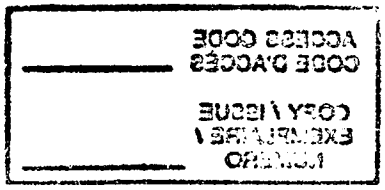
COMMISSION OF INQUIRY
HINTON TRAIN COLLISION

REPORT OF THE COMMISSIONER
THE HONOURABLE MR. JUSTICE RENÉ P. FOISY
DECEMBER, 1986



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COMMISSION OF INQUIRY
HINTON TRAIN COLLISION

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TO HER EXCELLENCY
THE GOVERNOR GENERAL IN COUNCIL

MAY IT PLEASE YOUR EXCELLENCY

I, the Commissioner appointed by Order in Council dated 10th February 1986 as revised and amended on 26th June 1986 to inquire into and report upon the specific circumstances, reasons and causes for the Hinton Train Collision on the 8th February 1986; the adequacy of federal law, regulation, and standards and the adequacy of railway practices, procedures and standards, all as they relate to safe railway operations and this collision; and to offer recommendations for changes and reforms in railway operations that will reduce the risk of future mishaps and contribute to overall rail safety in Canada and as more specifically set forth in the said Order in Council as revised and amended: Beg to submit to your Excellency this Report.

René P. Foisy
Commissioner

December, 1986

Canada

REPORT OF THE COMMISSION OF INQUIRY INTO THE HINTON TRAIN COLLISION

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HINTON RAIL COLLISION

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I. Background

A. The Collision

On the morning of Saturday, 8 February 1986, a westbound CN Rail freight train collided with an eastbound VIA Rail passenger train on the CN main line approximately 11 miles east of Hinton Alberta.

23 people were killed in the collision. 71 others were injured seriously enough to require hospitalization or medical treatment. The value of property destroyed or damaged in the mishap was in excess of $30 million.

Investigations into the causes of the collision by CN, the Canadian Transport Commission, the R.C.M.P., and the office of the Medical Examiner, began immediately.

B. The Appointment of the Commission of Inquiry

On Monday, 10 February 1986, the Governor General-in-Council appointed the Honourable Mr. Justice René Paul Foisy of the Court of Queen's Bench of Alberta pursuant to the *Inquiries Act* to inquire into the collision, and report.

The Commission held 48 days of Public Hearings in Edmonton and 8 days in Jasper, beginning 24 March 1986 and ending on June 25. It heard from a total of 150 witnesses including the surviving crew members, passengers, officers of CN, VIA, CP, the Brotherhood of Locomotive Engineers and the United Transportation Union, medical doctors, officers of the Canadian Transport Commission (CTC), the R.C.M.P., the Medical Examiner's Office, private citizens, and several experts and advisors who the Commission either retained or otherwise invited to provide detailed information on specific subjects.

The Commission focused its work on three general areas. These were:

- identification of the specific circumstances and causes which led or contributed to the mishap on 8 February 1986;
- identification of conditions, operational systems, policies and attitudes relating to railway safety which were of significance to the circumstances of the 8 February mishap; and
- preparation of recommendations for changes and reforms in railway operations and in the regulative and other activities of the Government of Canada that will contribute to greater rail safety in Canada and reduce the risk of such collisions in future.

II. Findings

A. Main Findings: the 8 February Collision

The collision occurred because the westbound freight train (Train 413) failed to obey signals along the track calling for it to stop, and ran a switch governing its entry onto a single-track section where it came into collision with the passenger train (Train 4).

The 8 February collision and the resulting loss of life, injury, and loss of property, could have been averted if *any* of the following had occurred:

- had the Engineer of Train 413 observed and obeyed the signals displayed along the track, the train would have been stopped prior to entering the single-track section where the collision occurred, and the accident would have been avoided;
- had the trainman in the head of Train 413 observed the signals and brought them to the attention of the engineer or, in the event the engineer was incapacitated, had the trainman responded to the signals himself and braked the train, train 413 would have been stopped prior to entering the single-track section where the collision occurred, and the accident would have been avoided;
- had the conductor in the caboose of Train 413 succeeded in contacting the head of the train by radio as the train approached the signals to receive confirmation of the signal reading (railway operating rules require that the conductor contact the locomotive crew by radio to confirm approach signal readings), unless the engineer and trainman were incapacitated, they could have stopped Train 413 prior to entering the single-track section where the collision occurred, and the accident would have been avoided;
- had the conductor followed the railway's operating rules and applied the emergency brake if he was unable to make the required radio contact with the head of the train; even if both the engineer and trainman were incapacitated, Train 413 would have stopped prior to entering the single-track section where the collision occurred, and the accident would have been avoided;
- even if the engineer and trainman were both incapacitated and the conductor, for whatever reason, failed to establish radio contact with the head of the train and then failed to follow procedures and activate the braking system, if the "deadman's pedal" safety device in the locomotive been operating properly, and had the engineer's foot been removed from the pedal in sufficient time, the train would have stopped automatically, and the collision would have been avoided;
- had the lead locomotive of Train 413 been equipped with a modern "reset safety control" – a safety device which is more reliable and difficult to tamper with than the deadman's pedal – it is far more likely that Train 413 would have been stopped prior to entering the single track section where the collision occurred, and the accident would have been avoided;
- had CN had a policy of marshalling locomotives equipped with a modern reset safety control device as lead locomotives in trains, the second locomotive in Train 413, which was equipped with a reset safety control, would have been in the lead position, and it is more likely that Train 413 would have stopped prior to entering the single track section where the collision occurred, and the accident would have been avoided.

The Commission is satisfied that all the signals governing the movement of the two trains operated as designed and that nothing in the design of the system was inadequate so far as the events of 8 February are concerned.

The Commission also concludes that there was no mechanical failure in either train which could have contributed to the accident.

Although it is uncertain what effect, if any, it would have had on the severity of the collision, the Commission notes that the evidence indicated that no brakes were applied on either train prior to impact despite the fact that the trains were clearly visible to one another for some seconds prior to the collision.

B. Main Findings: general levels of rail safety

It is the Commission's conclusion that the 8 February disaster resulted from a lack of alertness and a failure to follow established railway operating rules on the part of the CN employees involved in the operations of Train 413, and from a failure on the part of CN to install the superior safety devices in the lead locomotive of Train 413.

The Commission has found no reason to suppose that these were isolated circumstances within the context of the operations of the railway system.

Rather, the Commission believes that the style of operations and the culture of the "railroader", as it has evolved within CN, creates an environment in which otherwise well motivated and responsible people throughout the company place inadequate priority on safety and, in effect, give tacit acceptance to rules violations that affect the safety of CN's rail operations.

Within this culture, rules and procedures intended and developed to ensure the safe and prudent operations of the system have become "background" and ritual, with the result that CN management and its partner in the definition of work environments and conditions – organized labour – fail to place proper or effective emphasis on safety.

This attitude is reflected in measures related to the development, proving, and installation of safety technology, both by the railway and the CTC. There is insufficient priority given to safety technology or to its orderly and effective implementation throughout the system.

It is the opinion of the Commission that the legislative and regulatory environment within which the railway system operates, including the supervisory activities of the CTC, the process whereby regulations are promulgated and enforced, and the effectiveness and rigour with which the CTC moves to correct identified problems, is inadequate.

III. Discussion: the 8 February collision

The Commission concludes that human error did contribute in large part to this mishap, and that management shares in the responsibility for the conditions that contributed to the human errors involved in this case. The Commission looked carefully at the condition, background, and circumstances of the crew members.

A. Crew Fatigue

All three of the crew members of Train 413 were certainly fatigued at the time of the accident.

- Evidence put before the Commission indicates that the running crew of Train 413 had little rest during the lay-over at Edson prior to taking control of Train 413; at most Engineer Hudson slept 3 1/2 hours, Trainman Edwards 5 hours, and Conductor Smith 4 hours during this lay-over.
- Ergonomic and other evidence put before the Commission indicated that the long and irregular shifts worked by running crews, the monotonous nature of much of their work, and the working conditions to which they were exposed contributed to the risk of crew fatigue.

In the Commission's opinion, crew fatigue contributed to the series of human errors that, in turn, contributed to the 8 February collision.

B. The Health of the Crew

The Commission also inquired into the health of the three crew members. Personnel and health records indicated that Conductor Smith and Trainman Edwards had no unusual health problems, although Trainman Edwards was reported to have been suffering from "a touch of the flu" and to have stated that he needed a good night's sleep when he reported for duty at Jasper on the evening of 7 February.

Engineer Hudson, however, did suffer from a number of medical conditions that could have affected his ability to perform his duties or contributed to the causes of the 8 February collision.

- Hudson was diagnosed as suffering from high blood pressure in 1976; this problem was again identified in 1980. He was not receiving treatment for this condition and there is no reason to believé that it was not still a problem at the time of the accident.
- Hudson had been diagnosed as an alcoholic in 1982. He was compelled to seek treatment for this condition in late 1984, with the treatments occurring in January and February of 1985. Evidence put before the Commission indicated that he had experienced continuing difficulties with alcohol as late as January 1986.
- In July 1985, it was determined that Hudson had diabetes. This condition could be normalized through control of diet but, at the time of his last medical examination in January 1986 his diabetes was not under control.
- In July 1985, he had had surgery to correct interruption of blood supply to the large bowel resulting from pancreatitis. At the time of the accident he was still reliant on a colostomy.
- He had booked off work for health, or other reasons, for a total of 44 days between January 1985 and 15 January 1986, and had taken a total of 26 days in vacation, in addition to an extended sick leave of 107 consecutive days in July – October 1985.
- Medical evidence indicates that, at the time of the collision there was no alcohol or drug in Hudson's system.
- Although there is no direct medical evidence to suggest that Hudson suffered heart attack, stroke, or any other catastrophic health event which disabled him prior to the collision, in light of his medical history, the Commission is unable to discount this possibility.

There was no adequate program of medical supervision or support provided for Hudson by CN management. He was returned to full duties with no restrictions although his health problems were well known to management and although there was a significant possibility that one or more of the conditions from which he suffered could at any time affect his ability to perform his duties in a safe and effective manner.

The Commission concludes that the poor overall state of Engineer Hudson's health may have contributed to the events leading to the 8 February collision.

C. Crew Performance History

The Commission also concerned itself with the employment and performance history of the crew members of Train 413.

The employment records of Trainman Edwards and Conductor Smith revealed no particular area of concern related to safety of operations.

Engineer Hudson's personnel records did reveal a variety of performance and rules violations.

- In September 1983, Engineer Hudson had accumulated 50 demerit points; when an employee accumulates 60 such points, he is automatically dismissed. He was interviewed by management at that time and warned that further violations would result in his dismissal. Subsequent to this interview, his records show other violations but no further demerit points were assessed.

Despite this record of repeated performance violations, evidence put before the Commission indicated that CN failed to take appropriate measures to provide the supervision and discipline that Hudson's performance clearly demanded.

The Commission finds this inexplicable, particularly in light of the fact that, during this period, Hudson's alcoholism was known to CN management.

D. Safety Technology

The Commission also addressed the role that available safety devices played in contributing to the accident.

- There are two different safety devices used in CN's fleet of locomotives: the traditional "deadman's pedal" and the more modern and effective "reset safety control" (RSC); both these devices operate to stop the train automatically should the engineer become incapacitated. At the time of the accident, CN was involved in a long term program of replacing deadman's pedals with RSCs throughout its fleet.
- CN's policy, by agreement with the Brotherhood of Locomotive Engineers, was to select as lead locomotives those units equipped with "comfort cabs" regardless of which of the two safety devices was installed; CN did not, however, have a policy of installing reset safety controls first in comfort cab equipped locomotives.
- The lead locomotive of Train 413 was equipped only with a deadman's pedal safety device. Evidence put before the Commission indicated clearly that these safety devices are routinely disabled by running crews. The second locomotive in the train was equipped with the more modern and effective reset safety control.

The Commission has concluded that the absence of a policy giving priority to the installation of reset safety controls, and the absence of a policy regulating the deployment of locomotives such that lead locomotives have reset safety controls, is a factor contributing to the cause of this collision.

IV. Discussion: general levels of rail safety

The Commission is concerned that general levels of safety throughout the Canadian railway system are adversely affected by the attitude, or culture, of the railroader that exists within CN, by the approaches taken to the development and deployment of safety related technology, and by deficiencies in the regulatory environment within which the railway operates.

A. The Railroader Culture

Evidence presented to the Commission led to the conclusion that neither employees nor management within CN place appropriate weight on the observance of rules established to promote safe operations.

Notwithstanding the fact that crew members and union spokesmen who testified before the Commission stated that they appreciated the fundamental importance of the rules to the safe operations of trains, examinations by a CTC official of the statements and testimony of only those running crews involved in the movement of trains in the region of the collision on the morning of 8 February revealed 19 different possible rule violations. Many of these occurred in a way that was visible to other employees, but that did not seem to raise any concern.

Similarly, although CN management professed a deep regard for safety, evidence indicated that long-standing rule violations occurred routinely without management intervention. An example was the common practice of changing train crews "on the fly" at Edson – a practice of which the responsible CN managers claimed to have no knowledge. In addition, in at least one case, management made significant changes to a fundamental operational safety rule without sufficient regard for the safety implications of the change.

