

Special Report

# Questions on Hotbox Detectors

Hotbox detection is a lively topic of discussion whenever and wherever railroad men meet. The following questions and answers reflect upon current thinking about this subject.

The material presented is a result of Railway Signaling and Communications editors trips in the field to hotbox detector installations, plus conversations with railroad men from the various departments concerned:

signal, communications, mechanical, operating, traffic and engineering.

This report is by no means the last word on this subject, but is in the form of a progress report on thinking as of this date.

## 1 Should hotbox detectors be connected into signal systems?

**YES!** Two railroads have installations where the actuation of the hotbox detectors sets a signal to the Stop aspect. An alarm bell is sounded at the recorder location to alert the operator. The train which actuated the detector will first pass a signal displaying an Approach aspect. This is in accordance with Section 136.602 of the ICC's Rules, Standards and Instructions with reference to dragging equipment and slide detectors and other similar protective devices which are connected into the signal system. "... this does not mean that where hotbox detectors are installed in automatic block signal territory, they must be interconnected with the signal system," says G. B. Anderson, ICC Bureau of Safety. "It simply means that where they are connected into the signal system, the indications of any signals affected by their actuation must be consistent with the normal functioning of the system."

An advantage for interconnection of hotbox detectors with the signal system is that there is no delay between hotbox detection and the setting of a signal to the Stop aspect. Without such

interconnection, the signal would not be set until the attendant at the recorder location has read and interpreted the tape. Proponents state that interconnection eliminates the possibility of the attendant overlooking a hotbox. One railroad had an incident where the operator mistook a roller bearing indication for a hotbox and set a signal to stop the train. This would not have occurred if the hotbox detector had been interconnected with the signal system.

**NO!** One railroad does not interconnect the detectors with the signal system because the recorder center attendant radios the train crew immediately upon receipt of hotbox indications. The crew promptly stops the train and inspects the car with the indicated hot journals.

Where hotbox detectors have been installed on line of road and are not interconnected with the signal system, two types of signals are used for stopping trains when a hotbox is indicated: (1) CTC or interlocking signals; and (2) special aspects on these

or automatic block signals. The controlled signals are set to the Stop aspect, and the special aspects on these and automatic block signals are displayed. When stopping at the signal, a member of the train crew calls the operator to ascertain hotbox locations.

Another reason for not interconnecting hotbox detectors into the signal system is that there are varied opinions as to what amount of differential deflection constitutes a hotbox. The deflection that is critical (would indicate a hotbox) is affected by such varying conditions as weather, time of year, car rollability, etc. If tied in with the signal system, the hotbox detector differential deflection must be set at a certain value, above which all trains will be stopped. This stopping of trains is of great concern to many railroad men. This brings up the question of whether the detector should have an automatic alarm system to indicate that a hotbox has been detected and action should be taken, or whether the recording tape should be read by some person in authority to make the decision about stopping the train.

## 2 Is the automatic alarm feature desirable?

**YES!** Those who favor the automatic alarm feature contend that the dispatchers or interlocking operators have much to do already, and cer-

tainly should not be required to read a recorder tape, particularly when such tape should be read at the time of the train passing the detector. If a hotbox

is detected, the automatic alarm feature will indicate the journal or journals so that the dispatcher has to read only a counter. If no hotboxes are de-

tected, the dispatcher need not pay any attention to the recorder or alarm system.

Proponents of the automatic alarm feature feel that the state of the art has developed to the point where reliable automatic alarms are now available. Hotbox detector equipment now on the market can provide two degrees of abnormal conditions: (1) indicates a hotbox condition, and (2) indicates a lower differential deflection but one that could be considered an incipient hotbox. Thus the hotbox detector system is not a burden on the employee.

The tendency to centralize dispatcher locations and the more widespread use of pushbutton CTC control machines enabling a dispatcher to control longer territories than formerly, would tend to indicate that automatic alarm features would be desirable to reduce the duties of the dispatchers.

