations such as current weather and temperature conditions, and the general condition of the snow pack. As noted previously in the section on packing, grooming is most effective in a relatively narrow temperature range just below the freezing point (0 to -10 C.). Cold dry snow doesn’t pack well, so grooming in extreme cold won’t be completely productive, but it also won’t do any real damage if it must be done. Warm, wet snow is another matter. Whenever possible the best course of action in extremely sloppy conditions is to leave it alone.

This is especially true if cold weather is predicted for the immediate future. The extra compaction produced by grooming melting snow can turn trails into armour plate if temperatures drop suddenly. Still, there will be times when grooming in the slop has to be done, and in some areas (coastal zones, for example) where warm and wet are the norm, there will be no choice. Even in warm periods there may be times when temperatures and surface moisture levels drop enough for productive grooming (usually late night or very early morning). Snowmobile groomers with their limited horsepower will often have to time their work for a small window when snow has cooled and dried enough, but not yet frozen solid.

For ski races grooming should usually be done in the evening before the event, allowing maximum time for set up.

Obviously, final grooming and tracksetting may have to be delayed until early morning with completion planned for just before the race if heavy snowfall is predicted

Manual Grooming

Although machines do most of the work there will often be a need for some manual labour in competition and recreational grooming. In thin snow conditions shovellers may have to fatten up thin spots, especially in high wear areas such as tight downhill corners. Cat growser marks and other rough spots left by machines should be raked smooth. During competitions manual groomers with rakes and shovels should be stationed at high speed corners and downhills where hazards (rocks, bare patches, icing) can be expected to turn up under racer traffic. Extra lookouts may be needed on blind corners.

There is an ongoing debate among race groomers about the ruts which form in downhill corners during races. Some argue that ruts should be regularly flattened out before they can become hazards to less competent skiers. Others maintain that they should be left alone (unless obvious hazards such as rocks turn up), since they can actually be useful to high-level skiers. There is no absolute answer to this debate, but the general trend in high-level races (FIS sanctioned events) is to leave ruts alone unless hazards appear.

Tracksetting

Setting tracks is normally the final step in the whole process of trail grooming. However, with modern equipment it is often done as part of a single grooming pass. Although skating and the recent shift toward mass starts for most events on the international calendar have reduced somewhat the significance of track setting in competition skiing it is still an important element for many competitions and an essential element for the recreational sport of cross country skiing.

TRACK SPECIFICATIONS

The FIS and Cross Country Canada rules specify standards for track depth, width, and separation for competition track setting. FIS Rule 315.3.2 (ICR 2004) reads as follows:

“The ski tracks must be prepared so that ski control and gliding are possible without a lateral braking effect by any parts of the bindings. The two tracks should be set 17-30 cm. apart, measured from the middle of each track. The depth of the track should be 2-5 cm, even in hard or frozen snow.”

Most tracksetters being marketed today have track moulds which will set tracks within the FIS specification range. On some, distances between track moulds are adjustable. There used to be different specifications for distances between tracks for men’s and women’s races or for children’s races, but these spec’s are usually ignored now, and most setting is done by equipment with mould blocks positioned at the factory settings.

Track depths are determined by the thickness of the track moulds. The BAECHLER tracksetters (snowmobile and cat versions) in common use around the country use moulds at the deep end of the FIS specifications (5 cm or 2 in.). YELLOWSTONE TRACK SYSTEMS moulds are usually at the shallow extreme (deeper moulds are available from YTS).

In practice skiers seem to notice little difference between shallow or deep tracks, as long as they are well formed. For competition or recreational trails, any of the tracksetters currently being marketed will produce acceptable tracks in the right conditions.

