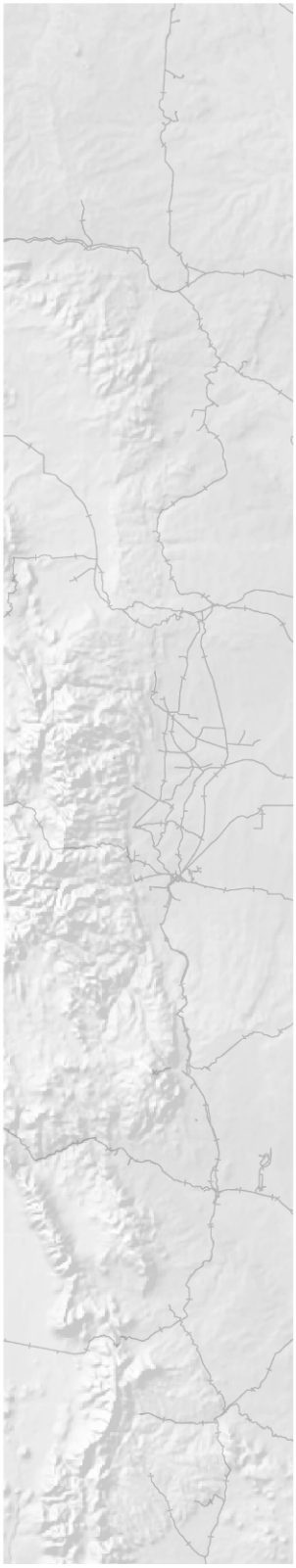

Technical Memorandum No. 5

Project No. C SWOO-242

May 18, 2005

DOT DEPARTMENT OF TRANSPORTATION | DMJM HARRIS AN AECOM COMPANY | HDR

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All information and assessments contained herein are the sole responsibility of the Consultant. Although many other parties contributed substantially to the report, they shall not be held accountable for its accuracy.

Introduction

This technical report and its appendices present the data, methods, assumptions, and results used to estimate the economic benefits and costs associated with development of the proposed BNSF-UP Front Range Railroad Rationalization Project (the Project). These benefits and costs are estimated at a conceptual level for purposes of determining if further investigation of the Project is justified by the potential net benefits. Under the Build Option, the railroads will continue to maintain a competitive balance.

The numerous categories of direct and indirect benefits (and costs) considered in this analysis are aggregated into six general classifications:

1. Transportation Benefits
2. Economic Development and Land Use Benefits
3. Safety and Security Benefits
4. Environmental Impacts
5. Quality of Life Benefits
6. Passenger Rail Facilitation Benefits

Within each category, various subcategories of benefits are examined with respect to their geographic location, and when they occur. When supported by existing data or conceptual-level analysis, quantitative estimates of the net benefits are developed for the highest dollar benefit categories. In other cases, a more qualitative discussion is presented. In addition, given the high level of uncertainty associated with many of the benefits, a range of potential benefits is considered: low, midrange, and high estimates are developed for the most uncertain and numerically significant variables. These ranges are subsequently used in a Monte Carlo analysis of the uncertainty associated with total Project benefits.

Two project alternatives are considered in this analysis: the No Build Option and the Build Option. The No-Build Option assumes that the Rail Rationalization Project (the Project) will not develop and that current trends will continue into the future. The Build Option assumes that the Project will be developed in its entirety with construction occurring from 2006 to 2009, with completion in 2010. This completion date is an assumed completion date for analysis purposes and may change in future phases when more definitive completion dates are known. It is further assumed that portions of the Project will be completed sooner than others. For example, the Utah Junction improvements and other improvements related to east-west rail mobility, are assumed to be complete in 2007. This completion date is an assumed completion date for analysis purposes and may change in future phases when more definitive completion dates are known. This completion date is used as an assumption to calculate benefits, and is different than the railroads projected completion date of 2005, which will be used in future phases of analysis. This more accelerated schedule is due to fewer uncertainties associated with environmental compliance requirements and less right of way to acquire. Improvements associated with the new rail lines in Eastern Colorado are assumed to be complete in 2010. This longer-term construction period is assumed to be due to more extensive environmental studies and more extensive right of way acquisition. These alternatives are described in greater detail in Technical Memorandum No. 4. In most cases, this analysis focuses upon the differences between the No Build and Build Options. This difference, often termed the "delta", represents the Project's net impact for the resource in question.

Transportation

Types of benefits and costs considered in this category include:

- Increases in efficiencies for the railroads moving goods through or around the Denver area, resulting in lower operation costs

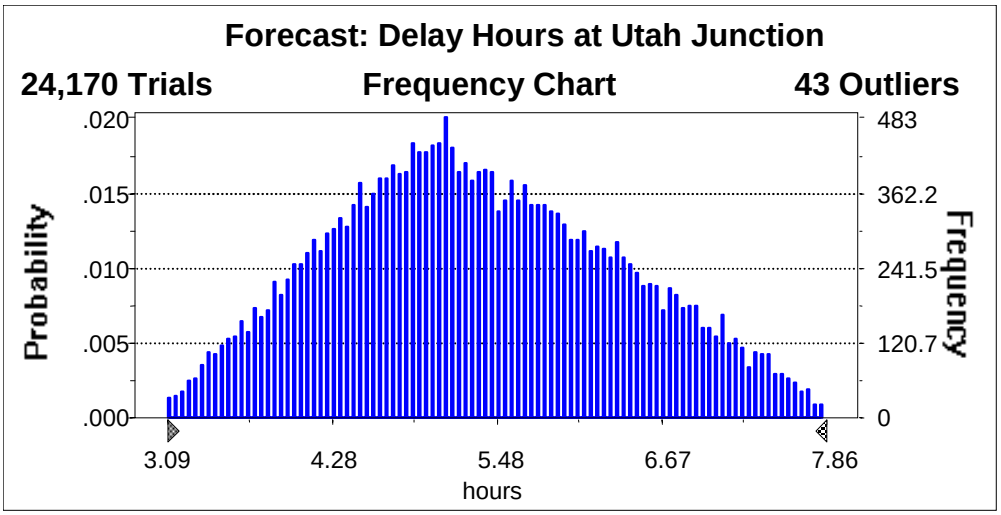
- Potential for fewer railroad-roadway grade crossings along the Front Range and a reduction in maintenance costs
- Reductions in traffic delays for highway travelers
- Fewer instances of emergency vehicle delays at railroad crossings
- Impacts to trucking operations

Efficiency Gains in Railroad Operations

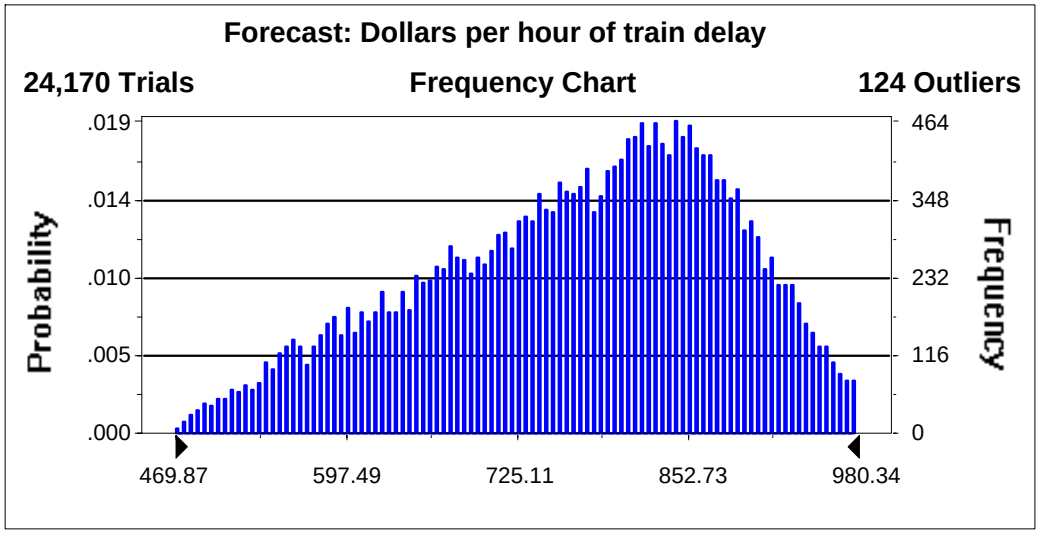
Efficiency gains in railroad operations are due to reduced mileage and increased speeds associated with more direct routes for coal trains passing through Colorado. In addition, there are time savings associated with more efficient movement of east-west rail traffic through Denver due to the improvements in the Utah Junction area. These sources of time savings can be translated into quantitative benefits.

Table 5-1 accounts for efficiency gains associated with reduced mileage and increased speeds for coal trains passing from Wyoming's Powder River Basin through Colorado to points southeast and southwest. There is a mileage reduction of approximately 96 miles associated with the more direct route through Eastern Colorado that, when combined with speed increases, results in an estimated 2.8 hour reduction in the time required to traverse this area. It should be noted that approximately ½ of the trains will be fully loaded with corresponding high horsepower requirements and high rates of fuel usage, and the remaining ½ will be empty coal trains with relatively lower horsepower requirements and fuel usage. However, for simplicity, a constant rate of fuel usage, crew requirements, and other operating costs are represented by a single dollar per hour cost estimate that applies to all trains affected by these efficiencies. This assumed cost is $850 per hour, based on estimates prepared for the Bridging the Valley Study (HDR, 2002). This value incorporates fuel cost, crew cost, and other operational costs associated with the locomotives and train.
Time saving and economic benefit for east-west rail traffic through Denver are shown in Table 2. Consistent with the above estimates, a benefit of $850 per hour for time saving was used to estimate the improvements the Project would have to these railroad operations. However, during the review process of this document, the Union Pacific indicated that they believe the hourly cost for these specific operations was closer to $460 per hour, based on a previous in-house analysis of standard URCS (Uniform Rail Costing System) costs. Therefore, there are two major uncertainties driving the east-west rail operation benefit associated with the Utah Junction improvements: the effective time savings, whose impact on benefit is shown in Table 5-2, and the hourly dollar value of the savings.

The following graphic illustrates the range of values considered for the estimate of effective time savings and the associated probabilities attached to each, for analysis purposes:



As shown, the delay time is estimated to be centered at 5 hours with values as low as 3 or as high as 8 possible. The following graphic illustrates the range and assumed probabilities associated with the estimated delay cost, expressed in dollars per hour of delay:



As shown, the value is assumed to range from about $460 per hour to approximately $1,000 per hour, with $850 assumed to be value with the highest probability of occurring. As previously noted, these uncertainties will be examined more closely in a subsequent Monte Carlo analysis of total benefit.

Overall, the reduction in mileage with the Project is estimated to save approximately $235 million in railroad operational costs over the study period. Time savings associated with improvements to Utah Junction and east-west freight movement are shown to save approximately $275 million to $733 million in operational costs over the period 2004 to 2030.

