DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

Federal Railroad Administration
Office of Safety
Headquarters Assigned
Accident Investigation Report
HQ-2006-10

Norfolk Southern (NS)
York, Alabama
February 10, 2006

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report 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.

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2006-10

1.Name of Railroad Operating Train #1 Norfolk Southern Corp. [NS]	1a. Alphabetic Code NS	1b. Railroad Accident/Incident No. 24148
2.Name of Railroad Operating Train #2 N/A	2a. Alphabetic Code N/A	2b. Railroad Accident/Incident N/A
3.Name of Railroad Responsible for Track Maintenance: Norfolk Southern Corp. [NS]	3a. Alphabetic Code NS	3b. Railroad Accident/Incident No. N/A
4. U.S. DOT_AAR Grade Crossing Identification Number	5. Date of Accident/Incident Month 02 Day 10 Year 2006	6. Time of Accident/Incident 03:15:00 ☐ AM ☑ PM

7. Type of Accident/Indicent (single entry in code box)
1. Derailment 2. Head on collision 3. Rear end collision 4. Side collision 5. Raking collision 6. Broken Train collision 7. Hwy-rail crossing 8. RR grade crossing 9. Obstruction 10. Explosion-detonation 11. Fire/violent rupture 12. Other impacts 13. Other (describe in narrative)
01

8. Cars Carrying HAZMAT 0	9. HAZMAT Cars Damaged/Derailed 0	10. Cars Releasing HAZMAT 0	11. People Evacuated 0	12. Division Virginia

13. Nearest City/Town Montgomery	14. Milepost (to nearest tenth) N285.5	15. State Abbr N/A Code VA	16. County MONTGOMERY

17. Temperature (F) (specify if minus): 45 F

18. Visibility (single entry) 1. Dawn 2. Day 3.Dusk 4.Dark — Code 2

19. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5.Sleet 6.Snow — Code 1

20. Type of Track 1. Main 2. Yard 3. Siding 4. Industry — Code 1

21. Track Name/Number: #2 Main Track

22. FRA Track Class (1-9, X) — Code 3

23. Annual Track Density (gross tons in millions): 28.5

24. Time Table Direction 1. North 2. South 3. East 4. West — Code 3

OPERATING TRAIN #1

25. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect.car A. Spec. MoW Equip. — Code 1

26. Was Equipment Attended? 1. Yes 2. No — Code 1

27. Train Number/Symbol: 23GV50 9eas

28. Speed (recorded speed, if available) R - Recorded E - Estimated: 29 MPH — Code R

29. Trailing Tons (gross tonnage, excluding power units): 8357

30. Method(s) of Operation (enter code(s) that apply)
a. ATCS b. Auto train control c. Auto train stop d. Cab e. Traffic f. Interlocking g. Automatic block h. Current of traffic i. Time table/train orders j.Track warrant control k. Direct traffic control l.Yard limits m.Special instructions n. Other than main track o. Positive train control p. Other (Specify in narrative)
Code(s): e | N/A | N/A | N/A | N/A

30a. Remotely Controlled Locomotive?
0 = Not a remotely controlled
1 = Remote control portable
2 = Remote control tower
3 = Remote control transmitter - more than one remote control transmitter
0

31. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded(yes/no)
(1) First involved (derailed, struck, etc)	N/A	9	yes
(2) Causing (if mechanical cause reported)	0	0	N/A

32. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.

