NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

February 1, 2013

On-Board Image Factual Report

Specialist's Factual Report
By Christopher Babcock

1. EVENT

Location:	Midland, Texas
Date:	November 15, 2012, 1635 Central Standard Time (CST)
Vehicle 1:	2006 Peterbilt Truck-Tractor Combination
Operator 1:	Smith Industries
Vehicle 2:	Freight Train ZLCAI-14
Operator 2:	Union Pacific
NTSB Number:	HWY13MH003

2. GROUP

A group was convened on November 19, 2012.

Chairman: Christopher Babcock
Aerospace Engineer
National Transportation Safety Board

Member: Terry J. Hite
General Director – Signals
Union Pacific Railroad

Member: Tom A. McFarlin
Staff Director, Signal and Train Control
Federal Railroad Administration

Member: Vincent G. Verna
Director of Regulatory Affairs
Brotherhood of Locomotive Engineers and Trainmen

3. DETAILS OF INVESTIGATION

On November 18, 2012, the NTSB Vehicle Recorder Laboratory received the following equipment.

Recorder Manufacturer/Model:	**Wabtec Traintrax Track Image Recorder**
Recorder Serial Number:	**KB0816B089**
Recorder Manufacturer/Model:	**Midland County Sheriff Unit 306 Dash Recorder DVD**
Recorder Serial Number:	**NA**
Recorder Manufacturer/Model:	**Go Pro Video File from Lead Flatbed**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**Witness video from unknown camera**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**Midland Police Department (MPD) Unit 5867 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5777 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5116 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5861 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5856 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5950 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5113 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**MPD Unit 5061 Dash Recorder DVD**
Recorder Serial Number:	**N/A**
Recorder Manufacturer/Model:	**Wabtec Traintrax Track Image Recorder**
Recorder Serial Number:	**KBAAR2982**
Recorder Manufacturer/Model:	**Wabtec Traintrax Track Image Recorder**
Recorder Serial Number:	**KB0841A017**

3.1. Video Description

3.1.1. Wabtec Traintrax Track Image Recorder

The lead, 2nd, and trail locomotives of freight train ZLCAI-14 were equipped with a Wabtec Traintrax track image recorder (TIR). The recorders were received undamaged and downloaded normally. The content of the hard drives were downloaded using a Wabtec readout station appropriate for this model recorder. This process extracts video files encoded with a proprietary codec from the recorder which are then viewed using a Wabtec supplied viewing program. The system captured data to a series of individual files, each containing approximately 1 hour of audio and video.

Several weeks of data were present on the hard drives, however only video from the day of the accident was downloaded. Figure 1 shows an exemplar external hard drive where the video files are stored.

Figure 1. Exemplar Wabtec Traintrax TIR hard drive.

3.1.1.1. Lead locomotive TIR

The TIR on the lead locomotive recorded black and white video at a resolution of 720x480 pixels and 15 frames per second (fps) with a view out the front of the locomotive. External audio was also recorded as well as locomotive speed. Video from this TIR captured the accident and is summarized later in this report.

3.1.1.2. 2nd Locomotive TIR

The TIR on the 2nd locomotive recorded black and white video at a resolution of 720x480 pixels and 15 frames per second (fps) with a view out the front of the locomotive. This view consisted primarily of the rear of the lead locomotive. External audio was also recorded. No video pertinent to the accident was recorded.

3.1.1.1. Trail locomotive TIR

The TIR on the trail locomotive recorded black and white video at a resolution of 720x480 pixels and 15 frames per second (fps) with a view out the front of the locomotive. External audio was also recorded as well as locomotive speed. This locomotive faced the rear of the train so the view of the camera was actually facing rearwards. The train stopped before this locomotive reached the grade crossing where the accident took place so no video pertinent to the accident was recorded.