Table 5-1
Railroad Operational Benefits Due to Reduced Mileage Associated with North - South Improvements, 2004-2030

Assumptions:

Growth rate in the number of trains, 2004-2015 /1	2.00%
Growth rate in the number of trains, 2016-2030	1.00%
Value per Hour /2	$850
Time Savings per Train (hr) /3	2.80
Days trains are running, per year	360
Discount Rate	3.00%

Year	Number of trains affected	Total Time	Total Value	Disc. Value
2004	16.1	-	$ -	$ -
2005	16.4	-	-	-
2006	16.8	-	-	-
2007	17.1	-	-	-
2008	17.4	-	-	-
2009	17.8	-	-	-
2010	18.1	18,276	$ 15,534,825	$ 13,010,171
2011	18.5	18,642	$ 15,845,521	$ 12,883,859
2012	18.9	19,015	$ 16,162,432	$ 12,758,773
2013	19.2	19,395	$ 16,485,681	$ 12,634,901
2014	19.6	19,783	$ 16,815,394	$ 12,512,232
2015	20.0	20,178	$ 17,151,702	$ 12,390,754
2016	20.2	20,380	$ 17,323,219	$ 12,150,157
2017	20.4	20,584	$ 17,496,451	$ 11,914,232
2018	20.6	20,790	$ 17,671,416	$ 11,682,888
2019	20.8	20,998	$ 17,848,130	$ 11,456,035
2020	21.0	21,208	$ 18,026,611	$ 11,233,588
2021	21.2	21,420	$ 18,206,877	$ 11,015,460
2022	21.5	21,634	$ 18,388,946	$ 10,801,568
2023	21.7	21,850	$ 18,572,836	$ 10,591,829
2024	21.9	22,069	$ 18,758,564	$ 10,386,162
2025	22.1	22,290	$ 18,946,150	$ 10,184,489
2026	22.3	22,512	$ 19,135,611	$ 9,986,732
2027	22.6	22,738	$ 19,326,967	$ 9,792,815
2028	22.8	22,965	$ 19,520,237	$ 9,602,663
2029	23.0	23,195	$ 19,715,439	$ 9,416,204
2030	23.2	23,427	$ 19,912,594	$ 9,233,365
			Total Savings	**$ 235,638,878**
			Annualized saving	**$ 13,181,236**

/1 Train count estimates through 2015 were supplied by the railroads. HDR has assumed that growth would continue at a 1% rate through 2030.
/2 Obtained from the "Bridging the Valley" study, CH2M HILL and HDR, 2002. This estimate reflects fuel cost, crew cost, and other train operation and maintenance costs.
/3 This estimate reflects a 96 mile reduction in the trains' route through Colorado, plus the additional speed that can be gained by using a more "wide open" roadway at lower elevations than before.

Table 5-2
Estimate of Time Savings Associated With Utah Junction and Related East-West Improvements

Assumptions:		Source:
Cost of train delay ($/hour)	850	"Bridging the Valley", CH2M HILL and HDR, 2002
Number of trains per day impacted (2004)	15	UP railroad; this estimate will grow at 1% per year
Days per year trains running	360	Assumed
Discount rate	3%	Assumed

	Number of trains impacted	Low scenario: assumes 3 hours per train is saved	Discounted benefit	Midrange scenario: assumes 5 hours per train is saved	Discounted benefit	High scenario: assumes 8 hours per train is saved	Discounted benefit
2004	15.0	-	-	-	-	-	-
2005	15.3	-	-	-	-	-	-
2006	15.6	-	-	-	-	-	-
2007	15.9	$ 14,612,834	$ 13,372,813	$ 24,354,724	$ 22,288,022	$ 38,967,558	$ 35,660,835
2008	16.2	$ 14,905,091	$ 13,242,980	$ 24,841,818	$ 22,071,634	$ 39,746,909	$ 35,314,614
2009	16.6	$ 15,203,193	$ 13,114,408	$ 25,338,654	$ 21,857,346	$ 40,541,847	$ 34,971,753
2010	16.9	$ 15,507,257	$ 12,987,083	$ 25,845,428	$ 21,645,139	$ 41,352,684	$ 34,632,222
2011	17.2	$ 15,817,402	$ 12,860,995	$ 26,362,336	$ 21,434,992	$ 42,179,738	$ 34,295,987
2012	17.6	$ 16,133,750	$ 12,736,131	$ 26,889,583	$ 21,226,885	$ 43,023,332	$ 33,963,016
2013	17.9	$ 16,456,425	$ 12,612,479	$ 27,427,374	$ 21,020,799	$ 43,883,799	$ 33,633,278
2014	18.3	$ 16,785,553	$ 12,490,028	$ 27,975,922	$ 20,816,713	$ 44,761,475	$ 33,306,741
2015	18.7	$ 17,121,264	$ 12,368,766	$ 28,535,440	$ 20,614,609	$ 45,656,705	$ 32,983,375
2016	18.8	$ 17,292,477	$ 12,128,595	$ 28,820,795	$ 20,214,326	$ 46,113,272	$ 32,342,921
2017	19.0	$ 17,465,402	$ 11,893,089	$ 29,109,003	$ 19,821,814	$ 46,574,404	$ 31,714,903
2018	19.2	$ 17,640,056	$ 11,662,155	$ 29,400,093	$ 19,436,925	$ 47,040,148	$ 31,099,080
2019	19.4	$ 17,816,456	$ 11,435,705	$ 29,694,094	$ 19,059,509	$ 47,510,550	$ 30,495,214
2020	19.6	$ 17,994,621	$ 11,213,653	$ 29,991,035	$ 18,689,421	$ 47,985,655	$ 29,903,074
2021	19.8	$ 18,174,567	$ 10,995,912	$ 30,290,945	$ 18,326,520	$ 48,465,512	$ 29,322,432
2022	20.0	$ 18,356,313	$ 10,782,399	$ 30,593,854	$ 17,970,665	$ 48,950,167	$ 28,753,064
2023	20.2	$ 18,539,876	$ 10,573,032	$ 30,899,793	$ 17,621,720	$ 49,439,669	$ 28,194,752
2024	20.4	$ 18,725,275	$ 10,367,731	$ 31,208,791	$ 17,279,551	$ 49,934,065	$ 27,647,281
2025	20.6	$ 18,912,527	$ 10,166,415	$ 31,520,879	$ 16,944,026	$ 50,433,406	$ 27,110,441
2026	20.8	$ 19,101,653	$ 9,969,009	$ 31,836,088	$ 16,615,015	$ 50,937,740	$ 26,584,025
2027	21.0	$ 19,292,669	$ 9,775,436	$ 32,154,448	$ 16,292,394	$ 51,447,118	$ 26,067,830
2028	21.2	$ 19,485,596	$ 9,585,622	$ 32,475,993	$ 15,976,037	$ 51,961,589	$ 25,561,658
2029	21.4	$ 19,680,452	$ 9,399,493	$ 32,800,753	$ 15,665,822	$ 52,481,205	$ 25,065,316
2030	21.7	$ 19,877,256	$ 9,216,979	$ 33,128,760	$ 15,361,632	$ 53,006,017	$ 24,578,610
			$ 274,950,908		$ 458,251,514		$ 733,202,422

3.0	Hours per train	
5.0	5	5
8.0		
	Dollars per hour	
	850	850
		$ 274,950,908
	458251514	$ 458,251,514
		$ 733,202,422

Grade-Separated Crossings

Avoided Cost of Future Grade Separations

The purpose of examining grade separations was to estimate the benefit to the public of avoiding the cost of grade separations at railroad crossings because of the railroad project. This is based on the assumption that, in certain instances, grade separations that might be required by 2030 because of high train volumes might not be required with lower train volumes.

The starting point was the Colorado Crossing Inventory database, downloadable from the Federal Railroad Administration's (FRA) Web site. This matrix has 4755 rows representing that number of railroad crossings in the state. The matrix has 152 columns of data covering numerous types of information such as the railroad being crossed, the crossing road, traffic volume, locality, train count, type of crossing protection devices, and railroad branch. The matrix thus contains nearly three-quarters of a million pieces of data.

In order to sort this large database into a manageable format the column for average annual daily traffic (AADT) was multiplied by the column for daily train volume (trains per day or TPD). The result was a product called Exposure Factor that is a rough guide to how much exposure road traffic has to delay and accidents at a crossing. The matrix was then sorted by the Exposure Factor. As expected, the crossing location that rose to the top was Santa Fe Drive crossing the BNSF tracks in south Denver. Its Exposure Factor was over one million.

A subset of the sorted matrix was chosen consisting of the top 135 crossings and the 12 most useful columns. This matrix is shown on Table 5-3, First Crossing Screening. The Exposure Factor of the last row is less than one percent that of the top row so that a detailed review of the 135 crossings would cover all likely candidates for grade separation.

The Transportation Engineer for the Colorado Public Utilities Commission (PUC) who has been responsible for grade crossings for several decades reviewed the matrix with the team. He was specifically familiar with the individual crossings and was able to reduce the 135 to 39 potential candidates. This reduction process is shown schematically on Figure 5-1, Grade Separation Screening, and the 39 locations are shown on Figures 5-2 and 5-3, Candidate Grade Separations for the state and the Front Range respectively. Table 5-4, Second Crossing Screening, is the matrix of the 39 candidate crossings.

The last six columns of Table 5-4 present the results of the review. Comments are those of the PUC's engineer and Denver's Assistant Manager of Public Works. The fifth from last column (Candidate for G.S.) indicates whether the crossing is a likely candidate for grade separation by 2030. The fourth from last column (Regardless of the RR Project) indicates whether a railroad Build versus No Build decision would affect the grade separation decision. Where both of these columns are checked (ten crossings) the judgment is that these crossings will be grade separated in any event. These are therefore dropped from further consideration in this analysis.

The last three columns indicate the judgment about crossings where the Build or No Build decision would make a difference. The third from last column (G.S. under No Build) indicates those crossings where higher train volumes without the railroad project would likely require grade separation. The second from last column (G.S. under Build) indicates those crossings where higher train volumes with the railroad project would likely require grade separation. The last column (Qualitative Benefit w/ RR Project) shows those crossings where reconstruction of existing grade separations is likely and the reconstruction could be aided or avoided by the lower train traffic of a Build decision.

Following is a summary of results of the review:

- Grade Separation Less Likely Under Build (less train traffic)

- 104th Avenue east of US 85, UP tracks
- 1st Avenue in Fort Lupton
- 13th Avenue in Denver
- 47th Avenue and York Street in Denver
- Grade Separation More Likely Under Build (increased train traffic)
- Peoria Avenue north of Smith Road
- Washington Avenue at 62nd
- Reconstruct Existing Grade Crossing Less Likely Under Build
- 38th Avenue overpass
- Reconstruction Possibly Facilitated Under Build
- Alameda Avenue underpass

There are 18 candidates for grade separation checked in the fifth from last column. Of these, 8 are likely to be affected by the Build/No Build decision. The history of grade separation projects in Colorado is that about one per year gets built. The impetus has been traffic delay as opposed to safety although accident reduction can be a corollary benefit. This trend is well established and is likely to continue. During the 27 years between now and 2030 we expect 27 grade separation projects to be completed. The review of candidates identified 18 of these, leaving 9 more to account for. These 9 must be generic, non-site specific since no more than 18 could be specifically identified at this time. We could expect that about half, or four might be affected by the Build/No Build decision based on the ratio for the 18. We could also expect that one is more likely under Build and 3 are less likely under Build, again based on the ratio for the specific candidates (2 of 6 more likely). These estimates are summarized below.

GRADE SEPARATION RESULTS:

18 Specific Candidates Identified
- 8 Impacted by Railroad Project
  - 5 Unlikely under Build Option
    - 4 New
    - 1 Reconstruct Existing
  - 2 Likely under Build Option
  - 1 Reconstruction facilitated under Build Option

9 Non-Specific Candidates
- 4 Impacted by Railroad Project
  - 3 Unlikely under Build Option
  - 1 Likely under Build Option

27 Total Candidates (One per year through 2030)

The cost savings from grade separations avoided due to the build project were estimated as follows. The results show 5 specific grade separation projects unlikely to be required under the build scenario, 4 new and one reconstruction. These 4 new candidates are offset by 2 candidates likely to be required for a net of 2 specific required projects. These are in built up areas where the cost for each project is estimated to be $20 million each. Thus the net cost saved under the Build scenario for specific locations is $40 million. The non-specific grade separation projects are estimated to cost $10 million each since they are likely to be located in less developed areas. As an example, a new grade separation might be built in conjunction with roadway improvements to support a new development.

A new grade separation could also be justified by accident potential rather than exposure factor in rural areas where train volumes increase under Build but where traffic volumes are relatively low. An example of such a case might be in the town of Limon where train volumes could go from existing 6 trains per day to 51 trains per day

across the at-grade crossing of State Highway 71. Although the predicted exposure factor on HS 71 is low even with the high number of trains per day, the location of the State Penitentiary on one side of the tracks and the hospital on the other side of the tracks might necessitate a grade separation.

There are 4 non-specific crossings impacted by the railroad project, 3 unlikely and 1 likely under the Build option for a net of 2. Thus the cost saving for non-specific projects is estimated to be $20 million. The total estimated cost saving for grade separations not needed under the Build scenario is $60 million. Reconstruction projects are not given a cost but are considered a qualitative benefit of the railroad project. Five grade separations were assumed by the railroads for the new lines and costs for these were included in the railroad project cost estimate. Thus these five are not included in this analysis.

