Appendix K –
Transportation Safety and Delay

K. TRANSPORTATION SAFETY AND DELAY

K.1 Rail Transportation

This section provides background information on rail safety used to provide context and evaluate potential impacts of the proposed action and alternatives, including the No-Action Alternative. The information is based on accident/incident reports that railroads are required by law to submit within 30 days after occurrence. Federal Railroad Administration (FRA) interchangeably uses the terms "accidents" and "incidents" to describe all reportable events. As defined by FRA in *Railroad Safety Statistics*, accidents/incidents are divided into three major groups for reporting purposes (FRA, 2005):

- Train accident. A safety-related event involving on-track rail equipment (both standing and moving), causing monetary damage to the rail equipment and track above a threshold amount.
- Highway–rail grade crossing incident. Any impact between a rail and highway user (both motor vehicles and other users of the crossing) at a designated crossing site, including walkways, sidewalks, etc., associated with the crossing.
- Other incident. Any death, injury, or occupational illness of a rail line employee that is not the result of a train accident or highway-rail incident.

Table K-1 summarizes rail accident data for the top five freight rail line companies in the United States and the Alaska Railroad (FRA, 2008). Alaska Railroad Corporation's (ARRC's) accident rates (per million train miles traveled) are lower than the rates of four of the top five rail lines.

Table K-1
System-wide Accident Frequencies

Rail line	Total Number of Accidents[a]		Total Train Miles[a] (millions)		Accidents per Million Train Miles	
	5-Year (2003–2007)	10-Year (1998–2007)	5-Year (2003–2007)	10-Year (1998–2007)	5-Year (2003–2007)	10-Year (1998–2007)
Union Pacific	3,947	7,554	901	1,705	4.38	4.43
BNSF Railway	2,853	5,272	868	1,612	3.29	3.27
CSX	2,015	3,819	500	979	4.03	3.90
Norfolk Southern	1,321	2,373	459	853	2.88	2.78
Kansas City Southern	498	968	45	90	11.04	10.80
Alaska Rail Road	12	31	7	14	1.62	2.28
All Rail lines	13,814	26,746	3,585	6,856	3.85	3.90

[a] Source: FRA, 2008

K.2 Road Transportation

Table K-2 characterizes the public roads at current and proposed new at-grade crossings that would be used by new rail traffic associated with the proposed action and alternatives, including

road classification, annual average daily traffic (AADT) in 2008, number of lanes in both directions, whether the road is paved, and level of service (LOS).

The Section of Environmental Analysis (SEA) obtained AADT volumes on public roads in the region of influence from multiple sources, including FRA's *Highway-Rail Crossing Inventory* (FRA, 2007a) and the Alaska Department of Transportation and Public Facilities' (ADOT&PF) *2006 Northern Region Annual Traffic Volume Report* (ADOT&PF, 2006). Where AADT values available from these sources were out of date, SEA used the historical growth rate in vehicle-miles traveled (VMT), which was calculated using VMT data from the Federal Highway Administration (FHWA) Highway Statistics publications (FHWA, multiple years), to update the AADT values. For existing at-grade crossings without available AADT data, SEA assigned a traffic volume value by extrapolation, using the value of the closest crossing sharing the same road classification for which AADT information was available.

SEA estimated the current levels of service, shown in Table K-2, according to the guidelines in the *Highway Capacity Manual 2000* (TRB, 2001). Two-lane roads were modeled as two-way, two-lane, highway segments; and roads with more than two lanes were modeled as multi-lane, highway segments. One-way roads had very little traffic, and a formal analysis was not conducted based on the results obtained for the roads with higher traffic volumes.