3.1.2. MSO Unit 306

Midland County Sherriff's Office unit 306 was equipped with a forward facing video camera looking out of the windshield of the cruiser. They recorded color video at a resolution of 640x480 pixels and 30 fps. The camera also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was not recorded. This unit escorted the accident tractor-trailer for the majority of the parade on the right side of the roadway. Video from this record captured video pertinent to the accident and is summarized later in this report. After the accident, unit 306 was caught on the north side of the tracks.

3.1.3. Go Pro

A Go Pro video camera was attached to the lead flatbed and recorded color video at a resolution of 1280x720 pixels and 30 fps. The camera faced toward the rear of the lead flatbed. No time reference, other than elapsed time, was available on this recording. Audio was recorded. After the accident, the lead flatbed was on the south side of the tracks. Video from this record captured video pertinent to the accident and is summarized later in this report.

3.1.4. Witness video

Witness video from an unknown device was provided that showed portions of the parade from on the lead float, as well as from spectators on the side of the road from downtown Midland until the parade passed the Midland Fire Department Central Station on Wall Street, prior to the parade turning left on Garfield Street. No time reference other than elapsed time was present. The video was 140 seconds long. The video showed that the passenger side window on the accident tractor appeared to be open.

3.1.5. MPD Unit 5867

MPD unit 5867 was equipped with a camera system that recorded two video tracks that recorded video of the back seat area and forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1638:46 CST and ended at 1653:04 CST. The video began as the vehicle was responding to the scene. The vehicle arrived on scene at the north side of the tracks at 1642 and departed at 1650. No video pertinent to the accident was recorded.

3.1.6. MPD Unit 5777

MPD unit 5777 was equipped with a camera system that recorded two video tracks that recorded video of the back seat area and forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1635:00 CST and ended at 1651:22 CST. The video began as the vehicle was responding to the scene. The vehicle arrived on scene at the north side of the tracks at 1640 and departed at 1649. No video pertinent to the accident was recorded.

3.1.7. MPD Unit 5116

MPD unit 5116 was equipped with a camera system that recorded two video tracks that recorded video of the back seat area and forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1642:34 CST and ended at 1715:08 CST. The video began as the vehicle was responding to the scene. The vehicle arrived on scene at the south side of the tracks at 1652 and departed at 1656. It arrived on the north side of the tracks at 1700. No video pertinent to the accident was recorded.

3.1.8. MPD Unit 5861

MPD unit 5861 was equipped with a camera system that recorded one video track that recorded forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1635:24 CST and ended at 1842:50 CST. The video began as the vehicle was responding to the scene. The vehicle arrived on scene at the north side of the tracks at 1638. No video pertinent to the accident was recorded.

3.1.9. MPD Unit 5856

MPD unit 5856 was equipped with a camera system that recorded two video tracks that recorded video of the back seat area and forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1634:58 CST and ended at 1918:43 CST. The video began as the vehicle was responding to the scene. The vehicle arrived on scene at the north side of the tracks at 1638. No video pertinent to the accident was recorded.

3.1.10. MPD Unit 5950

MPD unit 5950 was equipped with a camera system that recorded two video tracks that recorded video of the back seat area and forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1634:53 CST and ended at 1714:17 CST. The video began as the vehicle was responding to the scene. The vehicle arrived on scene at the north side of the tracks at 1638 and departed at 1656. It arrived on the north side of the tracks at 1700. No video pertinent to the accident was recorded.

3.1.11. MPD Unit 5113

MPD unit 5113 was equipped with a camera system that recorded two video tracks that recorded video of the back seat area and forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1628:21 CST and ended at 1724:47 CST. The video began as the vehicle was responding to what appeared to be a traffic stop. The vehicle left the traffic stop at 1644 to respond to the accident. The vehicle arrived on scene at the south side of the tracks at 1646. No video pertinent to the accident was recorded.

3.1.12. MPD Unit 5061

MPD unit 5061 was equipped with a camera system that recorded one video track that recorded forward facing video out of the windshield. The cameras also recorded vehicle speed, position, time, and operation of brakes, lights, and siren. Audio was recorded of the interior of the vehicle.