Table 5-5, Total Benefits from Reduced Number of Grade Separated Crossings, illustrates how this $60 million total cost-savings, or benefit of a Build decision, would be allocated over the period 2004 to 2030. This benefit is a cost savings shared by public and private funding sources determined by the Public Utilities Commission. It was assumed that construction of grade separations within the Project area would be avoided in 2006, 2009, and 2012. The present value of these benefits is approximately $52 million.

Table 5-3
First Crossing Screening

RANK	RAIL ROAD	RRDIV	HIGHWAY	STREET	BRANCH	MAX SPEED	AADT	TOTAL TRAINS	AADT xTPD	COUNTY NAME	CITY NAME
1	BNSF	POWDER RIVER	FAU1477	SANTA FE AVE	20TH ST-PUEBLO	30	043000	24	1,032,000	DENVER	DENVER
2	UP	DENVER		W 48TH AVE	YARD	5	005000	148	740,000	DENVER	DENVER
3	BNSF	POWDER RIVER	FAU1513	BROADWAY AVE	20TH ST-PUEBLO	45	030700	24	736,800	DENVER	DENVER
4	BNSF	COLORADO	FAU 88	BELLVW WO WINDEM	20TH ST-PUEBLO	25	022500	27	607,500	ARAPAHOE	LITTLETON
5	UP	DENVER	FAU1377	PECOS NOCARGILLDR	MAIN	45	011000	44	484,000	ADAMS	WESTMINSTER
6	UP	DENVER	SH 86A	5TH EO PERRY	MAIN	45	013300	36	478,800	DOUGLAS	CASTLE ROCK
7	BNSF	POWDER RIVER	FAU1698	72ND AVE	E BRUSH-20TH ST	79	017600	27	475,200	ADAMS	COMMERCE CITY
8	UP	DENVER	SH 88	BELLVW EORIOGRAND	MAIN	15	022500	20	450,000	ARAPAHOE	LITTLETON
9	UP	DENVER	SH 75	ALAMO EORIOGRANDE	MAIN	10	009750	38	370,500	ARAPAHOE	LITTLETON
10	BNSF	POWDER RIVER	FAU1266	MISSISSIPPI AVE	20TH ST-PUEBLO	30	013200	27	356,400	DENVER	DENVER
11	BNSF	POWDER RIVER	FAU1718	80TH AVE	E BRUSH-20TH ST	79	013200	27	356,400	ADAMS	COMMERCE CITY
12	BNSF	POWDER RIVER		96TH AVE	E BRUSH-20TH ST	79	013100	27	353,700	ADAMS	ROCKY MT ARSENAL
13	BNSF	POWDER RIVER	FAU1477	KALAMATH AVE	20TH ST-PUEBLO	30	014000	24	336,000	DENVER	DENVER
14	UP	DENVER	FAU2262	GAR OF GOD EO I25	MAIN	25	011000	30	330,000	EL PASO	COLORADO SPGS
15	BNSF	POWDER RIVER	FAU1154	W DARTMOUTH AVE	20TH ST-PUEBLO	45	009350	34	317,900	ARAPAHOE	ENGLEWOOD
16	BNSF	POWDER RIVER	FAU2910	FONTAINE BLVD	20TH ST-PUEBLO	55	013200	24	316,800	EL PASO	FOUNTAIN
17	UP	CENTRAL REGION	SH 7D	BRIDGE EO CABBAGE	D P M L	40	015500	20	310,000	ADAMS	BRIGHTON
18	UP	CENTRAL REGION	FAU1687	PEORIA NO SMITHRD	SALINA SUB	35	016700	18	300,600	ADAMS	AURORA
19	UP	DENVER	SH 75	MAIN EO RIOGRANDE	MAIN	10	007850	38	298,300	ARAPAHOE	LITTLETON
20	BNSF	POWDER RIVER	FAU2225	MAIN ST	20TH ST-PUEBLO	55	012300	24	295,200	EL PASO	SECURITY
21	UP	DENVER	FAU1266	MISSISS-WOBROADWY	MAIN	25	013200	21	277,200	DENVER	DENVER
22	BNSF	CENTRAL	FAU1102	QUINCY AVE	MAIN	45	007000	34	238,000	ARAPAHOE	ENGLEWOOD
23	BNSF	POWDER RIVER	FAU 75	ALAMO AVE	20TH ST-PUEBLO	45	009750	24	234,000	ARAPAHOE	LITTLETON
24	BNSF	POWDER RIVER	FAS 44	104TH AVE	E BRUSH-20TH ST	79	008550	27	230,850	ADAMS	ROCKY MT ARSENAL
25	UP	CENTRAL REGION	SH 44A	104THAVE EO US 85	D P M L	79	011300	20	226,000	ADAMS	THORNTON
26	UP	DENVER	FAU1471	WASHTNST SO62NDAV	BELT LINE	20	012000	18	216,000	ADAMS	DENVER
27	BNSF	CENTRAL	FAU1050	RIDGE EO SAN FE	MAIN	25	006350	34	215,900	ARAPAHOE	LITTLETON
28	BNSF	POWDER RIVER	FAU1734	W 88TH AVE	DEN UD-WENDOVER	49	030500	7	213,500	ADAMS	BROOMFIELD
29	UP	DENVER	FAU1101	SIMMSST SO 76THAV	MAIN	65	011100	18	199,800	JEFFERSON	ARVADA
30	UP	DENVER	FAU2282	WOODMEN RD(CR55)W	MAIN	45	006650	30	199,500	EL PASO	COLORADO SPGS
31	BNSF	POWDER RIVER	FAU7223	SHERMAN	E BRUSH-20TH ST	79	007300	27	197,100	MORGAN	FORT MORGAN
32	UP	DENVER		LINKRD(EOLDPUEBRD	MAIN	55	006450	30	193,500	EL PASO	FOUNTAIN
33	BNSF	POWDER RIVER	FAU1130	OXFORD ST	20TH ST-PUEBLO	45	008000	24	192,000	ARAPAHOE	ENGLEWOOD
34	UP	CENTRAL REGION		BUCKLEY NOSMITHRD	SALINA SUB	60	016000	12	192,000	ADAMS	AURORA
35	UP	DENVER	SH 115A	SH 115 SO US 50	MAIN	45	014700	13	191,100	FREMONT	CANON CITY
36	BNSF	POWDER RIVER	FAU 75	LITTLETON BLVD	20TH ST-PUEBLO	45	007850	24	188,400	ARAPAHOE	LITTLETON
37	UP	DENVER	I70H	HWY MP .307	MAIN	50	015600	12	187,200	EAGLE	AVON
38	UP	DENVER	FAU1154	DARTMOUTH EO US85	MAIN	25	009350	20	187,000	ARAPAHOE	ENGLEWOOD
39	DRGW	MIDWEST	FAU1050	RIDGE EO SAN FE	MAIN	10	004700	38	178,600	ARAPAHOE	LITTLETON
40	UP	DENVER		LASANIMASEOCONEJO	MAIN	25	003000	57	171,000	EL PASO	COLORADO SPGS
41	BNSF	POWDER RIVER	FAU1642	56TH AVE	E BRUSH-20TH ST	40	006300	27	170,100	ADAMS	COMMERCE CITY
42	BNSF	CENTRAL		TUFTS AVE	MAIN	45	005000	34	170,000	ARAPAHOE	ENGLEWOOD
43	UP	CENTRAL REGION	FAU1691	HAVANA-NO SMITHRD	SALINA SUB	35	009350	18	168,300	DENVER	DENVER
44	UP	CENTRAL REGION	SH 32A	TOWERRD NOSMITHRD	SALINA SUB	20	013700	12	164,400	ADAMS	AURORA
45	BNSF	COLORADO	FAP 119	SH CO 119	DEN UD-WENDOVER	20	023100	7	161,700	BOULDER	LONGMONT
46	BNSF	POWDER RIVER	FAU5002	HORSETOOTH	DEN UD-WENDOVER	40	023000	7	161,000	LARIMER	FORT COLLINS
47	UP	DENVER	FAU1153	CARR ST NO OBERON	MAIN	65	008800	18	158,400	JEFFERSON	ARVADA

Table 5-3 Continued
First Crossing Screening

RANK	RAIL ROAD	RRDIV	HIGHWAY	STREET	BRANCH	MAX SPEED	AADT	TOTAL TRAINS	AADT xTPD	COUNTY NAME	CITY NAME
48	UP	DENVER	FAU1205	WADSWORTH SO 61ST	MAIN	65	007500	21	157,500	JEFFERSON	ARVADA
49	UP	DENVER	FAU1213	LAMARST SO 60THAV	MAIN	60	006000	26	156,000	JEFFERSON	ARVADA
50	UP	DENVER	SH 53A	BROADWAY SO 60TH	BELT LINE	20	012900	12	154,800	ADAMS	DENVER
51	BNSF	POWDER RIVER	FAU1410	13TH WO SHOSHONE	20TH ST-PUEBLO	30	006400	24	153,600	DENVER	DENVER
52	UP	DENVER	FAU2145	SIERRAMADRESOFOUN	MAIN	25	002650	57	151,050	EL PASO	COLORADO SPGS
53	ATSF	EASTERN LINES	FAU1262	LOUISNA WO BROAD	DENVER DIST	30	006500	23	149,500	DENVER	DENVER
54	BNSF	POWDER RIVER	FAP287	MAIN ST	DEN UD-WENDOVER	20	021200	7	148,400	BOULDER	LONGMONT
55	BNSF	EASTERN LINES	FAU1138	KENYON EO SAN FE	MAIN	40	004350	34	147,900	ARAPAHOE	SHERIDAN
56	BNSF	POWDER RIVER	FAU2926	OHIO ST	20TH ST-PUEBLO	55	012300	12	147,600	EL PASO	FOUNTAIN
57	UP	DENVER	SH 141	SH 141 SO US 6	MAIN	70	006350	23	146,050	MESA	CLIFTON
58	BNSF	POWDER RIVER	FAP 287	N COLLEGE AVE	DEN UD-WENDOVER	49	020800	7	145,600	LARIMER	FORT COLLINS
59	UP	CENTRAL REGION	FAU1734	88THAVEWOROSEMARY	D P M L	79	010400	14	145,600	ADAMS	THORNTON
60	UP	DENVER		MESA RD EO US 85	MAIN	55	009500	15	142,500	EL PASO	FOUNTAIN
61	BNSF	POWDER RIVER	FAP 925	MAIN ST	PUEBLO-TRINIDAD	49	008850	16	141,600	HUERFANO	WALSENBURG
62	BNSF	POWDER RIVER	FAU5026	PROSPECT ST	DEN UD-WENDOVER	40	020200	7	141,400	LARIMER	FORT COLLINS
63	BNSF	POWDER RIVER	FAU5010	DRAKE RD	DEN UD-WENDOVER	40	020000	7	140,000	LARIMER	FORT COLLINS
64	BNSF	KANSAS	FAP 50	MAIN ST	ELLINOR-LAJUNTA	79	013800	10	138,000	PROWERS	LAMAR
65	BNSF	POWDER RIVER	FAP 119	3RD AVE	DEN UD-WENDOVER	20	019600	7	137,200	BOULDER	LONGMONT
66	DRGW	DENVER	FAU1262	LOUISIANA WO BRD	M L DEN TO PUE	25	006500	21	136,500	DENVER	DENVER
67	DSNG			MAIN AVE &14TH ST	MAIN	10	017000	8	136,000	LA PLATA	DURANGO
68	BNSF	POWDER RIVER	FAP 121	WADSWORTH BYPASS	PROS JCT-GOLDEN	20	045100	3	135,300	JEFFERSON	ARVADA
69	UP	DENVER	FAU1698	72ND WO MILLER ST	MAIN	65	007500	18	135,000	JEFFERSON	ARVADA
70	BNSF	COLORADO	FAU 26	ALAMEDA EO NAVAJ	SHERIDAN BRANCH	40	033400	4	133,600	DENVER	DENVER
71	BNSF	COLORADO	FAP 287	SH287 SO DILLON	DEN UD-WENDOVER	30	019000	7	133,000	BOULDER	BROOMFIELD
72	UP	DENVER		COMANCHEVIL(EO85)	MAIN	45	008800	15	132,000	EL PASO	FOUNTAIN
73	UP	CENTRAL REGION	FAU1633	DAHLIA NO SMITHRD	SALINA SUB	35	007300	18	131,400	DENVER	DENVER
74	BNSF	POWDER RIVER	FAU8296	29TH ST	DEN UD-WENDOVER	49	018600	7	130,200	LARIMER	LOVELAND
75	BNSF	COLORADO	FAU1471	WASHINGTON ST-N	JERSEY CUT-OFF	10	013000	10	130,000	DENVER	DENVER
76	UP	DENVER	CITY	22ND AVE	GREELEY SUB	60	008000	16	128,000	WELD	GREELEY
77	UP	CENTRAL REGION	FAU1605	YORKST-SO E43RDAV	SALINA SUB	35	007050	18	126,900	DENVER	DENVER
78	BNSF	COLORADO	FAP 6	VASQUEZ NO 52ND	MKT. ST. LINE	10	020800	6	124,800	ADAMS	COMMERCE CITY
79	BNSF	CENTRAL	SH 470A	CTYLN RD EO US85	MAIN	45	003600	34	122,400	DOUGLAS	LOUVIERS
80	UP	CENTRAL REGION	FAU1605	JOSEPHINE SOE43RD	SALINA SUB	35	006750	18	121,500	DENVER	DENVER
81	BNSF	DENVER	US 287C	COLLEGEAVSOCHERRY	GREELEY LINE	15	020200	6	121,200	LARIMER	FORT COLLINS
82	BNSF	POWDER RIVER		HARMONY RD	DEN UD-WENDOVER	40	017300	7	121,100	LARIMER	FORT COLLINS
83	BNSF	POWDER RIVER	FAU1293	PRINCE ST	20TH ST-PUEBLO	45	005000	24	120,000	ARAPAHOE	LITTLETON
84	DRGW	DENVER		CONTYLINRD EOUS85	MAIN	45	003600	33	118,800	ARAPAHOE	LITTLETON
85	UP	DENVER	FAU1245	LOWELLBLVD-NO56TH	MAIN	60	005750	20	115,000	ADAMS	DENVER
86	BNSF	POWDER RIVER		MESA RD	20TH ST-PUEBLO	45	009500	12	114,000	EL PASO	FOUNTAIN
87	BNSF	POWDER RIVER	FAU1115	KIPLING ST	PROS JCT-GOLDEN	15	014200	8	113,600	ADAMS	ARVADA
88	BNSF	POWDER RIVER	FAP 160	7TH ST	PUEBLO-TRINIDAD	49	007100	16	113,600	HUERFANO	WALSENBURG
89	DRGW	COLORADO	FAU2145	E LAS VEGAS ST	M L DEN TO PUE.	30	003500	32	112,000	EL PASO	COLORADO SPGS
90	UP	CENTRAL REGION	SH 35	QUEBEC SB RAMP	SALINA SUB	35	006200	18	111,600	DENVER	DENVER
91	UP	CENTRAL REGION	SH 35	QUEBEC NB RAMP	SALINA SUB	35	006200	18	111,600	DENVER	DENVER
92	BNSF	POWDER RIVER	FAU5042	LAUREL ST	DEN UD-WENDOVER	49	015800	7	110,600	LARIMER	FORT COLLINS
93	UP	CENTRAL REGION	FAU1649	HOLLYST &SMITH RD	SALINA SUB	35	006100	18	109,800	DENVER	DENVER
94	BNSF	POWDER RIVER	FAP 2	COLO BL SO 50TH	MKT. ST. LINE	10	027000	4	108,000	DENVER	DENVER

