Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2014-8

Montana Rail Link (MRL)
Alberton, MT
July 3, 2014

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report, including this one, made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2014-8

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Montana Rail Link	MRL	2014093

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Montana Rail Link	MRL	2014093

2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident	4. Time of Accident/Incident
	7/3/2014	12:00 AM

5. Type of Accident/Incident
Derailment

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated	10. Subdivision
16	3	0	0	Fourth

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Alberton	164.4	MT	MINERAL

15. Temperature (F)	16. Visibility	17. Weather	18. Type of Track
90 ˚F	Day	Clear	Main

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Main	Freight Trains-60, Passenger Trains-80	53	West

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OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	HKCKSP0128

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross exluding power units)	6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter	Code
31 MPH	R	6676		0

6. Type of Territory

Signalization:

Signaled

Method of Operation/Authority for Movement:

Signal Indication

Supplemental/Adjunct Codes:

Q, N/A

7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.	Alcohol	Drugs
(1) First Involved *(derailed, struck, etc.)*	TILX642143	9	yes		0	0
(2) Causing *(if mechanical, cause reported)*	0	0		9. Was this consist transporting passengers?		No

10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End e. Remote
(1) Total in Train	3	0	0	0	0
(2) Total Derailed	0	0	0	0	0

11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	43	0	47	0	0
(2) Total Derailed	20	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
500000	250000

14. Primary Cause Code

T199 - Other track geometry defects (Provide detailed description in narrative)

15. Contributing Cause Code

Number of Crew Members

16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen
1	0	1	0

Length of Time on Duty

20. Engineer/Operator	21. Conductor
Hrs: 2 Mins: 6	Hrs: 2 Mins: 6

Casualties to:	22. Railroad Employees	23. Train Passengers	24. Others
Fatal	0	0	0
Nonfatal	0	0	0

25. EOT Device?	26. Was EOT Device Properly Armed?
Yes	Yes

27. Caboose Occupied by Crew? No

28. Latitude	29. Longitude
47.000000000	-115.000000000

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CROSSING INFORMATION

Highway User Involved		Rail Equipment Involved
1. Type		5. Equipment
2. Vehicle Speed *(est. mph at impact)*	3. Direction *(geographical)*	6. Position of Car Unit in Train
4. Position of Involved Highway User		7. Circumstance
8a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? N/A		8b. Was there a hazardous materials release by N/A
8c. State here the name and quantity of the hazardous material released, if any.		

9. Type of Crossing Warning	10. Signaled Crossing Warning	11. Roadway Conditions
1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew 2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other *(spec. in narr.)* 3. Standard FLS 6. Audible 9. Watchman 12. None N/A		N/A

12. Location of Warning	13. Crossing Warning Interconnected with Highway Signals	14. Crossing Illuminated by Street Lights or Special Lights
N/A	N/A	N/A

15. Highway User's Age	16. Highway User's Gender	17. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train	18. Highway User

19. Driver Passed Standing Highway Vehicle	20. View of Track Obscured by *(primary obstruction)*

Casualties to:	Killed	Injured	21. Driver was	22. Was Driver in the Vehicle?
23. Highway-Rail Crossing Users	0	0	24. Highway Vehicle Property Damage *(est. dollar damage)*	25. Total Number of Vehicle Occupants *(including driver)*

26. Locomotive Auxiliary Lights?	27. Locomotive Auxiliary Lights Operational?
N/A	N/A
28. Locomotive Headlight Illuminated?	**29. Locomotive Audible Warning Sounded?**
N/A	N/A

10. Signaled Crossing Warning

1 - Provided minimum 20-second warning
2 - Alleged warning time greater than 60 seconds
3 - Alleged warning time less than 20 seconds
4 - Alleged no warning
5 - Confirmed warning time greater than 60 seconds
6 - Confirmed warning time less than 20 seconds
7 - Confirmed no warning
N/A - N/A

