



RAILWAY OCCURRENCE REPORT

**CN NORTH AMERICA
COLLISION
BETWEEN FREIGHT TRAIN NO. 386
AND STATIONARY FREIGHT TRAIN NO. 448
MILE 5.8, HALTON SUBDIVISION
ETOBICOKE, ONTARIO
28 OCTOBER 1994**

REPORT NUMBER R94T0334

MANDATE OF THE TSB

The *Canadian Transportation Accident Investigation and Safety Board Act* provides the legal framework governing the TSB's activities.

The TSB has a mandate to advance safety in the marine, pipeline, rail, and aviation modes of transportation by:

- conducting independent investigations and, if necessary, public inquiries into transportation occurrences in order to make findings as to their causes and contributing factors;
- reporting publicly on its investigations and public inquiries and on the related findings;
- identifying safety deficiencies as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- conducting special studies and special investigations on transportation safety matters.

It is not the function of the Board to assign fault or determine civil or criminal liability.

INDEPENDENCE

To encourage public confidence in transportation accident investigation, the investigating agency must be, and be seen to be, objective, independent and free from any conflicts of interest. The key feature of the TSB is its independence. It reports to Parliament through the President of the Queen's Privy Council for Canada and is separate from other government agencies and departments. Its independence enables it to be fully objective in arriving at its conclusions and recommendations. Its continuing independence rests on its competence, openness, and integrity, together with the fairness of its processes.

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The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Railway Occurrence Report

CN North America

Collision

between Freight Train No. 386
and Stationary Freight Train No. 448

Mile 5.8, Halton Subdivision

Etobicoke, Ontario

28 October 1994

Report Number R94T0334

Summary

At approximately 0440 eastern daylight time (EDT), CN North America (CN) freight train No. 386-3M-27 (train 386), travelling eastward on the south main track of the Halton Subdivision, collided with the rear of stationary freight train No. 448-3A-27 (train 448) at Mile 5.8.

Two empty hopper cars at the rear of train 448 and the front wheels of the lead locomotive of train 386 derailed. There were no injuries.

Ce rapport est également disponible en français.

Other Factual Information

Train 448 consisted of 2 locomotives, 30 loaded cars, 47 empty cars, and 8 residue cars. A Sense and Braking Unit (SBU) was mounted to the rear coupler of the last car. Train 448 had been travelling approximately one signal block ahead of train 386 from Burlington, Ontario (Mile 49.5), to Brampton, Ontario (Mile 15.4). Train 386 consisted of two locomotives. The lead locomotive had been placed in idle to conserve fuel. At approximately 0300¹, at about Mile 43.5, the locomotive engineer of train 386, due to tiredness and the need to stretch, turned over the operation of the train to the conductor who was also a qualified locomotive engineer.

At approximately 0430, train 448 was stopped by signal 046S at Mile 4.6 just west of the MacMillan Yard at the end of double-track territory to wait while an opposing train passed. The rear of train 448 was located at approximately Mile 5.8.

At approximately 0437, train 386 received a restricting signal indication on signal 064S at Mile 6.4. At this time, the conductor at the controls of train 386 heard radio instructions from the MacMillan Yard concerning the yarding of a train and assumed that train 448 had moved off the main track. The locomotive engineer was reportedly attending to paperwork and not paying close attention to train operation.

Immediately after passing the restricting signal at Mile 6.4, the headlight was dimmed and the ditch lights were turned off in accordance with the Canadian Rail Operating Rules (CROR) as a westward train was approaching on the adjacent north track. At Mile 6.4, the track was tangent, providing clear visibility within the range of train lights.

As soon as the lead locomotive of the westward train had passed, the headlight of train 386 was restored to bright and the ditch lights were turned on in preparation to inspect the remainder of the passing train. At this time, the conductor saw the stationary train ahead. He immediately made a full independent brake application but could not stop his movement before striking the standing train.

Although the SBU on train 448 was equipped with a red reflectorized marker, the conductor noticed the last car of the standing train before the marker.