Table K-2
Public Roads That Cross Existing or Proposed Rail Lines

Rail Segment[e]	Road	Road Classification[b]	2008 AADT[c]	Number of Lanes[a]	Paved Road	LOS[f]
Eielson 1 (existing)	College Road	U. Oth. Prin. Arterial	16,259	4	Yes	A
	Old Steese Hwy	U. Minor Arterial	13,943	2	Yes	D
	New Steese Expressway	U. Oth. Fwy & Expwy	13,393	5	Yes	A
	C Street	U. Local	1,868	2	Yes	A
	D Street	U. Local	847	2	Yes	A
	E Street	U. Local	847	2	Yes	A
	Farewell Ave.	U. Collector	1,810	2	Yes	A
	River Road	R. Local	901	2	Yes	A
	Trainor Gate Bridge	R. Minor Collector	1,324	1	Yes	A
	Vest Road	R. Local	360	2	No	A
	Vest Road	R. Local	360	2	No	A
	Gaffney Road	U. Oth. Prin. Arterial	7020	4	Yes	A
	Whidden Road	R. Local	901	2	Yes	A
	10 Ave.	R. Local	901	2	Yes	A
	Neely Road	U. Minor Arterial	10,159	2	Yes	D
	Alder Ave.	R. Local	451	2	No	A
Eielson 2 (existing)	3 Mile Gate	R. Local	10,229	2	Yes	D
Eielson 3 (existing)	Badger Road	R. Minor Arterial	12,000	4	Yes	A
	Five Houses	R. Local	54	2	No	A
	Dennis Road	R. Minor Collector	2,390	2	Yes	A
	Baptist Church	R. Local	90	2	No	A
	K&K Recycle (Spur Ct.)	R. Local	180	2	No	A
	Mitch Road (Durango Tr.)	R. Local	90	2	No	A
	Rental Street	R. Local	451	2	No	A
	Club 11	R. Local	360	2	No	A
	Richardson Hwy.	R. Interstate	11,739	4	Yes	A
	Ruby Drive	R. Local	90	2	No	A
	Cross Way Road	U. Local	654	2	Yes	A
	5th Ave.	U. Collector	2,677	2	Yes	A
	8th Ave.	U. Collector	10,452	2	Yes	D
	Small Crossing	R. Local	90	1	No	A

Table K-2
Public Roads That Cross Existing or Proposed Rail Lines (continued)

Rail Segment[e]	Road	Road Classification[b]	2008 AADT[c]	Number of Lanes[a]	Paved Road	LOS[f]
Eielson 4 (existing)	Laurance Road	R. Minor Collector	2,238	2	Yes	A
	Armistice St.	R. Local	270	2	No	A
	Dyke Road	R. Minor Collector	1,007	2	Yes	A
North Common (new)	Chena Flood Road	R. Local	80	2	No	A
	Eielson Farm Road	R. Local	80	2	No	A
Eielson Alt. 1 (new)	Old Valdez Trail	R. Local	80	2	No	A
Eielson Alt. 2/3 (new)	Stringer Road	R. Minor Collector	205	2	No	A
	Old Richardson Hwy	R. Minor Collector	190	2	No	A
Salcha Alt. 1 (new)	Ruger Trail	R. Local	80	1	No	A
Salcha Alt. 2 (new)	Ruger Trail	R. Local	80	1	No	A
	Old Richardson Hwy	R. Minor Collector	190	2	No	A
	Old Richardson Hwy	R. Minor Collector	190	2	No	A
	Country Road	R. Local	80	1	No	A
Delta Alt. 1 (new)	No at-grade crossings					
Delta Alt. 2 (new)	Jack Warren Road	R. Major Collector	1,091	2	Yes	A
	Nistler Road	R. Minor Collector	168	2	Yes	A

[a] In both directions.
[b] Based on the classification included in FRA's Highway-Rail Crossing Inventory (FRA, 2007a). U = Urban. R = Rural.
[c] Annual average daily traffic (AADT), considering both directions of traffic.
[d] These crossings would be grade separated.
[e] Segment 1: FBX depot to Fairbanks airport turn-off
Segment 2: Airport turn-off to SE corner of Fort Wainwright
Segment 3: SE corner of Fort Wainwright to North Pole Refinery
Segment 4: North Pole Refinery to Chena Flood Road
[f] Level of service (LOS)

All references to levels of service shown in Table K-2 are defined by the *Highway Capacity Manual 2000*, which is an industry standard for traffic engineering published by the Transportation Research Board (TRB, 2001). This manual defines six levels of service that reflect the level of traffic congestion and qualify the operating conditions of a road. The six levels are given letter designations ranging from A to F, with A representing the best operating conditions (free flow, little delay) and F the worst (congestion, long delays). Various factors that influence the operation of a road or intersection include speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Levels of service A, B, and C are typically considered good operating conditions in which motorists experience minor or tolerable delays of service. Based on the annual average daily traffic listed in Table K-2, most roads within the region of influence are currently operating at LOS A. The exceptions are four roads that are operating at LOS D. These are Old Steese Highway in Fairbanks; Neely Road in Fairbanks; 3-mile Gate, just south of Fort Wainwright; and 8th Avenue in North Pole. For these four roads, the LOS rating of D is the result of road characteristics other than the highway-rail grade crossing.