Tracksetting Equipment

There have been some changes in the market over the past decade, especially in the snowmobile equipment lines, but there are still less than a dozen suppliers and the basic types of setter haven’t changed very much. There are only two suppliers of snowcat tracksetters, YELLOWSTONE and BAECHLER. The pan type tracksetter introduced into North America by BAECHLER in the 1970’s is still the most common snowmobile setter. BAECHLER is no longer marketing its snowmobile setters in Canada (its snowcat versions often come with KASSBOHRER cats), but YELLOWSTONE TRACK SYSTEMS, TIDD TECH, ADVANCE TRACKSETTING, and others manufacture and sell pan type snowmobile track setters. There used to be several sled-type setters around, but the only one now on sale in Canada is the JACA built in Sweden, but sold by a Canadian distributor, (FIRST TRACKS).

All of the current commercial tracksetters use plastic mould blocks to shape and compress snow into tracks. Most of the moulds produce tracks with smooth sloped sidewalls wider at the top to allow for boot/binding clearance. A few tracksetters such as the JACA use a stepped profile mould to provide boot/binding clearance and extra sidewall compression. Most of the modern setters also use

metal precutters to slice up and –in some cases- to direct snow towards the outer sidewalls before final shaping by the mould blocks.

Additional Considerations for Snowmobile Tracksetters.

Down Pressure - Weight

The amount of pressure required to mould acceptable tracks will vary with snow conditions. Very little pressure will be needed to shape perfect tracks into soft snow, but as snow hardens more will be needed. Snowcat tracksetters use hydraulic down pressure, but most snowmobile tracksetters have to rely on auxiliary weights to increase pressure.

Since snowmobile groomers have to manhandle their equipment, tracksetters should not be too heavy to haul around.

Removable weights can add the extra down pressure needed for tracksetting in harder snow conditions. These can be in the form of steel plates (YTS), concrete blocks (JACA), lead (older BAECHLER), and in dire extremes homo sapiens (much of the track set for the 1988 Olympic races was done with an assistant sitting on the tracksetter - primitive, but effective).

Track Removal

All race courses and many recreational trails have sections which should not be trackset (sharp downhill curves, for example). Tracksetters which can lift or scrub out tracks eliminate the tedium of having to get off and manually rake out tracks. There are two ways to leave untracked sections while tracksetting. One is to lift the moulding blocks off the snow. The other is to rake out tracks after they have been set.

Snowrakes-Scrubbing Track after Setting

The older BAECHLER track pans could be fitted with a manually operated flip-down snowrake. JACA 's latest model tracksetter (since year 2000) also uses a rear rake device to wipe out tracks, but it is electrically controlled . The operator can scrub out or begin resetting tracks on the move.

While track rakes are relatively simple and relatively fast-acting, the process of scrubbing out track after setting does have some drawbacks. There is always a danger of stirring up dirt in thin snow sections. And, in some cases, while tracks may appear to have been wiped out the compacted tracks may simply have been filled in with loose snow which will sometimes melt out or evaporate (sublimate) after a few days reopen, allowing the tracks to reappear.

Tracksetter Lifting Devices

A number of devices for raising track moulds out of the snow have been available for some time (i.e. the YELLOWSTONE Lever lift , and BAECHLER Compactor pan – both of which tilted the pan to elevate track moulds). TIDD TECH's Trail Tenderizer uses a light weight track pan mounted on hinges at the rear, with a simple cable and lever to pivot the setter up out of the snow. All of these are manual systems requiring the operator to stop and get off the snowmobile. The track pans available with the newer Ginzugroomer and G-2 groomers allow operators to set or remove tracks on the move. Electric rams raise or lower the pans with the flip of a switch on the snowmobile. Being able to take out and reset tracks on the move is particularly helpful when setting competition courses where having to stop to lower the track moulds at the bottom of a steep downhill corner often brings the danger of getting stuck on the following tough uphill.

When to Trackset

As noted above in the grooming section, tracks should be allowed time to set up and harden before skiers use them.

This normally means grooming at night or early in the morning. If separate grooming passes are required before tracking the setting should be done shortly after grooming before the groomed snow has hardened. This timing will vary with conditions, but it will usually be within two hours (less in conditions of high humidity).