Table 5-3 Continued
First Crossing Screening

RANK	RAIL ROAD	RRDIV	HIGHWAY	STREET	BRANCH	MAX SPEED	AADT	TOTAL TRAINS	AADT xTPD	COUNTY NAME	CITY NAME
95	UP	DENVER	SH 67E	SH 67E WO US 85A	MAIN	45	005350	20	107,000	DOUGLAS	SEDALIA
96	BNSF	POWDER RIVER	FAU2929	COMANCHE VILLAGE	20TH ST-PUEBLO	55	008800	12	105,600	EL PASO	FOUNTAIN
97	BNSF	COLORADO	FAP287	CLEVELND NO 10TH	DEN UD-WENDOVER	25	015000	7	105,000	LARIMER	LOVELAND
98	BNSF	COLORADO	FAP287	LINCOLN NO 10TH	DEN UD-WENDOVER	25	015000	7	105,000	LARIMER	LOVELAND
99	UP	CENTRAL REGION	FAU1698	72NDAV WO FAIRFAX	D P M L	60	013000	8	104,000	ADAMS	COMMERCE CITY
100	UP	CENTRAL REGION		E.96THAVE EO I76	D P M L	79	007350	14	102,900	ADAMS	THORNTON
101	BNSF	POWDER RIVER	FAU2934	ILLINOIS AVE	20TH ST-PUEBLO	55	008550	12	102,600	EL PASO	FOUNTAIN
102	BNSF	COLORADO		E 120TH AVE	E BRUSH-20TH ST	79	003800	27	102,600	ADAMS	BRIGHTON
103	UP	CHEYENNE	FAU1718	80THAVE WO MONACO	GREELEY	70	005650	18	101,700	ADAMS	COMMERCE CITY
104	BNSF	POWDER RIVER	FAU5046	MULBERRY ST	DEN UD-WENDOVER	49	014500	7	101,500	LARIMER	FORT COLLINS
105	UP	DENVER	FAU1293	PRINCE SO CHURCH	MAIN	20	005000	20	100,000	ARAPAHOE	LITTLETON
106	UP	DENVER	FAU2926	OHIO WO MESA ROAD	MAIN	45	006550	15	98,250	EL PASO	FOUNTAIN
107	BNSF	POWDER RIVER	FAU1698	W 72ND AVE	DEN UD-WENDOVER	25	014000	7	98,000	ADAMS	WESTMINSTER
108	UP	CENTRAL REGION	FAU1425	BLAKEST & 37TH ST	DOWNTOWN SPUR	5	009800	10	98,000	DENVER	DENVER
109	UP	CENTRAL REGION	FAU1453	23RD AT BLAKE	DOWNTOWN SPUR	5	019500	5	97,500	DENVER	DENVER
110	UP	CENTRAL REGION	FAU1657	MONACO NO SMITHRD	SALINA SUB	35	005400	18	97,200	DENVER	DENVER
111	UP	CENTRAL REGION	FAU1621	STEELE SO E43RDAV	LIMON SUB	35	005350	18	96,300	DENVER	DENVER
112	UP	DENVER	SH 83A	ACADEMY SO CONST	COLO SPGS BRNCH	30	048100	2	96,200	EL PASO	COLORADO SPGS
113	CS		FAU 2	COLO BLVD AT BUCH	CONNORS	10	046800	2	93,600	DENVER	DENVER
114	UP	DENVER	FAU7457	9THST SO SOUTHAVE	YARD	70	005750	16	92,000	MESA	GRAND JUNCTION
115	UP	CENTRAL REGION	FAU6202	BROMLEYLN EO MAIN	D P M L	79	004600	20	92,000	ADAMS	BRIGHTON
116	UP	CHEYENNE	SH 263A	8TH ST EO 7TH AVE	D P M L	20	005050	18	90,900	WELD	GREELEY
117	UP	CENTRAL REGION	SH 22A	124THAVE EO US 85	GREELEY SUB	79	004500	20	90,000	ADAMS	HENDERSON
118	BNSF	POWDER RIVER	FAU 72	WARD RD	PROS JCT-GOLDEN	20	029500	3	88,500	JEFFERSON	WHEAT RIDGE
119	UP	CENTRAL REGION	FAU5550	5TH ST EO 7TH AVE	D P M L	20	005500	16	88,000	WELD	GREELEY
120	DRGW	MIDWEST	FAU1138	KENYON EO FAP85	MAIN	25	004350	20	87,000	ARAPAHOE	SHERIDAN
121	UP	CENTRAL REGION	FAU6228	LONGSPKSTWO4THAVE	D P M L	40	004350	20	87,000	ADAMS	BRIGHTON
122	UP	CENTRAL REGION	SH 52A	1ST ST EO MAINAVE	D P M L	79	004300	20	86,000	WELD	FORT LUPTON
123	UP	DENVER	FAU1130	OXFORD EO US 85	MAIN	20	004250	20	85,000	ARAPAHOE	ENGLEWOOD
124	RTDZ	DENVER	SH 121A	13TH&WADSWORTHBLV	REMACO SPUR	10	042100	2	84,200	JEFFERSON	LAKEWOOD
125	BNSF	COLORADO	FAU1453	23RD AT MARKET	MKT. ST. LINE	10	021000	4	84,000	DENVER	DENVER
126	BNSF	POWDER RIVER	FAU8256	14TH ST	DEN UD-WENDOVER	25	012000	7	84,000	LARIMER	LOVELAND
127	BNSF	SOUTHWEST	US 160	UNIVERSTY AVE	LAJUNTA-L VEGAS	20	009100	9	81,900	LAS ANIMAS	TRINIDAD
128	BNSF	COLORADO	FAP 34	SH CO 34 & 6	UNION-BRUSH CTR	60	003900	21	81,900	MORGAN	BRUSH
129	BN	DENVER	FAU 25	NEVADA	TRAK NO. 1	10	020300	4	81,200	EL PASO	COLORADO SPGS
130	BNSF	POWDER RIVER		OLD BARLOW RD	E BRUSH-20TH ST	79	003000	27	81,000	MORGAN	FORT MORGAN
131	UP	CENTRAL REGION	FAU5546	13THST EO 6TH AVE	D P M L	20	005000	16	80,000	WELD	GREELEY
132	UP	CENTRAL REGION	FAU1605	YORK ST-N E.40TH	DOWNTOWN SPUR	5	006550	12	78,600	DENVER	DENVER
133	BNSF	POWDER RIVER	FAU5053	9TH ST	DEN UD-WENDOVER	20	011100	7	77,700	LARIMER	FORT COLLINS
134	UP	CENTRAL REGION	SH 33A	E40THAVEOFRANKLIN	DOWNTOWN SPUR	5	009550	8	76,400	DENVER	DENVER
135	UP	CENTRAL REGION	SH 33A	E40THAV WOWILLIAM	DOWNTOWN SPUR	5	009550	8	76,400	DENVER	DENVER