This disregard for safety is a reflection of the railroader culture. Within this culture, great value is placed on loyalty, on endurance, and on productivity. An employee gains standing by being willing to work very long hours regardless of fatigue; he would lose standing by claiming a rest period. He gains standing by "protecting" a fellow employee by failing to report rules violations or health or other problems that could adversely affect performance; he would lose standing by drawing such elements to the attention of management and demanding help or support for his co-worker.

B. Hours of Work

This disregard for key safety factors is institutionalized in several aspects of the relationship between management and labour within CN.

Railway running crews are exempt from regulatory limits on hours of work.

The work scheduling and pay system for running crews that has evolved within the railway has built-in features that contribute to crew fatigue, and that can provide incentives for crew members to work very long shifts.

Although this problem was drawn to the railways' attention in 1972 by the Gallagher Inquiry into the exemption granted the railway under the Canadian Labour Code, no measures have been taken to correct this situation.

In testimony before the Commission, CN management indicated that it was not commercially practical for the company to move to patterns of work scheduling that would provide more regular and predictable hours of work, notwithstanding the fact that other industries, including railways in other jurisdictions, have been able to do so, and notwithstanding the fact that CN already manages far more complex planning and scheduling operations relating to loads and rolling stock.

The Commission is also of the view that there are disincentives to crew members "booking rest" at away-from-home terminals (although they are technically permitted to do so). All crew members, except for the engineer, are required to take rest whenever a single crew member requests it, causing inconvenience and possible resentment among other crew members.

This same railroader culture is reflected in CN's failure to have established adequate procedures to ensure that crew members are sufficiently rested to perform their duties properly. The company's policy is that the employee is the only judge of his condition. In the CN environment, this policy operates in effect to absolve management of any responsibility for

ensuring that workers are reasonably fit to perform their duties safely and well. CN contents itself with extracting an assertion from the employee that he is fit to perform his duties, rather than meeting its management responsibility to create an environment in which it will be probable that employees will be adequately rested. The Commission notes that the railway unions have taken no action to correct this abdication of management responsibility.

C. Management Supervision

The Commission was shocked by the failure of CN to provide appropriate medical or supervisory support or response in the case of Engineer Hudson, although management and the medical staff had all the information necessary to determine that the ability of this employee to perform his duties in a safe and effective manner had clearly been at risk for a prolonged period of time.

The Commission believes that this is not an isolated case, but rather that it is indicative of management attitude and of the culture of the organization generally.

The Commission further notes the failure of the unions purporting to represent the interests of CN employees to demand such support for their members. Rather, union members who were witnesses before the Commission went out of their way to attest to the fact that Hudson was a "top notch engineer" and a "100 percenter".

This kind of loyalty to a fellow worker is fully within the railroader culture. In the Commission's view, it is unfortunate that this culture did not also generate the kind of loyalty that would have demanded that, in light of his health and other problems, Hudson receive special medical or supervisory support from his employer – demands that may have averted the 8 February disaster and Hudson's own death as well as those of 22 other people.

D. Disciplinary Policies

The Commission notes management's decision to place a letter of reprimand on Hudson's personnel file rather than assessing him with additional demerit points when he was caught speeding in August 1984 at a time when such action could have led to his dismissal. This kind of consideration for an undoubtedly loyal employee is fully within the railroader culture. In the Commission's view, it is unfortunate that this culture did not also generate the kind of consideration that would have led management to take special supervisory steps to help Hudson improve his performance, especially in light of the knowledge management then had of his related health problems.

This is not uncharacteristic of the sense of "fairness" as it exists within the railroader culture. At CN, for example, "first offenses" are normally not recorded on an employee's personnel file. When such offenses are not recorded it is, in the Commission's view, problematic whether or not any offense will ever be identified as a "second offense".

Within the context of the kind of loyalty among employees that marks the railroader culture, this approach makes it very possible that consistent breaches of the rules or safety related performance problems will go unidentified and unremedied.

In short, the Commission is of the view that, within the railroader culture that has grown up within CN, both management and labour tend to resist change and to persist in established patterns of operation without adequate sensitivity to the safety implications of the practices within the railway over the years.

E. Safety Technology

This disregard of safety is apparent in the inappropriate development and deployment of technology related to safety within CN, and especially in the program to replace deadman's pedals with reset safety controls.

- CN and the CTC have long been aware of the inadequacies of the deadman's pedal. This device requires that the engineer keep his foot on the pedal at all times; if the pressure of the foot is removed, the train's braking system is automatically engaged.
- Evidence received by the Commission indicated clearly that engineers routinely disable this safety device (disabling the deadman's pedal is as simple as placing a weight on it other than the engineer's foot), and this practice has long been known to employees, unions, management, and the CTC, without appropriate remedial action having been taken by any of them.
- CN was involved in the development of the more sophisticated and effective reset safety control technology. This device requires that the engineer touch one of the six main control systems in the cab, or press a reset button on the console at regular intervals. If the engineer does not do so, a light blinks and an alarm sounds in the locomotive. If he still fails to reset the system, the train's brake system is automatically activated. The reset safety control is much more difficult to tamper with or disable than the deadman's pedal.
- At the time of the collison, CN had a program of installing reset safety controls in all of its locomotives. The pace of this program was inexplicably slow in light of the knowledge both CN and the CTC had of the inadequacies of the deadman's pedal. Further, the failure to install reset safety controls first in locomotives equipped with comfort cabs (which were marshalled as lead locomotives when available), or to establish a policy of marshalling locomotives with reset safety controls in the lead position, contributed to the causes of the collision.

The Commission is also concerned that CN does not use its existing and already operating communications systems with proper regard to its potential to contribute to enhanced safety. For example, there is no policy requiring the dispatcher to notify running crews of oncoming "meets", although this is sometimes done and witnesses testified that it would be useful. CN expressed a concern that running crews would become overly reliant on such information and relax their levels of vigilance. The Commission is satisfied that this concern is unfounded.

F. Advanced Train Control System Technology

Much of the work of railroaders is inherently boring and monotonous, making it perilous in any event to rely solely on the alertness of running crews to avert mishaps. After leaving Edson, for example, Train 413 would have proceeded under full throttle at a speed of about 20 miles an hour for approximately one hour, forty minutes to the top of the grade at Obed Summit. The crew had virtually nothing to do except look at a section of track they had seen many times before, at a time when all of the crew members were fatigued. This is in an environment that was noisy, hot, and poorly ventilated.

The main safety devices currently in use, the deadman's pedal and the reset safety control, are focused and dependent on the human factor: the behaviour, judgement and activities of running crew members.

Emerging remote train intervention and enforcement technologies are not dependent on the behaviour or capacity of crew members. These systems automatically control speeds and stop trains in the event that an order is being disobeyed or an authority exceeded. The presence of such systems would render a collision like that which occurred on 8 February virtually impossible.

In the Commission's view, it is essential that such remote intervention and enforcement technology be developed and deployed on the Canadian railway system as quickly as possible.

The Commission is uncertain as to the attitude of the major railway unions to the deployment of optimum safety technology. There is no evidence that the unions have worked to ensure the timely installation of reset safety controls in locomotives, for example, despite the fact that these devices would provide greater safety for union members.

G. Regulation of Rail Operations

The Commission notes that although the railways are, in many respects, a heavily regulated industry, there has been insufficient progress made in such areas as ensuring compliance with operating rules or deploying appropriate safety technology.

- The last major revisions of the Uniform Code of Operating Rules (UCOR) authorized by the CTC, and applying to all federally regulated railway operations in Canada, occurred in 1962, although there have been some adjustments to the regulations in the interim. In addition to being obsolete, in some cases, these regulations present in an unnecessarily obscure manner what are essentially simple and straightforward requirements in a form that makes it difficult to identify the most important safety-related regulations, or even to be sure of the intent of the regulations.
- CTC spokesmen indicated to the Commission that they have attempted to produce a new version of UCOR, but that this was difficult because of the very complex and time-consuming process which must be completed in order to change regulations. While the Commission has no doubt that this process is onerous, it is impossible to accept that this fact justifies the collective failure of government, the CTC, and the railways and their unions to achieve revisions and improvement to these basic rules for a period of 24 years.

V. Remedies

A. Modifying the Railroader Culture

There is much that is admirable in the railroader culture that has evolved within CN: loyalty to the company and to one's co-workers, a willingness to work very hard and for long hours in the face of working conditions that are arduous and difficult, a sense of fairness and community, and of sharing in a proud tradition.

At the same time, however, the culture tends to be resistant to change, even to acknowledging the desirability of change. It includes several features, discussed above, that tend to promote patterns of operation and interaction that result in a lower real priority than is desirable being assigned to considerations of safety both by employees and management.

Among the most important reflections of the culture that have adverse safety impacts are:

- a pay and scheduling system that permits, and even encourages, individuals to work very long shifts, and to work when fatigued;

- an operating philosophy that makes the employee the sole judge of his fitness to perform his duties;
- patterns of reporting and monitoring performance that do not lead effectively to the identification or correction of safety-related performance problems;
- failure to provide appropopriate medical support or follow-up to employees even in cases where known health conditions raise serious questions about employees' abilities to perform their duties safely or well; and
- attitudes to safety technology that place too little emphasis on the effective and timely deployment of this technology.

While the Commission knows it is not easy to change this long-standing culture quickly, it is important that the practices that institutionalize conditions contributing to the risk of extreme crew fatigue and to the disregard of safety rules be corrected.

Measures to correct these institutionalized factors leading to unsafe practices will contribute to the development of a greater sensitivity to safety within the railroader culture. The Report contains recommendations with respect to changes the Commission believes would have this effect.

To its credit, CN has already announced that it will be undertaking measures to establish national disciplinary standards. The railway should also re-evaluate or change its basically *laissez-faire* and fraternal supervisory philosophy.

CN has also announced some improvements in the scheduling information provided to running crews to make it somewhat easier for them to predict when they will be required to work. The railway should also alter those features that permit the working of very long shifts and contribute to the risk of extreme crew fatigue.

B. The Key Role of Safety Technology

The 8 February collision would in all likelihood not have occurred had the lead locomotive of Train 413 been equipped with a modern reset safety control system rather than the obsolete deadman's pedal.

It is essential that CN move immediately to install reset safety control devices in all locomotives, and that, in the period until these installations are completed, the railway adopt a policy of marshalling locomotives that are so equipped in the lead position of all trains.

- CN has announced that it is altering its policies relating to these safety devices by agreement with its unions. Henceforth, locomotives equipped with reset safety controls will be marshalled as the lead locomotive in the train regardless of whether or not they are equipped with comfort cabs.
- Further, CN has committed itself to the installation of reset safety controls in all of its locomotives by the end of 1987.

It is important that Canadian railways proceed with the development and timely deployment of such other advanced safety technology as remote intervention and enforcement systems to increase safety and reduce reliance on the alertness of individual employees.

Building on existing remote intervention technologies, the Canadian railways have begun to make significant progress in the development of Advanced Train Control Systems technology that can vastly improve safety on the Canadian railway system.

The Commission believes that the development and deployment of these technologies should be treated as a priority by the railways; in the event that, because of financial or other considerations, the railways appear to be delaying this critical activity, government measures to ensure timely development and deployment should be put into place.

There is also a range of measures that could be made to improve the working conditions in locomotive cabs to reduce the risk of fatigue and enhance the ability of crew members to communicate with one another.

The Commission notes that, while these conditions have, from time to time, been raised by the rail unions in negotiations with the railway, and while the unions have been successful in obtaining generous wages for their members, they do not appear to have achieved comparable success in obtaining safety related working condition improvements.

This report contains recommendations relating to the timely deployment of safety technology on the Canadian railway system.

C. The Governmental Responsibility

It is essential that the regulatory role of the CTC be strengthened where necessary to ensure safe operations of the railway, and that an independent agency be established with responsibility for enforcement and investigation of all safety related standards.

The Commission recommends that this agency be provided with effective means of enforcement of safety standards, and that it adopt a policy of prosecution of railways and individuals for breaches of these standards. A system of Ministerial penalties similar to that established in the amended Aeronautics Act, in addition to conventional prosecutions through the courts, could strengthen this necessary enforcement capability. In any event, the penalties for safety-related infractions should be severe.

The Uniform Code of Operating Rules should be updated and revised immediately to ensure that these rules are both current and clearly understood by railway employees.

Regulations should be passed to limit hours of work for running crews so as to reduce the likelihood of extreme crew fatigue.

The Commission believes that the CTC should require that firm programs with schedules and accountablities be established by the railways for the development and deployment of appropriate safety technology, including remote enforcement systems, as quickly as may be feasible, and that the CTC should monitor these programs to ensure that they are completed in a timely manner.

The Report contains recommendations relating to the role of government in achieving improved safety on the Canadian railway system.

REPORT OF THE COMMISSION OF INQUIRY INTO THE HINTON TRAIN COLLISION

On the morning of Saturday, February 8, 1986 a westbound CN Rail freight train collided with an eastbound VIA Rail passenger train on the CN main line approximately 11 miles east of Hinton, Alberta.

23 people, including 7 CN employees and 16 passengers, lost their lives in the collision. Among the dead were the 2 engineers operating the passenger train and the engineer and the front-end trainman in the lead locomotive of the freight train.

Having regard to the incredible forces of the collision it is nothing short of miraculous that 95 people survived. That number includes 78 passengers, 14 passenger service crew, 2 running crew on the passenger train, and the conductor of the freight train. 71 of the survivors were physically injured in the collision, some very seriously.