This video started at 1626:20 CST and ended at 2051:39 CST. The video began as the vehicle was approach the intersection at Garfield and West Front Street. The vehicle took up a position on the north corner of the intersection facing the train tracks.

As the parade approached the intersection the sound of the horn on the lead vehicle and train horn were audible. The accident took place outside the frame of the camera.

3.2. Timing and Correlation

Both the sheriff's unit and locomotive cameras contained a GPS time stamp. GPS time corrected to central standard time was selected as the time base to correlate all video data. The Go Pro video was synchronized to CST using the impact of the train with the trailer, visible in all three videos, to anchor the timing. Table 1 shows several key events, their timing, and the source video from which the event was taken. Precision of 0.1 seconds or better was achieved on each video by keying certain events to individual frames.

Table 1. Summary of key events.

Time (CST)	Event	Source
1602	Parade is underway from downtown Midland	Dash Camera
1610:00	Train is on left track	Lead TIR
1615:14	Train passes clear signal at approximately 61 mph	Lead TIR
1617:02	Train passes flashing yellow signal at approximately 54 mph	Lead TIR
1618:35	Accident flatbed transits intersection with blinking yellow signal	Dash Camera
1619:29	Train passes steady yellow signal at approximately 22 mph	Lead TIR
1619:40	Accident flatbed transits intersection with blinking yellow signal	Dash Camera
1621:09	Locomotive meets oncoming train on right track, bell sounding	Lead TIR
1625:39	Train passes a clear signal at approximately 21 mph	Lead TIR
1625:21	Train passes a clear signal at approximately 49 mph	Lead TIR
1627:45	Accident flatbed turns left on to Garfield Street with law enforcement vehicles blocking traffic. Sun is now coming from the right. Both flatbeds move from 2nd from right lane to 3rd from right lane	Dash Camera
1630:30	Train passes a clear signal at approximately 48 mph	Lead TIR
1632:14	Train passes a clear signal at approximately 57 mph	Lead TIR
1632:19	Train reaches end of double track section at approximately 57 mph	Lead TIR
1632:50	Police cruiser passes procession on the far left side of the roadway, camera vehicle up to 5-7 mph, spacing between two flatbeds increases	Dash Camera
1634	Procession speeds up to 9-11 mph	Dash Camera
1634:23	Train passes a clear signal at approximately 63 mph	Lead TIR
1634:38	Sound of air horn similar to train horn is heard emanating from one of the vehicles in the parade	Go Pro
1634:45	Sound of air horn similar to train horn is heard emanating from one of the vehicles in the parade	Go Pro
1634:48	Procession approaches Front Street. Law enforcement vehicle stopping traffic on left, escorting law enforcement vehicle on right stops traffic on right before continuing through Front St intersection at 1635:01	Dash Camera
1635:05	Accident flatbed crosses Front Street through red light with camera vehicle at 9 mph. Accident vehicle is in left lane.	Dash Camera