K.3 Grade Crossing Safety

To characterize the existing transportation safety conditions at existing and proposed grade crossings, SEA used several data sources:

- Information on current rail traffic from an ARRC response to a Surface Transportation Board (STB) information request (ARRC, 2007). This information is included in Table 11-1.
- Alaska Department of Transportation and Public Facilities (ADOT&PF) traffic count maps provided information on annual average daily vehicle traffic volumes at some grade crossings (ADOT&PF, 2005). Vehicle traffic volumes for the remaining grade crossings were provided by FRA's Highway-Rail Crossing Inventory. This information is included in Table K-2.
- FRA's *Highway-Rail Crossing Inventory* provided information on road and train traffic characteristics at highway-rail crossings, including number of tracks, number of road lanes, warning devices, daily vehicle traffic volume, road paving, road classifications, and 5 years of accident history (FRA, 2007a).
- FRA's Personal Computer Accident Prediction System (PCAPS) predicted accident frequencies for existing grade crossings along the Eielson Branch (FRA, 2007b).

SEA analyzed the potential impacts of the proposed action and alternatives on grade crossings and considered whether the proposed rail construction and operation would significantly affect traffic safety at-grade crossings. To evaluate the potential need for grade separation at proposed at-grade crossings, SEA analyzed the proposed at-grade crossings based on FHWA guidelines (FHWA, 2002). These guidelines suggest that-grade crossings should be considered for grade separation or otherwise eliminated across the rail line right-of-way whenever one or more of the following conditions exist:

- The highway is a part of the designated Interstate Highway System;
- The highway is otherwise designed to have full controlled access;
- The posted highway speed equals or exceeds 70 mph;
- AADT exceeds 100,000 in urban areas or 50,000 in rural areas;
- Maximum authorized train speed exceeds 110 mph;
- An average of 150 or more trains per day or 300 million-gross-tons per year;
- An average of 75 or more passenger trains per day in urban areas or 30 or more passenger trains per day in rural areas;
- Crossing exposure (the product of the number of trains per day and AADT) exceeds 1,000,000 in urban areas or 250,000 in rural areas;
- Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 800,000 in urban areas or 200,000 in rural areas;
- The expected accident frequency for active devices with gates, as calculated by U.S. Department of Transportation's (USDOT) Accident Prediction Formula, including 5-year history, exceeds 0.5; and
- Vehicle delay exceeds 40 vehicle hours per day.

SEA evaluated the proposed grade crossings in relation to these FHWA criteria for requirement of grade separation. SEA concluded that-grade separation is not warranted for any of the at-grade crossings that would be created by the proposed action and alternatives because the proposed location and operational characteristics of the proposed new rail crossings would not meet any of the FHWA criteria.

SEA quantitatively analyzed the traffic safety at existing grade crossings using the accident history from the past 5 years and calculated the potential change in the number of years between accidents resulting from operation of the proposed rail line. SEA did not calculate predicted accident frequencies for new grade crossings because it lacks the necessary data on accident history. SEA used PCAPS to calculate baseline accident frequencies and accident frequencies that would result from an increase of an average of ten trains per day. In doing so, SEA used the information on public grade crossings in the FRA *National Highway-Rail Crossing Inventory* (FRA, 2007a), with the exception of train count and AADT information. The train count information used in the analysis is described in Chapter 11 and an explanation of the methods used to obtain the information is described in Section K.2.

PCAPS requires that the user specify the number of day trains, the number of night trains, and the number of switching trains. For this analysis, SEA assumed that the trains would be distributed uniformly throughout a 24-hour period. For safety analysis purposes, FRA daytime hours were set as 6 a.m. to 6 p.m. Thus, SEA assumed that 50 percent of the trains would be night trains and 50 percent day trains.[1]

PCAPS also requires that the user specify a warning device code for each crossing. In situations where the FRA inventory provided two warning device codes for a crossing, SEA selected the code that yielded the higher predicted accident frequency.

Table K-4 shows the results of the grade crossing safety analysis for the proposed action and alternatives.

K.4 Grade Crossing Delay

For each grade crossing analyzed, SEA calculated the time that a particular crossing would be blocked for each train-crossing event and estimated the average delay per vehicle at that crossing in a 24-hour period. SEA used the average delay per vehicle at-grade crossings to determine the LOS. LOS is also used as a qualitative measure of road operating conditions and comfort level of passengers. SEA analyzed average traffic delays for all vehicles over a 24-hour period and used the average delay per vehicle to determine LOS for each grade crossing based on ratings described in Table K-3.