To provide maximum set up time, competition tracks should be set in the evening before the race. Extremely warm wet conditions may force a delay in tracksetting if there is a chance that a temperature drop in the very early morning hours could freeze tracks into dangerously icy ruts. In such cases grooming and tracksetting may have to be delayed until temperatures have fallen to near the freezing point. A forecast for snow the night before a race may also suggest a delay in tracksetting until just before event start time. If tracks set earlier in the evening have been covered by 5 cm or more new snow resetting may be necessary. If tracks have been hit with less than 5 cm of fresh snow and the race start is near it is usually best to have forerunners or volunteers ski in the tracks rather than attempting a fresh trackset

General Points on Snowmobile Tracksetting

- _ because most tracksetting is done at night the snowmobile should have a rear work light.
- _ tracksetting speeds should be moderate (10-12 km/hr)
- _ on straight sections the driver can keep tracks flowing straight by aiming for a fixed point down the trail.
- _ when setting competition tracks it is useful to have a helper "riding shotgun" to keep an eye on tracks behind

while the driver concentrates on the track line ahead. If raking with one of the older pan setters with manual rake or lifter the helper can handle these chores.

_ if working alone, a kneeling position on the snowmobile is usually best (one knee on the seat, one on the deck). This allows the operator to shift weight as needed and to do quick shoulder checks backwards.

_ competition tracksetters should carry a hand rake to erase footprints and machine marks.

_ normally, old tracks should be removed before new tracks are set. It is possible to set over old tracks if tracksetting is done with a renovator. The old BAECHLER Pull Renovator or the TIDD TECH Trail Tenderizer with cutter teeth lowered would work. The newer electrically controlled units such as the JACA tracksetter with built in renovator or the tracksetter equipped Ginzugroomer make the job much easier.

_ consider using shallow mould blocks for setting track in low snow conditions.

Competition Tracksetting – Classic Technique

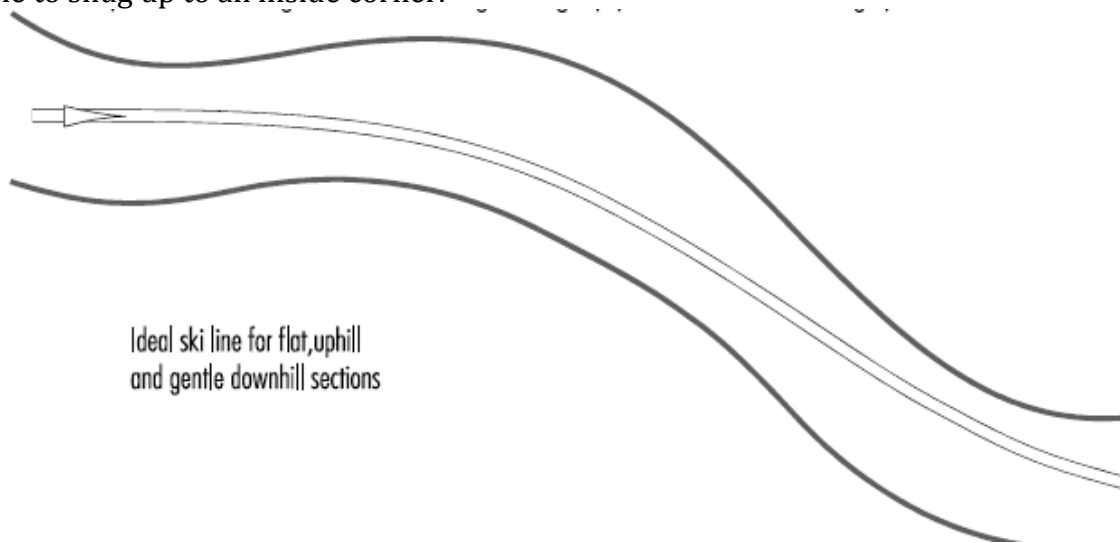
Competition tracksetting has been evolving along with race formats over the past two decades. In the late '70's and early '80's as trails widened and more sophisticated equipment was brought into trail grooming there was a general practice to double track race courses. The arrival of skating in the mid-'80's changed this. The FIS introduced a number of rules and practices in an effort to keep classical skiing alive in international competition. One of these was to specify that classical race courses be set with single tracks in the "ideal skiing line". This meant that groomers could no longer set race tracks with big cats. In what seemed a technological step backwards, they had to go back to using snowmobiles., because only small machines could follow the "ideal ski line" (often called "best line") as it flowed from side to side along the winding course. In the past five years things have changed again. Confronted with falling TV viewer ratings for traditional ski races in Europe, the FIS has changed most races on the international calendar from interval to mass start events in an attempt to increase spectator (and TV advertiser) appeal.

