

Some Equipment Innovations To Improve Safety of Highway Users and Maintenance Workers

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Among the many innovations developed in France in the field of road maintenance, three in particular may significantly improve users' and maintenance workers' safety: (a) the cone dispenser, which automatically and rapidly sets up and removes one or two rows of warning cones; (b) the mobile lane separator, which can place road marker blocks that are similar to the New Jersey type of barrier at either 12 or 30 km/hr; and (c) the G810 road surface marking lorry for road surface line painting using several new techniques that improve productivity as well as personnel and traffic safety. These machines and their advantages are discussed.

Three kinds of equipment for road maintenance are discussed in this paper.

CONE DISPENSER

With constantly growing volume of road traffic and the increasing number of maintenance operations, safety levels must be increased. Road maintenance implies millions of warning cones that have to be put in place and removed manually. This operation can now be handled automatically, thanks to a French industrialist's invention.

Description

The cone dispenser comprises a unit with 10 vertical cylindrical magazines in which as many as 230 cones 75 cm high can be carried. This unit is mounted on a chassis.

The cone dispenser can:

- Place cones to the right or left of the unit (Figure 1),
- Collect the cones (Figure 2), and
- Collect cones from one side while it is laying them on the other.

Thus a lane can be displaced laterally from 0.5 to 3.5 m. The driver can program all of these operations himself. Working speed is 15 km/hr.

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Driver-Controlled Applications

- Cones can be placed at the required distance on either side of the vehicle.
- Cones, even overturned ones, can be collected from either side of the vehicle.
- Cones can be picked up from one side and simultaneously moved up to 3.5 m away on the other side.
- A traffic lane can be designated by setting down two lines of cones separated by a preprogrammed distance.

The standard cone dispenser only operates moving forward, but an optional version is available for working in reverse.

Recommended Vehicle

The recommended vehicle has a gross laden weight of 4.5 tonnes and a wheelbase of 3.2 m.

Conclusion

The Société d'Etudes Pétrolières (Petroleum Studies Company) presented this machinery at the Fifth International ATEC Congress in June 1986. It provides considerably improved safety for personnel doing road work and road users



FIGURE 1 Cone dispenser placing cones; their spacing is adjustable.



FIGURE 2 Experimental cone dispenser picking up cones.

because warning cones can be used more frequently and more accurately.

MOBILE LANE SEPARATOR

Traditional temporary road marking methods have not kept up with increased traffic conditions and do not ensure the safety of personnel doing road work or road users. As a result of a number of fatal accidents involving vehicles crossing road marking systems and losing control, a study was carried out to find a solution that would ensure

- Simple, efficient marking;
- Swift setting up; and
- Rapid shifting of the cones or other markers to change traffic flow directions depending on traffic density.

The Technique Spéciale de Sécurité Company (TSS) has developed a new lane separator system.

Description

The basic system consists of a series of concrete blocks that are interconnected by an articulated arm around a vertical axis. Underneath is a passageway with rollers.

Concrete Blocks

The concrete blocks are 1 m long and 80 cm high. Their base width is 60 cm, and they weigh 670 kg (1,477 lb).

Working Principle

The machine picks up the blocks on one side and puts them down on the other side. The vehicle always works protected



FIGURE 3 Mobile lane separator laying first line of blocks in place.

by its own road marking blocks. The first block is laid in place (Figure 3), and then the machine is brought in front of the first block and the required width is adjusted "crabwise." The machine goes forward, and the blocks picked up slide across the rollers under the machine (Figure 4). The blocks are then put down on the other side of the machine; setting up is thus immediate. Vehicle speed is 30 km/hr for low blocks and 12 km/hr for high ones. The machine leaves when the transposition is finished.

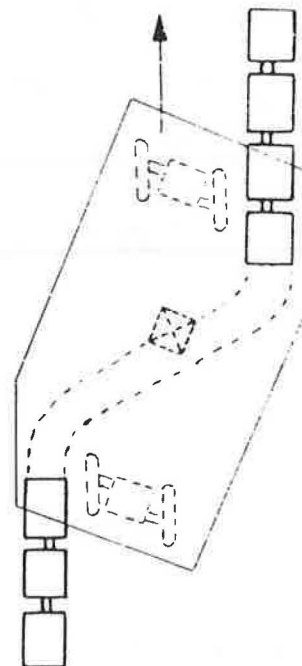


FIGURE 4 Schematic of operation of mobile lane separator.