[1] Train counts entered into the PCAPS model must be integer values. For rail segments with an odd number of trains, SEA assumed for this analysis that there would be one more day train than night train. For example, for a segment with 21 trains, SEA assumed 11 trains would be day trains and 10 trains would be night trains. This is a conservative assumption in that it yields a higher predicted accident frequency than would result from the opposite assumption. Further, SEA rounded non-integer train traffic estimates upwards for input into PCAPS, which also results in conservative (higher) predicted accident frequencies.

Table K-3
Grade Crossings Level of Service

Level of Service (LOS)	Average Total Delay (seconds per vehicle)
A	<= 10
B	> 10 and <= 20
C	> 20 and <= 35
D	> 35 and <= 55
E	> 55 and <= 80
F	> 80

Source: TRB, 2001

SEA used the following calculations to determine traffic delay for at-grade crossings. The traffic delay at a crossing includes the time for the train to pass, along with time for any warning device to engage. For simplification purposes, it is assumed that both rail and road traffic are uniform throughout the day.

The first step includes the calculation of gate-down time per train event (T).

$$T = T_W + \frac{L}{V}$$

T_W = Gate warning time
L = Average train length (weighted average between freight and passenger trains)
V = Average train speed (weighted average between freight and passenger trains)

The number of vehicles delayed per day (N_V) can be calculated as follows:

$$N_V = \frac{T}{24} * N * ADT$$

N = Number of trains per day
ADT = Average daily traffic
24 = Hours per day

The average delay per vehicle in a 24-hour period (D_V) is:

$$D_V = \frac{N_V}{ADT} * \frac{T * \frac{R_D}{R_D - R_A}}{2}$$

R_D = Departure rate (vehicles/lane/hour)[2]
R_A = Arrival rate, average daily traffic converted to vehicles/lane-hour
2 = Denominator to reflect that vehicles do not experience the entire time the train is blocking the grade crossing. They are assumed to arrive on average at the midpoint of the train crossing period.

[2] Based on the *Highway Capacity Manual* (TRB, 2001), departure rates (in vehicles/lane-hour) are the following: highways (1,800), arterials (1,400), collectors (900), and local roads (700).

Total vehicle delay (D) is the product of average delay per vehicle (D_V) and number of vehicles delayed per day (N_V).

$$D = D_V * N_V$$

Table K-4 presents the results of the grade crossing delay analysis for the proposed action and alternatives.

Table K-4
Results from Transportation Safety and Delay Analysis at Grade Crossings