Explanation Code

A - Insulated rail vehicle
B - Storm/lightning damage
C - Vandalism
D - No power/batteries dead
E - Devices down for repair
F - Devices out of service
G - Warning time greater than 60 seconds attributed to accident-involved train stopping short of the crossing, but within track circuit limits, while warning devices remain continuously active with no other in-motion train present
H - Warning time greater than 60 seconds attributed to track circuit failure (e.g., insulated rail joint or rail bonding failure, track or ballast fouled)
J - Warning time greater than 60 seconds attributed to other train/equipment within track circuit limits
K - Warning time less than 20 seconds attributed to signals timing out before train's arrival at the crossing/island circuit
L - Warning time less than 20 seconds attributed to train operating counter to track circuit design direction
M - Warning time less than 20 seconds attributed to train speed in excess of track circuit's design speed
N - Warning time less than 20 seconds attributed to signal system's failure to detect train approach
O - Warning time less than 20 seconds attributed to violation of special train operating instructions
P - No warning attributed to signal systems failure to detect the train
R - Other cause(s). Explain in Narrative Description

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SKETCHES

Sketch

HQ-2014-08

Sketch of MRL derailment on July 3, 2014 of westward MRL train H-KCKSPO1-28A on main track approximately ten miles west of Alberton, Montana

North ↓

Train direction: →

East West

Montana Rail Link Fourth Subdivision: Approximate location of derailment from MP 164.3 to MP 164.5
Superior, MT: West of derailment site at MP 183.6
Lothrop (Alberton), MT: East of derailment site at MP 150.8

List of derailed railroad cars:

Line 6: TILX 642143	Line 16: MTTX 978950
Line 7: TEIX 30058	Line 17: MTTX 978660
Line 8: TLEX 1034	Line 18: BNSF 800039
Line 9: TLEX 1195	Line 19: BNSF 800129
Line 10: TILX 642273	Line 20: BNSF 800034
Line 11: TILX 642640	Line 21: MTTX 981187
Line 12: TBCX 777004	Line 22: BNSF 800029
Line 13: MTTX 978649	Line 23: BNSF 800127
Line 14: BNSF 800022	Line 24: BNSF 800026
Line 15: BNSF 800103	Line 25: TBCX 777019

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SYNOPSIS

On July 3, 2014, at approximately 4:06 p.m. MDT, a westbound Montana Rail Link (MRL) freight train, H-KCKSPO1-28A, derailed 20 rail cars on single main track at MRL Milepost (MP) 164.4 between Alberton, Montana, and Superior, Montana. The derailment site is located on MRL's 4th Subdivision and is approximately 30 miles west of Missoula, Montana, and 170 miles east of Spokane, Washington. The method of operation at the accident site is by signal indication of a traffic control system under the authority of the MRL train dispatcher in Missoula, Montana. The MRL train was delivered to MRL in Laurel, Montana, by the BNSF Railway (BNSF). Three MRL train crews operated the train over the MRL system from Laurel, Montana, through Missoula, Montana, for delivery to BNSF at Spokane, Washington. The MRL freight train consisted of three locomotives located on the head-end of the train. The train had
90 rail cars, 43 loads, 47 empties, and was 6,306 feet in total train length with 6,676 trailing tons.

The train was traveling at a recorded speed of 31 mph approaching the derailment site. The train crew did not observe anything unusual at the time of the derailment when the train experienced an undesired emergency brake application. The train crew contacted the dispatcher and stated there were rail cars in the dirt and the head-end of the train was stopped at approximately
MP 165.

The train crew sustained no injuries and three hazardous material rail cars derailed without releasing any product. The 4th Subdivision is not an Amtrak route. The railroad reported $500,000 in equipment damage and $250,000 in track damage.

At the time of the derailment, it was daylight and clear with a northerly wind of 8 mph. The temperature was 90 degrees F.

The probable cause of the accident was FRA cause code T199 Other track geometry defects – misalignment and/or vertical deflection.

NARRATIVE

CIRCUMSTANCES PRIOR TO THE ACCIDENT:

The crew of westbound train H-KCKSPO1-28A with Lead Locomotive BNSF 5750, which was also the controlling locomotive, consisted of an Engineer and a Conductor (also known as an Assistant Engineer) on MRL. The crew reported for duty at their home terminal in Missoula, Montana, at 2 p.m. MDT on July 3, 2014, after completing the required statutory off duty period. The train was scheduled to travel from Missoula, Montana, to Spokane, Washington, a distance of approximately 280 track miles.

The crew had a copy of the train profile and there were hazardous material cars on the train. The crew participated in a job briefing prior to the start of work and also briefed as the trip progressed. No setouts or pickups were done en route and the Engineer did not take any issues with the handling of the locomotives or the train. There were no exceptions noted to the safety devices on the Lead Locomotive BNSF 5750, except the train crew noted the dynamic brakes on the second locomotive, BNSF 758, were tagged and cut out. The dynamic brake circuit breaker kept cutting out during the trip on the Lead Locomotive, BNSF 5750.

