



RE: NTSB Request for speed analysis relating to Q194-23 prior derailment at on the Monroe SD on Tuesday, 5/24/2011

Mr. Wayne Workman, NTSB phone conferenced HQ Safety Department staff members Bruce Rose, Tom Wolfe, and Dean Menefee, and requested train speed/braking simulations that would theoretically define where train Q694-23 would have stopped under certain circumstances.

Verified measurements

Senior RFE Tim Goddard was directed re-measure the following:

- Q618-22 EOT/rear car location measured to be 782 feet south of MP SG 314.0
- Northbound intermediate signal with dark aspect at MP SG 316.1 measured 115 feet south of MP SG 316.0

I-ETMS “PTC”, designed specifications currently not in production or approved for service implies this system if installed in and operating in an active state.

PTC warning and enforcement in relationship to the movements involved in Q194-23 following the movement of Q618-22.

A lead-equipped locomotive approaching a signal displaying restricted speed must operate at a speed no greater than a speed of 15 MPH. Afterward, the train could increase the speed to 18 MPH before an additional PTC warning would be audibly and visually displayed.

Q194-23 chronology

Q194-23 at NE Waxhaw SG 318.4 northbound received an approach indication. This indication requires a train exceeding 30 MPH to begin reduction to not exceeding 30 MPH and to be prepared to stop at the next signal location. The next signal location is the intermediate signal is located at SG 316.1 Q194-23’s engineer complied with signal indication when operating above 30 MPH reduced to 28 MPH at this location.

The PTC on-board display projects a forward five-mile view that displayed a *restricted proceed target* at the intermediate signal at SG 316.1. This represents the last intermediate signal prior to Q194-23 arrival at the rear of Q618-22.

The on-board system would display a maximum speed of *restricted speed* at the intermediate signal SG 316.1 continuing to a point that the system would have used predictive braking to enforce a *restricted speed* at the next intermediate signal at SG 313.8.

The on-board system would enforce a 15 MPH maximum speed at the intermediate signal. Once the train’s head end had passed this location, the on-board system for train’s exceeding restricted speed would induce warning at 18 MPH and enforce a stop at 20 MPH using a full service brake application.

Q194-23 was operating 28-30 MPH when approaching the restricted proceed aspect at intermediate signal SG 316.1, based on design criteria of the I-ETMS system, this train would have received both audible and visual warning, and if not acted upon, would have received a forced stop prior to passing this intermediate signal.

From the point of the intermediate signal SG 316.1 and the rear of train Q618-22, this system only has the enforcement capacity to limit train speed to restricted speed and to provide warning

at 18 MPH and enforcing stop at 20 MPH. The current state of software development does not allow my simulating these described behaviors.

Simulated speeds/Braking actions/Results

The subdivision used was the Florence Division’s Monroe SD from SG 306-442.

Train consist used is Q194-23 comprised the following:

Train Consist information

Q194-23 contained 12 loads, 0 empties, 1,562 tons and 1,977 feet in length.

Locomotive consist information

CSXT 7783 - model CW40-8 with a powered axle count of 6 and a dynamic brake axle count of 7. (modified 1/26/97 for continuous dynamic braking following emergency braking)

CSXT 8429 - model SD40-2 with a powered axle count of 6 and dynamic brake axle count of 6. (modified 9/21/96 for continuous dynamic braking following emergency braking)

Simulation results

Legend:

Full Service brake application - FS

Engineer initiated brake application – EIE

DB – Mode is dynamic braking

Measured mile between SG 315 and SG 314 is 5,332 feet.

Scenario Count	Activity	Beginning Location	Train Speed	Braking Action FS / EIE & w / wo DB	Stopping Location/ Distance (ft.)	Final Stopping Location	EOT location 314.146 Arrival Speed	Distance from EOT
1	Engineer observes EOT of Q618-22	314.2325	18.0	FS w DB @ 314.219	.087 mi or 463.88 ft.	314.140	6.3 mph	.006 mile or 31.99 ft. <i>past</i>
2	Engineer observes EOT of Q618-22	314.2325	18.0	EIE w DB @ 314.222	0.21 mile or 111.97 ft.	314.167	N/A	.021 mi. or 111.97 feet from EOT
3	Engineer observes EOT of Q618-22	314.2325	15.0	FS w DB @314.223	0.069 mile or 346.58 ft.	314.158	N/A	.012 mi. or 63.98 feet from EOT
4	Engineer observes EOT of Q618-22	314.2325	15.0	FS w/o DB @ 314.228	0.082 mile or 437 ft.	314.157	N/A	0.11 mi. or 58.65 ft from EOT

5	Engineer observes EOT of Q618-22	314.2325	15.0	EIE w DB@ 314.219	.041 mile or 218.61 ft.	314.178	N/A	.032 mi. or 170.62 ft.
6	Conductor sees EOT reflection on rail	314.2267	18.0	FS w DB @ 314.228	.077 mile or 410.56 ft.	314.157	6.7 MPH	.011 mi. or 58.65 ft. <i>past</i>
7	Conductor sees EOT reflection	314.2267	18.0	EIE w DB @ 314.218	.057 mile or 303.92 ft.	314.161	N/A	.015 mi. or 79.98 ft. from EOT
8	Conductor sees EOT reflection	314.2267	15.0	FS w DB @ 314.219	.066 mile or 351.91 ft.	314.153	N/A	.007 mi. or 37.32 ft. from EOT
9	Conductor sees EOT reflection	314.2267	15.0	EIE w DB @ 314.215	.04 mile or 213.2 ft.	314.175	N/A	.029 mi or 154.6 ft.
10	Conductor sees Train	314.2156	18.0	FS w DB @ 314.195	.077 mi. or 410 ft.	314.118	13.3 MPH	.028 mi. or 149.3 ft. <i>past</i> EOT.
11	Conductor sees Train	314.2156	18.0	EIE w DB @ 314.206	.06 mi. or 319.92 ft/	314.151	N/A	.005 mi. or 26.66 ft. from EOT.
12	Conductor sees Train	314.2156	15.0	FS w DB @ 314.207	.064 mi. or 341.2 ft.	314.143	4.2 MPH	.003 mi. or 15.99 ft. <i>past</i> EOT.
13	Conductor sees train	314.2156	15.0	EIE w DB @	.041 mi. or 218.61 ft.	314.167	N/A	.021 mi. or 111.97 ft from EOT.

In summary, if train Q194-23 after passing intermediate signal SG 316.1 had operated in compliance with restricted speed not exceeding 15 MPH while using sight distance for both engineer and conductor to the rear of train and initiating emergency brake application would have stopped this train short of the rear of Q618-22's standing train.

In fact, my simulations support that Q194-23 operating at a speed up to 18 MPH using the engineer's sight distance would have stopped this train short of the rear of Q618-22's standing train prior to impact using the same brake application.

The simulations further indicated that by operating at restricted speed not exceeding 15 MPH and applying a full service brake application using the engineer's sight distance would have all stopped Q194-23's movement prior to impact with the exception of simulation #12 which indicates an impact speed of 4.2 MPH and overrun of 15.9 feet.