At the most recent Olympics and World Championships there was only a single interval start race for men and one for women. At the same time courses have become shorter and much wider (4 -9 m or more throughout). The general practice now for mass start classical competitions is to double or even triple track courses throughout, leaving steep downhills and corners untracked. Tracksetting can now be done again by big cats with double, triple, or even quadruple tracksetters mounted on rear tillers.

The Ideal Ski Line

The concept of the "ideal ski line" hasn't completely died. There are still interval start classical races. FIS Rule 315.3.1 (ICR 2004) reads: For interval competitions in

classical technique a single track should be set along the ideal skiing line of the competition course. The track is normally set in the middle of the course except through curves. In curves there should only be set track where skis can glide unrestrained in the set track. Where the curves are too sharp and the speed is considered to be too high to stay in the track, the track should be removed. To decide the proper course preparation and track setting, the best competitors and highest possible speed must be taken into consideration. In curves the track is to be set close to the fence to avoid the possibility to ski between the track and the fence. (The FIS recommends setting "close to the fence" as a deterrent to skating) The "ideal ski line" is partly an attempt to discourage skating in classical races, but it also makes sense in a practical way. Perhaps the best way to describe it is to say that it is the line a skier in a hurry would take on a winding course. It is the shortest most direct line. When setting track through a flat "S" section, tracks should flow in as straight a line as possible, cutting corners like a Grand Prix race car driver. The FIS rule specifies that the track be set "close to the fence" to discourage racers from skiing outside the tracks to shorten the distance around the course (when competitors ski outside the course on a curve, it is common to see them take a few skating strides, which is illegal). However, it must not be so close to a corner that the skiers could snag any trailside obstacles. V boards along the inside of such a curve can also be used to prevent the cutting of corners if track grooming equipment is not able to snug up to an inside corner.