On 02 November 1990, paragraphs 1.1 and 1.22 of the Canadian Transport Commission Order No. R-41300, stipulating that a light be affixed to the rear of caboosless trains, were revoked to permit the use of a reflectorized marker to indicate the end of a train. Previous to this change, SBUs in Canadian service were equipped with a high-intensity red strobe light

or a Highly Visible Marker (HVM) (a white light). SBUs on trains operating from Canada into the United States must still be equipped with a HVM. Before caboosless operation, trains were required to

¹ All times are EDT (Coordinated Universal Time (UTC) minus four hours) unless otherwise stated.

have lit markers to the rear at night.

The restricting signal at Mile 6.4 indicated that the train was to proceed at a restricted speed. Restricted speed is a speed that will permit stopping within one half the range of vision of equipment, stopping short of a switch not properly lined and in no case exceeding slow speed (15 mph). Restricted speed also requires train crews to be on the lookout for broken rails.

The crew on train 386 declared that they were tired because of a lack of sleep. Both had reported for duty at 1930, 27 October 1994. The locomotive engineer had not slept since 0700, 27 October 1994, and the conductor, since 1000, 27 October 1994. Both crew members had last worked on 23 October 1994 and met mandatory rest requirements.

Depending on train scheduling and traffic conditions, the crew of train 386 would either proceed to MacMillan Yard from London and return home by taxi or turn around quickly in Toronto and return with another train to London. On 27 October 1994, train 386 did not leave London until 2300 and their trip to Toronto was delayed throughout. They anticipated a late arrival in Toronto and a return trip by taxi.

The event recorder from train 386 captured the following relevant information:

Entry	Recorded Time	Distance	Speed	Throttle Position	Brake Cylinder Pressure
1.	0430:14	173.3	31 mph	No. 8	2 psi
2.	0431:07	173.7	29 mph	No. 1	38 psi
3.	0431:24	173.8	15 mph	No. 1	23 psi
4.	0431:32	173.9	13 mph	No. 8	3 psi
5.	0432:15	174.2	48 mph	Idle	9 psi and increasing
6.	0432:26	174.3	33 mph	Idle	71 psi
7.	0432:26	174.3	22 mph	Idle	71 psi
8.	0432:30	174.4	0 mph	Idle	71 psi

The crew members on train 386 had not been communicating the signal indications to each other in accordance with the CROR.

Analysis

The event recorder information outlining the sudden deceleration from 33 mph to 22 mph is

considered to be the recorded point of impact (entry No. 7). The brake application indicated by the brake cylinder rise in entry No. 5 is the braking action taken when the train crew first observed the obstructed track. Based on detailed recorded time and recorded velocity data, train 386 was slightly less than 600 feet from the rear of train 448 (Mile 5.8) when the brake application was made. Based on the recorded train distance at impact, the location of the collision (Mile 5.8), and the location of signal 064S (Mile 6.4), entry No. 2 is a record of train operation as the train passed that signal. This record indicates that the throttle had been reduced and the brakes applied, but the recorded speed was 29 mph. Subsequently, the recorded information shows that, within 17 seconds, the brakes had been released (entry No. 3). After another eight seconds, the locomotive had moved approximately 1,000 feet beyond signal 064S and slowed to 13 mph with brakes fully released when the throttle was advanced to position No. 8. Train speed increased for another 43 seconds over approximately another 1,500 feet, reaching 48 mph before braking action was initiated in reaction to stationary train 448.

When the crew of train 386 accepted the restricting signal at Mile 6.4, they should have expected to encounter another train within that block and been prepared to maintain restricted speed to the next signal. In its least restrictive interpretation, a restricting signal means that a train must travel at a maximum speed of 15 mph. Depending on visibility and the distance the locomotive engineer anticipates it would take to stop the train at that location, train speed must be regulated between 0 mph and 15 mph. When the locomotive headlight was dimmed and the ditch lights were extinguished to avoid impairing the vision of the crew of the opposing train, range of vision was thereby reduced and train speed should have been reduced accordingly.

