C3 Train Versus Train Collision Resulting in a Train Yard Fatality

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After attending this presentation, attendees will be shown how a sequence of events and the actions of several railroad employees lead to a yardman being killed while on the job.

This presentation will impact the forensic science community by illustrating how the analysis of an event data recorder, voice recorder, and video were used to demonstrate the proper behavior of a railroad employee prior to a collision between two train cars.

Introduction: Train yards are intricate networks of parallel railroad tracks that provide temporary storage and passage of train cars. Linked train cars are called a "cut of cars." These cuts are moved about the yard in order to fulfill space and delivery requirements. Crossovers are manually operated track assemblies that allow movement of cars from one track to an adjacent track. The cuts on storage tracks subsequently do not block the main lines on which trains continually pass.

The cut of cars are moved within the yard by a remotely operated locomotive. A trainman uses a belt pack to control the locomotive's throttle and braking system. A belt pack is a radio frequency transmitter with a built-in safeguard. If the trainman tilts the belt pack for an extended length of time, that is the pack is not held level during the operation, it signals a tilt fault. A tilt fault causes the locomotive's brakes to be applied automatically.

Case Study: In the early morning hours of August 30, 2007, a trainman was remotely controlling a locomotive within a northern California train yard. The trainmaster in the tower overlooking the yard gave the trainman verbal instructions to move two hopper cars from one track to an adjacent track. To do so, the trainman used a crossover.

However, prior to the trainmaster's instructions, another trainman had positioned a second cut of cars on the adjacent track in a foul condition of the crossover. A foul condition occurs if any portion of a train car is positioned such that it will interact with another passing car. The car's position on the adjacent track within proximity of the crossover guaranteed a collision would occur.

The locomotive's operator was on the right front corner of the hopper car as it approached the tanker car in foul. The right front corner of the hopper sideswiped the left side of the tanker, and the operator was wedged between the impacting cars. He died as a result of his injuries.

Injuries: The coroner's report reveals the trainman suffered blunt force trauma injuries to the head, neck and chest. He also sustained lacerations, fractures, and abrasions to his extremities.

Locomotive Event Data: The remotely controlled locomotive contained an event driven data recorder that only records an event it is received from an operator. The event data retrieved from the locomotive was produced as a nine-page spreadsheet with 27 columns and 249 rows, containing a total of 6,723 data entries. The spreadsheet identifies the locomotive, date and time, as well as numerous event names like locomotive throttle position, track location and speed, among others. Each event name has an associated time stamp. The corresponding 28 minutes and 10 seconds of data captured the event during which the trainman was killed.

Physical Evidence: The hopper car sustained collision damage to a side platform and a ladder-like structure on which the decedent was riding. Additionally, the right side of the hopper reveals a large, longitudinal dent with an associated heavy black paint transfer from the tank car. Scaling photographs of the hopper taken at the scene indicates the cars were in contact for approximately 26 feet until the locomotive came to a stop.

Videotape and Voice Recorder Analysis: A fixed-position video camera is located near the tower in the train yard. This wide-angle camera has a fixed focal length and cannot pan side to side. From its location, the events leading up to the train collision are recorded; however the point of contact between the cars occurs to the right and out of the camera's field of view.

All radio communication within the train yard is continuously recorded by a voice recorder. The time stamp of the voice recorder is heard on tape followed by the corresponding verbal transmission from any trainman, trainmaster, or railroad employee. This voice recorder also records any audio transmission from the locomotive event data recorder, such as the announcement of a tilt fault.

The event data recorder and videotape time stamp are set to Pacific Standard Time, whereas the voice recorder time stamp is set to Central Standard Time. Not surprising is the fact that all time stamps do not match, despite the 2-hour time zone adjustment. However, the offset between the event data recorder and the voice recorder time steps can be calculated. By locating an entry on the event data recorder spreadsheet and its corresponding entry on the voice recorder, the offset between them was determined to be 2 hours, 5 minutes and 2 seconds, or 02:05:02. With this time offset, the time of specific voice recordings can be compared with what commands were sent to the locomotive by the trainman remotely operating it with his belt pack.

Analysis: An analysis of the recordings on the voice recorder reveal the sound of the impact was

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captured by the radio of the trainman remotely operating the locomotive. Therefore, the time stamp of the impact was determined. Comparing this time stamp with the event data spreadsheet shows the locomotive was commanded to slow approximately 25 feet before impact, in the area corresponding to entering the crossover. Three seconds later, the locomotive's brakes were applied and the locomotive transmission direction was changed from forward to reverse. These two commands were sent after contact between the two train cars had already occurred. Finally, a tilt warning transmitted from the trainman's belt pack corresponds to the time when he began to fall from the train car, and a tilt fault transmission corresponds to the time when he struck the ground.

In their defense, the train company stated that the trainman's actions were the cause of his own death, stating he failed to comply with General Code of Operating Rules (GCOR) section 6.28. Section 6.28 states:

> *Except when moving on a main track or on a track where a block system is in effect, trains or engines must move at a speed that allows them to stop within half the range of vision short of 1) Train, 2) Engine, 3) Railroad car, 4) Men or equipment fouling the track, 5) Stop signal, or 6) Derail or switch lined improperly.*

Conclusion: The plaintiff's argued successfully that:

1) The dark conditions of his early morning shift and the proximity to the tank car restricted the trainman's view of the imminent danger of collision with the car in foul of the crossover.
2) The cut of cars previously placed in foul of the crossover by another trainman was in violation of GCOR section 7.1 stating;

Do not leave cars or engines where they will foul equipment on adjacent tracks or cause injury to employees riding on the side of a car or engine.

3) The trainmaster on duty gave the other trainman permission to position the cars in foul of the crossover.
4) The trainmaster gave oral instructions to the decedent to use the crossover that eventually lead to the collision that resulted in fatal injuries.
5) The event data recorder and the trainman's operations of the locomotive indicate he was not aware of the car in foul. He simply began to slow the locomotive prior to entering the crossover.

Train Yard, Belt Pack, Locomotive Event Data Recorder

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