

Factual Report Addendum

NTSB Accident Number RRD23FR013

Norfolk Southern Train Derailment
Elliston, Virginia, July 6, 2023

This Factual Report Addendum presents information received by NTSB staff following the technical review of Factual Reports which was completed on 12/29/2023. The information was received from two Party Members of the Elliston, Virginia accident investigation: the Federal Railroad Administration (FRA) and Norfolk Southern Railway (NS).

1.0 FRA Fatigue Analysis of NS Employees.

The FRA completed their Fatigue Analysis Report form on 2/2/2024 and initially sent it to NTSB staff via email. The FRA report was revised and resubmitted to NTSB on 2/8/2024 (see Attachment 1 to this Addendum). The FRA conducted the Fatigue Audit InterDyne (FAID) assessment, which uses a biomathematical model to analyze an individual's responses to a set of questions pertaining to their recent work and sleep schedules, and a listing of work-rest hours for up to seven previous days. The model results provide a number (score) that is a prediction of likely fatigue exposure for a group of workers following that work-rest schedule¹. The FRA fatigue analyst then reviews the results and provides an interpretation of the FAID score.

The on-scene FRA investigator conducted the FAID assessment questions with the following NS employees: the train crew (Locomotive Engineer and Conductor), Dispatcher, Operations Manager and Senior General Supervisor, Mechanical Department (referred to as the SGMS in the FRA's Fatigue Analysis Report).

¹ FAID, and other biomathematical models of fatigue, provide estimates for a population average and not an individual's fatigue level. These estimates are not to be interpreted as applying to an individual, as stated in InterDynamics' paper on the use of their FAID model, "Practical and Contextual Use of Biomathematical Models."

The FRA Fatigue Analyst then completed the “FRA Fatigue Analysis Reporting Form.” This form is provided as attachment 1 to this Addendum.

2. NS’s Update on Post-Accident Actions

NTSB staff received an email providing an update to NS’s post-accident actions from Robert Lewis, Norfolk Southern’s Party Representative to this accident investigation, on 1/18/2024. This update included additional training and job aids developed and instituted post-accident, along with the list of post-accident Operations and Mechanical Department bulletins and instructions, and additional wayside detectors. The NS post-action actions are detailed in Appendix 2.

A list of post-accident actions related to mitigating fatigue or extended work hours, if any, was also requested but has not been received to date.

Attachment 1

FRA Fatigue Analysis Reporting Form



Fatigue Analysis Reporting Form

INSTRUCTIONS FOR INSPECTORS: Review the information provided and copy/paste the information from the final section into your accident report.

ACCIDENT NUMBER	RAILROAD
HQ-2023-1871	NS

ACCIDENT DETAILS	DATE OF ACCIDENT	TIME OF ACCIDENT
	July 6 th , 2023	1944

THE EMPLOYEE MEETS THE FOLLOWING CRITERIA: check all that apply

<input checked="" type="checkbox"/>	Less than 80% compliance with FAID score of 63 (threshold for analysis)				
<input checked="" type="checkbox"/>	High peak FAID in 3 shifts prior to accident				
<input checked="" type="checkbox"/>	High FAID score at time (within 1 hour) of accident				
<input checked="" type="checkbox"/>	High overall peak FAID				
<input checked="" type="checkbox"/>	Exceeds overall FAID threshold of 63 for 20% or more of the time in 3 shifts prior to accident				
	Karolinska Sleepiness Scale (KSS) >6 at time (within 1 hour) of accident				
Interviews with crew	<table border="1"> <thead> <tr> <th>CREW MEMBER</th> <th>INFORMATION</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> </tr> </tbody> </table>	CREW MEMBER	INFORMATION		
CREW MEMBER	INFORMATION				

PASTE THIS INTO ACCIDENT REPORT:

FRA analyzed the work and sleep schedules of all crew members using the biomathematical model known as Fatigue Audit InterDyne (FAID). FAID predicts the effect of different work schedules on fatigue and provides a representative score of the fatigue exposure of a worker. That score indicates the likely sleep opportunity that a work pattern allows. As the relative sleep opportunity associated with a work pattern decreases, the FAID score increases. The Karolinska Sleepiness Scale (KSS) score may also be used to evaluate fatigue exposure.

The FAID scores of the Dispatcher, Operations Manager, Locomotive Engineer, and Conductor did not show evidence of fatigue risk. However, the FAID scores of the SGMS indicated that FRA should start to consider whether fatigue was a contributor to the accident because the SGMS was only 27% compliant with a FAID score of 63 on his work history. Therefore, FRA performed further analysis other fatigue-related indicators and the context in which this accident occurred. Upon further analysis of other fatigue-related indicators, it was demonstrated that the SGMS had a high peak FAID in the 3 shifts prior to the accident (scores of 104, 102, and 101), had a high FAID score at the time of the accident (score of 75), had a high overall peak FAID (score of 110), and exceeded the FAID threshold of 63 for 20% or more of the time in the 3 shifts prior to the accident. The SGMS also told FRA that he had only had 1 hour of sleep since Wednesday July 5th. The SGMS should have told the Operations Manager and Dispatcher that the train should not exceed a speed of 10 mph, due to the distance to be traveled from the stopped train location to the set-out location, where the axle on the car would need to be replaced. It is likely, in the context of his fatigue, that the SGMS failed to indicate this to the Operations Manager and Dispatcher. Based on this further analysis, FRA concluded that fatigue was a likely contributor to the cause or severity of this accident.

Attachment 2

NS's Update on Post-Accident Actions

NTSB received the following information via an email received on 1/18//2024 from Robert Lewis, Norfolk Southern's Party Representative to this accident investigation:

"This is a list of items we enhanced quickly (the next day for OB-21) limiting the speed and distance this equipment may move. Further enhancements continued with the issuance of handheld thermometers for a precise temperature reading when inspecting this equipment. I have listed the items that I am familiar with.

Summary

- OB-21 issued the next day on July 7th (add 10MPH speed restriction, reinspection every 3 miles) no speed restriction was required before this bulletin.
- BR OB-29 on July 31st (detector notifications are sent to PTC on-board screen and MTR device) this requires an acknowledgement from the crew.
- Issuance of Infrared thermometer (OB-25) to all ground service employees and one on one training of the use of thermometer.
- Bulletins OB-21; OB-26 instruction on hot box detectors.
- Nine additional wayside detectors in service since July 6th on the Blue Ridge. (these are going in across the system, I am unaware of the total number NS is installing across the network).
- Mechanical Department revised MDI-0038 on 8/14/2023.

Additional training to all employees

- Mandatory video on the proper use of IR thermometer.
- Flow chart in OB 26 to assist with handing of equipment.
- Pictures illustrating proper use of Tempilstik and IR thermometers included in OB-26 26.”

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