The damage to running equipment and cargos was extensive. The monumental destruction discovered by those first on the scene was beyond description. Photographs which give one some appreciation of the destruction are produced within this Report.

The collision occurred on a section of single track less than one-half mile west of a lengthy section of double track. The area is hilly and heavily treed. It is sparsely populated and there are few roads. Fortuitously the collision site was only about 2 miles from the Yellowhead Highway and access was available by a secondary road leading from the highway to a narrow road running along the track and normally used by crews responsible for the maintenance of signals near the collision site.

The emergency response facilities in Hinton were called into action within minutes of the collision. With support from local industries and individuals, and from the Town of Edson and the City of Edmonton, the emergency response effort was efficient and effective.

Notwithstanding the magnitude of the disaster the emergency was under control quickly and it was possible for railway and Government officials to turn their attention to examining what had gone wrong. Investigations were initiated by CN Rail, the Canadian Transport Commission, the R.C.M.P. and the office of the Medical Examiner.

On Monday, February 10, 1986 the Governor-General-in-Council appointed the Honourable Mr. Justice René Paul Foisy of the Court of Queen's Bench of Alberta pursuant to the *Inquiries Act* to inquire into the collision and report. The Order-in-Council, which set out specific terms of reference, is reproduced in Appendix 1.

The Commission advertised its mandate across Canada seeking submissions from interested parties. Written submissions were received from a wide variety of sources and each was considered by the Commission. Some of these responses proved of extraordinary usefulness in directing the Commission's attention to matters which it might otherwise not have considered.

Public hearings were conducted commencing on March 24, 1986. There were 48 days of hearings in Edmonton and 8 days in Jasper. 6 parties were permitted to be represented throughout the hearings and to cross-examine the witnesses who appeared. These were CN Rail, the Canadian Transport Commission, VIA Rail, the Brotherhood of Locomotive Engineers (BLE), the United Transportation Union (UTU), and CP Rail. In total 150 witnesses appeared. These included the surviving crew members, several surviving passengers, officers of CN, VIA Rail, CP and the 2 Unions, operations and maintenance personnel from CN, medical doctors, officers of

the CTC, R.C.M.P. and Medical Examiner's Office, several private citizens and several advisors and experts who the Commission either retained or otherwise invited to provide detailed information on a wide variety of subjects. A list of the witnesses setting out the capacity in which they appeared forms Appendix 2.

The evidence was transcribed verbatim. During the course of the testimony 541 exhibits were admitted into evidence. The transcripts and exhibits have been lodged with the Department of Transport.

It became apparent very soon after the commencement of the public hearings that the issues into which the Commission was asked to inquire and the detail it had to attempt to absorb were such that the report deadline of May 30, 1986 which had been set by the Order-in-Council could not be met. Accordingly, that deadline was extended to December 31, 1986.

In an effort to be as thorough as possible the Commission was obliged to look at several issues in considerable detail only to discover that they did not bear the degree of significance originally thought. These matters accordingly may receive only peripheral mention in this Report. Some of them, though not within the Commission's Terms of Reference, are matters which the Commission considers to be in need of attention and they are so identified when they are mentioned.

The Commission has found it convenient to organize its report by setting out in detail that which is known about the events of February 8, 1986. This is followed by a discussion of several issues which arise from the description of the collision events including the Commission's analysis of the part, if any, that each of several factors played in the cause of the collision. Where this analysis has led the Commission to conclude that criticism is warranted, the discussion proceeds to consider recommended changes and improvements. The conclusions reached and recommendations offered by the Commission are then summarized.

I. THE CIRCUMSTANCES OF THE COLLISION

A. The Scene

1. Location of the Collision

The CN Rail time table for the Mountain Region, a page of which is Appendix 3, shows that there are 18 "stations" along the route between Edson and Jasper. These are places where some significant track feature is located – such as a siding or the commencement of a section of double track. Only one of these stations, Hinton, is a station in the sense of a depot – a place where passengers or freight might be put on or off a train.

The collision occurred a few hundred feet west of the station identified as "Dalehurst". Other stations of significance in the discussion of the collision events are Pedley, Hargwen and Medicine Lodge.

Points along the route are also identified by their distance expressed in miles from Edmonton. Dalehurst is located at Mile 173.0. which is approximately 11 miles east of the Town of Hinton, Alberta. The exact point of impact is determined to be Mile 173.13.

2. The Route Between Edson and Jasper

A map showing some of the relevant features of the route from Edson to Jasper is produced on page 18.

a) Double Track and Sidings

Of the approximately 100 miles of track between Jasper and Edson slightly more than half is double track. There are 3 double track sections, one at each end of the route, and one approximately in the middle which is 11.2 miles long. Dalehurst is located at its western end. The two tracks in this section are referred to as "the north track" and "the south track".

There are six sidings located along the single track portion of the route. The exact location and length of each siding is set out in the time table (Appendix 3).

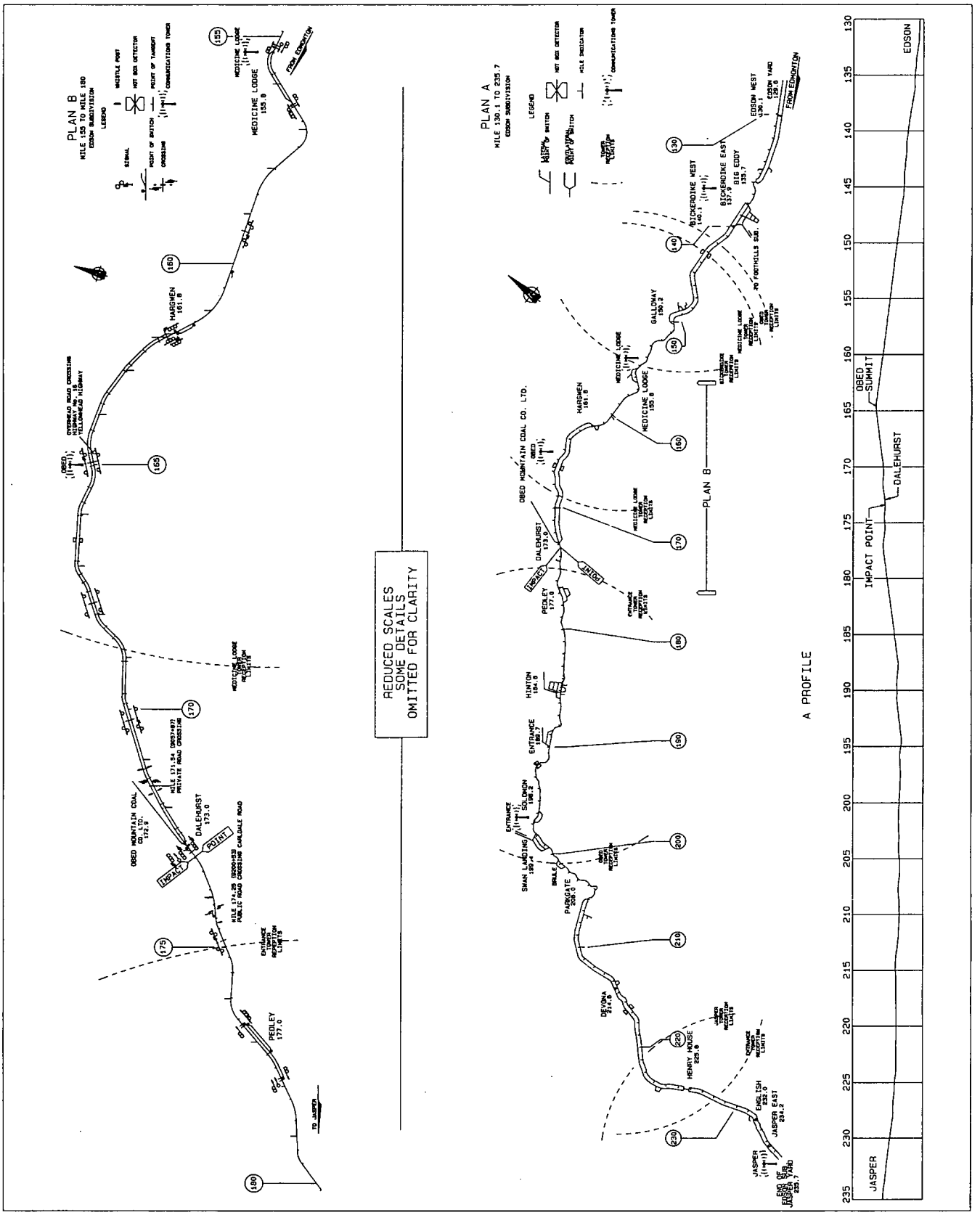
Each siding is a few hundred feet longer than the length published in the time table. This additional length is intended to provide an allowance for containing very long trains. For example, the siding at Medicine Lodge, into which Train 413 stopped on the morning of the collision, is shown in the time table as being 6,050 feet long. It is actually 6,400 feet long.

b) Grades

i) Westbound – Edson to Dalehurst

An important feature of the Edson-Jasper route is the grade encountered. It influences the abililty of crews to remain alert and affects the speed of trains. The first 35 miles proceeding west

FIGURE 1
MAP OF EDSON SUBDIVISION



from Edson is almost entirely ascending. The elevation gain is about 580 feet in that distance. The steepness of the grade over the whole ascending section averages about 0.3% and ranges as high as 0.67%. The average grade becomes generally steeper as the track proceeds west towards the point known as the Obed Summit located at Mile 164.5.

From the Obed Summit to Dalehurst there is an elevation drop of about 125 feet. The descending grade averages 0.4% over that distance. There is a one mile portion of that section where the elevation rises 5.4 feet creating a "sag or dip" which is of some significance in the evidence of the conductor of Train 413.

At the collision site itself the grade is virtually level.

ii) Eastbound – Jasper to Dalehurst

The climb to the Obed Summit for eastbound trains begins at Mile 194.5. Over the 30 miles from there east to the summit the elevation gain is about 345 feet. From Pedley to the site of the collision there is an interruption in the climb. In that 4 mile stretch the grade descends for 1.5 miles then ascends for the same distance and then is virtually level at the collision site itself.

c) Dalehurst Turnout

At Dalehurst the double track which commences 11.2 miles to the east at Hargwen becomes single track. The design of the "turnout", the junction of the double track section and the single track section, is such that moving west the north track becomes the single track. The south track curves north to join the single track.

The position of the track switch located at the junction determines to which of the double tracks the single track is lined. If the switch is lined to permit access to or egress from the south track it is lined against westerly moving traffic on the north track and is said to be "open" or "reversed". If the switch is lined to permit access to or egress from the north track it is lined against westerly moving traffic on the south track and is said to be "closed" or "normal".

d) Dalehurst Signals

i) Approaching from the East

Dalehurst is described as a "control point". This means that it is a place where trains may be stopped in the routine functioning of the traffic control system. There are, accordingly, signals located east of the point where the double track ends. These signals control westbound trains on the north and south tracks and are referred to as "home signals".

The signal for westbound trains on the north track is identified as Signal 1729N. It is located to the north of the track about 490 feet east of the turnout and consists of 3 lights in a vertical line above a triangular yellow sign bearing the letter "L", all mounted on a tall mast to create a high degree of visibility. A photograph of signal 1729N is included in the photograph section of this report.

The signal designations are derived from the location of the signals. Signal 1729N is therefore near Mile 172.9. However, the designation is not always precise. Signal 1729N is actually located at Mile 172.8.

To the east of this signal is a curve of about 1° which is to the left for westbound traffic. The line of sight of the Dalehurst home signal is not significantly affected by the curve. The evidence was that the lights of the Dalehurst home signal can first be seen from 3,300 feet east and are clearly visible from 2,900 feet east.

This home signal is the fourth of a series of signals which a westbound train would encounter in the section of double track between Hargwen and Dalehurst.

The first 2 signals in this series are called intermediate signals and are located to the north of the north track at Mile 165.0 and Mile 167.8 respectively. These each consist of one light which may display green, yellow or red. Neither is of relevance to the events of February 8 as both would have been green when Train 413 passed indicating that the train should proceed.

The third signal in this series is located at Mile 170.2 and consists of 2 lights. It is called an "approach" signal and is located 13,600 feet east of the Dalehurst signal. This signal is critical to the events of February 8.

A westbound train would encounter a 2°45' left-hand curve at Mile 169.8. The approach signal first comes into view at the start of that curve, about 2,400 feet east of the signal. The evidence was that this signal is clearly visible when it first comes into view.

ii) Approaching from the West

There is an approach signal at Mile 175.0 on the north side of the track. It consists of two lights above an "L" sign. The evidence did not indicate from what distance this approach signal would be visible to an eastbound engineer but the diagrams provided by CN indicate that the signal would become visible to an eastbound train about 2,000 feet to the east, in the course of a 2° left-hand curve.

The Dalehurst home signal governing eastbound traffic is located at Mile 173.0 on the north side of the single track. Like the westbound home signal it consists of three lights and a "L" sign.

There is a 1° curve west of this home signal. It is a left-hand curve for eastbound traffic. This curve obscures the signal until the train is about 2,000 feet west of it. From there the signal is clearly visible.

e) Hot Box Detector

At Mile 166.5, about two miles west of the Obed Summit there is a hot box and dragging equipment detector. The hot box detector measures the temperature of the axle journals of the railway rolling stock as the train passes by. The dragging equipment detector checks for the presence of any abnormal condition in the equipment such as a derailed wheel or a brake rigging hanging from the train between the rails. In addition, information regarding the time that a train passes and the speed at which it passes is recorded.

