

THE USE OF ARTICULATED WHEEL LOADERS IN SNOW REMOVAL

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The fact that articulated wheel loaders are very efficient snow-removal machines and in many instances are better at clearing snow than trucks or graders will not surprise the many government officials who, as an emergency measure, have outfitted loaders with plows to clear unexpected snow from rural and urban areas. For example, a 4-wheel-drive, heavy-duty truck with plow must slow to approximately 10 mph in moderate and heavy snowfalls, whereas a wheel loader and plow can clear the road under the same conditions at 15 mph. The articulated wheel loader is also able to clear heavily drifted roads by lifting the plow and digging its way through the drift. The center-point steering of the articulated wheel loader makes it a very maneuverable machine that is almost impossible to get stuck because the rear wheels track in the path of the front wheels. Wheel loaders can be outfitted with highly specialized plows, buckets, and snow blowers to suit almost any job condition.

•SNOW removal and ice control represent a very sizable portion of government expenditures in the United States. Approximately \$500 million is spent annually, of which \$170 million is spent on equipment, \$30 million on salt and chemicals, and \$300 million on labor and operating costs. In spite of these major expenditures, government agencies responsible for snow removal have very little to show in the spring for the dollars spent during the winter months. Because no real capital improvements such as better roads or schools result from snow-removal expenditures, it is difficult to hold the public's attention and to justify adequate funding for personnel and equipment after the snow season is over. Snow removal, like refuse disposal, is a problem that everyone would like to forget, but when emergencies occur the public demands prompt and complete service. Often, because of inadequate budgets and lack of understanding on the part of the public, when emergencies do occur road maintenance personnel are forced to press non-snow equipment into service. The use of farm tractors or refuse collection vehicles with plows is a typical example. This, of course, is not the most efficient way to plow snow, but it can be a prudent compromise between the most efficient method of snow removal and getting the job done.

In many cases, government agencies have decided to purchase specialized snow-removal equipment; however, this often results in tying up excessive amounts of money in equipment that is used only a relatively few hours each year. This equipment does an acceptable job of snow removal, but it normally sits on a lot three-quarters of the year because of its limited and specialized abilities. Some of the large 4-wheel-drive trucks used for snow removal can have an owning and operating cost in excess of \$30 per hour. Even though these specialized trucks could be used for road maintenance or sand and gravel hauling in the spring, summer, and fall, they normally are mothballed because of high operating and depreciation costs.

The individual charged with the responsibility of snow removal for a government agency, therefore, is faced with a dilemma. He can purchase specialized snow-removal equipment that is used only during winter storms or, on the other hand, he may choose

more versatile equipment that can be used throughout the year. The purpose of this paper is to suggest that standard wheel loaders equipped with snow-removal attachments are a logical solution to this problem.

Before discussing the relative advantages of the alternatives, a brief summary should be made of what basic snow-removal equipment and attachments are available to a government agency. Because of their high-speed capability, motor graders and 4-wheel-drive, heavy-duty trucks traditionally are the most widely used pieces of snow-removal equipment. More recently, articulated wheel-type front-end loaders are being used widely. These three pieces of equipment are generally equipped with the following basic attachments:

Trucks

1. Vee plow
 2. One-way plow
 3. Blower
- } with or without wing

Motor graders

1. Vee plow
 2. One-way plow
- } with or without wing

Wheel loaders

1. Vee plow
 2. One-way plow
 3. Blower
 4. Standard bucket
 5. Side dump buckets
- } with or without wing

The majority of the thousands of snowplows being used in the United States and Canada are mounted on trucks. This is not difficult to understand because snow removal is considered essentially an emergency measure requiring fast action by highway departments. At present, only trucks offer high-speed (above 30 mph) capabilities. However, truck plowing is not all done at high speeds. Snowstorms accompanied by high winds frequently deposit the snow at such a rate that trucks are unable to keep the highways clear. As an accumulation of snow builds up, the trucks must slow down. At this point other types of equipment are often more suited to job conditions. Also, the high-speed capabilities of trucks can seldom be used to open up secondary roads or highways that have drifted shut during a storm. In situations of this kind, trucks are forced to ram their way into the drift until they lose their forward momentum. By repeating this action they are able to open up some drifted sections of road. However, if the drifts are deeper than the height of the snowplow, the trucks are rendered useless because the snow falling over and behind the plow makes it impossible for the truck to back up in preparation for another forward pass. Motor graders can have the same problem with drifted snow. Like trucks, they rely on the ramming effect of their forward motion to clear deeply drifted roads. Trucks used in this way often incur damage to the power train from the shock loads caused by the drifts.