The conductor operating train 386 made an inaccurate assumption that the track ahead was clear due to the misinterpretation of the overheard radio communication. However, the restricting signal with its requirement of a maximum speed of 15 mph still applied within that block whether or not the track was clear.

If train 386, consisting of only two locomotives, had been travelling at the maximum possible restricted speed (15 mph), it could have been stopped within the distance available. However, a train with the usual number of cars operating at this speed could not have been stopped. It is noted that the train approached signal 064S with unobstructed visibility and, at this point, the rear of stationary train 448, about 3,000 feet beyond the signal, was not observed even with the headlight on bright and the ditch lights illuminated. It is also noted that, at about 600 feet, under the same illumination, the car body on the last car was said to

have been noticed before the reflectorized marker. The marker was therefore not visible with the headlight on dim and ditch lights off at distances beyond 600 feet. It is therefore concluded that, in this situation, the standard reflectorized marker provided little safety advantage.

Various people involved in the investigation have suggested that crew fatigue was a factor in this occurrence. The crew's work/rest cycles in the period before the occurrence and the circumstances of

the occurrence itself do not support a definitive finding of crew fatigue. However, both crew members reported that they were tired. Also, it is noted that the accident occurred at a time when studies have shown that tiredness under similar circumstances, i.e. keeping awake through the night, is greatest. Furthermore, an alert crew should not have misinterpreted the radio communication that led to the assumption that the track ahead was clear. Therefore, reduced alertness from disruption of the normal sleep cycle probably was a contributing factor in the inappropriately high speed just before the collision. It can also be said that both crew members had found the trip (with its untimely beginning and frequent delays en route) very frustrating and, facing a long taxi ride home at the end of a long tour of duty, they were anxious to arrive at the MacMillan Yard.

The requirement to dim the headlight and turn off the ditch lights for the approaching train lessened forward visibility, but according to requirements, should have prompted a commensurate reduction in speed, i.e. less than the prescribed 15-mph maximum. It is also considered that the requirement to inspect the passing train would not unduly detract from observing the track ahead at a speed of 15 mph or less.

Conclusions

Findings

1. The operation of train 386 did not conform to the requirements of the indication displayed on signal 064S.
2. The speed of train 386 was far in excess of the prescribed maximum and, therefore, the train could not be stopped before striking the rear of standing train 448.
3. The range of vision for the crew of train 386 was shortened when they dimmed the headlight and turned off the ditch lights for the opposing train.
4. The reflectorized marker provided a very limited safety advantage.
5. Reduced alertness from disruption of the normal sleep cycle probably was a contributing factor in the inappropriately high speed just before the collision.

Causes and Contributing Factors

The collision resulted from the operation of train 386 at a speed far in excess of the prescribed maximum limit.

Safety Action

Action Taken

Following this occurrence, the railway employees involved presented information sessions to fellow employees on the different aspects contributing to the occurrence and on proposed methods to prevent recurrence. In addition, a film was produced on this occurrence and will be used as an education and training tool.

CN North America (CN), Canadian Pacific Limited (CP) and VIA Rail Canada Inc. (VIA), with the cooperation of the Brotherhood of Locomotive Engineers, have jointly sponsored a major research activity into factors that influence the alertness of railway operating crews. That research study, called *CANALERT*, directly addresses an important railway safety issue which is referred to in Finding No. 5 of this investigation. A report on the *CANALERT* study was recently published and is being reviewed by the railways and Transport Canada (TC).

In July 1995, a TSB Rail Safety Information Letter was forwarded to TC concerning two occurrences where crews reported not seeing the rear reflective marker on a train ahead until the cars were illuminated by the headlights of their locomotive. TC has subsequently pointed out that, notwithstanding the requirements of "restricted speed", ease of tail-end identification is a consideration. Thus, there is a move within the railway industry to begin replacing SBUs presently in use with the next generation of SBUs which are equipped with marker lights.

