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TECHNICAL MEMO

Title: Rail Accident Rate Calculation Methodology

From: Lisa Bendixen, Cristiano Facanha
ICF International

To: Mike West
Potomac-Hudson Engineering

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The accident rates used in Sections 4.2.10.2.3.1.2 and 4.2.10.2.3.2.2 (Occupational and Public Health Safety) are based on FRA's accident data (http://safetydata.fra.dot.gov/officeofsafety/) from the period between January 1, 1995 to September 30, 1999, as they are extracted from a detailed analysis done in early 2000. Accident rates have been holding steady in recent years (DIRS 178016-DOT 2005), so this time period is still considered representative.

Accidents involving freight trains on main line tracks were selected, providing a dataset of 3,185 trains in accidents on Class I railroads. Accidents on non-Class I railroads were excluded from the analysis. The definition of freight trains in main line accidents excludes accidents to passenger trains, work trains, on-track maintenance and inspection equipment, light locomotives and cuts of cars, as well as accidents on yard sidings and industry tracks. Grade crossing collisions reported as train accidents are included. These accidents were broken down by cause-code and each cause group was defined as car-mile or train-mile related, depending on whether accident likelihood was considered to be a function of the total car-miles or train-miles operated.

The other piece of information needed to calculate accident rates is exposure to accidents in terms of freight train- and car-miles operated over the 4.75-year period from January 1, 1995 to September 30, 1999. For Class I railroads, this information was obtained from industry statistics published by the AAR (AAR, "Analysis of Class I Railroads" and AAR, "Railroad Ten Year Trends," periodical publications providing railroad traffic data) up to 1997 and estimated for 1998 and 1999 from railroad traffic data published in the railroad trade press.

Table 1. Estimated Aggregate Car- and Train-miles (January 1, 1995 – September 30, 1999)

Year	Freight Train-Miles (millions)	Freight Car-Miles (billions)
1995	458	30.38
1996	469	31.72
1997	475	31.66
1998	480 (E)	32.01 (E)
1999 (9 months)	375 (E)	25.14 (E)
Total, Class I	2,257	150.90

E: estimated

Train and car-miles were distributed among FRA track classes based on a survey performed for the risk model that was subsequently used in the CN/IC EIS (DIRS 174623-STB 1998), focusing on track class 3 for this study. Higher classes have lower accident rates and using track class 3 is therefore conservative if the track is actually rated as class 4 or 5.

Table 2. Distribution of Traffic by Track Class (Class I Railroads)

FRA Track Class	X/1	2	3	4	5 and 6	Total
Percent Car-miles	0.30	3.20	11.60	63.10	21.90	100
Percent Train-miles	0.30	3.30	12.10	61.80	22.60	100
Billion Car-miles	0.45	4.83	17.51	95.22	33.05	150.90
Million Train-miles	6.8	74.5	273.1	1394.8	510.1	2,257

As previously mentioned, train accidents were divided into two categories: those considered to be correlated with train-miles and those correlated with car-miles. The counts of trains in accidents were summed and divided by the total exposure value. This calculation was done separately for the two groups, yielding train and car-mile accident rates by track class for Class I railroads. The resulting values are shown below for track class 3.

Table 3. Train Accident Rates for Track Class 3

		FRA Track Class 3	Fraction with Cars Derailed
Train-mile (per million train-miles)	Derailments	0.51	0.93
	Collisions	0.19	0.57
	Other	0.51	0.15
	TOTAL	1.21	0.54 (weighted average)
Car-mile (per billion car-miles)	Derailments	25.8	0.98
	Collisions	0.51	0.44
	Other	0.74	0.17
	TOTAL	27.05	0.95 (weighted average)

This gives the rates used in this study, 1.2×10^{-6}/train-mile (7.5×10^{-7}/train-km) and 2.7×10^{-8}/car-mile (1.7×10^{-8}/car-km). These rates were then combined for an 8-car train by the following formula, resulting in 8.9×10^{-7} accidents per 8-car train-km:

Combined Rate (accidents/8-car train-km) = Train-km Rate (accidents/train-km) + 8 x Car-km Rate (accidents/car-km)

Virtually all car-mile related accidents result in a derailment of one or more cars (95%), while for train-mile related accidents the fraction is a bit more than 50%. If there is a derailment, there are usually multiple cars involved, with the number varying by train length. For the purpose of this analysis, it was conservatively assumed that an SNF/HLW car would be involved in each accident.