Alcohol	Drugs
N/A	N/A

33. Was this consist transporting passengers? (Y/N): N/A

34. Locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End c. Remote
(1) Total in Train	5	0	0	0	0
(2) Total Derailed	0	0	0	0	0

35. Cars	Loade a. Freight	Loade b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	54	0	0	0	0
(2) Total Derailed	20	0	0	0	0

36. Equipment Damage This Consist 901450	37. Track, Signal, Way, & Structure Damage 141000	38. Primary Cause Code H521	39. Contributing Cause Code H504

Number of Crew Members

40. Engineer/ Operators	41. Firemen	42. Conductors	43. Brakemen
N/A	0	1	0

Length of Time on Duty

44. Engineer/Operator Hrs 5 Mi 15

45. Conductor Hrs 5 Mi 15

Casualties to:	46. Railroad Employees	47. Train Passengers	48. Other
Fatal	0	0	0
Nonfatal	N/A	0	0

49. EOT Device? 1. Yes 2. No — 1

50. Was EOT Device Properly Armed? 1. Yes 2. No — 1

51. Caboose Occupied by Crew? 1. Yes 2. No — 2

OPERATING TRAIN #2

52. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect.car A. Spec. MoW Equip. — Code N/A

53. Was Equipment Attended? 1. Yes 2. No — Code N/A

54. Train Number/Symbol: N/A

55. Speed (recorded speed, if available) R - Recorded E - Estimated: 0 MPH — Code N/A

57. Method(s) of Operation (enter code(s) that apply)
a. ATCS b. Auto train control g. Automatic block h. Current of traffic m.Special instructions n. Other than main track

57a. Remotely Controlled Locomotive?
0 = Not a remotely controlled
1 = Remote control portable

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56. Trailing Tons (gross tonnage, excluding power units) N/A

c. Auto train stop
d. Cab
e. Traffic
f. Interlocking
i. Time table/train orders
j.Track warrant control
k. Direct traffic control
l.Yard limits
o. Positive train control
p. Other (Specify in narrative)

Code(s)				
N/A	N/A	N/A	N/A	N/A

2 = Remote control tower
3 = Remote control transmitter - more than one remote control transmitter N/A

58. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)
(1) First involved (derailed, struck, etc)	0	N/A	N/A
(2) Causing (if mechanical cause reported)	0	N/A	N/A

59. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.

Alcohol	Drugs
N/A	N/A

60. Was this consist transporting passengers? (Y/N) N/A

61. Locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End c. Remote
(1) Total in Train	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0

62. Cars	Loade a. Freight	Loade b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0

63. Equipment Damage This Consist 0

64. Track, Signal, Way, & Structure Damage 0

65. Primary Cause Code N/A

66. Contributing Cause Code N/A

Number of Crew Members

67. Engineer/ Operators	68. Firemen	69. Conductors	70. Brakemen
N/A	N/A	N/A	N/A

Length of Time on Duty

71. Engineer/Operator Hrs 0 Mi 0

72. Conductor Hrs 0 Mi 0

Casualties to:	73. Railroad Employees	74. Train Passengers	75. Other
Fatal	0	0	0
Nonfatal	0	0	0

76. EOT Device? 1. Yes 2. No N/A

77. Was EOT Device Properly Armed? 1. Yes 2. No N/A

78. Caboose Occupied by Crew? 1. Yes 2. No N/A

Highway User Involved

79. Type
A. Auto
B. Truck
C. Truck-Trailer.
D. Pick-Up Truck
E. Van
F. Bus
G. School Bus
H. Motorcycle
J. Other Motor Vehicle
K. Pedestrian
M. Other (spec. in narrative)
Code N/A

80. Vehicle Speed (est. MPH at impact) N/A

81. Direction geographical) 1.North 2.South 3.East 4.West Code N/A

82. Position 1.Stalled on Crossing 2.Stopped on Crossing 3.Moving Over Crossing 4. Trapped Code N/A

86a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither Code N/A

Rail Equipment Involved

83. Equipment
1.Train (units pulling)
2.Train (units pushing)
3.Train (standing)
4.Car(s) (moving)
5.Car(s) (standing)
6.Light Loco(s) (moving)
7.Light(s) (standing)
8.Other (specify in narrative)
Code N/A

84. Position of Car Unit in Train N/A

85. Circumstance 1. Rail Equipment Struck Highway User 2. Rail Equipment Struck by Highway User Code N/A

86b. Was there a hazardous materials release by 1. Highway User 2. Rail Equipment 3. Both 4. Neither Code N/A