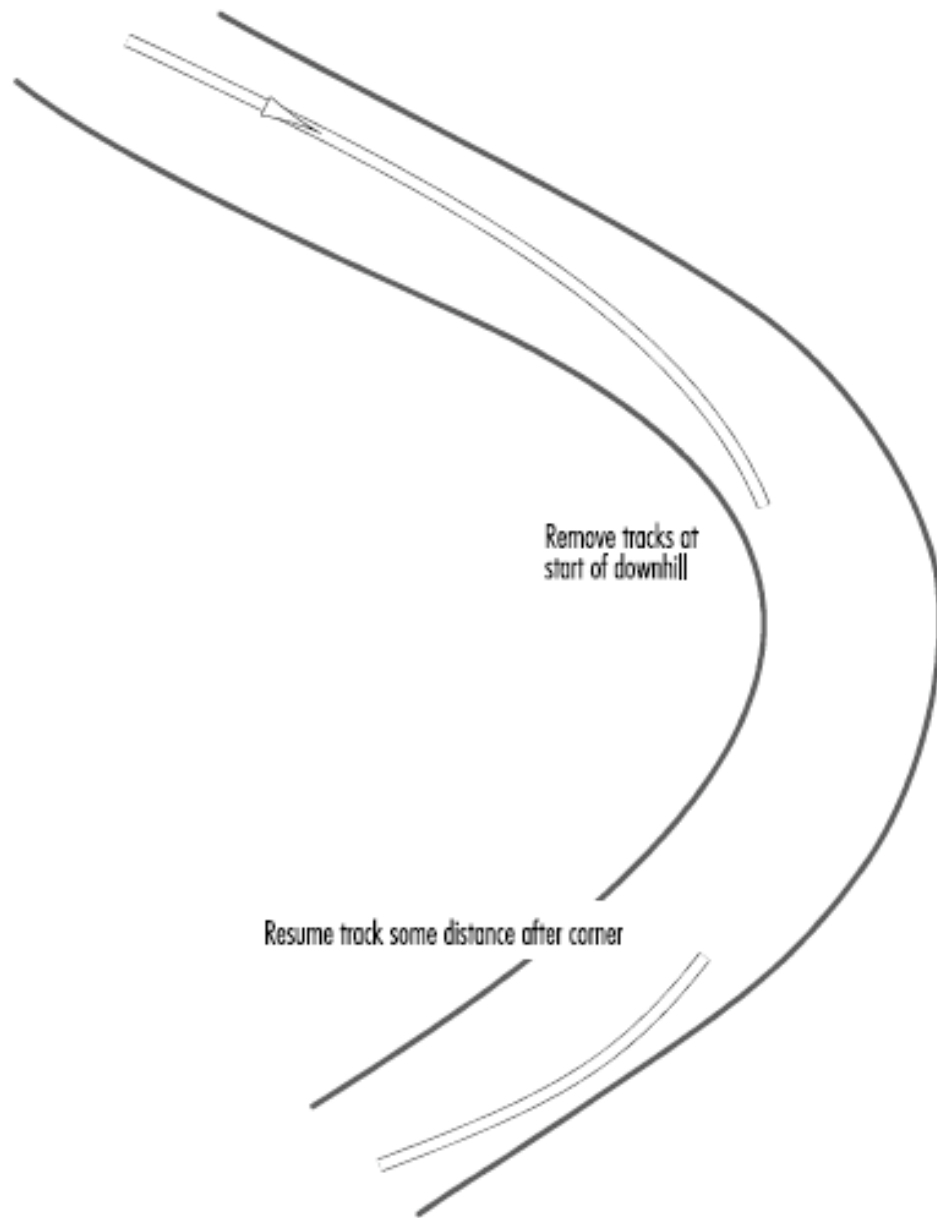
Uphills in interval start classical races should be set in the ski line unless they are steep enough to require herringboning. In that case they are best left untracked.

Downhill corners present the biggest challenges of judgment for tracksetting. Sharp downhill corners should not be tracked. Experience is required to determine just where to take tracks out and when to resume them coming out of tight corners. As a general rule track is set following the best line to the upper inside of the corner. Tracks are removed around the corner, and they should not be started again until some distance after the corner. This is to allow skiers to see the tracks

and to get themselves set up to step back into them. In fast conditions the untracked zone may have to be lengthened to give skiers more room to see the tracks and prepare for reentry.