FIGURE 5 Mobile lane separator.

Equipment

The machine (Figures 5–7) is 9 m long and 2.5 m wide and weighs 6 tonnes. It has a 200-hp diesel engine and a complete hydraulic system. Side travel capacity is 2.1 to 5 m. The machine is self-adjusting, self-driven, and totally reversible. Transposition is performed by sliding the concrete blocks along a roller system.

Application

Where at certain times of the day traffic is heavier in one direction than the other, the number of lanes available to priority traffic can be increased in a few minutes by shifting the separating elements over one lane (Figures 8 and 9). At each end a traffic guidance device, with or without remote control, allows traffic flow to be directed.

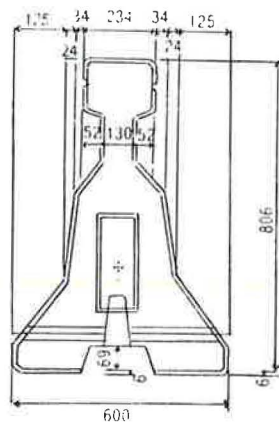


FIGURE 6 Series 800: concrete or metal; Series 500 has a similar profile except it is 50 cm high and 50 cm long.

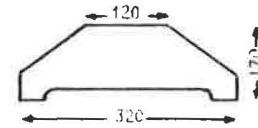


FIGURE 7 Series 200: metal.

Conclusion

This equipment is now in continuous use. Lane changing takes place with no problems in the middle of heavy traffic.

In addition to applications that have now become standard during road works, the following areas could also benefit from use of this equipment in the future:

- Irregular traffic flow spots,
- Temporary traffic increases on weekends or in holiday periods, and
- Planning and design.

ROAD SURFACE MARKING LORRY—G810

The quality of road surface markings depends to a large extent on application conditions, and even more on mastering the use of correct quantities of paint. The safety of road workers and users during line painting is less than it should be.

Studies carried out by the Laboratoire Central des Ponts et Chaussées have shown that widely differing quantities of paint are applied without the driver's realizing what is happening, and research has been undertaken to find different methods and designs, and the Gregory Company has designed the G810 road surface marking lorry.

Technology

Marking Process

The paint spraying system is of the hydraulic airless type, has been patented by Gregory, and has the following advantages:

- Dosage is constantly regulated regardless of temperature,
- There is no need for discs to determine line width, and
- Daily cleaning of the tubes is not necessary.

Traditional methods are not capable of painting two lines simultaneously with different dosages.

Definition of Systems Installed

Airless Pump The airless pump system has two high-pressure pumps the flows of which can be directed toward the

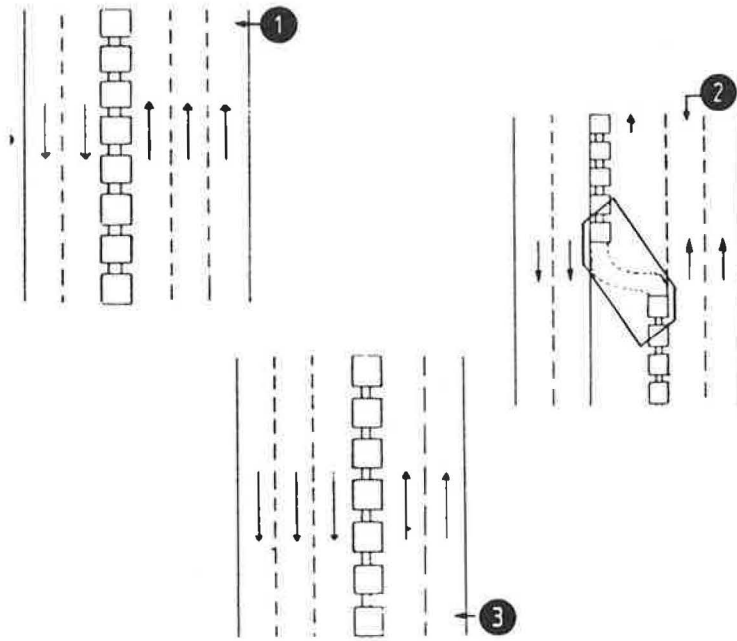


FIGURE 8 Schematic of use to separate traffic: 1, light traffic-heavy traffic during morning rush hour; 2, blocks moved during slack periods; 3, heavy traffic-light traffic during evening rush hour.

centerline of the road or along the roadside, depending on requirements. The output of one pump is 12.5 L/min; the other is a double pump that has an output of 25 L/min.