The all-wheel-drive articulated wheel loader is a machine particularly suited to work of this type. In drifts too deep for the truck, the loader can raise its plow and clear the way. In making the opening pass through a deep drift a wheel loader equipped with a plow can move straight ahead with the plow raised. The operator is able to keep the plow in the upper portion of the drift by raising the lift arms and permitting the blade to throw the snow aside (Fig. 1). After knocking off the top part of the drift the loader can return and with one or more passes complete clearing the drift. Loaders working in this way can plow drifts as high as 15 to 16 ft as they actually shovel the drifts aside. Once a road has been opened, an articulated loader with a vee plow is very effective in widening because the machine has center-point steering. If banks are high they may be pushed back with the vee plow. A loader working at a 45-deg angle to the curb line can easily handle banks 6 ft or higher, pushing them back about 6 to 8 ft on each swing. With lower banks a wing can be used effectively with the vee plow (Fig. 2). Slightly crab-



Figure 1. Articulated wheel loader equipped with a reversible one-way plow.



Figure 2. Articulated wheel loader equipped with vee plow and wing.

walking the wheel loader by articulating the machine enables the operator to easily overcome any side drifting that might result from the winging operation.

One-way plows on articulated wheel loaders are also very effective road-widening tools, particularly after a road has been opened with a vee plow. An all-wheel-drive loader should maintain a 15-mph road speed to obtain proper rolling action of material across the moldboard and to cast the snow to the side. In clearing large areas such as parking lots, a wing can also be successfully used with a one-way plow. By placing the wing at ground level, a very wide swath can be cleared.

Snow blowers are high-production tools and can be used very effectively with wheel loaders. In this way the loader, which might otherwise be idle during the snow season, becomes a very valuable snow-removal tool; during the summer months only the blower, and not the prime mover, is idle. Blowers mounted on the lift arms of wheel loaders can load trucks (Fig. 3). For example, a 200-hp blower can load a 10-ton truck in about 30 sec. Blowers with 300 hp or more can be used to throw snow up to 200 ft to widen drifted highways or clear airport runways.

A right- or left-side dumping bucket can be a very high-production snow-removal tool. When locked into the 30-deg angle position, this type of a bucket is also an effective one-way plow. A side dump bucket coupled with the articulated steering of a wheel loader makes it possible to follow the curb line on a curve. This type of snow clearing is extremely difficult with trucks or motor graders. This side dump bucket can also be used to widen roads and push back banks. In addition, the operator can use it for loading salt, sand, or snow into hauling units. The side dump feature of this type of a bucket makes it an especially valuable tool in congested areas where minimum interference with traffic is essential (Fig. 4).



Figure 3. Snow blower mounted on the lift arms of an articulated wheel loader.



Figure 4. Wheel loader with side dump bucket, loading trucks.

An invaluable feature of wheel loaders is that most steer by pivoting about a center point. This gives a longer wheelbase and a shorter turning radius, which allows a loader to circle in less than twice its length. In this way a loader can negotiate narrow mountain roads and dead-end streets and work close to curbs in cramped quarters.

Loaders also are often able to operate at higher speeds than trucks in heavy or deep snow. Given a light snow, a truck can plow roads at a speed of 30 mph. Wheel loaders can almost match that by plowing light snow at 20 to 25 mph. More importantly, a wheel loader can clear heavy snow at a faster rate than trucks. In snow that slows trucks to 10 mph, a wheel loader can often operate at 15 mph or better. This superiority is the result of 4-wheel drive, power shifting, and low weight-to-horsepower ratio.

It is very difficult to get wheel loaders stuck because of their 4-wheel drive. Also, if the loader is center-articulated, the rear wheels will track the front wheels and ride only over compacted material. Articulation also allows the machine to duck-walk out of sticky situations. In addition, snow packed behind the blade can be released by raising the blade.

The following are some operational points to be considered in equipping wheel loaders:

1. A full match torque converter will increase the machine's performance in snow-plowing;
2. Oversized tires and ballast will result in greater tractive effort and greater machine stability at high speeds;
3. Double chains with traction-type tires are of great value in icy conditions; and
4. If blowers are used, they should be carefully matched to the size of the loader.

In summary, careful selection of the basic machine and the correct attachments will give a government agency the best snow-removal tool. The wheel loaders discussed in this paper will not replace all other types of snow-removal equipment. For example, the truck-mounted plow is still generally the logical choice for high-speed plowing on expressways and major highways. For very heavy drifts, trucks equipped with large blowers may be a logical choice, but the possibility of using blowers on large wheel loaders should be considered. Motor graders also have their place in rural areas and for ice control. The articulated wheel loader equipped with vee plow, one-way plow, or side dump bucket is outstanding for opening and widening county and secondary roads, winging, and high-production snow-loading.

Anyone considering expanding or replacing his snow-removal fleet should keep in mind the versatility of the wheel loader—not only for snow clearing but also for year-round utility. Every agency involved in road maintenance can benefit from the year-round production capabilities of the wheel loader.

In any case, and whatever the final selection of equipment may be, it is essential that the job conditions and requirements be thoroughly analyzed and that machinery be properly matched to the job requirements.