**NO!** One group of railroad men contends that the recorder tape should be

### Problem—Long Wheelbase Cars?

Automatic alarm systems usually include an "engine eliminator" which depends upon wheelbase. The system is put into operation by the first standard axle spacing. A number of new cars already have a somewhat longer wheelbase, and the Mechanical Division of the AAR is considering making larger wheels mandatory, which may require a longer wheelbase. This may in turn require changes in the automatic system to respond to all freight car trucks.

examined by a responsible person who should make the decision concerning train stoppage.

Opponents of the automatic alarm feature also contend that the state of the art has not progressed to the point where a dispatcher or operator need only stop trains which have actuated the alarm system, or look at the recorder tape at only those journals. Opponents feel that due to changing weather conditions and time of year,

it is essential that the dispatcher or attendant at the recorder location read the entire tape for the train to ascertain whether a high differential deflection is abnormal or indicates a potential hotbox. Where detectors are used to inspect trains as they approach yards, some railroads want car foremen to examine the tape for incipient hotboxes which might not be hot enough to actuate an automatic alarm system.

## 3 Should the recorder tape be examined?

**YES!** One railroad has the automatic alarm feature in which hotboxes are indicated by counters. An interlocking operator also examines the recorder tape. Such double checking may appear useless, but examination of tapes has revealed incipient hotboxes which have not reached the critical differential deflection that is required to activate the automatic alarm system.

This factor is, according to many railroads, an important one, and the reason why many roads insist that the recording tape be examined. Some roads have experienced extreme cold weather conditions where hotboxes had differential deflections which were

above those of the rest of the train, and yet were below that normally required to actuate an automatic alarm system, or below that normally encountered during summer months. Thus it would appear that if an automatic alarm system were used, that adjustments must be made for the varying climatic and weather conditions.

Where hotbox detectors are installed in approach to yards, a common practice is to have car inspectors or car foremen examine the recorder tapes. Most roads that have such installations inspect only those journals which are indicated either hot or potentially hot.

**NO!** One railroad has a hotbox detector installation with the automatic alarm feature. When a hotbox is detected, an adding machine tape is printed out at the dispatcher location with the number of the car in the train and the location of the hot journal. No recorder tape is prepared.

Another road which is installing hotbox detectors with the automatic alarm feature is planning to have the recorder tape at the detector location. They intend to have the signal maintainer change recorder tapes once each week. The recorded tape will be kept for 30 days, as a matter of record in case of any questions concerning train stoppages.

## 4 Should detector indications be sent to a central office?

**YES!** A railroad has installed hotbox detectors at a number of locations, but does not interconnect them with the signal system. Recorders which receive information of journal conditions are located at a central point under constant observation. When information is received at the recorder center that some abnormal or dangerous condition exists, the train is immediately contacted by radio and the crew informed as to the location in the train

of the car in trouble.

Other railroads which have made hotbox detector installations in centralized traffic control territory have generally made it a practice to bring the indications into the dispatcher's office where the CTC machine is located. Thus when a hotbox indication is received, the dispatcher can set a CTC controlled signal to the Stop aspect. When a member of the train crew calls in, he can inform him

which journal or journals are indicated hot. Where railroads are consolidating their dispatcher locations, it may well be that hotbox detector indications will be sent to such a central dispatching office.

**NO!** When hotbox detectors are installed in approaches to yards, the recorders are usually in the yard office or the car foreman's office. In these installations the detectors may be from

10 miles in approach to the yard. In these installations, the customary practice is to have the train continue to the yard even though hotboxes are indicated. Roads which have a few hotbox de-

tor installations or relatively isolated ones, send the indications to an interlocking tower. The detector is usually located a few miles in approach to such an interlocking. The recorders are at such towers because

there is an operator on duty 24 hours daily. If, at a later date, a transfer of interlocking control is made, then undoubtedly, the hotbox detector recorders and equipment would be moved to the new location.