Figure 5.1 Grade Separation Screening

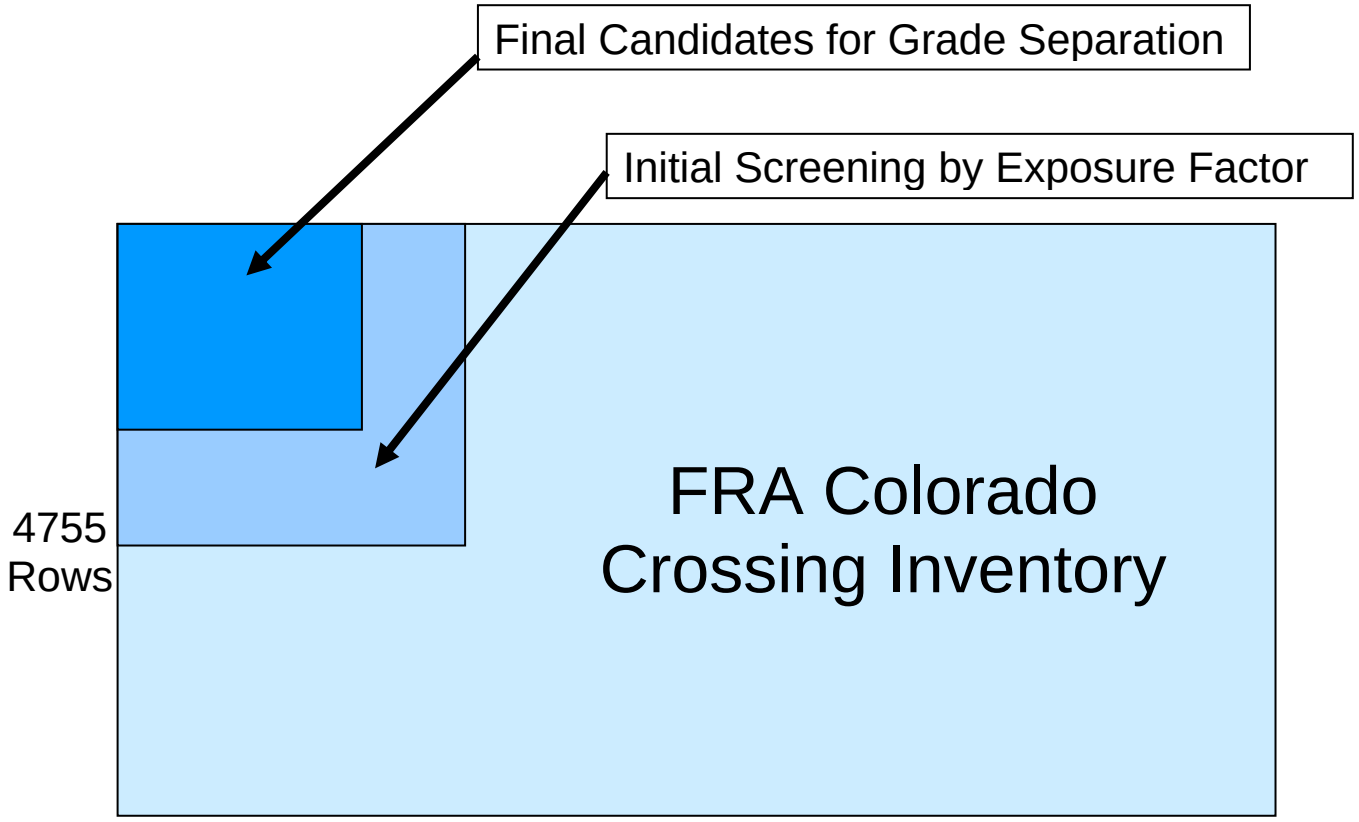


Figure 5-2 Candidate Grade Separations – Colorado

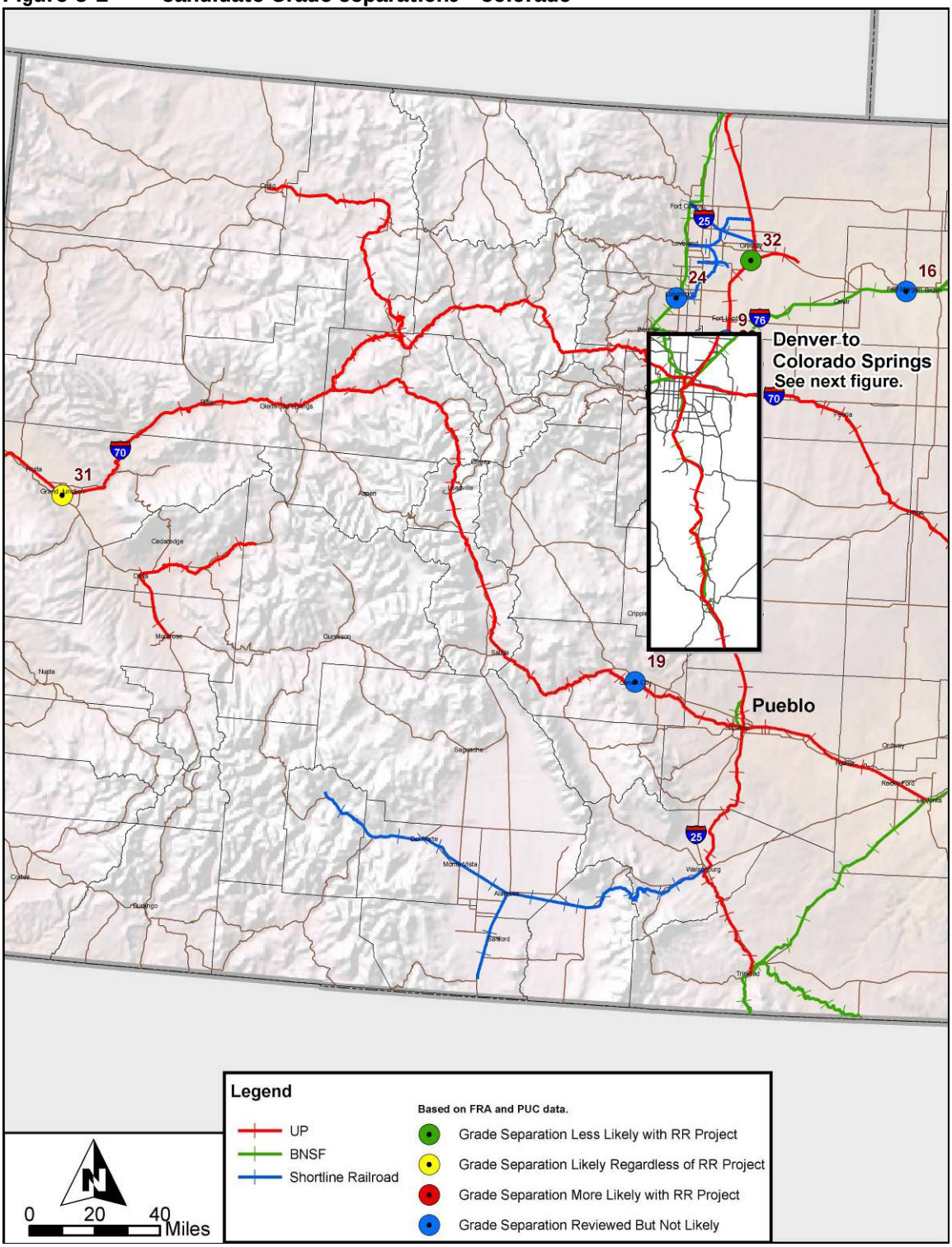
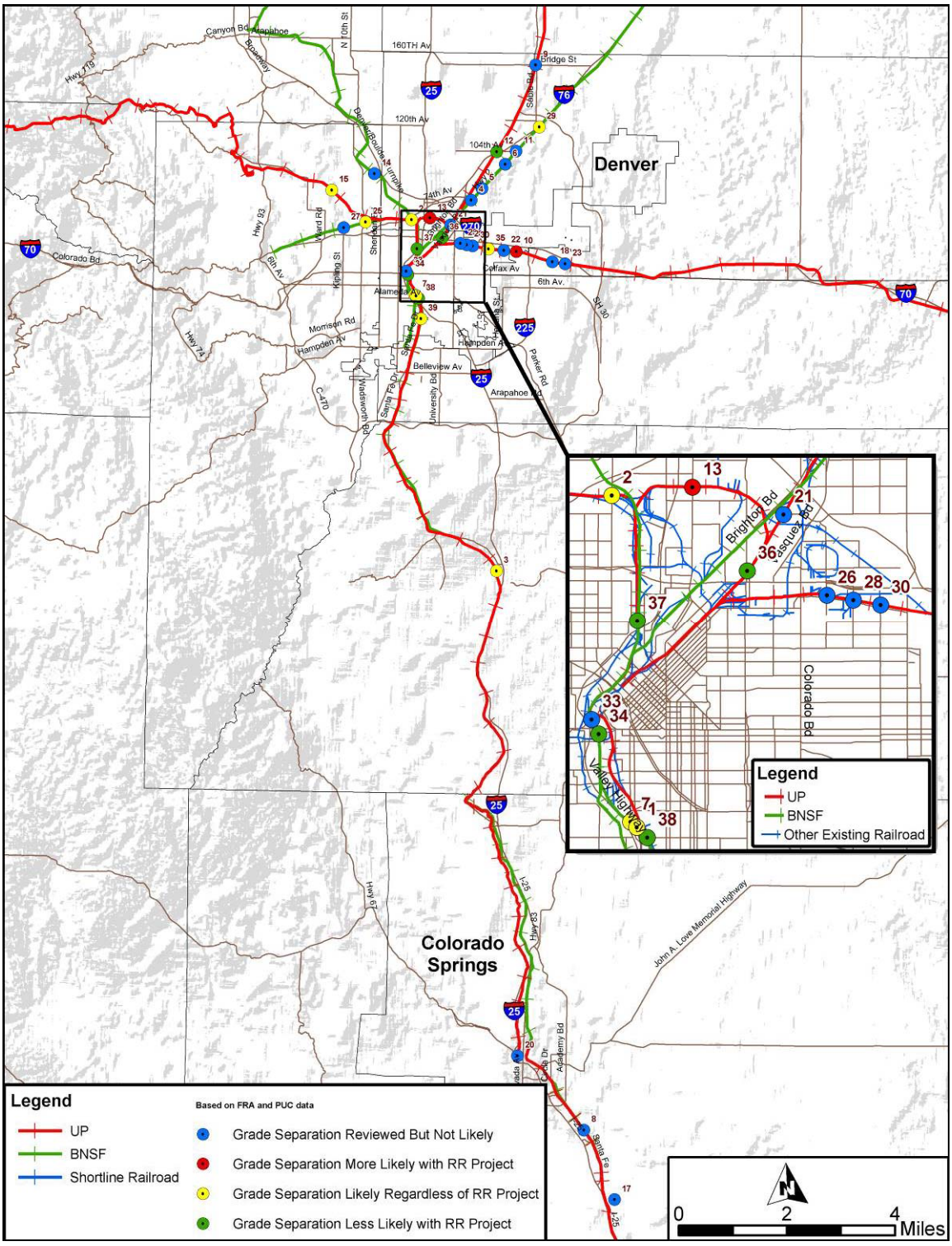


Figure 5-3 Candidate Grade Separations – Front Range



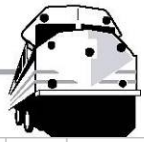


Table 5-4
Second Cross Screening

ROW NO.	RANK (by existing exposure factor)	RR	HIGHWAY	STREET	FRA AADT	2004 TPD	EXPOSURE FACTOR	COUNTY NAME	CITY NAME	COMMENTS	Candidate for G.S.	Regardless of The RR Project	G.S.w/o RR Project	G.S.w/ RR Project	Qualitative Benefit w/ RR Project
1	1	BNSF	FAU1477	SANTA FE AVE	043000	24	1032000	DENVER	DENVER	Will be built by 2030	X	X			
2	5	UP	FAU1377	PECOS NOCARGILLDR	011000	44	484000	ADAMS	WESTMINSTER	Phase 1 of the Utah Junction project will put Pecos under the RR	X	X			
3	6	UP	SH 86A	5TH EO PERRY	013300	36	478800	DOUGLAS	CASTLE ROCK	Committed Castle Rock flyover will remove majority of traffic from this crossing. March court date will determine if crossing is closed.	X	X			
4	7	BNSF	FAU1698	72ND AVE	017600	27	475200	ADAMS	COMMERCE CITY	Abnormally expensive and difficult to construct thus will probably never be grade separated.					
5	11	BNSF	FAU1718	80TH AVE	013200	27	356400	ADAMS	COMMERCE CITY	Adjacent to Rocky Mountain Arsenal Wildlife Refuge - will never be grade separated.					
6	12	BNSF		96TH AVE	013100	27	353700	ADAMS	ROCKY MT ARSENAL	High Accident intersection. $3M of improvements to at-grade crossing. Grade separation not likely due to feasibility and cost.					
7	13	BNSF	FAU1477	KALAMATH AVE	014000	24	336000	DENVER	DENVER	Will be built by 2030 as part of # 1 grade separation project.	X	X			
8	16	BNSF	FAU2910	FONTAINE BLVD	013200	24	316800	EL PASO	FOUNTAIN	No room to separate. Not going to happen in our 25 year period - too much residential in the					
9	17	UP	SH 7D	BRIDGE EO CABBAGE	015500	20	310000	ADAMS	BRIGHTON	Grade separation would impact traffic movement in downtown Brighton. Lots of benefit to public at this crossing given the build option.					
10	18	UP	FAU1687	PEORIA NO SMITHRD	016700	18	300600	ADAMS	AURORA	Could g.s. with Peoria underpass	X			X	
11	24	BNSF	FAS 44	104TH AVE	008550	27	230850	ADAMS	ROCKY MT ARSENAL	CDOT master plan for SH85 will divert traffic to 120th which is grade separated. This crossing will remain at-grade.					
12	25	UP	SH 44A	104THAVE EO US 85	011300	20	226000	ADAMS	THORNTON	Will be grade separated in the No-build, questionable in the build.	X		X		
13	26	UP	FAU1471	WASHTNST SO62NDAV	012000	18	216000	ADAMS	DENVER (?)	Will probably grade separate. Pressure would be greater in the Build.	X			X	
14	28	BNSF	FAU1734	W 88TH AVE	030500	7	213500	ADAMS	BROOMFIELD	Missed the window of oppurtunity. Will never grade separate.					
15	29	UP	FAU1101	SIMMSST SO 76THAV	011100	18	199800	JEFFERSON	ARVADA	Grade separate in Build or No-build.	X	X			
16	31	BNSF	FAU7223	SHERMAN	007300	27	197100	MORGAN	FORT MORGAN	Developed - won't be done					
17	32	UP		LINKRD(EOLDPUEBRD	006450	30	193500	EL PASO	FOUNTAIN	Unlikely candidate for grade separation					
18	34	UP		BUCKLEY NOSMITHRD	016000	12	192000	ADAMS	AURORA	G.S. not likely, especially if Peoria grade separated					

