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Contributions

Normal Clear and Normal Danger Signals.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The normal clear system of operating automatic block signals originated in 1871, the date of the first installation of automatic signals. This method was used exclusively until 1891, when the first normal danger circuit was tried. This new system gradually won adherents and of late years much has been written favoring either the new or the old system. The arguments of those who have written in favor of the normal clear system may be summarized as follows:

1. A false clear indication is as liable to be given under the normal danger system as under the normal clear.
2. The normal danger system uses more line wire and contact points and so is more liable to get out of order and more expensive to install.
3. The signals on double track roads can be more easily inspected from the rear of a train under the normal clear system than under the normal danger.
4. The fact that there is a larger number of signals installed on the normal clear system shows that there are many who believe this system to be the better.
5. The normal danger system employs normal clear circuits plus additional complications.
6. The cost of operation under the normal danger system is only a trifle less than under the normal clear.

First.—A false clear indication is less liable to occur under the normal danger system than under the normal clear. The accumulation of ice and snow on the bearings upon which the blade of a semaphore signal moves has occasionally frozen so as to stop any movement of the blade. If this blade stands normally in the clear position the freezing will naturally keep it in that position. If it stands normally in the stop position the freezing will keep it there. Electro-pneumatic signals have failed in the clear position on account of the freezing of the valves which control the escape of the air. Electric motor signals have failed in the clear position from the accumulation of frost on the clutch magnets. All these failures from freezing or frost difficulties tend to hold the signal in the position in which it normally stands. Should it normally stand in the clear position these checks to movements will hold it clear, and pave the way for a tail-end collision.

Second.—That the normal danger system uses more line wire and so is more liable to get out of order and more expensive to install is partially untrue. In all recent double track installations of signals with normal danger "wire" circuit only one line wire has been used for the distant signals, the same as required for the normal clear "wire" circuit. Where distant signals are not used no line wire is required for the signal circuit. The normal danger circuits for single track protection

require less line than do the normal clear. "Wireless" circuits are quite as practicable under the normal danger system as under the normal clear. There is at present being installed on the Central Railroad of New Jersey a system of home and distant signals on the normal danger plan which requires absolutely no line wire. One and sometimes two back contacts are used in a normal danger circuit which would be unnecessary under the normal clear system. Since the amount of line wire is the same and the additional contacts are few the initial cost and complexity of the two systems are nearly equal.

Third.—That signals on double track roads can be more easily inspected from the rear of a train under the normal clear system than under the normal danger seems questionable. On the track on which the train is running the conditions are identical under both systems as the signals should be at danger behind the train. Hence what force the argument has applies to one track alone. Under the normal danger system failures at danger caused by the track circuit (and a vast majority of the signal failures are from this cause) can be readily detected by seeing the next signal in the rear held at clear with no train in the clearing section. Under the normal clear system failures at danger can be readily detected, but failures at clear cannot be seen. Under the normal danger system failures at danger cannot always be detected, but failures at clear can be easily seen. Thus this rear end inspection discovers only the minor or delay-causing failures under the normal clear system, but it is sure to find the dangerous or wreck-causing failures under the normal danger system. Should the circuits be properly inspected on the ground one system is as easily tested as the other, although this fact is not understood by those unfamiliar with normal danger circuits.

Fourth.—That there is a larger number of automatic signals installed on the normal clear plan than on the normal danger and that many people believe the former to be the better system is undoubtedly correct. But other facts should be borne in mind before drawing an inference from this statement. In a progressive science the argument that one system is better than another because it has been used more is of little value. A few years ago the same argument could have been advanced for the clock work signal over all automatic signals, yet its mechanism had to be daily wound up. Automatic block signals have been installed for over 30 years, and it is only during the last 11 years that the normal danger system has been developed. The one company supplying either system indiscriminately, has installed 69 per cent. of its signals under the normal danger system, and it would seem that a majority of those having an equal choice between the two systems had chosen the normal danger.

Fifth.—The old argument that normal danger circuits are merely normal clear plus additional complications is probably no longer used. The "wireless" normal danger circuit now being installed on the Central Railroad of New Jersey is perhaps the most striking answer to that argument.

Sixth.—The cost of operation under the normal danger system is only a trifle less than under the normal clear. The statement that it is somewhat less has probably never been questioned. If we assume that a signal is in the clear position four hours a day under the normal danger system, and this would imply very heavy traffic, and at clear 20 hours per day under the normal clear system, it is plain that there is a draft on the electrical energy to hold the signal clear five times as long under the normal clear plan as under the normal danger. Thus to bring the cost of operation of normal clear signals approximately near to signals operated on normal danger circuits it is necessary to employ extremely high resistance clutch magnets. These high-wound coils necessarily make the circuit more susceptible to lightning, chilled batteries and the permanent magnetization of the magnet cores and hence more easily deranged. It is also practicable, with the normal danger system, to use a normal open track circuit which can be operated with either potash or gravity batteries. If potash batteries be used the cells will operate without renewal from six months to a year, dependent on the amount of traffic. On normally closed track circuits where gravity batteries have been used it has been found advisable by most signal engineers to have the batteries cleaned once in two weeks and renewed once each month. The economy of this normal danger circuit is so obvious as to need no further comment.