The train crew was in possession of their general track bulletins and no restrictions were noted for the location of the derailment. Interviews conducted by the Federal Railroad Administration (FRA) revealed that the trip was uneventful prior to the derailment except for the lack of operative dynamic brakes. An extended haul inspection was performed on this train at the MRL Yard in Missoula, Montana, on July 3, 2014. The air brake test slip was in the lead locomotive. The train departed Missoula at 2:45 p.m. MDT on July 3, 2014.

As the train approached the derailment area, the Engineer was seated at the controls of the lead locomotive on the right side of the cab and the Conductor was seated on the left side of the cab.

Approaching the derailment site by rail from east to west beginning at Milepost (MP) 164.0, there is, in succession, 352 feet of tangent, a 352-foot 1-degree 0-minute curve to the left, a 423- foot tangent, and a 528 foot 5-degree 0-minute curve to the left preceding 425 feet of curved track to the right to the point of derailment (POD) at MP 164.4 on the west end of a 528-foot
6 degree 40 minute curve to the right. The POD at the west end of the curve is on a 0.01 percent descending grade toward the west.

The railroad timetable direction of the train was west. The geographic direction was southwest. Timetable directions are used throughout this report.

THE ACCIDENT:

As the train approached the derailment site traveling westward at a recorded speed of 31 mph, the Engineer and the Conductor did not observe any problems with the track or feel any rough track conditions in the locomotive cab while traveling through the derailment site. The maximum authorized speed for mixed freight trains at the derailment location is 35 mph, as designated in the current MRL Timetable No. 17. The Engineer and the Conductor stated they felt several tugs, as the train experienced an undesired emergency brake application. The train crew reported to MRL's dispatcher their train was stopped at MP 165. The Conductor walked back to inspect the train and noticed a hazardous material car lying on its side. The train crew called the dispatcher a second time and received permission to cut away from the train and move the locomotive consist away from the derailment site.

The investigation revealed that the lead locomotives and the first five loaded railcars traversed through the derailment site and remained on the track. Twenty rail cars starting at the sixth rail car behind the locomotive consist derailed, and several rail cars slid down an embankment into the Clark Fork River.

POST-ACCIDENT INVESTIGATION:

On July 7, 2014, FRA Region 8 management assigned a chief inspector as investigator-in-charge for this incident. FRA completed its investigation and the following analysis and conclusions, as well as any possible contributing factors to the probable cause represent the finding of FRA investigation.

MRL's "Procedures for the Installation, Adjustment, Maintenance and Inspection of CWR [Continuous Welded Rail] as Required by 49 CFR 213.118," Chapter 1, CWR Installation Procedures, Rule 1.1 "Neutral Temperature," states: "The neutral temperature is the temperature at which the rail is neither in tension nor compression. Designated rail laying temperatures have been established to provide a high neutral temperature to prevent track buckling. When laying or adjusting CWR use the neutral temperature of 90 degrees F." The investigation revealed 141 # CWR on curve 164-B was laid in 2002 at a neutral temperature of 90 degrees F per MRL Engineering Instruction Procedures.

MRL's "Engineering Instruction Procedures for Inspection of CWR," Chapter 7, Extreme Weather Inspections, Rule 7.1 "Hot Weather Inspections," states: "On main track class 2 and above, heat inspections must be performed as directed by the Chief Engineer when the temperature is expected to exceed the threshold temperature for the territory. Typically the ambient temperature is above 90 degrees before heat inspections are required."

The investigation revealed an MRL roadmaster traversed the derailment site 4 hours prior to the derailment on a heat run inspection at approximately 1 p.m. on the day of the accident. No exceptions were noted at the POD or surrounding area by the inspector during this inspection. Documentation on MRL track inspection records noted the roadmaster traversed the track from MP 162.1 to MP 219.1 twice during the week prior to the derailment. The inspection records showed the last documented main track inspection between MP 162.1 and MP 219.1 was on June 27, 2014. MRL inspectors make out heat run reports only if tight rail locations are noted during the heat inspections. Heat run reports provide information on the day of inspection, location inspected, time of inspection, ambient and rail temperature during the inspection, and any tight rail location identified. The investigation revealed a heat run inspection was conducted on the day of the accident and no tight rail evidence within the area of the derailment was observed. The railroad complied with its engineering instruction procedures for CWR heat inspections as required by MRL.