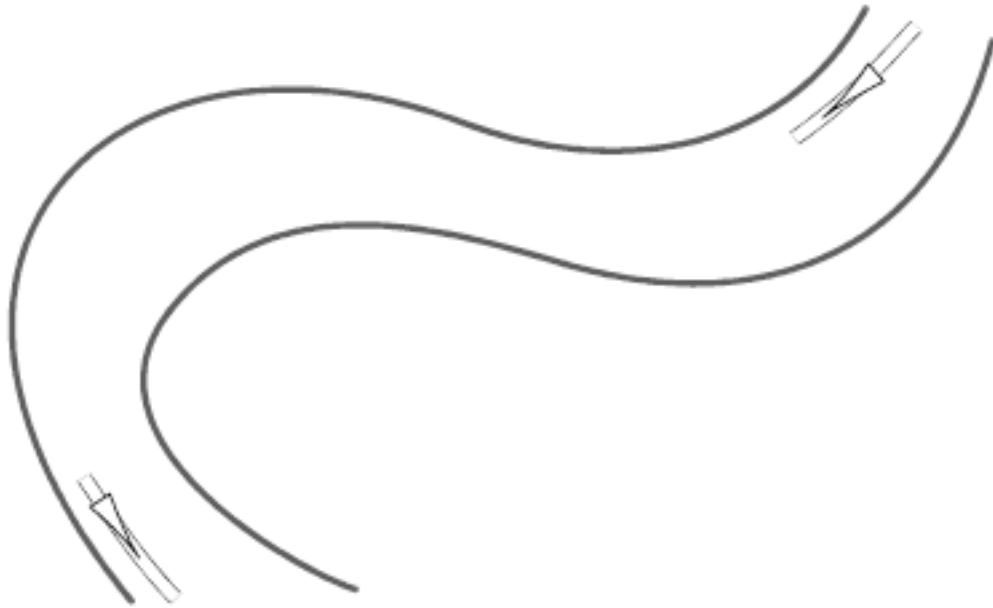
Trackable Downhill Turns

Downhill corners which are moderate enough for skiing in tracks should be set in the ideal ski line. This used to be the norm for both classical and free technique races, but now it tends to be done for interval start classical races only since so many come together in a mass start format. The general rule for setting downhill curves is to go into the corners tight (toward the inside), but to come out wide. (Some of these considerations must be applied in the actual design of the course.) Skiers at race speeds cannot stay in tracks which are set too tightly around curves. This is another one of the areas in which judgment based on the tracksetter's experience and skiing ability is vital. In fast conditions, track lines through curves will have to be straightened, meaning that they will come out of the corners more towards the outside edge of the course.



Trackable Downhill Turns

Trackable Downhill Short straight sections (30 m. or less) between untrackable corners are best left untracked.



Untrackable Downhill

SO YOU GOT STUCK, DID YOU?

Or - Who moved that trail marker, anyway?

By David Zink, Tidd Tech, Ltd.

Can you have too much of a good thing? We all hope for snow, but this year the northern mountains in Colorado have been blessed with the best conditions we have seen for 15 years. Recently, I was day dreaming while grooming out the trail edges, and I ended up pulling the classic “fell off the trail move”. I happened to have a camera, so I thought I would record my foolishness and possibly turn it into a “teaching opportunity”...

This little problem occurred at a point where the trail crosses a draw perpendicular to the prevailing winds, and therefore, drifts in constantly. What we end up with is a packed trail surface that is perfectly flush with the unpacked snow on either side of the trail. On January 20th, the packed trail surface was exactly 48” above the ground in this spot, and the snow on either side of the trail is our typical dry powder – basically if you step off, your boots go right to the ground. And,



that is exactly what happened when I staggered off the seat on the low side...

Step 1. Unhitch. We are using the new G2 gooseneck hitch, which makes unhitching pretty easy. Just release the receiver catch, unpin the adjusting post, and lift the post up off of the ball. This is much simpler than dealing with the conventional loop and pintle, which at this point would likely be jammed tight.

Step 2. Swing the hitch end of the G2 back onto firm trail. Again, the gooseneck offers an advantage: about 4' of lever arm makes it easy to pull the front end over. Because I did not fool around trying to move without unhitching, (and because the G2 floats so well) the G2 itself was not buried at all and easily pivoted over into a safe position for re-hitching.



Step 3. Shovel. You did bring a shovel didn't you? Actually, I had left it behind because it was going to detract from the pictures I was planning to take later. Fortunately, a handy shovel was found in the barn 100 yards up the trail. I shoveled enough from under the snowmobile so that it rolled back onto the track, and removed enough snow from the front and low side of the machine to give it room to "get going" when we were ready.

Step 4. The fun part. Ok, I admit it, after hours and hours of 8 mph, it is a treat to "have" to go 30 mph just to get the machine to plane on the powder and steer a wide circle back to the trail.



Step 5. Back up and re-hitch.



Step 6. Replace your divot AND put that trail marker back in the right place.