Marking Guns Marking guns of the airless type are set up for use on roadsides and centerlines. In roadside use three permanently placed paint spray guns give widths of 15 to 18 cm and 22.5 cm. There are also two beading spray guns. The spray guns can be selected from the cabin. Any other desired

width can be produced with the 22.5-cm gun. In centerline use three groups of spray guns allow double lines to be painted in one pass.

Power Unit The paint pumps are driven by hydraulic motors the flow and pressure of which are controlled by a hydraulic unit. The hydraulic pump required for the whole unit produces 105 L/min at 110 bars and operates by direct drive from the truck engine.



FIGURE 9 Paris exit of Autoroute A1, July-August 1984.

Air Compressor A 300-cm³ capacity cylindrical air compressor is driven by the truck engine and does various jobs:

- It controls vehicle braking and the attachment controls with a pressure of 12 bars and
- It controls pistol pressure (5 bars) and glass bead pulverization (2 bars).

The secondary circuit is connected to the attachment outlet.

Power Control System The equipment is entirely hydraulic. A specially designed hydraulic unit includes all of the checking, adjusting, and control systems for moving, guiding, and filling the paint trolleys.

Electronic Control System A rack is installed inside the cab to be used as a control panel to perform relay, calculation, and management operations. The electronic control system is divided into two separate parts; one controls right-hand marking and the other left-hand marking. This arrangement has two major advantages:

- Simplicity of system design and
- In the case of a breakdown, the vehicle is not entirely immobilized because one half is still usable.

When the machine is working, all operations, including speed changes, road surface signs, double lining, arrow spacing, and additional layers, are controlled from the control panel.

Each system includes an industrial-type robot and a printer. The system receives data from a radar device under the vehicle.

Spray Gun Trolleys All of the spray guns are fitted preadjusted and are manually adjustable on two paint trolleys to right and left. These trolleys slide, without play, perpendicularly to the median axis of the vehicle. Paint trolley outward movement is 1.2 m.

Camera Guidance Given the high speed of painting (up to 22 km/hr), a mechanical guide would not be sufficiently accurate and would also lead to excessive eye strain. On this vehicle two matrix cameras are fitted to each of the two trolleys. Their images are shown on screens in the cab.

Dosage Control System The control rack provides the operator a permanent visual check of dosage for each side. The automatic system has warning lights to indicate

<i>Situation</i>	<i>Indication</i>
More than maximum dosage	Red lamp
Less than minimum dosage	Orange lamp
Correct dosage	Green lamp
Breakdown	All three lamps on

By using a switch on the control panel the operator can manually correct flow. Actual dosage is shown every 15 sec and is based on the average of instantaneous dosages measured at the processor speed during the opening of the spray gun excluding its reaction time and that of the hydraulic system.

Daily Distance Data A printout can be produced at any time by pressing a single key; the printout gives, for example, the distance since last reinitialization at the start of the job or that covered during the day.

Carrying Vehicle The problem of sideways movements is solved by using a four-wheel-steering vehicle. A standard all-purpose, multifunction Brimont type ETR 206 S vehicle is used.

Conclusions

The technical performance of this system gives better productivity than that of traditional machines, and, at the same time, it gives the staff safe working conditions without interfering with traffic.

GENERAL CONCLUSIONS

In each of the three parts of this paper conclusions have been drawn about particular applications and uses. These three cases are only examples from a wide range of new ideas for meeting maintenance requirements.

In a more general sense it can be said that users' needs will require more and more innovations that, like the ones discussed here, reduce the time spent actually on the road for any given job or feature automation, or both. Such innovations will lead to increased safety for maintenance workers and motorists.