Information detected by these devices is transmitted to and recorded in the Edmonton Traffic Control office. If there is an indication of overheated bearings or of dragging equipment, the dispatcher in the Edmonton office contacts the train crew by radio.

As discussed later in this Report, the information recorded as Train 413 passed this hot box detector on February 8 was useful in determining the speed at which the train was travelling at that point.

f) Radio Towers

In several places along the route from Edson to Jasper there are radio towers which are components of the system of radio communication between the dispatch office in Edmonton and the trains. The ranges of the towers overlap to ensure that continuous communication with the dispatch office is possible from every point along the route. The site of the collision was within the range of the Obed Tower located at Mile 165 near the Obed Summit.

g) Other Features

Other features of less significance include a spur line serving the Obed Mountain Coal Company Ltd. which joins the main line 187 feet west of the Dalehurst turnout. The switch controlling access to that spur is arranged so that entry is possible only from the west. A separate signal regulates traffic on the spur. The presence of this spur near the collision site did not affect the events of the collision.

At Mile 171.5, 1.5 miles east of Dalehurst, a private road serving the Union Oil Plant of the Obed Marsh Coal Field crosses the double track. This level crossing is controlled by flashing lights, bells and gates.

At Mile 174.25, about one mile west of the collision site, there is a public level crossing. A locomotive engineer approaching this crossing is required to sound the train whistle. The crossing is protected by flashing lights and bells.

A narrow gravel road proceeds east from that crossing on the south side of the track to Dalehurst. This road provides access by CN maintenance crews to the signal and switch equipment at Dalehurst. The road proved vital to the success of the emergency response action after the collision.

3. The Weather on February 8, 1986

Environment Canada records indicate that the temperature at 0800 on February 8 at Edson was -14°C and at Jasper was -13°C. At 0900 the temperature at Edson was still -14°C and at Jasper -12°C.

There was thin and broken cloud cover. Visibility at Edson was 40 miles. At Jasper it was 25 miles. There was no wind at Edson and very light winds at Jasper. There was no fresh snow on the roadbed. Sunrise at Hinton was at about 0823 and at Obed it was at about 0822.

Some of the running crew employees who appeared before the Commission recall that the "northern lights" were particularly active before dawn. The Commission was also advised that there was a particularly severe geomagnetic storm on February 8. The relevance of this geomagnetic activity is discussed further and discounted on page 67 of this Report.

B. Train 413

Train 413 was a general freight train marshalled at the Calder yards in Edmonton from which it departed at 0155 on February 8. There was nothing unique or unusual about the equipment or the marshalling of this train.

1. Composition

Train 413 was powered by three diesel locomotives. The lead locomotive, Unit 5586, had 2,000 horsepower, and the two trailing units, Units 5104 and 5062, had 3,000 horsepower each, giving the engine consist a total capacity of 8,000 horsepower.

Behind the three locomotives of Train 413 there were marshalled 114 loaded cars and a caboose. The cars and their positions were as follows:

Positions	Description
1 – 3	Locomotives
4	High speed spreader
5 – 39	Hopper cars (grain)
40 – 46	Flat cars (dimensional loads)
47 – 91	Open top hopper cars (sulphur)
92 – 103	Tank cars (caustic soda)
104 – 111	Tank cars (ethylene dichloride)
112 – 117	Hopper cars (grain)
118	Caboose

Each of the 7 flat cars was loaded with 75,000 pounds of 78 inch diameter pipe. The dimensions of these loads were greater than standard for cars in the Mountain Region and these cars were, accordingly, referred to as "dimensional loads". Because of these loads, special train orders were issued for Train 413 giving specific instructions for the handling of the train in certain places along the route between Edmonton and Vancouver. None of these orders is of relevance to the collision.

The tank cars in positions 92 to 111 carried commodities classified as dangerous goods. The transportation of these goods is governed by Federal regulations none of which was violated in this case.

The length and weight of Train 413 was typical of trains travelling on the Mountain Region of CN. The freight consist of the train weighed 12,292 tons and was 5,932 feet long. The whole train, including the engine consist, weighed 12,804 tons and was 6,124 feet long.

2. Locomotive Cab

The layout of the cab of the lead unit of Train 413 is depicted in Figures 4 and 5. The cab was classified by CN as a "comfort cab" meaning only that it had certain features which were intended to render it more comfortable than the previous generation of cabs.

The front of the cab had a reinforced hood called a "short hood" designed to withstand a substantial collision. Access to the cab was through a door in the front of this hood. In the short hood on the engineer's side was a small toilet compartment.

3. Caboose

The caboose on Train 413 was standard equipment. Next to the back door there was a desk where the conductor would keep the documents relevant to the operation of the train including the train manifest, train orders and the documents relating to the dangerous commodities carried by that train.

In the middle of the caboose was an observation room elevated above the main roof. This room is called the cupola, and is designed to provide the conductor with a good view of the train. Access to it is provided by a ladder in the centre of the caboose. On either side of the cupola is a rotating chair. The walls of the cupola contain large windows. Between the two chairs the floor is open to the main portion of the caboose.

Located at each end of the caboose and in the cupola are gauges which show the level of air pressure in the automatic brake line. At each end and in the cupola there are also cords which when pulled effect an emergency brake application. There is also a whistle in the caboose which is designed to sound when any brake application is made. This gives the rear-end crew warning of the jerking motion that may occur at the rear-end when the train brakes are applied.

C. Train 4

1. Composition

Train 4 was marshalled as follows:

Position	Description
1	Diesel Unit 6566
2	Diesel Unit 6633
3	Baggage Car
4	Day Coach/Snack Bar
5	Dome Car/Lounge
6	Sleeper
7	Sleeper
8	Diesel Unit 6300
9	Steam Generator Car
10	Baggage Car
11	Day-Nighter, Coach
12	Cafe/Lounge Car
13	Sleeper
14	Steam Generator Car

The units in the first seven positions had formed the entirety of Train 4 on its journey from Vancouver to Jasper. The units in positions 8 through 13 inclusive had formed Train 6 from Prince Rupert to Jasper. For reasons of economy these two trains were joined in Jasper and traveled on as one train, Train 4. The locomotive of Train 6 which was in position 8 of Train 4 was not providing pulling power on the trip from Jasper. A steam generator car, unit 14, was added in Jasper and was being taken to Edmonton for servicing.

The passenger coaches, sleepers and lounges were conventional equipment. Exits were located at each end of each car.

The two locomotives at the head-end of the train were over 30 years old. Together they had a capacity of 3,250 horsepower. The layout of the cab of the lead unit is shown on page 78.

2. Passengers and Crew

At the time of the collision Train 4 was carrying 94 passengers, 14 VIA Rail passenger service personnel and 7 CN running crew employees. 9 of the VIA Rail passenger service employees had received first aid training. 1 of these was trained in the use of oxygen and in cardio-pulmonary resuscitation.

3. VIA Rail

VIA Rail is a Crown corporation created in 1977 when the Government of Canada consolidated the railway passenger services then operated by CN Rail and CP Rail. Originally, VIA Rail was responsible only for marketing operations while the 2 railways continued to operate the trains. Subsequently VIA Rail assumed ownership of all rolling stock and continued to operate on CN and CP tracks pursuant to contractual arrangements with those railways.

At the time of the collision CN (and CP on CP lines) provided their employees as running crews for VIA trains but VIA had plans to terminate this arrangement and to hire its own running crews.

D. The Crew of Train 413

1. Wayne Smith

The conductor on Train 413 was Wayne Rodney Smith. He was in the caboose at the time of the collision and survived. In February 1986 Smith was 33 years old and resided in Jasper. He first worked as a CN employee in Melville, Saskatchewan in the summer of 1971 as a yardman. In the summers of 1972 and 1973 he was a trainman.

From April 1974 on he worked throughout the year for CN in various capacities and in various places. He qualified as a conductor on April 3, 1976 and transferred to Jasper in January 1978. He worked out of Jasper from that time to February 1986 as a trainman and as a conductor.

2. Jack Hudson

The locomotive engineer on Train 413 was John Edward (Jack) Hudson. Engineer Hudson died in the collision.

Hudson was 48 years old and a resident of Jasper Alberta. He had commenced service with CN in May, 1970 as a "train engine watchman". He worked as a "hostler" in CN's Jasper yard until 1973 when he joined the running trades as a trainman. In 1976 he attended the CN training school at Gimli, Manitoba. Having completed that course of instruction and 159 tours of duty, he qualified as a locomotive engineer on March 5, 1977. All of Hudson's service with CN was out of Jasper, Alberta.

Engineer Hudson was classified as an engine service brakeman at the time of the collision. That classification is of significance only to the operation of the collective agreement – there was no restriction on his functioning as a locomotive engineer.

3. Mark Edwards

The third member of the crew of Train 413 was the front-end trainman, Mark Jenkins Edwards. Trainman Edwards also lost his life in the collision.

At the time of the collision Edwards was 25 years old and a resident of Jasper. He had joined CN as a trainman in June 1980. He qualified as a conductor in June 1982 and from that time until the collision worked out of Jasper as a trainman and conductor.

E. The Crew of Train 4

1. Mike Peleshaty

As is required on a passenger train, both of the men on the lead locomotive of Train 4 were qualified locomotive engineers. At the time of the collision the engineer at the controls is believed to have been Mike Peleshaty. Engineer Peleshaty died in the collision.

Peleshaty was 57 years old at the time of the collision. CN records show his residence to have been in Hanna, Alberta but he was working out of Jasper. He had joined CN in August 1952 as a locomotive fireman. On July 1, 1967 he qualified as a locomotive engineer and began working in that capacity in August 1969. From August 1970 to the date of the collision he worked out of Jasper.

2. Emil Miller

The second engineer on Train 4 was Emil Miller. It is believed Engineer Miller was at the controls from Jasper to Hinton. Miller was also killed in the collision.

Miller was 53 years old and a resident of Jasper. He joined CN in December 1951 as a carman and became a locomotive fireman in May 1952. He worked mostly in Hanna, Alberta until December 1983 when he transferred to Jasper as an engineer.

3. William Brownlee, Murray Guy MacMillan, Mark Tretiak

3 of the running crew members of Train 4 were positioned in the day coach which was in position 4 on the train. They were William Brownlee, the conductor, Murray Guy MacMillan, the assistant conductor, and Mark Tretiak, the baggageman. All lost their lives in the collision.

Brownlee was 59 years old and a resident of Edmonton. He had joined CN in 1947 and qualified as a conductor in 1951. MacMillan was 52 years old and a resident of Edmonton. He had worked with CN as a trainman and conductor since June 1953. Tretiak was 54 years old, a resident of Edmonton and had worked with CN as a trainman and conductor since September 1950.

4. Herbert Raymond Timpe, Nelson Quast

The other 2 members of the running crew of Train 4 were positioned in the rear passenger portion of the train and both survived the collision. They were Herbert Timpe, the assistant conductor and Nelson Quast, the rear trainman.

In February 1986 Timpe was 61 years old and a resident of Edmonton. He had worked with CN since May 1948 in various capacities including trainman, switch foreman, yardmaster, baggageman and conductor.

Quast was 51 years old at the time of the collision and resided in Edmonton. He had been with CN in a number of different capacities since August 1957.

F. Train 413 – Edson to Dalehurst

The dispatcher's Train Sheet for February 8th indicates that Train 413 departed Edson at 0640. The train had not actually stopped in Edson. It had been slowed enough to permit the incoming and outgoing crews to exchange positions while the train was still moving but had not been stopped in order to avoid the difficulty of starting up the long heavy train from a standstill on an uphill grade. This technique is referred to as "taking the train on the fly" and is a violation of the Uniform Code of Operating Rules (UCOR).

There was radio communication between Smith and Hudson as the train departed Edson. As well, Smith's evidence was that at each of the control points which the train passed, up to and including Hargwen, he and Hudson communicated the indication of the signals by radio as the rules require.

Prior to the train's arrival at Medicine Lodge, the dispatcher, Mr. Zavaduk, contacted Hudson from Edmonton. That conversation was recorded, as are all conversations between trains and dispatchers, and has been transcribed as follows:

RADIO TONE

DISPATCHER:	Dispatcher to 413, 5506 West, over . . 5586 West, over.
ENGINEER HUDSON:	Good morning, dispatcher.
DISPATCHER:	Good morning, Jack. That aw . . length of your train, there, 5932 that is the right length, is it?
ENGINEER HUDSON:	Aw, I'll get a measure at Medicine Lodge, here, I haven't had a chance, yet.
DISPATCHER:	Oh, that's aw . . . that might be a little too late . . I've got two eastbounds coming – 202 is at Hargwen and 354 is on the north track right on his ass. I'm gonna bring both over to the Lodge, there, aw . . . you've got pretty well all grain cars, eh.
ENGINEER HUDSON:	Yeah, I think so: I haven't had a chance to look at it. It's just starting to get daylight here now, I think so, yeah.

DISPATCHER: Yeah, it should be the right length, then, O.K., O.K. thanks.

At Medicine Lodge, Mile 155.8, Hudson brought Train 413 into the siding to the north of the main track to allow two eastbound trains to proceed on the main track. As Train 413 was just shorter than the siding the process of moving the train into the siding without passing the signal at the siding's west end involved careful train handling by Engineer Hudson. As the train entered the siding Smith "spotted the caboose", advising Hudson by radio of the number of cars still on the main line.