86c. State here the name and quantity of the hazardous materials released, if any. N/A

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

Code(s)						
N/A	N/A	N/A	N/A	N/A	N/A	N/A

88. Signaled Crossing Warning (See instructions for codes) Code

89. Whistle Ban 1. Yes 2. No 3. Unknown Code N/A

90. Location of Warning 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach Code N/A

91. Crossing Warning Interconnected with Highway Signals 1. Yes 2. No 3. Unknown Code N/A

92. Crossing Illuminated by Street Lights or Special Lights 1. Yes 2. No 3. Unknown Code N/A

93. Driver's Age 0

94. Driver's Gender 1. Male 2. Female Code N/A

95. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train 1. Yes 2. No 3. Unknown Code N/A

96. Driver 1. Drove around or thru the Gate 2. Stopped and then Proceeded 3. Did not Stop 4. Stopped on Crossing 5. Other (specify in narrative) Code N/A

97. Driver Passed Standing Highway Vehicle 1. Yes 2. No 3. Unknown Code N/A

98. View of Track Obscured by (primary obstruction) 1. Permanent Structure 2. Standing Railroad Equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicle 7. Other (specify in narrative) 8. Not obstructed Code N/A

101. Casulties to Highway-Rail Crossing Users	Killed	Injured
	0	0

99. Driver Was 1. Killed 2.Injured 3. Uninjured Code N/A

100. Was Driver in the Vehicle? 1. Yes 2. No Code N/A

102. Highway Vehicle Property Damage (est. dollar damage) 0

103. Total Number of Highway-Rail Crossing Users (include driver) 0

104. Locomotive Auxiliary Lights? 1. Yes 2. No Code N/A

105. Locomotive Auxiliary Lights Operational? 1. Yes 2. No Code N/A

106. Locomotive Headlight Illuminated? 1. Yes 2. No Code N/A

107. Locomotive Audible Warning Sounded? 1. Yes 2. No Code N/A

108. DRAW A SKETCH OF ACCIDENT AREA INCLUDING ALL TRACKS, SIGNALS, SWITCHES, STRUCTURES, OBJECTS, ETC., INVOLVED.

109. SYNOPSIS OF THE ACCIDENT

On February 10, 2006, at 3:15 p.m., EST, Norfolk Southern Corporation (NS) Train 23GV509 was traveling east on the Virginia Division, Christiansburg District, en route from Bristol, Virginia on the No. 2 main track with five locomotives and 54 loaded freight cars. The recorded speed was 29 mph, when the train received an undesired emergency brake application and stopped with the head end of the train at Milepost N285.3, just west of the Montgomery Tunnel, near Montgomery, Virginia. Inspection of the train revealed 20 cars derailed, positioned 9th through the 28th head cars. The derailment fouled both the No. 1 and No. 2 main lines.

Investigation of the derailment indicated that 18 cars were turned over and two of these cars caught fire when new automobiles from a multilevel automobile car(auto rack) caught on fire. New automobiles from NS TTGX 964907 were ejected and caught fire upon initial derailment. Fire spread from TTGX 964907 to TTGX 991049 before the fire was extinguished by the Elliston Fire Department. There were no injuries. No hazardous materials were involved in the derailment.

The weather at the time of the derailment was clear and 45 degrees Fahrenheit.

The primary cause of the accident was determined to be train handling. Improper use of the dynamic brake during the running release of the automatic brake application caused slack run-in of 288,000 lbs., forcing a lightly loaded 89' car to derail to high side of a 5.7 degree curve, according to the NS Research and Test Department. A contributing factor was the train makeup. The train consist was made up of 15 loaded auto racks, followed by 11 loaded frame cars, followed by 28 loaded double stack cars. All of the first 26 cars were 89' long with end-of-car cushioning, and all were fairly light weight. Approximately 6037 tons of the 8357 tons trailed this block of long/light cars. Excessive buff forces caused by the slack run-in of the heavier cars on the rear contributed to the derailment. The 16th car in the consist was considered to be the car that caused the derailment. A flatbed loaded with frames, the car was on the high side of the 5.7 degree curve on a descending grade and derailed, subsequently causing the 7 cars in front of it and the 12 cars following to derail.