Table 5-4
Second Cross Screening

ROW NO.	RANK (by existing exposure factor)	RR	HIGHWAY	STREET	FRA AADT	2004 TPD	EXPOSURE FACTOR	COUNTY NAME	CITY NAME	COMMENTS	Candidate for G.S.	Regardless of The RR Project	G.S. w/o RR Project	G.S. w/ RR Project	Qualitative Benefit w/ RR Project
19	35	UP	SH 115A	SH 115 SO US 50	014700	13	191100	FREMONT	CANON CITY	No g.s. - Tenn Pass line					
20	40	UP		LASANIMASEOCONEJO	003000	57	171000	EL PASO	COLORADO SPGS	No g.s. - to power plant					
21	41	BNSF	FAU1642	56TH AVE	006300	27	170100	ADAMS	COMMERCE CITY	Refinery - no g.s.					
22	43	UP	FAU1691	HAVANA-NO SMITHRD	009350	18	168300	DENVER	DENVER	Will need to move west, possibly at Peoria					
23	44	UP	SH 32A	TOWERRD NOSMITHRD	013700	12	164400	ADAMS	AURORA	G.S. not likely, especially if Peoria grade separated					
24	45	BNSF	FAP 119	SH CO 119	023100	7	161700	BOULDER	LONGMONT	Missed opportunity to g.s.					
25	68	BNSF	FAP 121	WADSWORTH BYPASS	045100	3	135300	JEFFERSON	ARVADA	CDOT final g.s. plans prepared	X	X			
26	73	UP	FAU1633	DAHLIA NO SMITHRD	007300	18	131400	DENVER	DENVER	G.S. not likely					
27	87	BNSF	FAU1115	KIPLING ST	014200	8	113600	ADAMS	ARVADA	On Coors line - no g.s.					
28	93	UP	FAU1649	HOLLYST &SMITH RD	006100	18	109800	DENVER	DENVER	G.S. not likely					
29	102	BNSF		E 120TH AVE	003800	27	102600	ADAMS	BRIGHTON	G.S. as part of I-76/120th interchange	X	X			
30	110	UP	FAU1657	MONACO NO SMITHRD	005400	18	97200	DENVER	DENVER	G.S. not likely					
31	114	UP	FAU7457	9THST SO SOUTHAVE	005750	16	92000	MESA	GRAND JUNCTION	Maybe g.s. - Grand Jcn UP yard, build not a factor	X	X			
32	122	UP	SH 52A	1ST ST EO MAINAVE	004300	20	86000	WELD	FORT LUPTON	Could g.s Hwy 51 if TPD increases under no-build	X		X		
33	N/A			WALNUT				DENVER	DENVER	Bronco game problem. Could be solved by RTD West Line or Build scenario					
34	N/A			13TH AVENUE				DENVER	DENVER	G.S. possibly avoided in Build scenario	X		X		
35	N/A			YOSEMITE				DENVER	DENVER	Will be grade separated	X	X			
36	N/A			47TH & YORK				DENVER	DENVER	Low volumes but community pressure may require g.s.	X		X		
37	N/A			38TH AVE OVERPASS				DENVER	DENVER	Substandard, flooding, needs reconstruction - Build could obviate	X				X
38	N/A			ALAMEDA UNDERPASS				DENVER	DENVER	Needs reconstruction to widen Alameda - Build could facilitate	X				X
39	N/A			IOWA UNDERPASS				DENVER	DENVER	Could be closed and replaced by Florida Ave underpass	X	X			

Table 5-5
Total Benefits From Reduced Number of Grade Separated Crossings

Rate of growth	2.00%
Discount rate	3.00%

	Avoided Capital Costs for New Grade-separated Crossings	
	Benefits by year	Discounted benefits
2004	$0.00	$0.00
2005	$0.00	$0.00
2006	$20.00	$18.85
2007	$0.00	$0.00
2008	$0.00	$0.00
2009	$20.00	$17.25
2010	$0.00	$0.00
2011	$0.00	$0.00
2012	$20.00	$15.79
2013	$0.00	$0.00
2014	$0.00	$0.00
2015	$0.00	$0.00
2016	$0.00	$0.00
2017	$0.00	$0.00
2018	$0.00	$0.00
2019	$0.00	$0.00
2020	$0.00	$0.00
2021	$0.00	$0.00
2022	$0.00	$0.00
2023	$0.00	$0.00
2024	$0.00	$0.00
2025	$0.00	$0.00
2026	$0.00	$0.00
2027	$0.00	$0.00
2028	$0.00	$0.00
2029	$0.00	$0.00
2030	$0.00	$0.00
Total discounted benefits		$51.89

Reductions in Delays

This Project will be a benefit to motorists along the Front Range who currently experience frequent and/or long train delays. Relocation of coal trains will help reduce the delays created at crossings, especially during the morning and afternoon commutes. The value of time is assumed to be $10.40 per hour for vehicle travel and $18.06 per hour for truck drivers. Travel time savings are estimated based on the change in vehicle-hours of delay experienced by highway vehicles in segments with applicable crossings. The estimating equation of average daily delay time is given as follows:

*Vehicle Hrs of Delay = Highway Volume * Delay per Blocked Vehicle * Prob. of Being Blocked*

where:

Highway Volume	average annual daily traffic (AADT) across the grade crossing;
Delay per Blocked Vehicle	average wait time for a blocked vehicle, in hours;
Prob. of Being Blocked	probability that a vehicle arriving at the crossing is blocked.

Travel time savings are then estimated based on the annualized average costs of delay time of passenger vehicle, truck, and bus, in the following manner:

$TrTimeBenefits = Delay\ Costs_{nobuild} - Delay\ Costs_{build}$

where:

TrTimeBenefits	annual travel time savings in dollars
$Delay\ Costs_{nobuild}$	annual delay costs for no-build option
$Delay\ Costs_{build}$	annual delay costs for build option

The above benefit estimates include only the benefits accruing to existing users of the roadway network. Since the project would reduce the generalized cost of travel by car, an increase in highway traffic could be expected through induced demand.[1]

Table 5-6 shows the benefits of travel time savings and induced demand from reduced congestion. The total delay savings and induced demand under the Build Option is over $332 million for the period 2004 to 2030.

[1] The model assumes that bus and truck traffic in the region are not sensitive to changes in generalized travel cost from grade crossing improvements.

Table 5-6
Benefits of Travel Time Savings and Induced Demand, 2004-2030

Assumptions:
Value of time for auto travel = $10.40/hour
Value of truck driver time = $18.06/hour
Vehicle hrs of delay=highway volume*delay per blocked vehicle*prob. of being blocked
Travel time benefits = Delay costs of no build option - delay costs of build option

Rate of growth	2.00%
Discount rate	3.00%

	Travel time savings/yr	Discounted benefit	Induced Demand Benefits/yr	Discounted benefit
2004	$0.00	$0.00	$0.00	$0.00
2005	$0.00	$0.00	$0.00	$0.00
2006	$0.00	$0.00	$0.00	$0.00
2007	$0.00	$0.00	$0.00	$0.00
2008	$0.00	$0.00	$0.00	$0.00
2009	$0.00	$0.00	$0.00	$0.00
2010	$17.79	$14.90	$0.96	$0.80
2011	$18.45	$15.00	$0.98	$0.80
2012	$19.00	$15.00	$1.01	$0.80
2013	$19.70	$15.10	$1.04	$0.80
2014	$20.29	$15.10	$1.08	$0.80
2015	$20.90	$15.10	$1.11	$0.80
2016	$21.67	$15.20	$1.14	$0.80
2017	$22.32	$15.20	$1.17	$0.80
2018	$22.99	$15.20	$1.21	$0.80
2019	$23.68	$15.20	$1.25	$0.80
2020	$24.23	$15.10	$1.28	$0.80
2021	$24.96	$15.10	$1.32	$0.80
2022	$25.71	$15.10	$1.36	$0.80
2023	$26.48	$15.10	$1.40	$0.80
2024	$27.09	$15.00	$1.44	$0.80
2025	$27.90	$15.00	$1.49	$0.80
2026	$28.74	$15.00	$1.53	$0.80
2027	$29.41	$14.90	$1.58	$0.80
2028	$30.09	$14.80	$1.63	$0.80
2029	$30.99	$14.80	$1.68	$0.80
2030	$31.70	$14.70	$1.73	$0.80
Subtotal		$315.60		$16.80
Total benefits				$332.40

Emergency Vehicle Delay

The Build Option of this Project will allow for the reduction of a large number of through- moving freight trains out of the Front Range. These trains block at-grade road crossings, adding to commuters' travel times for commuters and interfering with the ability to respond to emergencies quickly and effectively. Although coordination efforts have improved over the years between emergency response teams and railroads, the reduction of extra rail traffic from the Front Range would improve the ability to respond more quickly to emergencies. The extent to which the reduction of rail traffic will help improve emergency response times was not quantified, but improvements can be expected.

The Build Option will adversely impact emergency response times in Eastern Colorado along the proposed new line and the existing lines experiencing greater levels of train traffic. These impacts will likely be experienced near the population centers along the line, including Limon, Aroya, Peoria, and Las Animas, though the extent of this impact will depend upon whether the more critical crossings are grade separated. Partially mitigating this impact is the potential for local emergency service providers to communicate with trains (and railroads) regarding emergencies and imminent needs for a clear crossing in these relatively rural areas. This cooperation in life threatening situations will assist in maintaining Eastern Colorado's emergency service capabilities in light of the increased train traffic.

Trucking Operations

Trucking operations and railroad services tend to operate in tandem. Both provide convenience and customers for the other, meeting together at intermodal facilities. With the implementation of this Project, it is not expected that there will be a negative impact on the trucking industry, however, it is expected that there will be a change to how the trucking industry in Colorado currently operates.

Relocation of the intermodal facilities as described as part of the Project will undoubtedly have an impact on local truck traffic patterns. The intermodal facilities under the Build Option of the Project are slated move to the eastern edges of the Denver metro area. Truck traffic that once visited intermodal facilities in the center of the metro region will navigate to the east under the Build Option. This change in intermodal locations equates into an increase in mileage for many hauls. Not only will the intermodal facilities change location, there is expected to be a change in operations at the new facilities. There are still many uncertainties related to the intermodal facilities, the businesses that will locate there, the economic growth connected to them, and the impacts these changes may have on the trucking industry.

Impacts to the trucking industry are also expected to be the result of economic development. This Project is anticipated to bring about new economic development to the Front Range and in Eastern Colorado. Along with economic development comes the need for transportation services. The trucking industry may see an increase in demand for trucks associated with the expected economic development. Increased demand for trucks would be an indirect benefit of the Project and economic development. The levels of demand increases are difficult to quantify with so many uncertainties in the extent to which economic development will occur.