## Should hotbox detectors be located along line of road?

**IS!** While most roads maintain a thorough and continuous journal maintenance program, hotboxes continue to develop which should be remedied before the train will arrive at an inspection point. To detect such conditions is the reason for installing hotbox detectors along the right-of-way between yards and inspection points. The most obvious advantage of line of road detection is the elimination of wrecks due to overheated journals. A majority opinion seems to favor installation of detectors about 30 miles out of yards and junction or interchange points where cars are received. This distance depends upon stops and run-

ning speed. These detectors, it is reasoned, will catch hotboxes which have developed since the train departed.

A growing opinion among a few railroad men is that hotbox detectors should be located about every 30 miles to make a continuous check on journal conditions. This would aid in detecting incipient hotboxes, and those that take longer than the running time of 30 miles out of an inspection point to become hot.

**NO!** Others contend that by installing hotbox detectors in approaches to yards, hotboxes and incipient hotboxes which require attention will be caught.

Also, hotboxes will be detected just before the trains pull into the yards where they will receive immediate and proper inspection and attention. If the practice is followed that only those journals indicated hot or incipient are inspected, then an immediate saving in yard inspection costs can be realized. This reasoning, more than the elimination of a potential wreck, has sold hotbox detectors to some railroad managements.

However, many railroad men agree that the detection problem is really solved by a combination of installations along line of road and in approaches to yards.

## How efficient are hotbox detectors?

The subjects of train stopping and what constitutes the proper differential deflection for a hotbox are basic to answering this question. In the early days of hotbox detector operation (1956-57), opinion favored stopping all trains showing an 8 to 10 mm or more differential deflection between ends of the same axle. A not-too-rare occurrence was for a train crew to come in that they had inspected those cars which had indicated hot journals and could find nothing wrong with them. Some of these cars had incipient hotboxes which had cooled off. One railroad, after analyzing this problem, found that one reason might be that crasses which were not properly treated, thus causing the abnormal condition, became reseated due to slack action in stopping the train.

Some railroad men contend that they are stopping far too many trains. A trainmaster commented, "We do not want to stop them, unless the situation is such that if we don't stop them we will put them in the ditch." Some roads have overcome this train stopping problem by readjusting their critical differential deflections to higher minimums. One railroad which stops trains with axles showing a differential deflection of 8 mm or more,

has made it a practice for those trains with axles showing 6 to 8 mm deflections to have them inspected at the next wayside operator location. The operator is informed as to which particular cars he is to give close attention.

On another road if, in the judgment of the man reading the tape, there seems to be reasonable doubt about a particular car, instead of stopping the train, he notifies the crew by radio to watch the car and to inspect it at the next regular stop. On this road, men are not instructed to stop a train at any definite pulse amplitude, but use their own judgments by comparing the abnormal pulse against the overall amplitude pattern.

As to present efficiency, railroad men will cite figures ranging from 60% to over 90%. One road, over a five-month period, had the following record on 136 trains stopped for hotbox indication: 107 trains (79%) found hotboxes; 5 trains (4%) found sticking brakes; 21 trains (15%) reported no trouble, and 4 trains (2%) found new wheels, new style packing or roller bearings as causing hotbox indications.

From the experience of this and other roads, a good average efficiency figure appears to be about 80%. While some would like to see this figure

higher, incipient hotboxes appear to help keep this figure down. The reason advanced by some railroad men is that the incipient hotbox, having a lower deflection, has a good chance of cooling during and after the train has stopped. The crew is then probably unable to detect any difference in heat between this journal and any other in the train.

Many railroads report improved efficiency ratings with increased detector usage. This is due to better performance by crews in inspecting trains. Standard practice is to inspect all journals on three cars: the car on which a hot journal is indicated, the one in front and the one behind. Improved hotbox detector maintenance practices also have helped improve the efficiency factor.

The automatic alarm feature now available for hotbox detectors is another factor which will affect their efficiency. If the critical deflection is set low, the alarm will indicate more potential hotboxes than actually occur. This will tend to lower the efficiency factor. On the other hand, setting the critical differential deflection too high may cause the alarm system to pass over a hot journal that might cause a wreck.