Innovation of Equipment for Snow and Ice Control in the State of Indiana

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INTRODUCTION

Winter, with all of its snow and ice, has provided the Indiana State Highway Commission with the monumental task of keeping state highways passable under snow and ice conditions. The task has involved many kinds and types of equipment through-out the past forty years to improve service through equipment innovation.

The vehicles utilized to carry salt/sand and plow snow were much smaller in size and capacity years ago, with far less horsepower derived from the six cylinder engines of the day. (Figure 1). A comparison to vehicles in use today (Figure 2) can leave no doubt of the tremendous improvement in equipment and work load of today's vehicles.

The application of salt/sand by means of a spreader is an interesting one. Figure 3 shows the use of a barrel that had to be filled by hand shoveling, which allowed material to fall through a tube onto the road surface. This method was very slow and required personnel to be out in the elements during spreading operations.

Figure 4 shows a great new improvement in spreading material. One man was needed to keep the hopper full by means of a shovel, while one turned the crank that propelled the spinner plate allowing material
to be spread behind the vehicle. This now required two men to be out in the elements, but many more miles of road could be covered in less time.

Today’s equipment (Figure 5) utilizes a complete, hydraulically operated spreader unit placed in the bed of a dump truck. The unit holds six to eight cubic yards depending on the length of unit used. The hand shoveling and crank turning has been replaced with a hydraulic operated conveyor chain and spinner plate. In the course of one and half hours twenty miles of two-lane highway can be treated, totaling forty lane miles, with one driver inside the vehicle, equipped with a hot water heater delivering approximately 130° of hot air into cab, quite a contrast to the “good old days.”

ELECTRIC REMOTE CONTROL OF HYDRAULICS

One might agree the plateau of equipment perfection had been achieved after all these years. Well as the saying goes “Time waits for no one.” Thus, under the direction of our Equipment Committee, the Indiana State Highway Commission chose the area of hydraulic application to take the next step forward to combat the elements with the application of remote controlling for their snow fleet.
The use of hydraulic oil at scalding temperatures has been totally removed from the cab of the vehicle providing a safer and much cooler in cab condition during summer operations. This has been accomplished by replacing the standard type of hand operated hydraulic controls with an electric remote control console (Figure 6). The remote control console, as it is designed today, can provide twelve functions. Seven functions are hydraulic and provide the following: Power take-off; spreader on/off; spinner and conveyor control with twelve separate speeds for each control; the snowplow up/down; snowplow angle left/right; and dump bed up/down operations. The engagement of the power take-off may be accomplished on the move. There is no need to pull a vehicle out of the line of traffic and stop it to engage the power take-offs as with old gear driven models. This is done by means of a hydraulic clutch, therefore an electro-magnetic clutch has been eliminated as well as the use of belts. This arrangement allows the pump to be mounted directly to a Chelsea 27 DD “Hot-Shift” P.T.O., which is mounted directly to the right side of the Allison MT-653 automatic transmission without shafts and/or U-Joints and a great deal less hydraulic hose.

The use of the on/off switch for the spreader allows an operator to spot spread, without operating valves and/or levers, by simply flipping the spreader switch on and off. With the utilization of a twelve position conveyor switch, locations such as bridge decks and overpasses with ex-
cessive ice build-ups can have twice the ice melting material at the twist of a single switch. After covering an area with a higher amount of material, the operator may return to his established rate by turning the switch to its original position. The time lapse from introducing a change into the remote control console to a physical change in spreader function is about three to four seconds. Both spinner and conveyor have the twelve speed switching for a more accurate control of materials.

Momentary of deadman switches are employed to raise or lower the snowplow and to angle the plow left or right as needed, with the vehicle either standing still or plowing snow. The response to plow controls is about one second and can be accomplished without the operator taking his eyes from the road. The use of a deadman type momentary switch is also used for the dump body operation with the response being about one second. All hydraulic controls have their own pilot light built into or along side the switch depending on its function.

All hydraulic controls are protected by means of a master switch which must be placed into the on position before any hydraulic function can take place. The remainder of twelve functions provide self-illuminating switches for the following auxiliary lighting: cab strobe light; two rear mounted strobe lights; snowplow lights; and two rear mounted pattern lights.

The remote control console has provided a great advantage over
past installations since the unit is completely wired by the manufacturer of the console. Only one wire is provided by the truck manufacturer to supply the console its power source. This feature alone has allowed us to provide wiring diagrams of all functions to field personnel. The unit has a built-in "Short Circuit Alert" which informs the operator of an electrical short by means of a flashing light inside the switch or pilot light having the short circuit. An operator can place the "flashing" function into the off position and thus prevent burned wires and/or a fire. This feature alone will save many hours of critical downtime. The technician repairing a short can also tell that a problem is cleared when light discontinues in the flashing mode. The system is protected entirely by circuit breakers which are 30 AMP for the main line and 15 AMP for each individual circuit. A numbered circuit board is provided to allow a vendor to install his wares on the designated terminal and once this is done the remainder of the wiring is provided by the Remote Console. The Remote Control Console activates all hydraulic function inside of the hydraulic oil reservoir rather than on the outside, (Fig. 7). This, to

![Figure 7.](image-url)

the best of our knowledge, is the first time this system has been used. It provides the ideal condition since dirt, salt, moisture, and rust cannot affect the valves or their respective solenoids. The reservoir runs at a temperature of 120° which is ideal for the valves and solenoids inside of the unit. In the event a unit insider of hydraulic oil reservoir would fail,
the reservoir would be changed as a unit. The complete unit can be changed in less than two hours without special tools. Each district will have a back-up unit at their disposal which will cut many hours of shop time at the peak of activity.

**HYDRAULIC HOSE LENGTH REDUCED**

The application of the old system required a total of ninety-two feet of hydraulic hose. The application of our new system has dropped this figure to an average of only fifty-six feet of hose which reflects a 51.5% drop in hose use and lessens the possibility of leaks. A special test facility has been made to test a reservoir unit under operating conditions in the event of a failure. This unit allows viewing the actual function of components while under road-like conditions which eliminates unnecessary replacement of components and minimizes the time necessary to repair a unit. Through the guidelines of the Equipment Committee new standardization in lighting, snowplows with pneumatic tires and quick-hitches have also been achieved.

**NEW LIGHTING STANDARDS**

The new lighting standards have provided a new cab mounted Strobe Light which incorporates a Foto Cell to allow a change from one-million candle power to two-million candle power depending on available outside light conditions. The rear of each dump body or chassis mounted spreader now provides two thousand candle power strobe lights, stop lights, tail lights, and two amber pattern lights which contain 25 watt miniature seal beams placed at approximately 45° angles behind amber lenses to observe the flow of material through the vehicle's rear view mirror.

**CLOSURE**

The Indiana State Highway Commission, Division of Maintenance, is watching their new ice and snow control fleet with great optimism to provide the motoring public safe and better service.