The normal danger system is a surer protection than the normal clear because stoppages by frost or freezing tend to hold the signal "stuck" in the position in which it normally stands. It is more reliable, efficient and more easily maintained because high resistance magnet coils are unnecessary, lessening the greater dangers of lightning and residual magnetism and decreasing the failures from chilled batteries.

The normal danger system is only slightly more expensive to install than the normal clear, since it uses the same number of track sections and line wires, and is admittedly much more economical to operate. The additional cost of installation is usually less than the amount saved in operation during the first year of service.

It is easier to inspect for dangerous failures. It helps track workers and section men by indicating the approach of a train and gives time for hand cars to be removed from the tracks. A minor but somewhat attractive feature of the normal danger system is its convenience for the passengers, the customers of the road, while stand-

ing on the platform or hurrying to meet a train. The position of the blade shows the approach of a train and they soon learn to recognize and rely upon the indication. This is not a theory, it is a fact observed on roads on which the normal danger system is in use. Section men, passengers, everybody knows whether or not a train is coming.

Automatic intermediate signals between manual block towers can be operated on the normal danger plan without change in locking circuits or in operating regulations. Since the interlocking and manual signals are kept normally at danger the same system applied to automatic signals obviates the necessity of new rules and practices when these signals are installed.

It is a suggestive fact that many railroads, after using the old normal clear system for years, have changed to the normal danger. That its superiority has been broadly recognized is shown by the fact that although invented but a few years ago and installed by only one signal company, one-third of the automatic block signals in the United States are operated on the normal danger system.

D. B.

Maintenance of Air-Brakes Under Freight Cars.\*

On the Intercolonial Railway, we aim to give every freight car air-brake on the road a general overhauling once a year. To get this result, we cannot confine our operations to repair tracks, and we find an ideal place to reach the cars is on the loading and unloading tracks of the freight depots at our larger terminals, where cars stand for hours and sometimes days. We have already installed air plants at some of these points, and will in time have all of them thus equipped, so that the work is thoroughly tested. We thus avoid much delay to freight trains from holding them for air-brake repairs. We are doing this work at five such points, and are employing 14 men working in pairs.

Of course we cannot do this work in the winter season; we therefore get at it as soon as possible in the spring, and work until all the freight equipment has been gone over. As an example, at St. John, N. B., we extended the air plant to reach the freight depot tracks, and located the piping to reach 10 tracks, holding altogether 300 cars, so there are always plenty of cars to work on. We use 1½-in. pipe, locate the hose boxes about 100 ft. apart and carry 90 lbs. air pressure. We put two men at work there, who do nothing else during the season but test and overhaul air-brakes on these tracks. We are now equipping such points having air plants with the Westinghouse triple valve testing devices for cleaning rooms and yard trips.

The men work under the various terminal foremen, and we keep them supplied with all repair parts required. They have been specially instructed for this work, and have become very proficient. They stencil their work on the side of the auxiliary reservoir, giving letter designating place and the date—for instance, St. J., 20-8-03. This stencil covers the following work done:

- Triple valve cleaned and oiled or changed.
- Brake cylinder cleaned and oiled.
- Pipe clamps and cylinder blocks tightened.
- Piston travel adjusted.
- Hose tested with soap suds, and couplings and gaskets tested and renewed if required.
- Angle cocks, cut-out cocks, release valve, and retaining valve tested and required repairs made.
- Pipe work tested and repaired if required, and brake-shoes applied if needed.

Every brake gets a general overhauling if in service one year since the last stencil mark, or in any case if the test shows that it requires it. The result of one season's work at that point, which is fairly indicative of the work done at all such points, is as follows:

Eight hundred and fifty-five brakes received a general overhauling, and were turned out in first class condition.	
The material used cost	\$241.00
Labor	380.00
Total	\$621.00

An average cost of 73.8 cents per car, which does not include cost of brake-shoes. Besides the work done at the five points spoken of, the usual air-brake running repairs are carried on at the repair shop and tracks. A form for keeping record of these general repairs to all our air-brakes is sent in by the terminal foreman at the end of each month. A set of car record books, enough books to index every car on the system, is kept in which the foremen's reports are copied. Each book will index 4,000 car numbers and for this system of air-brake records will last 10 years. We are thus able to tell just when and where any car on the road had its air-brake overhauled, what was done to it, and when it is due to be again overhauled. We are also able to keep a record of air-brake work done on foreign cars which serves as a check on bills for such repairs. In tracing up responsibility for slid flat wheels and damage to landing or draft-gear the record is also very valuable as a time saver.

For our system of keeping daily check on the condition of freight car air-brakes running on the whole system we use three printed forms, the air-brake defect card; the conductor's report of condition of air-brakes; and a third form which is simply a printed letter with a few blank spaces to fill in.

The air-brake defect card is only to be used to indicate defects in the air-brake when found, but the second

\*Extracts from a paper read at the October meeting of the Canadian Railway Club, by W. C. Hunter, Intercolonial Ry.