Time (CST)	Event	Source
1635:06	Preceding flatbed begins crossing the track	Lead TIR
1635:09	Traffic signal at Industrial Avenue changes from red to green for southbound traffic on Garfield Street.	Dash Camera
1635:11	First flatbed clears the crossing. Crossing signal bells and lights begin operating for northbound traffic	Go Pro
1635:11	Front end locomotive passes milepost 555	Lead TIR
1635:11.1	Lights of crossing signal begin operating, front of accident flatbed is at far edge (SE edge) of Front Street. Lights on the crossing arms begin operating. The section of roadway between Front Street and the railroad tracks is at a slight incline.	Dash Camera
1635:15	Red traffic signal for northbound Garfield Street traffic at Industrial Street comes into view. Unmarked police car is preventing traffic from turning on to northbound Garfield Street	Go Pro
1635:18.3	Right crossing arm begins to descend, front of accident flatbed appears to be in the plane of the right crossing arm.	Dash Camera
1635:19	Accident tractor approaching foul of track	Dash Camera
1635:21	Sheriff escort vehicle comes to stop prior to crossing arm. The accident tractor passes a bump, consistent with front axle of accident vehicle crossing north rail.	Dash Camera
1635:22	Sound of air horn similar to train horn is heard emanating from one of the vehicles in the parade	Go Pro
1635:24	Start of locomotive horn	Lead TIR
1635:24	Crossing arm contacts first flag on the right side of the flatbed.	Dash Camera
	The flatbed is in continuous motion, does not come to stop prior to impact	Dash Camera
1635:25.3	Rear tractor wheel crosses over south rail	Lead TIR
1635:27	One person jumps off left rear of flatbed, 6 or 7 people jump off right side of flatbed, 5 people end up on the north side of the crossing	Dash Camera
1635:27	Sheriff escort vehicle moves forward a few feet	Dash Camera
1635:27	Emergency brake application begins on train travelling approximately 63 mph	Lead TIR
1635:29.3	Flatbed midlength wheel crosses north rail	Lead TIR
1635:30.9	Flatbed rear wheel crosses north rail	Lead TIR
1635:31.8	Locomotive impacts rear portion of flatbed	Dash Camera
1635:51	First sheriff's car (lead flatbed escort) arrives on scene.	Go Pro
1636:33	Four Midland PD cars arrive on scene (3 cars, 1 pickup)	Go Pro
1636:46	Train comes to stop. Several passengers from lead flatbed respond and bring blankets to the accident site	Go Pro
1637:00	Four officers and bystanders climb over coupling between two train cars	Go Pro
1637:32	Northeast volunteer fire unit arrives on scene northbound on Garfield Street	Go Pro
1637:35	Unmarked gray police pickup truck arrives on scene	Go Pro
1637:50	Several responders and bystanders are holding their hands/arms to block sunlight, shadows are nearly exactly parallel to crossing arm from southwest to northeast	Dash Camera
1639:08	Unmarked police car arrives on scene westbound on Industrial Street	Go Pro

Time (CST)	Event	Source
1640:08	Green fire truck, marked E-2, arrives on scene northbound on Garfield Street	Go Pro
1640:23	Unmarked police car and white ambulance arrive on scene northbound on Garfield Street. Ambulance parks at southwest corner of intersection of International and Garfield Streets	Go Pro
1640:35	Two bags that appear to be medical supplies are given to an officer and passed to the far side of the train	Dash Camera
1640:38	Fire marshal vehicle arrives on scene	Go Pro
1643:45	Sherriff unit arrives on scene and parks next to the lead float	Go Pro
1644:03	A patient is loaded aboard ambulance parked at southwest corner of intersection of International and Garfield Streets	Go Pro
1644:58	Two red ambulances arrive on scene eastbound on Industrial Street	Go Pro
1645:13	White ambulance arrives on scene westbound on Industrial Street	Go Pro
1646:31	White ambulance that arrived at 1640:23 begins backing up southbound on Garfield Street	Go Pro
1646:43	White ambulance arrives on scene eastbound on Industrial Street	Go Pro
1647:41	White ambulance that arrived at 1640:23 turns and leaves the scene southbound on Garfield Street	Go Pro
1648:33	One of the red ambulances moves on to Garfield Street	Go Pro
1652:45	White ambulance that arrived at 1645:13 leaves the scene eastbound on Industrial Street	Go Pro
1653:17	A patient is loaded into red ambulance	Go Pro
1653:19	White ambulance at southeast corner of intersection of International and Garfield Streets leaves the scene eastbound on Industrial Street	Go Pro
1653:32	Red ambulance that arrived at 1644:58 leaves the scene eastbound on Industrial Street	Go Pro
1702:30	End of GoPro video	

Christopher Babcock
Aerospace Engineer
Vehicle Recorder Division