



Figure 1. Artificial snow being made at an approach to an ice bridge crossing.

# Making Artificial Snow: Equipment and Limitations

**WHEN BUILDING WINTER ROADS AND SNOW-FILL CROSSINGS, YOU NEED A** large supply of clean snow. This can be challenging during winters when natural snow is not produced in sufficient quantities. To deal with this problem, some operations are making artificial snow (Figure 1).

## Equipment

There are two main types of snow making machines, both of which work in freezing temperatures.

A traditional snow gun combines cooled water and compressed air. The compressed air forces the water stream into smaller droplets while ejecting the water into the air, often with the aid of a large fan. The water droplets cool and freeze as they travel through the air and produce snow as they descend to the ground.

An airless snow gun forces water through a simple nozzle to create a fine mist. The mist is typically aimed into the air. However, in some cases the water is forced through a long pole to gain height to allow the flakes to form during their descent. (Figure 2).

## Limitations

A few limitations to consider when making artificial snow are the amount of water required, the air temperature and the productivities of the equipment.

A tremendous amount of water is needed to make artificial snow—552 liters of water is needed to produce one cubic meter of un-compacted snow. So you need to assess if there is a suitable local water source at the construction location. If water is not available, one option is to locate a



Figure 2. Airless system used for making snow.



Figure 3. A stock pile of artificial snow conveniently built at roadside.

All photos courtesy of FPInnovations

central landing at a known water source where a stockpile of snow could be produced (Figure 3). The snow produced at the landing will then be loaded and trucked to the construction site(s). Another option is to utilize water trucks which typically contain 20,000 litres. A small crossing requiring approximately 220 m<sup>3</sup> of un-compacted snow (expect a 70–80% compaction ratio) would require six full water trucks to make enough snow.

For successful snow making, temperatures need to be between -10 and -20° C. The relationship between temperature and relative humidity also plays a role with respect to the quality of snow made. If the temperature is not cold enough, or if the relative humidity is too high, the snow produced becomes slushy and this is not the desired consistency for building winter roads and snow-fill crossings.

Trucking snow can be costly considering the low volume to haul ratio. Snow is approximately 400 kg/m<sup>3</sup> whereas typical soil is approximately 1500 kg/m<sup>3</sup>. If a local source with a short haul can be used then it may be economical. Considering the low volume-to-haul ratio, the use of an insulating material, such as straw, which was used during the Vancouver Winter Olympics, can be used to help preserve the snow

for a longer period of time.

You also need to consider the amount of snow needed to complete your construction project as each system has different capacities. The compressed air system typically produces 40 to 80 m<sup>3</sup>/hour while the airless system produces significantly less at eight to 30 m<sup>3</sup>/hour.

Mother Nature may not always cooperate when it comes to bringing us winter when we are ready for it. There is more than one way to make snow, but for certain it requires lots of water. Making artificial snow is one way to get our forest roads and snow-fill crossings in place in time for winter operations. If snow has to be hauled a great distance, it becomes a valuable commodity. Hauling snow approximately 200 km for the Vancouver Winter Olympics turned it into gold. 🏆

*Clayton Gillies, RPF, RPBio, is a senior researcher with FPInnovations – Forest Operations Division. He has 15 years research experience in various aspects of forestry including partial cutting for visual quality objectives, interior hoe-chucking, and evaluation of embedded culverts, erosion and sediment control for resource roads and stream crossings. Most recently, his research has been in wetland crossings in the boreal forest.*