The crew was taken for mandatory Post Accident Toxicological Testing at the local hospital in Salem, Virginia.

The estimate for damages was $901,450 for equipment and $141,00 in track damages. Lading damages amounted to $2,720,000. Total damages excluding lading amounted to $1,042,450.

The No. 1 main track was restored for service on February 11, around 10 p.m. The No. 2 main track was restored for service on February 12, around 1:30 a.m. The Christiansburg District is a heavily traveled route under traffic control authority to operate between West Virginia and Roanoke, Virginia.

110. NARRATIVE

Circumstances Prior to the Accident

The crew of NS Train 23GV509 East included a locomotive engineer and a conductor. They first went on duty at 10:00 a.m., EST, February 10, 2006 at the NS Bristol Yard in Bristol, Virginia. This is the away-from-home terminal for both crew members. Both received more than the required statutory period off duty prior to reporting for duty.

Their assigned train consisted of five locomotives and 54 loaded cars made up of auto racks, articulated frame cars, and articulated double stack cars (many of which were multiple platform). It was 8,357 tons and 8,513 feet long. The lead locomotive was NS 2623. The train was scheduled to travel to Roanoke, Virginia, with no stops en route. The train received a Class 1 initial terminal brake test in Shelbysville, Kentucky on February 9. At the time of the brake test, there were 15 cars on the train. In Louisville, Kentucky, 11 cars were added at 9:20 a.m., according to the brake slip. An additional 16 cars were added at 10:05 a.m. and another brake test was performed, which included the EOTD test information. Another pickup of 11 cars was made en route, at location 283W. The train received a proper brake test and the EOTD was tested prior to departing Bristol Yard at 11:05 a.m. The train makeup placed the lighter loaded auto racks at the head of the train, flatbeds loaded with auto frames in the middle, and heavy double stack articulated cars at the rear. Both the engineer and conductor commented on the issue of slack run-in with this particular train, due to the heaviest cars being placed on the rear.

As the eastbound train approached the derailment site, the engineer was seated at the controls on the west side of the leading locomotive and the conductor was seated on the east side of the leading locomotive.

In this area of the railroad, traveling eastward, the crest of Christiansburg Mountain is reached around MP N289.5; the main line then drops to a 1.34% long descending grade approaching the derailment site at MP N285.5. There is an elevation of upwards to 2.00", with a long 5.7 degree curve to the right, prior to arriving at the Montgomery Tunnel. This area has a succession of curves, with very little tangent track.

The railroad timetable direction of the train was east. Both the timetable and geographic direction are the same in this area.

The Accident

Train 23GV509 was being operated at 29-30 mph approaching the derailment site. At the time the accident occurred the train was being operated at 29 mph. Both speeds were recorded by the event recorder of the controlling locomotive, NS 2623. The maximum authorized speed for freight trains at this location is 30 mph, as designated in the current NS Virginia Division Timetable No. 7.

Train 23GV509 crested the mountain at Christiansburg (MPN289.5) and the engineer slowly bunched his train using dynamic brake; while in full dynamic brake, the train speed climbed to 31 mph. The engineer made a 10 lb. automatic brake reduction at that time. He left the brake on and reduced his dynamic amperage to a level sufficient to hold the train back on the descending grade. The train speed climbed slightly, to a high of 33 mph; as soon as the train speed exceeded 30 mph, the engineer took action and made an automatic train reduction. The engineer stated he felt a “bump” when the train speed jumped to 33 mph and then shortly after, a second bump. He released the train brake and slowly increased the dynamic brake amperage. He had fully released the automatic brake and he was in maximum dynamic braking power when the train experienced an undesired emergency brake application, around 3:15 p.m., with the head end stopped at MP N285.3, just west of the Montgomery Tunnel.