The changes in trucking operation and the possible increase in demand for trucks from potential economic development in the Front Range may cause changes in wear and tear to the roadways in the Front Range area. The relocation of the intermodal facilities will likely change which roads are impacted by the wear and tear associated with freight traffic to intermodal facilities, but is assumed to have little net increase in the overall cost of maintenance of freight traffic wear and tear to roadways. Increases in numbers of trucks on the roadways as a result of economic development will, in fact, have additional maintenance costs for roadways associated with the increase. The extent to which there will be increases in roadway maintenance costs is unknown due to the uncertainties in the level of economic development the Project may bring to the Front Range and how much the economic development will result in an increase in demand for trucks.

This Project has the potential to cause a major commodity mode shift in grain transportation in Eastern Colorado in addition to impacts along the Front Range. The construction of this Project brings a north-south moving rail line to Eastern Colorado that was not previously present, allowing more grain to move by rail and increasing accessibility to southern markets. This shift in transportation modes could have an adverse impact on the trucking industry. However, evidence suggests that this impact will be relatively minor compared to the related benefits, if detected at all by the industry. The section titled "Benefits to Grain Producers" describes in greater detail the potential impacts of mode shifts in Eastern Colorado.

Economic Development and Land Use

Economic development and land use impacts of the Project will comprise significant portions of the overall benefit of the Project. Since these benefits will accrue to both private and public stakeholders, both are considered with equal weight in the analysis. Economic development benefits focus upon the net increase in economic activity generated by the project. Evidence of this increase in activity will be an increase in final demand for Colorado-based goods and services, which is analogous to an increase in Colorado's gross domestic product (GDP). This increase will result in new job creation in the directly effected businesses, plus new jobs in supporting and ancillary industries. It will also result in higher federal and local tax revenues through corporate taxes, income taxes from the newly created jobs, and other fiscal impacts.

Project related land use benefits are primarily related to redevelopment of urban rail yards in the Denver area that would be relocated from the inner city to the eastern portion of the metropolitan area. Although the development of passenger rail will certainly create land use and property value impacts, it has been assumed that passenger rail will develop the same with or without the Project.

It is recognized that all economic development and land use benefits may not be reimbursable. The benefits are spread over a potentially large number of industries and individuals, and developing cost sharing arrangements across such as diverse group would be problematic. However, since the purpose of this analysis is to comprehensively identify and estimate all Project benefits, regardless of whom they accrue to or where they occur, the economic benefits are addressed.

Measuring Economic Development and Land Use Benefits to the Private Sector

Due to the wide range of Western Colorado, Front Range, and Eastern Colorado industries that could be affected by the Project, measuring the private sector benefits is straightforward and not specific to any single industry. Overall, it is assumed that private sector benefits are represented by profit, and that a firm's profit can be adequately approximated as 10 percent of its gross revenue. Therefore, multiplying increases in gross revenues by 0.10 yields the profit, or benefit, accruing to the industry in question. Further, gross revenues are assumed equal to the change in final demand for the goods and services of the industry in question. For example, if the Project increases final demand for a commodity by $10 million per year, the benefit accruing to the business owner(s) is $1 million per year. The above method of estimating private sector economic development benefits is clearly imprecise and simplistic, yet yields credible order-of-magnitude benefit estimates for purposes of this study.

For estimating land redevelopment benefits, the benefit is approximated by the increase in value of the land in question. Therefore, if changing the land use from industrial to mixed use increases the market value of the property by, for example, $3.00 per square foot, this benefit accrues to the landowner.

Measuring Economic Development and Land Use Benefits to the Public Sector

The public sector economic benefits are expressed in terms of increases in employment and federal, state, and local tax revenues. Several commonly available economic models, such as the IMPLAN input-output model, use multipliers to relate final demand for goods and services to employment and tax revenue impacts. Therefore, by estimating the change in final demand for a given industry, a corresponding number of jobs are estimated to be created, and a corresponding level of tax revenues accrue to federal, state, and local governments. Similarly, if one estimates the number of jobs that might be created in an industry, the same relationships can be used to estimate the tax revenues and the change in final demand for goods and services for a given industry.

The IMPLAN input-output model was used to estimate the annual employment, earnings, and fiscal impacts associated with an increase in demand for Colorado goods and services. More specifically, four input-output models were developed: a Western Colorado model, a Front Range model, an Eastern Colorado model, and a statewide model. The model estimates the direct, indirect, and induced impacts to income and employment associated with a change in demand for a given commodity or service. These models are explained in greater detail in Appendix A of this Technical Memorandum.

For presentation purposes, the economic development and land use benefits are discussed in geographic order, from west to east.

Western Colorado Economic Development

The primary Western Colorado beneficiaries of rail improvements in Front Range and Eastern Colorado are the coal industry, the railroads hauling the coal, and communities' dependent upon the coal industry. Although other Western Slope industries will likely benefit from more efficient rail service to the east, the coal industry appears to have the most immediate and tangible potential for benefit. Historically, the train traffic bottleneck at Utah Junction and other inefficiencies in east-west train movement through Denver, have constrained coal trains moving from Western Colorado mines for shipment to power plants east and south of Colorado. Based on increasing long-term demand for low sulfur coal for use in power plants, relief from this congestion will increase the market for Western Colorado coal and increase mining output in the western portion of the State.

It should be noted that the coal mining and the coal transportation industries are quite competitive. As a result, it is uncertain how each industry will react to additional rail capacity. However, it appears nearly certain that the Project will result in an incremental increase in Western Colorado coal production. This increase in production will result in additional jobs in mining and its support industries. These new wages will induce additional economic growth and also generate tax revenues to the Federal, State, and local governments. In addition, the increase in coal mining will increase State severance taxes.

Assumptions

The potential increase in coal mining is highly uncertain and ultimately dependent upon the complex demand and supply relationships characterizing the industry. Price may also change depending on how supply and demand curves shift. Lacking this detailed information, a range of potential impacts is alternatively developed. Three scenarios describe this range:

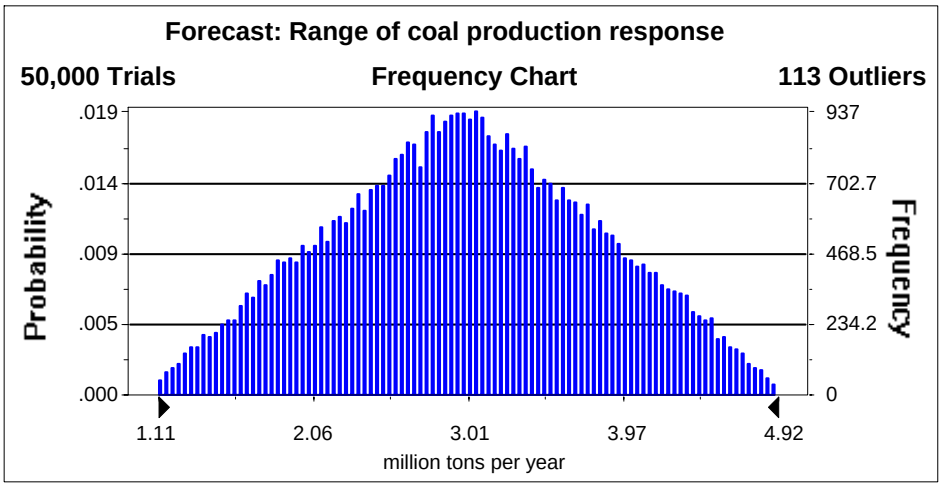
Low scenario: an additional 1.0 million tons of Western Colorado coal can be marketed outside of the State each year. This represents a 3 percent increase in total Colorado coal production, equating to about 2 additional coal trains per week passing through Utah Junction. Based on an average price of $20 per ton, this equates to a $20 million increase in demand for Colorado coal.

Midrange scenario: an additional 3.0 million tons of Western Colorado coal can be marketed outside of the State, representing a 10 percent increase in Colorado coal production. These equates to about 6 trains per week and a value of $60 million per year.

High scenario: an additional 5.0 million tons of Western Colorado coal can be marketed outside of the State, representing a 17 percent increase in Colorado coal production. This equates to about 10 trains per week and a value of about $100 million per year.

Regardless of the scenario considered, it is assumed that the increase in coal production occurs as a near-term jump in production, and grows at a rate of 2 percent per year thereafter.

The range of additional tonnage considered and the relative probabilities that are assumed to be associated with each are shown in the following graphic:



Though Colorado coal representatives were consulted regarding this range of possible impacts, either through the Technical Advisory Committee (TAC) or other contacts, these scenarios were independently developed by the consultant. The estimates of the amounts of coal likely to be shipped from Western Colorado coal mines resulting from this Project are subject to change based on uncertainties regarding future market conditions, environmental regulations, and pricing of competitive energy sources.

Results

The results of the input-output analysis are shown in Table 5-7. The low scenario, representing a 3 percent increase in total coal production, is estimated to create a total of 186 jobs across the State, consisting of 164 jobs in Western Colorado communities and 22 jobs in other portions of Colorado. Of these jobs, approximately 69 are relatively high paying mining jobs. These jobs translate to an approximately $9.5 million per year increase in total wage earnings within the state, under the low scenario. Further, these increases in economic activity account for an estimated $2.74 million in federal tax generation, plus $3.24 million in tax revenues accruing to the State of Colorado and the local jurisdictions.

The low scenario results can be proportionately increased to estimate the results for the midrange and high coal demand scenarios. These results are also shown in Table 5-7.

Table 5-8 shows the private sector benefits over the period 2004 to 2030. These benefits begin in approximately 2006 and grow at a rate of 2 percent per year throughout the period of analysis. The future costs are discounted back to 2004 dollars at a 3 percent rate. The sum of the discounted benefits represents the net present value of the future private benefits.

Table 5-7
Impacts to the Coal Industry in Western Colorado

	Low Scenario	Midrange Scenario	High Scenario
Increase in annual coal production (1 mil tons)	**1.00**	**3.00**	**5.00**
Value of coal ($/ton)	$20.00	$20.00	$20.00
Value of increased coal production (mil/year)	$20.00	$60.00	$100.00
Approximate private industry benefit ($1 mil/year)	$2.00	$6.00	$10.00
Colorado employment and earnings impacts			
Impacts to Western Colorado			
Mining jobs	68	204	340
Other jobs	96	288	480
Total job creation	164	492	820
Wage earnings associated with these jobs ($1 mil/yea	$7.70	$23.10	$38.50
Impacts to the Remainder of Colorado			
Mining jobs	-	-	-
Other jobs	22	66	110
Total job creation	22	66	110
Wage earnings associated with these jobs ($1 mil/yea	$1.80	$5.40	$9.00
Total Colorado impacts			
Mining jobs	68	204	340
Other jobs	118	354	590
Total job creation	186	558	930
Wage earnings associated with these jobs ($1 mil/yea	$9.50	$28.50	$47.50
Tax impacts			
Federal taxes			
Personal income tax	$ 1.09	$ 3.27	$ 5.45
Social Sec. Tax	$ 0.90	$ 2.70	$ 4.50
Corporate profits tax	$ 0.23	$ 0.70	$ 1.16
Indirect business taxes	$ 0.52	$ 1.55	$ 2.58
Subtotal increase in federal taxes (million/year)	$ 2.74	$ 8.21	$ 13.69
State and local taxes			
Personal income tax	$ 0.22	$ 0.66	$ 1.10
Other personal taxes	$ 0.05	$ 0.15	$ 0.25
Social Sec. Tax	$ 0.01	$ 0.04	$ 0.07
Indirect business taxes (inc. sales tax)	$ 2.36	$ 7.08	$ 11.81
Coal severance tax ($0.60/ton)	$ 0.60	$ 1.80	$ 3.00
Subtotal increase in Colorado tax revenues (million/y	$ 3.24	$ 9.73	$ 16.22