In addition to track inspections, a valid search for internal rail defects must be made on Class 3 track once a year. Inspection equipment must be capable of detecting defects in the joint area, as well as in the body of the rail. Copies of the railroad's last rail detector inspection reports for the 4th Subdivision were examined. The detector car defective rail report noted the last test through the accident area was conducted by Sperry Rail Detector Car Number 991 on Thursday, May 29, 2014. The car conducted a rail integrity test between MP 157.078 and Rivulet MP 168.989, and documented 13 rail defects. The rail defects consisted of a bolt hole break (BHB) at MP 160.875, defective weld (DWF) at MP 158.998, transverse fissure (TD) at MP 157.078, crushed head (CH) at MP 165.999, crushed head (CH) at MP 166.011, crushed head (CH) at MP 166.047, defective weld (DWF) at MP 166.815, transverse fissure (TD) at
MP 167.29, transverse fissure (TD) at MP 167.305, transverse fissure (TD) at MP 167.411, transverse fissure (TD) at MP 167.415, engine burn fracture (EBF) at MP 167.436, and a bolt hole break (BHB) at MP 168.989. No rail defects were found between MP 157.078 and
MP 165.999, which includes the derailment site. Remedial action records for the defects detected were examined and found to be in compliance with FRA standards.

A copy of the geometry car test report for the last 4th Subdivision test run was examined. Records note BNSF Geometry Car 087 conducted a main track test through the derailment site on October 28, 2013, approximately 8 months prior to the derailment. The geometry car is used to monitor track irregularities, some caused by dynamic forces influenced by rail traffic tonnage. Track conditions monitored include rail cant (side to side rail tilt), track unbalance (deviation from a 3-inch unbalance allowed for maximum speed on curves), curve elevation (elevation of outside high rail to accommodate track unbalance), crosslevel (deviation from zero crosslevel rail to rail), gage (distance between the two rail gage lines), rail alignment (thermal or irregular alignment), and running rail profile (longitudinal dips and humps). At MP 164.40 (the site of the POD), the geometry car measured 1/8-inch outward cant on the right rail, ¼-inch outward cant on the left rail, a plus 2-inch curve unbalance, 3 7/8-inch curve elevation, 57 ½-inch gage, ¼-inch misalignment, ½-inch profile on right rail, and ½-inch profile on the left rail. The unbalance detected on the sharp curve due to the 3 7/8-inch crosslevel was acceptable for a maximum allowable speed of only 33 mph. All measurements detected on October 28, 2013, were within FRA Track Safety standards for Class 3 track with the exception of the unbalance speed limitation of 33 mph on the 35 mph curve.

An FRA field inspection of the derailment site was conducted on July 15, 2014. The track at the POD consisted of 141-pound CWR laid on wooden ties with Pandrol-type tie plates and Pandrol clip fasteners. The inspection revealed 7/16-inch gage rail head loss (ball wear) on the curves high side portion of rail. Outer edge of wheel wear on the top of the low side rail was noted indicating a history of gage widening. The inspection also noted cracked Pandrol tie plates on the inner side of the rail had existed on the high side of the curve. This was an indication that excessive vertical and lateral deflection at the POD was occurring, making the track unstable at the time of the accident.

On the same day of the inspection, an interview was conducted with the roadmaster responsible for track inspections in the area. The roadmaster stated the gage measurement at POD had been checked prior to the derailment and measured 57 ¼ inches which is within the limits for Class 3 track. The roadmaster also said rail gage side head loss at POD had been checked prior to the derailment and measured 57 ¼ inches which is within the limits for Class 3 track. The roadmaster also said rail gage side head loss measured 7/16 inches which is also less than MRL's allowable of ½ inch. In response to the gage widening and curve unbalance indications noted by the geometry car on October 28, 2014, the roadmaster said a follow-up inspection on the same day discovered broken Pandrol plates and lag screws on the high side of the curve. The roadmaster said these were repaired immediately, but the crosslevel and curve unbalance on the curve was not checked or addressed. The roadmaster stated that on April 8, 2014, approximately 5 months later, 10 broken Pandrol plates and 75 broken lag screws were detected and repaired at the exact same location. The roadmaster said the latest discovery was repaired on May 1, 2014, but again the crosslevel and curve unbalance was not measured or addressed.