The conductor told the engineer he was going to inspect the train, to determine the cause of the emergency brake application. He got off the train and walked back to inspect the cars. He called the engineer on the radio and told him that they had wrecked the train. He told him they had wrecked on Main 1 (as well as Main 2) and he needed to call the dispatcher and let him know that all traffic needed to be stopped and to send officials to the site. The conductor found they had derailed from the 9th car back. He saw smoke and relayed the information to the engineer. The engineer called the New River Dispatcher and told him they had derailed. The conductor attempted to put out the fire, which started in one of the auto racks and spread to another. The local Elliston Fire Department arrived and put out the fire. According to the conductor, the NS police were the first to arrive on the scene of the accident.

Officers arrived and began investigation of the accident. The crew was eventually taken for FRA mandatory Post Accident Toxicological Testing, around 6:40 p.m., arriving at the hospital in Salem, Virginia, around 7:40 p.m.

Investigation of the accident revealed the 9th through the 28th cars had derailed, with the point of derailment located in a curve, at MP N285.5. The investigation determined the derailment to have occurred when the 16th car climbed to the high side of a 5.7 degree curve on a descending grade, causing the 7 cars in front of it and the 12 cars following to derail. Considerable buff forces created by slack run-in appeared to be a major factor in the cause.

Analysis and Conclusions

Investigation of the accident revealed that from the outset, the crew perceived problems with NS Train 23GV509, due to the train makeup. The conductor, who regularly works this train, made a statement during his interview that the train makeup had recently changed for this train. He said the heavier cars were placed on the rear, making the train unbalanced and creating slack run-in and buff forces. He said he and others had complained to NS management regarding the train makeup, but had not seen a change. According to the conductor, the changes in train makeup occurred during December and January.

The engineer stated he had not operated the type of locomotive located on the head end of Train 23GV509, NS 2623, except one other time. He indicated he was unfamiliar with all the operating features. He also stated he felt the dynamic brakes on the locomotive were not operating properly. He said during the trip, he had problems getting the dynamic brakes to stay in the mid range, between 600-700 amps.
He said because of the rear of the train was heavier than the rest of the train, he had to go slower and be more patient, due to slack run-in.

NS officers examining the scene of the accident, determined that a sudden action had occurred at the full body of the 5.7 degree curve, with TTGX 853085, TTGX 995062 and FTTX 972647 crossing over the high side (south side). No definite marks were found on the rail to indicate an exact point of derailment. However, the initiation site was in the body of the curve as noted.

The track structure was destroyed in the body of the curve. Examination of the ties and ballast revealed they had remained in place and were in good condition. The rails were displaced in the curve where the derailment occurred. Examination of the last test performed by the NS 33 Track Geometry Car on December 5, 2005 indicated no defects in the area. There were no conditions observed that would have contributed to rapid deterioration of the track structure. All rail was subsequently accounted for with no defects found in any of the rail fractures. Track did not appear to have contributed to this derailment.

The first derailed cars appeared to have been TTGX 853085, TTGX 995062, and/or FTTX 972647. No obvious defects were detected in any of these cars. No broken wheels, side frames, etc. were subsequently found that would explain the abrupt nature of the derailment.

Examination of the inspection and test records for the train/locomotives/equipment failed to indicate any mechanical issue which could have caused the derailment.

Examination of the train consist indicated that the head 15 cars were loaded auto racks, followed by 11 loaded frame cars, followed by 28 loaded double stack cars (many of which were multiple platform). All of the first 26 cars were 89' long with end-of-car cushioning, and all were fairly light weight. Approximately 6037 tons of the 8357 tons trailed this block of long/light cars. Maximum safe trailing tonnage behind Restricted Equipment between Roanoke and Walton is 5300 tons for an eastward move. The loaded frame cars did not meet Restricted Equipment guidelines per Virginia Division Timetable No. 7, page 128.