The crews of the trains which met Train 413 at Medicine Lodge saw nothing irregular about the train or its crew as they passed. Some of the crew members saw Edwards on the ground next to the locomotive observing their trains as they passed. Some saw Smith on the caboose. None of the crews saw Hudson but it would not be expected that he would have been visible given his position on the right side of the cab and the dawn visibility conditions.

The time of the arrival of each train at the various stations along the route is recorded by a computer which is used in the traffic control system. This record shows that Train 413 departed the Medicine Lodge siding at 0802:55.

Rule 3.2(b) of the CN General Operating Instructions requires a member of the rear-end crew to contact when practicable a member of the engine crew as the train approaches an approach signal to inquire as to the display of the upcoming approach signal. The crew of the train following 413 say they overheard Hudson call the signal displayed at Hargwen back to Smith.

The computer record shows that Train 413 arrived at Hargwen at 0820:47. It arrived at the hot box detector at Mile 166.5 at 0833:19.

When the caboose arrived at Mile 169, Smith says he was sitting at the back desk of the caboose and that he saw the mileboard for that mile on the north side of the train. This mileboard was the landmark which Smith said he used as a reference point to determine that it was time to call the head-end to inquire about the aspect of the Dalehurst approach signal, Signal 1703. When the caboose was at Mile 169 the head-end would be just west of Mile 170 and the approach signal would be well within the engineer's range of sight.

Smith said he made the call on his grey radio from the back desk of the caboose. He says he got no response and that he tried to reach the head-end several times on the grey radio with no success. He concluded that his grey radio was not working. He said he had no concern that anything was amiss in the locomotive. He said two things indicated to him that the train was under control; first, he thought the train was going about track speed, 50 miles per hour. Second, he said he perceived that a slight brake application was in effect.

There is no speedometer in the caboose. The conductor is trained to determine the speed of the train by clocking the lapsed time between mileboards.

There are means by which a conductor can determine whether there is a brake application in effect. The air pressure gauges will indicate any reduction in air pressure which occurs when the brakes are applied. Smith said he did not look at the air gauges at any time.

In addition the caboose whistle sounds when the brakes are applied. Smith said he does not recall hearing the caboose whistle sound at any time. Crews occasionally tie a rag around the

whistle or otherwise interfere with it so that it cannot be heard. They apparently consider the whistle bothersome. Smith said he did not examine the whistle to see if it had been rendered inoperative by a previous crew.

Smith's evidence was that when he was unable to communicate with the head-end on his grey radio, he climbed partway up the cupola ladder, turned on the red radio (he had turned it off when he left the cupola after Hargwen) and again tried to call the head-end. Again, he said he received no response.

He said he then turned the channel selector knob of the red radio to the other channels. The knob seemed to turn without clicking into other channels and Smith lost track of which channel the radio was on. His evidence is that he went through all four channels, calling on each one, and did not receive any response.

The evidence of a CN signal expert was that when the locomotive of Train 413 was approaching Signal 1703 that signal would have displayed yellow over red. According to Rule 285 of the UCOR, this is a command for the engineer to slow the train down to "medium speed", 30 miles per hour, so that he will be able to stop the train if necessary at the next signal. The rule is:

> Proceed, preparing to stop at next signal. Trains exceeding medium speed must at once reduce to that speed. Reduction to medium speed must commence before passing signal.

Smith said he recalls that when he was standing on the cupola ladder he saw the signal mast for Signal 1703 as the caboose passed it. It is immaterial that he did not see the display of the approach signal. As will be explained later when the operation of the signal system is discussed in detail, the signal would have displayed red at that time regardless of what it displayed when the locomotive approached it.

Smith stated that as the caboose was passing the signal he felt the "run-in" of slack that would result when the locomotive went up the west side of the Mile 170.5 sag or dip. Such slack action does not result from the action of the engineer, it results from the topography. Train handling can however exaggerate or reduce the extent to which the slack action is felt in the caboose. Apparently nothing about the intensity of the slack action experienced that day gave Smith any concern about whether Hudson was in control of the train.

Smith testified that having tried all the channels on the red radio unsuccessfully, he returned the setting to what he thought was Channel 1, sat down in the cupola and tried to again reach the head-end now to inquire as to the aspect of the home signal at Dalehurst. Again he received no response.

Smith said he did not hear the train whistle when the headend passed the level crossing for the Obed mine, 1.5 miles east of Dalehurst. There is a requirement that the engineer sound the whistle before that crossing. Smith said, however, that he would not expect to hear the whistle from the caboose. The RCMP interviewed people who were at the mine site that morning but could find no one who recalled seeing Train 413 or hearing the whistle.

The evidence of a CN signal expert was that when Train 413 approached the home signal, all 3 lights of that signal would have displayed red. UCOR Rule 292 states that such a signal is a command to stop.

Smith said he did not at any time pull the cord which would have caused an emergency application of the train brakes. He said that a few seconds after he sat down in the cupola the

train went into an emergency brake application and he saw a huge fire ball ahead. At that time the caboose had just passed the road to the Obed mine.

After observing the fire ball Smith said he transmitted a message of warning to the head-end – telling them that there was a big explosion, and that the front-end crew should stay away from the dangerous goods on the train.

He said he then decided to jump off the train as the caboose was still moving. He was concerned that the caboose and the dangerous commodities in front of it might travel into the fire. He got down from the cupola, stopped at the back desk to grab the train documentation and the grey radio, went to the back platform, assessed which way to jump and jumped off the caboose to the ground between the double track.

Conductor Smith's evidence is that he then tried to raise someone on his grey radio. He heard a radio tone coming from the red radio on the caboose which indicated a call coming through from the dispatcher. He ran to the caboose which by this time had stopped and spoke to the dispatcher on the red radio. That exchange was recorded and has been transcribed as follows:

RADIO TONE	
DISPATCHER:	Dispatcher to Number 4, over.
VOICE:	Hello, dispatcher.
DISPATCHER:	Dispatcher.
VOICE:	413 here dispatcher. There was ah . . a meeting here. We're just over the switch and we're all over the bush, here. I can't seem to raise the head-end.
DISPATCHER:	You mean you're derailed?
CONDUCTOR 413:	Yeah, we got a big explosion up here too dispatcher, ah. I'm about maybe 40 cars from the . . . where the smoke and everything's in the air – I saw a big cloud of . . .
VOICE:	Hello Edson West Conductor 413 ah, it looks pretty serious ahead, here. There's a lot of ah . . . fumes and stuff around here. I don't know if I should walk up. But I can't seem to get a hold of the head-end.

G. Train 4 – Jasper to Dalehurst

Train 4 departed Jasper at 0715, ten minutes late. In preparation for departure there had been a brake test which involved use of the locomotive radio. That communication was overheard by Assistant Conductor Timpe on his portable radio.

Engineer Miller had two conversations with the dispatcher in Edmonton prior to departure, one at approximately 0630 and the other at 0705. These were about routine matters and there is no indication on the transcript of anything irregular. There was no further radio contact between Train 4 and the dispatcher prior to the collision.

The trip from Jasper to Hinton was uneventful. Train 4 arrived at Hinton at 0820 and stopped to allow passengers to detrain. The train's brakes were used to bring the train to a stop at Hinton.

Engineers Miller and Peleshaty had a routine of exchanging positions in the head-end at Hinton. Because it was Miller who conversed with the dispatcher prior to departure from Jasper, it is presumed that he was at the controls from Jasper to Hinton. The positions in which the remains of the 2 men were found in the wreckage after the collision, indicate that they followed their routine on February 8. Accordingly, Peleshaty was at the controls at the time of the collision.

The train departed Hinton at 0825, five minutes behind schedule.

The 2 surviving running crew members, Timpe and Quast recall no radio communication with the head-end after Hinton.

Entries on a computer system log indicate that just about one minute after Train 4 left Hinton, the dispatcher made a request for some sort of action at Pedley, the first station west of the collision site. It cannot be determined what the request was and the dispatcher cannot recall. The computer, for a reason which also cannot be determined, would not permit the requested action to occur. The "illegal request" was followed immediately by a request to reverse (or open) the switch at Dalehurst and the record indicates that the switch opened at 0829, about 11 minutes before the collision.

This series of entries on the computer system log suggests that perhaps the dispatcher may have contemplated stopping Train 4 in the siding at Pedley and letting Train 413 pass, but that the computer would not accept that instruction. However, the records do not reveal any field condition which would have made such a request "illegal" and the dispatcher cannot recall trying to arrange the meet that way. Accordingly, this suggestion would appear to be unfounded.

Train 4 reached Pedley at 0837:15 and proceeded on to Dalehurst. The evidence of a CN signal expert is that the approach signal at Mile 175.0 would have authorized Train 4 to proceed. One of the passengers recalls observing a signal which was yellow over green shortly before the collision. If this was the approach signal, such a display is called "approach limited" and the UCOR Rule 282(a) instruction is "proceed, approaching next signal at limited speed", that is, at a speed not exceeding 45 miles per hour.

Two passengers on the Train 4 reported seeing the approaching Train 413 prior to the accident. Mr. Ken Cuttle was sitting at the front of the dome of the dome car, the fifth unit of the train. He saw the headlight of Train 413 and from the lateral swaying motion could tell that the approaching train was moving. He assumed the track was double and, accordingly, did not anticipate the collision.

The other passenger who saw Train 413 before the collision was Mr. Perry Warniski who was seated in the day coach, which was the fourth unit of the train. He did appreciate that the approaching train was on the same track as Train 4 and yelled out, "he's on our track", prior to the impact.

Mr. Cuttle also recalls seeing red signals east of the lead locomotive of Train 4. His evidence was that he saw two such red signal lights and a third red signal light to the east of the point of impact all on the north side of the track. Another passenger, Mr. Grosh, reported seeing three red lights on the north side of the track just before the collision.

Mr. John Raistrick, a CN running crew employee on holiday with his family, was in the day coach, which was in position 4 of the train, a few minutes before the collision. He had been talking

to the 3 CN crew members, Brownlee, MacMillan and Tretiak, who were in the middle of the day coach at seats designated for them. Mr. Raistrick says that the portable radios these crew members had were on. Mr. Raistrick returned to his wife and daughter in the car in the fifth position prior to the collision.

There was a requirement that the engineer sound the whistle before the public crossing at Mile 174.25. The passengers who gave evidence did not recall hearing the whistle sound although they had heard it on other occasions.

None of the witnesses on Train 4 felt any brake application prior to impact. This includes several passengers and at least three persons who might be expected to have appreciated that there was a brake application had there been one: Raistrick, and the two surviving crew members, Timpe and Quast.

Timpe and Quast had their radios turned on, monitoring Channel 1 at all times during the trip, but did not hear any radio transmissions from Train 413 prior to the collision. Timpe's evidence was that his radio was receiving properly prior to the collision and that after the collision he received transmissions from dispatch and overheard communications between Smith and dispatch clearly.

H. The Collision

From observations made by moving two locomotives gradually back in both directions from the point of impact and assuming speeds of 59 miles per hour and 49 miles per hour for Trains 413 and 4, respectively, CN prepared an analysis of the collision events. The results are depicted in Figure 3 on page 73. The validity of the assumptions used in this analysis is reviewed later.

The relevant conclusions of this exercise are that as Train 4 approached Dalehurst the permissive display on Signal 1730 would have been first visible 20.4 seconds prior to impact and clearly visible 19 seconds prior to impact.

Also, 19 seconds prior to impact, it would have been possible to see either train from the other. At that time Train 413 would still be east of the Dalehurst switch and the permissive signal would still be displayed to Train 4.

At 18 seconds before impact, Train 413's lead locomotive entered the turnout. As is explained later in this report when the signal system is described in detail, this would have the effect of breaking the signal circuit affecting Signal 1730 and causing that signal to turn to red.

According to this analysis, the two trains were on the same track for 18 seconds before the collision.

The last event recorded on any of the computer records relating to the movement of Train 413 and Train 4 is the arrival of Train 413 at Dalehurst. The time of that arrival is shown as 0840:34. The time of impact would have been about 18 seconds later.

I. The Damage

The devastation caused by the impact defies description. It is not possible to appreciate the horror that the victims of the collision experienced.

23 persons lost their lives. These included the head-end crews of both trains, 18 occupants of the day coach which was in position 4 on the train and 1 occupant of the dome car which was in position 5.

The destruction and horror caused by the impact was intensified by fire fuelled by the spilled locomotive diesel oil. The fire broke out almost immediately following the impact and engulfed the lead units of both trains, the baggage car and the day coach. The contents of a grain car which was thrown into the wreckage also spilled into the day coach. This may possibly have saved some passengers' lives by smothering the fire.

Miraculously, 18 occupants of the day coach managed to escape. Some did so despite having suffered serious injuries.

The passengers in the observation dome escaped through a broken window. The passengers on the lower level of that car escaped through a hole in the side of the car created when one of the cars of the freight train which had been thrown in the air, smashed into the rear of the dome car.

The 2 sleeper cars immediately following the dome car, units 6 and 7 of the train, were derailed and thrown onto their sides. Some of the passengers in these cars had difficulty finding a route of escape but eventually they did.