Rail Segment Name	Crossing ID	Street	Average daily traffic in both directions (veh/day[a])	Number of Daily Trains (including loaded and empty)		Number of vehicles delayed per day (veh/day)		Average Delay per Stopped Vehicle (min/veh[b])		Average delay per vehicle in a 24-hour period (sec/veh[c])		Total delay in a 24-hour period (hours)		Predicted Accident Frequency (accidents/year)	
				No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
EIELSON SEGMENT 1	868405C	COLLEGE ROAD	17,319	6	16	191	294	1.52	1.25	1.01	1.27	4.85	6.13	0.0317	0.0439
	868406J	OLD STEESE HWY	14,598	6	16	161	248	1.69	1.39	1.12	1.42	4.55	5.75	0.2692	0.4131
	868296B	NEW STEESE EXPRESSWAY	13,393	6	16	148	228	1.41	1.16	0.94	1.18	3.48	4.40	0.1113	0.1350
	868407R	C STREET	2,117	6	16	23	36	1.41	1.16	0.94	1.18	0.55	0.70	0.0209	0.0308
	868408X	D STREET	960	6	16	11	16	1.36	1.12	0.90	1.14	0.24	0.30	0.0238	0.0358
	868409E	E STREET	960	6	16	11	16	1.36	1.12	0.90	1.14	0.24	0.30	0.0238	0.0358
	868410Y	FAREWELL AVE	2,210	6	16	24	38	1.40	1.15	0.93	1.17	0.57	0.72	0.0212	0.0311
	868412M	RIVER RD	1,014	6	16	16	23	1.92	1.62	1.79	2.20	0.50	0.62	0.0234	0.0353
	868413U	TRAINOR GATE BRIDGE	1,538	6	16	24	35	2.01	1.69	1.87	2.29	0.80	0.98	0.0162	0.0244
	868417W	VEST RD	406	6	16	6	9	1.89	1.59	1.76	2.16	0.20	0.24	0.0103	0.0166
	868419K	VEST ROAD	406	6	16	6	9	1.89	1.59	1.76	2.16	0.20	0.24	0.0103	0.0166
	868422T	GAFFNEY RD	7,477	6	16	116	169	1.97	1.66	1.84	2.26	3.81	4.69	0.0394	0.0525
	868423A	WHIDDEN RD	1,014	6	16	16	23	1.92	1.62	1.79	2.20	0.50	0.62	0.0234	0.0353
	868424G	10 AVE.	1,014	6	16	16	23	1.92	1.62	1.79	2.20	0.50	0.62	0.0234	0.0353
	868425N	NEELY ROAD	10,637	6	16	165	241	2.47	2.08	2.30	2.83	6.80	8.35	0.0434	0.0566
	868426V	ALDER AVE.	507	6	16	8	11	1.89	1.59	1.76	2.16	0.25	0.30	0.0112	0.0179
EIELSON SEGMENT 2	868427C	3 MILE GATE	11,508	5	15	93	154	1.77	1.36	0.86	1.09	2.75	3.50	0.1702	0.2166
EIELSON SEGMENT 3	868434M	BADGER ROAD	13,407	5	15	109	180	1.29	0.99	0.63	0.80	2.34	2.98	0.0287	0.0412
	868438P	FIVE HOUSES	61	5	15	0	1	1.17	0.90	0.57	0.72	0.01	0.01	0.0054	0.0093
	868441X	DENNIS ROAD	2,778	5	15	22	37	1.25	0.96	0.61	0.77	0.47	0.59	0.0216	0.0326
	868442E	BAPTIST CHURCH	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
	868443L	K & K RECYCLE (Spur Ct.)	203	5	15	2	3	1.17	0.90	0.57	0.72	0.03	0.04	0.0082	0.0139
	868445A	MITCH ROAD (Durango Tr.)	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
	868447N	RENTAL STREET	507	5	15	4	7	1.18	0.91	0.57	0.73	0.08	0.10	0.0113	0.0187
	868449C	CLUB 11	406	5	15	3	5	1.18	0.90	0.57	0.73	0.06	0.08	0.0104	0.0174
	868453S	RICHARDSON HWY.	12,121	5	15	98	163	1.25	0.96	0.61	0.77	2.05	2.60	0.0281	0.0404
	868454Y	RUBY DRIVE	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
	868456M	CROSS WAY RD.	741	5	15	6	10	1.19	0.91	0.58	0.74	0.12	0.15	0.0643	0.0863

Table K-4
Results from Transportation Safety and Delay Analysis at Grade Crossings (continued)

Rail Segment Name	Crossing ID	Street	Average daily traffic in both directions (veh/day[a])	Number of Daily Trains (including loaded and empty)		Number of vehicles delayed per day (veh/day)		Average Delay per Stopped Vehicle (min/veh[b])		Average delay per vehicle in a 24-hour period (sec/veh[c])		Total delay in a 24-hour period (hours)		Predicted Accident Frequency (accidents/year)	
				No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
	868461J	5TH AVE.	3,268	5	15	26	44	1.26	0.97	0.61	0.78	0.56	0.71	0.0227	0.0341
	868463X	8TH AVE.	12,758	5	15	103	171	1.65	1.27	0.80	1.02	2.85	3.62	0.0469	0.0648
	868479U	SMALL CROSSING	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
EIELSON SEGMENT 4	868480N	LAURANCE ROAD	2,601	1	11	2	16	0.46	0.54	0.02	0.20	0.01	0.14	0.0153	0.0492
	868482C	ARMISTICE ST (VFW St.)	304	1	11	0	2	0.43	0.51	0.02	0.19	0.00	0.02	0.0046	0.0137
	868484R	DYKE RD	1,170	1	11	1	7	0.44	0.52	0.02	0.19	0.01	0.06	0.0127	0.0211
	TOTALS[d]		**137,806**	**-**	**-**	**1,415**	**2,225**	**1.67**	**1.34**	**1.03**	**1.30**	**39.45**	**49.65**	**1.1800**	**1.7200**

[a] veh/day = vehicles per day.
[b] min/veh – minutes per vehicle.
[c] sec/veh = seconds per vehicle.
[d] Totals might not equal sums of values due to rounding.

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