Examination of the event recorder data indicated a 3 mph speed increase occurred over a 2 second period, indicative of a slack run-in. The train line then showed dropping pressure 9 seconds after the run-in. Conditions prior to the run-in included a first service automatic brake application had been made while in full dynamic. As the brake application became effective, the dynamic brake was reduced to “D2" with 320 amps. After 3 minutes, 22 seconds, the automatic brake was released while in “D2" with 320 amps. After 32 seconds, the dynamic brake was then increased to “D3” and amperage slowly rose to 480 amps as the train accelerated. After 26 seconds, the dynamic brake was increased to “D8" and amperage rose to 920 amps. After 13 seconds in “D8", the head end experienced the 3 mph speed increase within 2 seconds, followed by the drop in train line pressure 9 seconds later. Distance calculations indicate that TTGX 978990 and TTGX 995062 were in the 5.7 degree curve at the time of the run-in. FTTX 972647 was just entering the spiral of the curve at that time. This would indicate that the run-in was a major factor in the cause.

One simulation of the incident by the NS Research and Tests Department using the Train Operating and Energy Simulator (TOES) computer model indicated that a 288,000 lb. run-in would have been generated by the actual consist make-up and train handling. This amount of buff force is excessive for 89' cars lightly loaded in a 5.7 degree curve. Another simulation with the same train handling and the consist modified to move the block of double stack equipment to the front of the train (as recommended by EQ-9) resulted in a reduction in the maximum buff force to 198,000 lbs. This amount of buff force should be acceptable for the heavily loaded double stack equipment.

An additional simulation with the original train consist make-up and modified train handling was performed. The modified train handling involved changing the time at which full dynamic brake (D8) was applied to correspond to the time when the automatic brake release was initiated. This change resulted in the maximum buff forces being reduced to 110,000 lbs. This buff force is acceptable for any of the car types in this train. It should be noted that this significant decrease in buff force was achieved with the poor train make-up.

Based on the NS Research and Tests Department’s analysis of the accident, the primary cause of this derailment was insufficient dynamic braking during the running release on the heavy descending grade, which allowed the train to stretch as the brakes released from front to rear. When the dynamic brake was fully applied, the run-in occurred and caused the derailment. Train make-up was a contributing factor in that the light, cushioned cars ahead of the block of heavy double stack cars on the rear increased the potential for heavy slack action in the train. However, proper train handling based on the knowledge of the train make-up and compliance with existing rules that require that “maximum dynamic brake amperage is use” (L-246) and “when making a running release of train air brakes, the dynamic brake must be kept fully applied with maximum amperage until air brakes have released throughout the train” (L-210) would have prevented this derailment.

Probable Cause and Contributing Factors

The primary cause determined for the derailment of NS Train 23GV509 was the improper use of dynamic brake during running release of automatic brake application, which caused slack run-in of 288,000 lbs, forcing a lightly loaded 89' car to derail to the high side of a 5.7 degree curve.

A contributing factor was the train make-up. The train make-up recommended in the NS System Timetable Equipment Restrictions, under EQ-9 states that heavier loaded articulated 5-well double-stack equipment should be handled in the head 25% of the consist. The much heavier double stack equipment in the train was located in the last half, creating buff forces that contributed to the derailment.

Recommendations by the NS Research and Tests Department included the following:

1. Engineers should be properly trained to comply with existing rules (L210 & L-246 pertaining to use of dynamic brakes when making running releases.
2. Train make-up guidelines should be followed. Although train make-up was not the primary cause for this derailment, such train make-up greatly increases the potential for derailment when unusual events such as an undesired emergency, intentional emergency to avoid a crossing accident, en route equipment failures, etc., do occur.