The diesel unit, steam generator unit and baggage car in positions 8, 9 and 10 of the train were derailed and overturned – the baggage car only partially. The 3 passenger cars at the rear of the train, units 11, 12 and 13, did not derail. The occupants of these cars were violently thrown about by the impact and some suffered injury.

The Commission heard accounts of remarkable heroism exhibited by passengers and VIA personnel. The number of survivors, an amazingly high number given the extent of the damage to the train equipment, indicates that there must have been many heroic acts performed that were not brought to the Commission's attention.

Photographs give a better impression of the extent of the damage and destruction than is possible through narrative. Some of these are reproduced in this Report. On Train 413 the 3 diesel locomotives, the high speed spreader, 35 grain hopper cars, 7 flat cars carrying large pipes and 33 hopper cars carrying sulphur were destroyed or damaged.

The cost to the two railways, CN and VIA, has been estimated to be in the area of $35,000,000. A breakdown of these costs appears in the following table.

TABLE 1

Estimated Costs of the Hinton Train Collision

VIA Rail Costs:

Item	$ Millions
Equipment Replacement	5.820
Equipment Repair	.202
Loss of Revenue (Long Term[1])	5.626
Allowance for Claims Settlements	7.000 – 9.000
TOTAL	18.648 – 20.648

[1] Includes revenue losses for Years 1986 – 1990.

CN Rail Costs:

Item	$ Millions
Equipment Replacement	11.262
Transportation	.404
Other[2]	2.317
TOTAL	13.983

[2] Includes engineering, police, claims services, management, overhead and task force costs.

J. Events after the Collision

One of the immediate concerns following the collision was the status of the dangerous goods carried by Train 413. Fortunately Train 413's 20 dangerous goods cars had been marshalled near the rear of the train and did not derail. The dispatcher in Edmonton instructed the engineer of the train which had been following Train 413 to stop, disconnect his locomotive units from his train, proceed to the remaining cars of Train 413, and move all cars not derailed or damaged, including the dangerous goods cars, back from the collision wreckage.

Conductor Smith and the head-end crew of that following train, Engineer C. Elliott and Trainman J. Keogan, undertook this operation but did not realize prior to pulling the cars back onto the north double track that the Dalehurst switch had been damaged by Train 413. Accordingly, when the cars were pulled back one derailed and damage was caused to the switch and track.

Photo I: Collision Site Looking East. Credit: The Edmonton Sun.

Photo II: Collision Site Looking East. Credit: Jim Cochrane, The Edmonton Journal.

Photo III: Ground Level View of the Wreckage.

Photo IV: Collision Site Looking North.

Photo V: View of Collision Site Looking West and Showing Section of Main Line Double Track in Foreground.

Photo VI: Collision Site Viewed Looking East and Showing Section of Main Line Double Track and Spur Line to the North.

Photo VII: Via Passenger Car. Credit: The Edmonton Sun.

Photo VIII: Signal 1729 N.

II. ANALYSIS AND RECOMMENDATIONS

The Commission's task was to carefully examine the available evidence to determine which of many possible factors contributed to the cause of the collision. The process involved gathering information relating to the condition and operation of all equipment involved in the movement of each train, the condition and actions of the crews in control of the trains, the operation of the system to control train traffic, the operation of the rules governing train movements, and the supervisory function of management and the government regulatory agency.

In the course of considering this information many issues arose for determination. The Commission has attempted to set out its conclusions on each issue. In several cases the conclusion is that a potential causal factor did not or probably did not contribute to the collision.

In other cases, the Commission concluded that the factor did or probably did contribute. In these instances the Commission has gone on to attempt to identify the deficiencies in the relevant system, to consider possible improvements and to make recommendations.

A. Evidence of Conductor Smith

As has been mentioned previously, the information which the Commission has used in this analysis was gathered from 150 witnesses and a very substantial number of documents. It was frequently necessary for the Commission to assess the relative weight or reliance it should place on the testimony of an individual witness. It has not been considered generally useful to set out the Commission's reasoning in deciding the degree of reliance to place on any particular evidence.

There is one exception. The Commission considers the evidence presented by Conductor Smith regarding his actions in the 10 or 15 minutes preceding the collision to be of fundamental importance to several of the issues that arose for consideration.

For example, that evidence is of significance in considering the possibilities as to what transpired at the head-end of Train 413 immediately prior to the collision.

Smith's evidence was that he initiated several radio calls to the head-end in the 3 or 4 minutes preceding the collision. If it is assumed that those transmissions were audible in the head-end, it might reasonably be expected that they would have restored the attention of Hudson or possibly Edwards if they were being inattentive.

The Conductor's evidence is also of significance to the question of the fundamental integrity of the radios, to the question of crew alertness and rest, and to the consideration of the operating rules generally, and CN General Operating Instruction 3.2(b) in particular.

Accordingly, it was particularly important to determine the degree of reliance that the Commission could place on the evidence of Conductor Smith and it is appropriate to describe in some detail the reasoning used in coming to that determination.

Smith's account of events, particularly of his attempts to contact the front-end was given within half an hour of the collision to the dispatcher by radio. That exchange has been transcribed:

DISPATCHER:	OK, ah . . . what . . . ah . . . what the . . what was the signal at Dalehurst ah . . when your head-end called it.
CONDUCTOR SMITH:	Pardon me.
DISPATCHER:	What was the indication on that ah . . signal at Dalehurst?
CONDUCTOR SMITH:	Well, I was callin' him for the signal at Dalehurst, ah quite a few times. And, ah . . . we'd been having trouble with the radio on the way down. And . . . ah . . . he never called and I felt the air set up, and ah . . you know, like he was in control of the train. And, ah . . I kept calling him and there was no answer and, ah . . . I tried on different channels eh. And, ah . . . so we could of gone through a red one, I think – he could of – I'm not sure. What was on your panel?
DISPATCHER:	Well, it should of been red on the panel.

CONDUCTOR SMITH: Well, he must have ran it dispatcher because I could not get a hold of him - I tried and tried. And I've been having trouble – like even last night coming on the way down – with the radios. And I'd . . . he just would . . you know I'd get some static on the radio and I figured he was, you know, in control of the train 'cause I felt the slack run in on the train . . . when he set em up. And then . . . the air went . . . and, ah . . . all I could see was a huge ball of fire in the air.

Several particulars of Smith's evidence have led the Commission to have doubts about its accuracy and reliability. These include:

1. The transmissions Smith says he made were not heard by Quast or Timpe in the rear of Train 4 though they had their radios on and though other evidence established that there was no reason why they would not have received such a transmission.

   It also seems unlikely that the transmissions were heard in the engine of Train 4 because if they were, it is reasonable to assume there would have been a reaction. The absence of a reaction is equally consistent with the locomotive radio not working and the possibility that the transmissions were not made.

2. Though Conductor Smith says he concluded before the collision that the grey radio was not functioning properly, when he jumped from the train he took it with him. Thereafter he made several transmissions to the dispatcher using that radio and did not seem to express any surprise that the radio was working.

3. Smith's conversation with the dispatcher after the collision referred to radios malfunctioning on the trip to Edson the previous night. This seems anomalous in that he sought no repairs or replacement for his grey radio. The other radios involved were on a different train.

4. Conductor Smith said he perceived a brake application when the front-end was at the approach signal. Other evidence suggests convincingly that there could not have been such an application.

5. Evidence which will be discussed below indicates that Conductor Smith was probably experiencing a significant sleep deficiency when he went on duty.

6. When Conductor Smith was asked about the position he had occupied in the caboose he acknowledged that shortly after his radio conversation with the head-end at the Hargwen signals, he had left the cupola and gone to the back desk of the caboose. He had remained there until shortly before the collision. Other witnesses advised that standard procedure is for the conductor to be in the cupola when his train is moving unless his duties require him to be elsewhere. Nothing about Conductor Smith's duties after Hargwen required him to be at the back desk. The possibility exists that Conductor Smith was not being attentive to his duties after Hargwen.

   This evidence is also of significance in determining credibility because when Conductor Smith gave the evidence, he originally justified his presence at the back of the caboose by noting that he had wished to be in a position to

communicate with a work crew which is often stationed near the Hargwen signals. He suggested that he had noticed work crews in that position on several of his trips in the preceding weeks. When he was advised that CN records indicate that there had been no work crews in that place for several months, he acknowledged that his real reason for going to the back of the caboose was that he simply preferred to sit there. The change in his evidence on this point when faced with a contradicting fact, aroused the Commission's concern.

7. There is an inconsistency between what Conductor Smith says he did and what he says his state of mind was in the few minutes preceding the collision. He says that he did not have any doubt that the train was under control. However, he said he had made repeated calls on the grey radio followed by repeated calls on the red radio, including calls on each of the four channels of the red radio. He said he had made the red radio calls while hanging on the bars of the steps leading to the cupola. His descriptions of his actions suggest some recognition of an urgency to the situation and yet he says he never had any concerns.

8. Accepting Smith's evidence at face value, there was a lapse of something in excess of three minutes between the time he says he received no response to his radio call and the time of the collision. This was more than ample time for him to have appreciated the significance of the situation. If he made all of the radio attempts he said he made they could not have occupied more than half that time, and it is difficult for the Commission to accept that three minutes could pass without him developing sufficient concern about the situation to take some action.

9. The day of the accident Conductor Smith was interviewed by the R.C.M.P. and in his statement to them said that he thought the front-end must have been asleep. It was obvious in his evidence to the Commission that he regretted having made that statement and his reflections after the accident resulted in him changing his mind on that speculation. However, the fact that he made that statement suggests to the Commission that the radio calls he says he made may not have been made. His statement that he thought the front-end crew was asleep was inconsistent with his statement that he had the impression that there was a brake application and that the train was under control.

It is not difficult to understand how in light of the proportions of this tragedy, Conductor Smith would rationalize events as he reflected upon his conduct. However, there are simply too many inconsistencies and difficulties with his evidence to allow the Commission to place any substantial weight on it.

B. Condition of Equipment

1. The Track

One of the first matters to which the Commission gave attention in the course of the Inquiry was the design and integrity of the track structures in the Dalehurst area.

The track in the vicinity of Dalehurst was constructed in 1982 to CN's standards for high tonnage mainline trackage. It consists of 136 lb. rail on softwood ties, with 12 inches of crushed rock ballast, on top of 12 inches of subballast which, in turn, sit on the finished subgrade.

The Dalehurst "turnout", that section of track where the single track joins the double track and in which the switch is located, is a 136 pound, No. 20, right-hand lateral turnout built to CN's standards for heavy duty mainline turnouts. Resilient fastenings attach the rail and other components to the tie plates, which are lag screwed into hardwood switch ties. The switch points are connected to, and controlled by, a power switch machine by means of the throw rod, lock rod and point detector rod.

The track and turnout were inspected on February 7 by an Inspection and Light Repair Section (IRS) foreman on a hi-rail and also by an IRS foreman travelling by train. The entire turnout had last been inspected in detail on January 30. These inspections were carried out in accordance with the CN standard practice circulars relating to track and turnout inspections. No items outside tolerance were noted.

The Commission is satisfied that nothing relating to the track design, structure or integrity contributed to the collision.

During the course of the inquiry, Commission members inspected CN's new Track Evaluation Systems (TEST) geometry test car. The advanced level of technology, which has been developed to maintain track in a safe and cost efficient manner, was impressive.

2. The Trains

The next matter considered by the Commission was the mechanical condition of the trains which collided. Was there any evidence of a mechanical deficiency which could have contributed to the collision?

a) Mechanical History of Locomotives

The Commission reviewed the documentary evidence regarding the long term maintenance and inspection of the locomotive units of Train 413 and Train 4 and is satisfied that they had received standard and proper long term maintenance.

Locomotive 5586, the lead locomotive of Train 413, had been placed in service with CN on November 10, 1973. It and the other two engines in Train 413 had CN standard quarterly, half-yearly and annual inspections and maintenance. Its last semi-annual inspection had been on December 10, 1985 and it was not due for a quarterly inspection until March 1986. The locomotive had been out of service for 156 days in late 1984 and early 1985 because of low traffic levels.

The other two locomotives of Train 413 had undergone regular inspections in December 1985 and January 1986. The evidence indicates that all required tasks were performed during these inspections.

The maintenance file for the lead locomotive of Train 4, Locomotive 6566, indicates that there had been several problems encountered with that locomotive in the several months preceding the collision. This is perhaps not surprising given that the locomotive was first placed in service in 1952. These problems included improperly opening and closing windows, fogging of windows, a speedometer malfunction, windshield leaks and a sticking throttle. The evidence presented however, including that of the engineer who brought Train 4 into Jasper on February 8, establishes that none of these items were causing difficulty on the day of the collision and, accordingly, any inadequacy in the maintenance received by that locomotive as evidenced by the existence of these difficulties, is of no relevance to the questions before the Commission.

The Commission is satisfied that nothing in the mechanical history of the maintenance of the locomotives gives cause for concern.

b) Pre-Trip Procedures – Train 413

The Commission heard evidence from several members of the crew who prepared the engine consist of Train 413 in the CN Calder yards in Edmonton. This crew was responsible for the performance of routine inspections and maintenance on 8 locomotive consists scheduled for departure on February 7 and 8. The routine procedures included inspection of all equipment and connections, as well as operational tests of the engines, brakes and related equipment, and the locomotive radio.