On the other hand, CN commented on rear markers by saying that adding a strobe light to SBUs would increase their weight by approximately 20 pounds, making it more difficult to carry them around -- something that may lead to more employee injuries.

Further Action Required

The issue of rear train markers is not new. In its 14 December 1987 Order (No. R-41300), the Railway Transport Committee of the Canadian Transport Commission granted permission for CP and CN to operate trains without cabooses with several conditions. Clause 1.1 of that order stated:

A train may be operated without a caboose and with the rear crew located in the cabs of the lead locomotive consist provided the train is equipped with a Digitair II end-of-train-information system with a rear train emergency braking feature and a red flashing marker light operated by an automatic light sensitive cell

This order was based on long and complex hearings and a number of field tests which, in part, involved the testing of the reliability of rear marker lights. Both CN and CP reported, at that time, that the results were excellent.

Rear marker lights are not a new technology. They were tested a decade ago and were required as a

provision to operate cabooseless trains.

On 05 November 1990, however, TC revoked the above-noted clause 1.1, in response to applications by CN and CP, and replaced it with a clause that did not require a marker light on the rear car of cabooseless trains, concluding that the changes were in the public interest and not likely to threaten safe train operations. On 11 August 1995, TC revoked the complete TC-revised Order No. R-41300 on the grounds that the order was being addressed effectively by other means and that the revocation of the order was in the public interest and would not likely threaten safe railway operations.

The question is whether the rear ends of trains are sufficiently conspicuous.

CN takes the position that, in this occurrence, if restricted speed requirements had been properly applied, there would not have been a collision. This is true. Although the crew was tired, there is event recorder evidence that the crew member at the controls was not asleep. Although the crew member at the controls did not abide by the provisions of "restricted speed", had there been a light on the rear of the train ahead, it may have offered the visual stimulus to the operating crew member to reduce speed and perhaps avert the collision.

The risk of rear-end train collisions has not so much to do with the frequency of such occurrences (indeed, they are rare), but also with the potential consequences. Given that tank cars carrying loads of even the most explosive or toxic dangerous goods are permitted to be marshalled at and close to the end of non-illuminated cabooseless trains, the consequences of a rear-end collision could be catastrophic for the operating crew of the following train and the public in proximity to the track. Measures to reduce the risk of rear-end collisions are therefore all the more important. The Board therefore recommends that:

The Department of Transport re-assess the risk associated with operating cabooseless trains without an illuminated rear marker.

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Safety Concern

The Board is also concerned that, once again, a qualified crew performed less than satisfactorily as a team, committing unsafe acts and breaching several built-in system defences, thereby creating a rear-end collision situation. The conductor was essentially operating the locomotive alone, and the assigned locomotive engineer was not acting with the conductor as a team in the minutes leading up to the collision. The conductor's assumptions about the train ahead are indicative of his inaccurate mental picture of the current situation. With unjustified expectation as to the clear track ahead and perhaps the natural desire to get home, his judgement to significantly exceed the speed limit was facilitated. The alertness and judgement of both crew members were undoubtedly compromised by their lack of recent sleep and the hour of the day. These aspects should have been anticipated by experienced crew members to warrant a heightened level of vigilance by both of them. Indeed, in this occurrence, in the minutes preceding the collision, there appears to be no indication of any teamwork between the crew

members whatsoever; they were not monitoring each other's performance; they were not challenging each other's actions; and there was apparently no communication between them as to the unfolding situation.

The complex interplay of human variables in this occurrence is typical of those seen by the Board in many rail occurrences. Sub-optimal crew performance in maximizing team effectiveness has been noted before in TSB investigations.

Given the expected positive impact of the industry's *CANALERT* project and the expected results from the Board's current investigation into the conditions leading to risks of collision, the Board is not making any specific recommendations to enhance team effectiveness at this time. Nevertheless, the Board believes that a coordinated industry-wide initiative will be required to effect the necessary attitudinal changes if team effectiveness is to be maximized.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Zita Brunet and Maurice Harquail, authorized the release of this report on 25 June 1996.

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