ANALYSIS and CONCLUSIONS:

Analysis - FRA Post Accident Toxicology Testing:
The accident met the criteria for FRA Post Accident Toxicology Testing, as required under Title 49 Code of Federal Regulations, Part 219 Subpart C.

Conclusion:
Test results were negative for both the Engineer and Conductor.

Analysis - Locomotive Data Recorder:
FRA obtained data from the event recorder on Lead Locomotive BNSF 5750 for analysis.

Conclusion:
Data analyzed from the printout of the leading locomotive's event recorder indicated the train was being operated at 31 mph at the location of the POD. The event recorder also indicated no unusual events related to train handling.

Analysis - Crew Fatigue:
FRA obtained fatigue-related information for the members of the train crew for the 10-day period preceding the derailment.

Conclusion:
Upon analysis of that information, FRA concluded that fatigue was not probable for any of the employees.

Analysis - On Board Video:
The outward facing video from Leading Locomotive BNSF 5750 was viewed by FRA.

Conclusion:
FRA was unable to determine any causal factors as the train approached the derailment site.

Analysis - Sperry Rail Detector Data and Defective Rail reports:
FRA obtained Sperry Detector Car 991 data for curve 164-B conducted by the test car on
May 29, 2014.

Conclusion:
After examination, FRA was able to determine that no internal rail defects were noted on curve 164-B or the surrounding area.

Analysis - Geometry: FRA obtained geometry car data for curve 164-B survey:

Conclusion:
After examination, FRA was able to determine that during the last test survey conducted on October 28, 2013, track geometry car data indicated the curve was experiencing geometry exceptions and a curve speed limitation problem at the west end of curve 164-B.

Analysis - Weather Conditions:
The ambient temperature on July 3, 2014, was 90 degrees F, daylight with clear visibility.

Conclusion:
On the day of the derailment, heat from 90 degree ambient temperature caused rail temperature influenced by the sun's radiant heat to increase to 120 degrees F. This created internal thermal compression forces within the rail trying to expand beyond the 90 degree laying temperature. The thermal forces accumulated against an existing solid object which consisted of an old torn out grade crossing at the west end of the curve. Track buckling will occur on curves under a combination of thermal forces and vehicle loads termed dynamic buckling. High temperatures and vehicle loading progressively weaken the track due to dynamic uplift (flexural waves) and a buckle mechanism response is induced by misalignment growth. Misalignment growth is caused by high lateral loads, increased longitudinal forces, uplift due to vertical loads, and train induced vibrations. Locations with geometry track imperfections are vulnerable to this type of dynamics creating a structural weakness where track buckling is more likely to occur.

The weakest portion of the track, next to the crossing alignment, was influenced by a crosslevel condition on the high outer rail of the curve, creating a curve speed limitation problem by changing the lateral vertical unbalance on the curve. The POD had a documented history and field evidence of settlement on the high rail making a crosslevel deviation. This condition was never addressed or repaired as acknowledged by the roadmaster during his interview. The
6 degree 40 minute curve was designed with 4 inches of elevation making a 3-inch unbalance to accommodate a maximum allowable train speed of 39 mph on the curve. The maximum authorized track speed on the curve was 35 mph at the time of the accident. High lateral loads, increased longitudinal forces, uplift due to vertical loads, train induced vibrations, and other track imperfections caused by the crosslevel deviation to worsen, further affected the unbalance of the curve which further limited the speed on the curve.

The evidence of broken tie plates and gage widening uncovered during the FRA inspection was caused by further loss of elevation on the high rail, changing the speed limitation unbalance, which greatly increased vehicle and loading dynamic uplift, progressively weakening the track at the POD. The event recorder indicated the train was being operated at 31 mph at the POD which more than likely had crosslevel and unbalance not suited for the 6 degree 40 minute curve at this speed. The event recorder indicated no unusual events related to train handling. Annual tonnage of 53.5 million gross tons on MRL's 4th Subdivision illustrate the force the heavy loaded rail cars with coal, oil, grain, and various commodities put on a sharp curve. Additional heat caused by friction between the train wheels and the top of the rail, with repeated vertical, longitudinal, and lateral forces from the trains, combined with the geometry defects on the unstable track section and caused a dynamic buckling misalignment to occur under the train.

PROBABLE CAUSE:

FRA's investigation determined that the probable cause of the accident was FRA cause code T199 Other track geometry defects – misalignment and/or vertical deflection.