In their statements to CN after the collision and in their evidence before the Commission the crew members were confident that all the routine procedures they were required to perform, had in fact been performed. Their evidence was quite clearly not founded on any specific recollection of the particular consist that led Train 413. It was founded on the assumption that each crew member had followed his regular routine in the case of each of the consists on which the crew worked that night and had either encountered no mechanical deficiency or remedied any deficiency found.

There is a record kept of the tasks performed by the pre-dispatch crew on each engine consist. The record is in the form of a list of the tasks required to be performed. As each task is completed, the crew member responsible for it indicates completion of the task by signing the list in the space provided beside the task completed.

If this document had been completed properly, it would have established with greater certainty that each required task had been performed on Train 413's engine consist. Unfortunately, it was not properly completed. As the crew was particularly busy on the night of February 7, the supervisor completed the check list. It was not completed by the crew members who did the work. Accordingly, the document adds nothing to the testimony of the crew members themselves. It too was completed on the assumption that as the routine requires certain tasks to be done, they were done.

Nevertheless, given the confidence of the maintenance crew that they followed the routine and given that the running crew who operated the train from Edmonton to Edson encountered no significant irregularities in the operation of the train, it is reasonable to conclude either that the Edmonton predispatch crew performed all of the functions required or that if they missed any, the omission was immaterial.

A second crew consisting of two carmen prepared the freight consist of Train 413 for departure. This crew walked the entire length of the train inspecting the air line and looking for any unsafe condition. They applied the yard air supply to the air line and made minor adjustments to eliminate minor leaks. No major leaking was found. They also tested the functioning of the brakes by initiating a brake application and release and inspecting each car to ensure that the brake shoes had applied and released.

Final testing of Train 413 in the Edmonton Calder yards was undertaken by the running crew assigned to the movement of Train 413 from Edmonton to Edson.

This crew conducted the routine inspections and tests on the engine consist when they took charge of it prior to it being coupled to the freight consist. They then moved the engine consist to the track on which the freight consist was located, coupled the two together and with the assistance of the carmen, conducted the required brake test. As the train departed, the rear-end crew performed a roll-by inspection prior to boarding the caboose. The crew also satisfied themselves that the radios were operating properly by using them to perform these tests and inspections and in communication with the Edmonton dispatch office.

There were some deficiencies evident in the inspection procedures followed in the Calder yards. The inadequacy of the record keeping by the crew who prepared the engine consist for departure has been noted. In addition, when the running crew performed the brake test on the engine consist, there was no one on the ground observing whether or not the brakes applied. However, this deficiency is immaterial because a proper test was done after the coupling of the engine consist to the freight consist.

Also, when the engineer tested the safety control appliance, the deadman's pedal, he did not wait for a brake application to be initiated. He ended the test upon hearing the whistle blow after the pedal had been released. However a complete operational test of the safety control appliance had previously been performed by the predispatch crew and in that test the appliance operated properly. The operation of the deadman's pedal is described in detail on page 131 of this Report.

These procedural deficiencies, placed in context, do not create any doubt that Train 413 was in proper running condition when it left Edmonton.

c) Operation of Train 413 – Edmonton to Edson

Except for two matters which the Commission considers to be of very minor significance, the trip from Edmonton to Edson was uneventful and supports the conclusion that Train 413 was in sound running condition.

The first exception was described by Engineer Michel Janusz as a "lurching" of the engines when they were operating at low speed. He thought that this was caused by the two trailing locomotive units loading more quickly than the lead unit. The lurching could be eliminated by maintaining load on all engines at low speed. Accordingly, Engineer Janusz avoided using brakes to slow the train and used throttle instead. The brakes were used only twice on the entire run from Edmonton to Edson.

The second exception was that during the trip a warning bell and light indicated a problem in the second locomotive unit. Trainman Ozubko investigated and found the excitation light on the electrical panel of the second unit to be lit. He reset the isolation switch and no further difficulties were encountered on the remainder of the trip.

The Commission is satisfied that neither of these incidents indicate any significant deficiency in the mechanical condition of Train 413 and that they have no significance to the events of the collision.

The rear-end crew on the Edmonton-Edson leg of Train 413's journey advised the Commission that the caboose air pressure gauges which indicate the pressure in the brake line were working properly. They could not however remember having heard the warning whistle sound on either of the two occasions when the brakes were applied. The crew also reported that the radios on the train worked properly throughout the trip.

d) Preparation of Train 4

The forward half of Train 4 was prepared for its journey in Vancouver. The rear half which, until it arrived in Jasper was Train 6, was prepared in Prince Rupert.

The crews who prepared these trains did not testify at the Commission Hearings. The Commission received the statements that members of these crews gave to CN following the collision and was satisfied on reviewing them that all inspections and tests of any possible relevance had been conducted prior to the trains leaving for Jasper.

e) Operation of Train 4 to Jasper

The run of Train 6 (which at Jasper became part of Train 4) from Prince Rupert to Jasper was completely uneventful.

There were reports of irregularities in the operation of Train 4 from Vancouver to Jasper. There was a temporary power loss in the dining car and a passenger reported seeing smoke belching from the locomotives in the mountains and the headlight flickering erratically. The running crews however reported no significant operational irregularities other than a difficulty encountered with the locomotive radio. That matter is discussed further when the subject of radios is considered in detail.

f) Servicing of Train 4 in Jasper

Upon their arrival in Jasper, each of the passenger trains were given a roll-by inspection and a walking inspection by carmen in the Jasper yard. The trains were coupled together and the air line coupling was inspected and tested. A steam generator was coupled to the rear of the train to be taken to Edmonton for servicing.

The required brake tests were performed prior to the departure of Train 4. Minor servicing was required to thaw a frozen steam connection on one of the locomotives.

The radios were employed in the course of the various tests and were found to be working properly. The attention given to the locomotive radio in Jasper is dealt with in the specific discussion of radios which appears later in this Report, and subject only to the observations there made, the Commission is satisfied that all appropriate inspection procedures were performed on Train 4 in Jasper.

g) Inspection of Equipment after Collision

Those portions of Trains 413 and 4 which were not damaged in the collision were later inspected by CN officers and by officers of the Canadian Transport Commission. In addition, portions of the wreckage were examined, particularly, the wheels of equipment that was destroyed. Some of the observations made during these inspections are discussed later in the section of this report dealing with brakes and radios. The general conclusion reached from these inspections was that there was no evidence revealed of any mechanical malfunction which might have contributed to the cause of the collision.

One potential deficiency which would not directly have affected the collision but which is of some peripheral significance was the testing of the brake line whistle in the caboose of Train 413. Tests on this whistle were performed on more than one occasion after the collision and the whistle did not always work in those tests. It is possible therefore that the whistle was not in working order during the run of Train 413 on February 8.

3. The Brakes

Evidence discussed in detail hereafter supports the conclusion that there was no brake application on either train prior to the collision. It, accordingly, was of fundamental importance to examine whether this resulted from a malfunction of the brake system of either train.

a) Brake Systems

Each train was equipped with two standard air braking systems. One operated only on the engine consist and is called the "independent brake". The other operated on the entire train, on both the locomotives and cars, and is called the "automatic brake".

The independent brake is operated by a lever on the console in front of the engineman. The automatic brake is operated by using a brake handle also located in front of the engineman. The automatic brake system requires that each car has its own separate braking system. These are interconnected by an air line, called the brake pipe, which runs the entire length of the train. Air pressure is maintained at a certain level in this line by a compressor and a main reservoir in the locomotive.

When a service brake application is desired the engineer moves his brake control to cause a reduction in the pressure in the air line. This causes a control valve in each car to allow air to flow to the brake cylinder which, in turn, allows the brake shoes to come in contact with the wheels. The force of the brake application depends on the degree of the air pressure reduction which the engineer creates. The highest normal brake application is called a full service application. The brakes are released when the engineer adjusts his control to allow air pressure in the line to be restored.

In the case of an emergency brake application, the maximum braking effort is achieved because the brake control valve of each car allows additional air from a separate emergency reservoir to flow to the brake cylinder. An extra 20% braking pressure is thus applied. An emergency brake application can be initiated by the engineer advancing the lever for the automatic brakes as far as it will go, by the front-end trainman pulling a lever located in front of his seat on the left hand side of the locomotive cab, and from the rear end of the train, by the crew pulling any of the levers or cords located in the caboose. The system is also designed so that the brakes will engage in an emergency application if there is a sudden loss of air pressure resulting, for example, from a rupture of the brake pipe from any cause whatsoever.

b) Condition of the Brakes

There was no evidence to suggest that the braking system of Train 413 was in any way faulty. There had been the appropriate test of the train brakes prior to the coupling of the engine consist in Edmonton and there was also a test of the brakes of the completely coupled train prior to departure from Edmonton. There was however no running brake test after departure from Edmonton and the required "Number 2 brake test" that ought to have been performed in Edson when the Edson-Jasper crew took over the train, was not performed because it was impossible to do so in the course of the "on-the-fly" crew exchange. Neither was there a running test of the brakes after departure from Edson. The Commission was advised by witnesses that this was because the uphill grade made a running brake test inconvenient.

The evidence indicates that there was very little use of the brakes on Train 413 in the trip from Edmonton to the collision. As described earlier, a "lurching" of the engines at low speed discouraged the Edmonton engineer from using the train brakes. He used them only once prior to Edson and on other occasions slowed and stopped the train by use of the throttle. There was a minimum application of the brakes at Edson in order to slow the train down for the crew exchange.

Conductor Smith assumed the train brakes were used to bring the train to a stop in the siding at Medicine Lodge. It is quite possible however that the train was stopped without use of the brakes and that only the independent brake on the locomotive engine was applied in the siding to prevent the train from rolling backwards.

After the collision the brakes on the 39 cars of the train which were not damaged in the collision were tested and found to be functioning properly.

The evidence leads the Commission to conclude that the brakes on Train 413 were in proper functioning condition. The quantity of information upon which that conclusion is based may not be as extensive as it might otherwise have been. However, the Commission considers the evidence adequate to support its conclusion.

As to Train 4, there was no report of any brake problem by the crews who operated the trains that made up Train 4 into Jasper. After Trains 4 and 6 were coupled in Jasper the required brake test was performed. The brakes were again used to bring the train to a stop in Hinton. The brakes of the undamaged cars of Train 4 were tested after the collision and worked properly.

It is therefore appropriate to conclude that the brakes of Train 4 were also in proper functioning order.

The Commission is accordingly satisfied that the absence of any brake application on either train prior to the collision was not the result of a malfunction in the braking systems of either train.

4. The Radios

The radios play an important role in traffic control. Although the messages transmitted by radio are subordinate to the directions conveyed by the signal system, the testimony of train crews established clearly that they consider radio communication to be of significant assistance to them in carrying out their duties. It is, for example, apparent from Conductor Smith's account of events immediately preceding the collision, that the radio is also fundamental to the effectiveness and value of the rear-end train crew on a CN freight train. It was therefore important to consider evidence regarding the condition of the radios on the two trains.

a) Radio Equipment

There were four different types of radios in use on the two trains. All were standard CN equipment.

i) Locomotive Radios

The locomotive radio on Train 413 was located on the console immediately in front of the locomotive engineer's seat. There was an auxillary speaker mounted on the ceiling intended to permit the front-end trainman to hear communications to the locomotive from either the conductor in the tail-end or the dispatcher. Not all locomotive cabs are equipped with such an overhead speaker but Train 413 was.

Transmission is performed using a hand control similar to a telephone receiver except that there is a press-to-talk button on it. There is also a control by which the engineer can adjust the volume. By the design of this control it is not supposed to be possible for the engineer to turn the volume down so low that the radio cannot be heard. The evidence of CN's radio expert however was that the design is inadequate in that regard. At normal operating noise levels it is not possible to hear the radio if the volume level is set very low.

The radio can transmit or receive on 4 preset frequencies or channels. It is designed such that when the hand set is replaced in its cradle the radio automatically reverts to Channel 1 regardless of which channel it was on previously. However, so that automatic reverting to Channel 1 can be avoided if it is not wanted, as for example when the locomotive is being used in yard service, many locomotives are outfitted with a "dummy cradle". When the hand control is placed there, the radio does not automatically revert. It was not possible for CN to have advised the Commission whether the locomotive radio in Train 413 had this feature.

The radio has a "tone" button which is used to signal the dispatcher when communication with him is desired.

The radio is used for end-to-end communication and for train-to-dispatch communication. It will also receive communications from other trains in the vicinity. This type of radio transmits at a power output level of 30 watts and is powered by the locomotive battery which is recharged automatically by the locomotive generator.

The locomotive radio on Train 4 was of the same specifications as that on Train 413.

ii) Caboose Radios

There were two radios in the caboose of Train 413. One of these was part of the caboose's permanent equipment and in the ordinary course would remain with the caboose unless removed for servicing. The plastic case of this radio is red and the radio is therefore called the "red radio". It is mounted in the cupola.

The red radio has a power output level of 5 watts and is powered by three standard lantern batteries. These batteries are not rechargeable and are intended to be replaced when they are low. There is a small light emitting diode that glows brightly during transmission if the battery supply is satisfactory. If the batteries are weak, the light will either blink or not illuminate at all during transmission.

The controls include an on/off switch, a press-to-talk switch on the microphone, a volume control, a "squelch" control and a channel select knob which provides a selection of four preset frequency channels. There is also a switch used to produce a "tone" for effecting contact with the dispatcher. The radio is connected to an external antenna on the roof of the cupola.

This radio is used primarily for communication with the head-end but can also be used in train-to-dispatch communication.

The other caboose radio on Train 413 was of the same specifications as the red radio except that its colour was grey. This radio was not part of the permanent equipment in the caboose but rather was brought on to the train by Conductor Smith. It had been obtained by Conductor Smith in Jasper on the evening of February 7 and was used by him on his run from Jasper to Edson that night. The radio would normally have been turned in at the Jasper terminal on Train 413's arrival there.

Normally, this radio is kept by the conductor at the desk at the back of the caboose. As there is no provision for an external antenna, when the grey radio is used inside the caboose, it is not as effective a transmitter or receiver as the red radio.

No 5-watt portable radio is used on passenger trains.

iii) 2-Watt Portable Radios

A front-end trainman such as Trainman Edwards would have had a small portable radio which he would have obtained from, and was intended to return to, his home terminal. This radio has a 2-watt output level and is powered by a rechargeable battery. In the ordinary course this radio is not used when the train is moving. It is provided to assist the front-end trainman in performing train inspections and other duties when he is off the train.

The rear-end crew of Train 4, that is the conductor and assistant conductor in the first half of the train and the assistant conductor and the trainman in the rear half of the train all had in their possession 2 watt portable radios of the same specification as Edwards' radio.

b) Condition of Radios

i) Train 413 – Locomotive Radio

One of the members of the predispatch crew that prepared Train 413 for departure from Edmonton was responsible for inspecting and testing the locomotive radio. He recalled that Locomotive 5586 did not have any radio when he first entered the cab. Accordingly, he installed a radio and tested it by calling the shop coordinator in the Calder yard.

The Commission was advised that the radios in locomotives are inspected during the quarterly inspection of the locomotive. The last such inspection of Locomotive 5586 had occurred on December 17, 1985. Presumably whatever radio was in the locomotive at that time was inspected. However, there was no record of when the radio installed in the locomotive on February 7 had last been inspected.

The antenna and other radio equipment permanently wired in the locomotive would have been inspected in that quarterly inspection if routine was followed. The inspection procedures include measurement of the reflected power of the antenna. If that measurement is greater than 1/2 watt, given a 30-watt output level, a reception problem could be encountered. Such a problem was in fact experienced on a locomotive radio used in the field radio testing undertaken as part of the collision investigation. The problem is usually remedied by cleaning the antenna and checking the connection.

The record of the December 17, 1985 inspections of Locomotive 5586 do not indicate that such a problem existed. The antenna would not therefore have been cleaned at the time of that quarterly inspection. The predispatch procedures do not include inspection or cleaning of the antenna. Accordingly, the antenna had not been cleaned for at least 5 months preceding the collision.

The Commission was also informed that locomotive radios are "bench tested" at least twice a year. This means they are removed from service and their components are inspected and tested by a technician. This is a very unsophisticated system intended to ensure that each locomotive radio receives regular testing. It was clear however that it would be very easy for a radio to be missed.

The Commission was not provided with any record of the bench testing of the locomotive radio in Locomotive 5586 at the time of the collision. As records relating to the maintenance of that radio were requested, the absence of such a record in the documents produced by CN leaves the Commission to conclude that no such record exists.

Nonetheless, other evidence presented to the Commission is sufficient to satisfy it that the locomotive radio was working properly. The predispatch crew in Edmonton did a successful operational test. Engineer Janusz used the radio during the run of Train 413 from Edmonton to Edson without difficulty. Many of the crew members of the trains in the vicinity of Train 413 after it departed Edson overheard transmissions initiated by Engineer Hudson using the locomotive radio. Conductor Smith said he had radio conversations with Engineer Hudson on departure from Edson and at each of the control points up to and including Hargwen. The dispatcher had a radio conversation with Engineer Hudson and the Commission heard a tape recording of that conversation in which transmissions from Train 413 were loud and clear. Accordingly, notwithstanding the inadequacies of the maintenance records, the Commission is satisfied that the locomotive radio on Train 413 was working properly.

ii) Conductor Smith's Grey Radio

The grey portable radio in the possession of Conductor Smith on February 8 had been obtained by him in Jasper the evening before. He recalled 3 incidents on the Jasper-Edson trip on February 7 which, in retrospect, he thought might have suggested a problem with the grey radio.

CN was able to produce a record of the maintenance history of the grey radio. There is no program of preventative maintenance for grey radios. They are only inspected if they are reported to be in bad order. The last inspection of the grey radio Conductor Smith had at the time of the collision had been done on October 9, 1985. The record does not indicate what malfunction had resulted in its being in the radio shop. Presumably whatever was wrong was remedied on that occasion.

Routine procedures call for an operational test of a grey radio prior to it being issued to a running crew member. If, during this test, the low battery indicator fails to glow steadily, the batteries are changed.

After the collision, tests were done of the output power level, transmission frequency accuracy and reception sensitivity on the grey radio at both -15°C and room temperature. For these tests, the same batteries that were in the radio on February 8 were used. The results of all the tests were satisfactory.

The radio was also used on a train running between Edson and Jasper on February 13, 1986 and on several field tests in February and March. Again, the original batteries were used. All transmissions from the grey radio were received loud and clear in the locomotive on these tests and all transmissions from the locomotive were received loud and clear by the grey radio.

The results of these tests, considered along with the fact that Smith took the grey radio with him when he jumped from the train and used it successfully in transmissions after the collision, permit the Commission to conclude that at all relevant times, the grey radio was working properly.

iii) Train 413 – Red Radio

There is also no program of preventative maintenance for caboose red radios. They are used until a rear-end crew member reports some malfunction or deficiency. There is no procedure for regularly changing or testing the batteries in the red radio, nor are there any fresh batteries available in the caboose should the batteries in the radio fail during a trip.

Testing of the batteries of Train 413's red radio after the collision revealed that they were sufficiently low that the warning light ought not to have glowed steadily during transmission. The fact that it did glow steadily must be taken as raising a doubt as to the trustworthiness of that indicator.

The post-collision inspections of the red radio confirmed that the channel indicator knob did not "click" into each channel as it ought to have. This had been mentioned by Conductor Smith in his evidence. He said he discovered this deficiency when he was attempting to call the head-end just prior to the collision.

Other bench tests of the red radio produced satisfactory results.

The antenna on the caboose to which the red radio is connected was examined after the collision and was found to be in proper working condition.

The rear-end crew from Edmonton to Edson reported that the red radio operated satisfactorily during the trip. Though he did not perform the required radio test on the red radio prior to departing Edson, Conductor Smith used the red radio several times prior to the collision. In fact he said that the last communication he had with the head-end at Hargwen was made using the red radio. The red radio also performed satisfactorily on several different channels when used after the collision by Conductor Smith and when tested in the field tests performed as part of the collision investigation. Accordingly, notwithstanding the low battery power and the "non-clicking" condition of the channel selector knob, the Commission is satisfied that the red radio was transmitting and receiving properly at all relevant times.

iv) Train 4 – Locomotive Radio

The crews who had operated Train 4 prior to its arrival in Jasper had experienced difficulties with the locomotive radio. In fact, the radio had been changed in Blue River. However, this did not remedy the situation and intermittent radio problems were experienced even after the change.

The engineer who brought Train 4 into Jasper says he made a note of the radio problem on a form provided for that purpose and left it in the locomotive cab. He did not mention the problem to any of the station personnel in Jasper.

The employee who normally would look at the form on which the engineer said he noted the problem said he did not do so on the morning of February 8 because when he entered the cab Engineers Miller and Peleshaty were already there and nothing was said of the deficiencies noted on the form.

The engineer who brought the train to Jasper advised the Commission that he told Engineer Peleshaty of the radio problem but it is not clear whether Peleshaty was told that the problem had been intermittent. It is possible that Peleshaty would have thought that because there was no problem with the radio when he used it prior to departure from Jasper, there was no longer any reason for concern.

The surviving crew of Train 4 were not aware of any problem affecting the locomotive radio. It was used in the brake tests performed prior to departure from Jasper and in communication with dispatch at the time of departure. The last communication made using the radio was when Rear Trainman Quast advised the head-end that the train was clear to depart Hinton at 0825. It is therefore clear that the locomotive radio was working shortly before the collision. There is no evidence of any use of the locomotive radio after Hinton and prior to the collision.

Some residual doubt must remain as to the condition of the radio because of the intermittent problems that had been experienced west of Jasper and the fact that nothing had been done to service the radio after those problems were experienced. Accordingly, although a definite conclusion that the locomotive radio of Train 4 was functioning properly cannot be made, it seems likely that it was.

v) 2-Watt Radios

The 2-watt radio used by Trainman Edwards would have been turned off at all relevant times and, accordingly, no consideration of its condition is necessary.

As to the 2-watt radios used by the rear-end crew of the passenger train, the Commission was advised by Mr. Raistrick, a vacationing CN employee who was a passenger on Train 4 that shortly before the collision he was in the company of Brownlee and MacMillan and that the portable radios in their possession were on. No other information as to the condition of those radios is available.

The 2 running crew members at the rear of Train 4, Timpe and Quast advised the Commission that the portable radios in their possession were on, and functioning properly on the morning of February 8.

c) Radio Propagation at Dalehurst

Many of the CN running crew employees who gave evidence to the Commission reported experiencing "dead spots" along the route from time to time. These are places where radio communication is not possible. There seemed to be a conflict in the evidence of running crew members and CN management on this point. CN management were prepared to acknowledge that dead spots exist only where physical features like tunnels made communication by radio impossible. Crew members gave the impression that the incidence of dead spots was greater than that.

CN presented evidence of radio propagation tests done after the collision in the vicinity of Dalehurst. These tests were done on more than one occasion using the actual red and grey radios from the caboose of Train 413 and radio equipment the equivalent of that which was on the two lead locomotives and in the rear of Train 4.

These tests showed that transmission from either the red radio or the grey radio on Train 413 from the points when Conductor Smith says he effected radio transmissions at or near Dalehurst would have been received by the radio in the head-ends of both Trains 413 and 4 and in the rear-end of Train 4.

The Commission accepts this evidence as establishing that there were no features of the Dalehurst topography which created any "dead spots" which could have affected radio communications on February 8.

The Commission was also advised by experts and accepted that the unusually severe geo-magnetic activity which occurred on February 8 would not have affected radio transmissions at Dalehurst.

d) Conclusions and Observations

The Commission concludes that there is no doubt that the radios in Train 413 were working properly at all relevant times. There is a possibility that the radio in the locomotive of Train 4 was not in satisfactory working condition at the time of the collision but the Commission considers that possibility to be sufficiently remote to permit it to conclude that there was no malfunction of the radios on either train. No deficiency in the radio communication system was among the factors which contributed to the collision.

The Commission's review of the radio system however did bring to its attention several matters which it considers of significance and which it suggests are in need of attention by either CN or the Canadian Transport Commission or both. However, in light of the conclusion reached regarding the radio systems' contribution to the collision, the Commission does not put these observations forward as formal recommendations. The Commission's observations regarding the radio system are:

1. If the use of a caboose is to be continued on freight trains,* then it should be equipped with a radio of at least the same standard as the locomotive. The Commission is of the view that the radio communication requirements of the conductor are no less significant than those of the engineer. The conductor is,

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* It is outside the terms of reference of this Commission to engage in the current debate as to the value and utility of the caboose. Nothing contained in this Report ought to be construed as a conclusion that the caboose is essential to the operation of a modern freight train. This Commission has simply not considered that matter.

after all, in charge of the train, in theory. CN suggested that a convenient power supply for a locomotive quality radio in the caboose would be a problem. The Commission is confident that this problem is capable of being overcome and that CN's effort in overcoming it would be worthwhile.

2. The Commission is also concerned that there is no procedure by which the rear-end crew is kept aware of what channel the engineer is using. Should there not be such a procedure?

3. End-to-end communication is not possible when the engineer is engaged in train-to-dispatch communication. Some means should be found for permitting the conductor to communicate at any time to the head-end that he wishes to speak to the engineer.

4. The Commission noted that many front-end trainmen indicated that they often cannot hear radio transmissions. The evidence that the volume can be turned so low as to make it impossible to hear the radio in noisy operating conditions was noted above. Front-end trainmen who hear transmissions received in the locomotive said that they often cannot hear the engineer's side of radio communications. Consideration ought to be given to the use of earphones so that all crew members can hear all radio communications.

5. Procedures must be established to ensure that radio malfunctions are brought to the attention of station personnel by an arriving crew and that they are repaired before the train is allowed to depart.

6. Similarly, the system by which locomotive radio maintenance is performed is in need of improvement to ensure that each radio receives a regular maintenance inspection.

7. Predispatch procedures for locomotives and for cabooses ought to involve inspection of the antennae to ensure that they are clean and properly connected to the radios.

8. Inspection procedures for red radios in cabooses should be improved. The system should not require a malfunction of a red radio before it receives any inspection. At the very least, spare batteries ought to be provided in the caboose so that the red or grey radio batteries can be replaced should they not work properly during a trip.

9. As the evidence suggested that the grey radio is used frequently in end-to-end communications there should be a hookup to an exterior antenna at the rear desk of the caboose for use with the grey radio. This mechanism should be such that the grey radio can be quickly attached to or detached from the antenna so its usefulness outside the caboose is not impaired.

10. The procedures relating to the assignment of a grey radio to a train crew should include not only the operational test of the radio but a test of the power output of the batteries. They should be discarded and replaced if low, even though the radio may work properly.