Table 5-8
Total Benefits From Increased Coal Mining, 2004-2030

Rate of growth	2.00%
Discount rate	3.00%

	Low		Midrange		High	
	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits
2004	-	-	-	-	-	-
2005	-	-	-	-	-	-
2006	-	-	-	-	-	-
2007	$2.00	1.83	$6.00	5.49	$10.00	9.15
2008	$2.04	$1.81	$6.12	$5.44	$10.20	$9.06
2009	$2.08	$1.79	$6.24	$5.38	$10.40	$8.97
2010	$2.12	$1.78	$6.37	$5.33	$10.61	$8.89
2011	$2.16	$1.76	$6.49	$5.28	$10.82	$8.80
2012	$2.21	$1.74	$6.62	$5.23	$11.04	$8.72
2013	$2.25	$1.73	$6.76	$5.18	$11.26	$8.63
2014	$2.30	$1.71	$6.89	$5.13	$11.49	$8.55
2015	$2.34	$1.69	$7.03	$5.08	$11.72	$8.46
2016	$2.39	$1.68	$7.17	$5.03	$11.95	$8.38
2017	$2.44	$1.66	$7.31	$4.98	$12.19	$8.30
2018	$2.49	$1.64	$7.46	$4.93	$12.43	$8.22
2019	$2.54	$1.63	$7.61	$4.88	$12.68	$8.14
2020	$2.59	$1.61	$7.76	$4.84	$12.94	$8.06
2021	$2.64	$1.60	$7.92	$4.79	$13.19	$7.98
2022	$2.69	$1.58	$8.08	$4.74	$13.46	$7.91
2023	$2.75	$1.57	$8.24	$4.70	$13.73	$7.83
2024	$2.80	$1.55	$8.40	$4.65	$14.00	$7.75
2025	$2.86	$1.54	$8.57	$4.61	$14.28	$7.68
2026	$2.91	$1.52	$8.74	$4.56	$14.57	$7.60
2027	$2.97	$1.51	$8.92	$4.52	$14.86	$7.53
2028	$3.03	$1.49	$9.09	$4.47	$15.16	$7.46
2029	$3.09	$1.48	$9.28	$4.43	$15.46	$7.38
2030	$3.15	$1.46	$9.46	$4.39	$15.77	$7.31
Total discounted benefits		$39.35		$118.06		$196.77

Uncertainty parameters:		
Low benefit estimate	$39.35	
Midrange benefit estimate	$118.06	$118.06
High benefit estimate	$196.77	

Front Range Economic Development

Any estimate describing the increased level of Front Range economic development afforded by the Project would be highly uncertain but potentially large. A large component of this increase would stem from development of the new intermodal facilities planned at the TransPort site (UP) and at Irondale (BNSF), both located east of Denver along I-70 and I-76, respectively. These facilities have the potential to relieve what many believe to be a capacity-constrained intermodal system in the Denver area. Although data was not available to measure the extent to which capacity has been constraining intermodal activities, the land area containing the current facilities, including UP's Pullman Yard (at 40th and York) and BNSF's Denver Intermodal Yard, is physically limited and located in a highly developed urban setting. Despite being located near the intersection of I-25 and I-70, there are significant access problems and traffic congestion at these sites. Further, the sites are distant from the metropolitan area's modern-day industrial centers most likely to use intermodal opportunities, and the sites are also distant from DIA and the regional airports.

In addition to simply relieving the capacity constraint, the size, location, and planned developments in proximity to the new intermodal facilities have the potential to significantly increase regional commerce. These areas will be the Front Range's only major convergence of three modes of transporting commerce: highway, rail, and air cargo. The TransPort site is an example of how these resources could combine to create a measurable net increase in regional commerce.

TransPort is a private development modeled after the "Alliance*Texas" facility located between Dallas and Fort Worth, Texas. The Alliance is a master-planned development combining major business parks and distribution centers, incorporating all modes of transportation: highway (I-35W and other local freeways), rail (BNSF and UP), and the Alliance Texas Airport dedicated solely to the facility. It incorporates the latest in technological innovation to facilitate efficient and just-in-time transportation of both domestic and imported commodities. Since 1989, Alliance has evolved into an economic force, creating more approximately 18,000 to 20,000 jobs and signing on numerous new and long-established companies – including more than 30 Fortune 500 corporations.[2] Although the number of jobs coming from within the region versus outside the region is uncertain, it appears highly probable that the vast majority were new jobs to the region.

With the Project's contribution to improved regional rail capacity, the developers of the TransPort facility are confident that the Alliance model will work as effectively in the Front Range as it has in Dallas-Fort Worth. They cite many similar conditions and transportation needs. This facility is adjacent to the UP's east-west main line and will contain UP's new intermodal facility on a portion of its complex. The facility is also adjacent to DIA and to the rapidly growing Front Range Airport, the latter of which will likely experience substantial increase in air cargo traffic over time. The combination of the new intermodal facility located at the TransPort site and the increased rail mobility throughout Colorado should contribute to generating a significant increase in regional economic activity.

Although there is less data to describe any plans the BNSF may have to replace its current facilities, it is reasonable to assume that they have plans of similar scale as UP's with respect to the role of their new facilities in the regional economy. Additionally, the relocation of the Denver facilities would most likely be east out of the urban center, which could lead to a site that is in close proximity to Denver International Airport and the Front Range Airport.

[2] Hunt, Harold D. "Alliance" *Tierra Grande*, Texas A&M Real Estate Center Journal. No. 1525. October, 2001. Numerous press releases from the Alliance were also utilized.

Assumptions

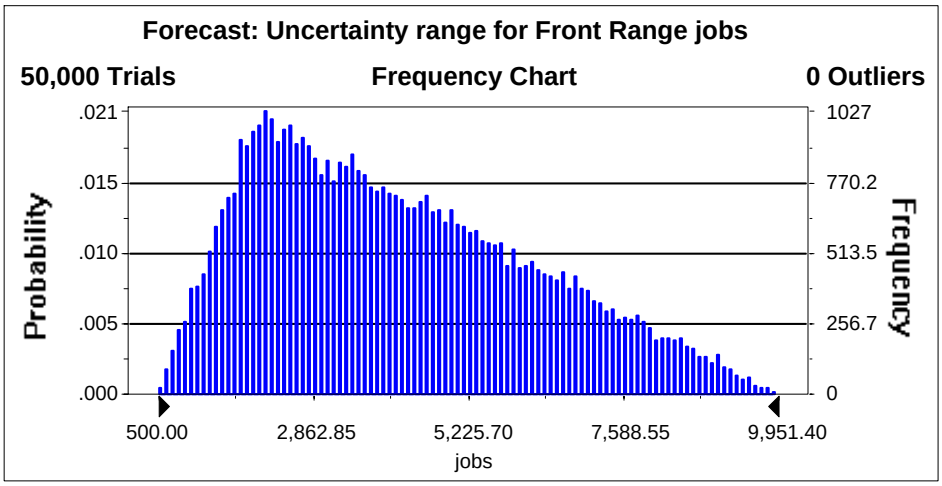
As previously mentioned, there are substantial uncertainties associated with the level of Project-driven economic development. Therefore, similar to the approach used for Western Colorado coal production, a plausible range of potential economic development impacts were developed and evaluated.

- Low Scenario: Under this scenario it is assumed that 500 new jobs are created in the various industries along the Front Range. The jobs are distributed across several industries, including warehousing and distribution facilities (30% of the assumed jobs), light manufacturing (30%), heavy manufacturing (10%), and various other categories (30%, collectively). It is further assumed that these jobs are phased-in over a 10-year period of time. The estimate of total jobs represents the mid-point of possible Low Scenario estimates discussed with representatives of TransPort.

- Midrange Scenario: The midrange scenario assumes that approximately 2,000 jobs are created over a 10-year period. These jobs are distributed across the same industries in the same proportions as assumed for the Low Scenario. This number of new jobs appears plausible in light of the Alliance experience in Texas; this estimate is approximately 11 percent of the number of jobs created by the Alliance facility.

- High Scenario: This scenario assumes that 10,000 new jobs are attributable to the project, distributed across the various industries described under the Low Scenario. This assumes that the combination of the TransPort facility, the Irondale facility, and other increases in Front Range rail efficiency will create slightly over half of the jobs created by the Alliance facility.

The following graphic illustrates the range of job increase considered and the assumed probabilities of each.



Using the IMPLAN input-output model (see Appendix A), these jobs were placed in the appropriate industrial categories to estimate: the change in final demand for goods and services implied by this employment increase; the number of indirect and induced jobs created; the Federal and state tax implications.

Results

The results of the input-output analysis are shown in Table 5-9. The low scenario shows that creation of 500 new jobs in these industries would ultimately increase the final demand for Colorado goods and services by about $88 million per year, contributing to private sector returns of about $8.8 million per year.

Approximately 850 jobs would be created statewide in the low scenario. It is assumed that 500 of these jobs would be created, with approximately 340 additional jobs in supporting and ancillary industries being created in the Denver area, and an additional 10 supporting jobs being created in the remainder of the State. The total annual earnings associated with these jobs are approximately $36 million per year.

The increase in final demand, jobs, and earnings increases federal and state tax revenues. Annual federal tax revenues of $9.5 million are associated with the low scenario; corresponding state and local taxes revenues total approximately $3.6 million per year.

Results for the midrange and high scenarios are proportionate to the number of jobs created, as shown in Table 5-9. Table 5-10 shows the private sector benefits over the period 2004 to 2030. These benefits begin in approximately 2006 and are phased-in over a 10-year period. Beyond the 10-year period, the benefits grow at a rate of 2 percent per year for the remainder of the analysis. The future costs are discounted back to 2004 dollars at a rate of 3 percent. The sum of the discounted benefits represents the net present value of the future private benefits.

Table 5-9
Impacts to Front Range Economic Development

	Low Scenario	Midrange Scenario	High Scenario
Assumptions:			
Number of new jobs created, consisting of:	**500**	**2,000**	**10,000**
10% Heavy manufacturing	50	200	1,000
30% Other manufacturing	150	600	3,000
30% Warehouse and distribution facilities	150	600	3,000
30% Other jobs	150	600	3,000
Jobs are assumed phased-in over the 10-year period 2006-2015			
Increase in annual Final Demand for Front Range goods and services	$88.0	$352.0	$1,760.0
Approximate benefit to private industry (assumed to be 10% of pre-tax reve	$8.8	$35.2	$176.0
Employment and earnings impacts			
Impacts to the Front Range			
Direct jobs	500	2,000	10,000
Indirect and induced jobs	340	1,360	6,800
Total job creation	840	3,360	16,800
Wage earnings associated with these jobs ($1 mil/year)	$36.0	$144.0	$720.0
Impacts to the Remainder of Colorado			
Direct jobs	-	-	-
Indirect and induced jobs	10	40	200
Total job creation	10	40	200
Wage earnings associated with these jobs ($1 mil/year)	$0.00	$0.00	$0.00
Total Colorado impacts			
Direct jobs	500	2,000	10,000
Indirect and induced jobs	350	1,400	7,000
Total job creation	850	3,400	17,000
Wage earnings associated with these jobs ($1 mil/year)	$36.0	$144.0	$720.0
Tax impacts			
Federal taxes			
Personal tax	$4.5	$18.0	$90.0
Social sec. tax	$4.0	$16.0	$80.0
Corporate profits tax	$0.5	$2.0	$10.0
Indirect business taxes	$0.5	$2.0	$10.0
Subtotal increase in federal taxes (million/year)	$9.5	$38.0	$190.0
State and local taxes			
Personal tax	$1.0	$4.0	$20.0
Social Sec. Tax	$0.1	$0.2	$1.0
Indirect business taxes (inc. sales tax)	$2.5	$10.0	$50.0
Subtotal increase in Colorado tax revenues (million/year)	$3.6	$14.2	$71.0

Table 5-10
Private Benefits from Front Range Economic Development, 2004-2030

Rate of growth 2.00%
Discount rate 3.00%

	Low		Midrange		High	
	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits
2004	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2006	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007	$0.88	$0.81	$3.52	$3.22	$17.60	$16.11
2008	$1.76	$1.56	$7.04	$6.25	$35.20	$31.27
2009	$2.64	$2.28	$10.56	$9.11	$52.80	$45.55
2010	$3.52	$2.95	$14.08	$11.79	$70.40	$58.96
2011	$4.40	$3.58	$17.60	$14.31	$88.00	$71.55
2012	$5.28	$4.17	$21.12	$16.67	$105.60	$83.36
2013	$6.16	$4.72	$24.64	$18.88	$123.20	$94.42
2014	$7.04	$5.24	$28.16	$20.95	$140.80	$104.77
2015	$7.92	$5.72	$31.68	$22.89	$158.40	$114.43
2016	$8.80	$6.17	$35.20	$24.69	$176.00	$123.44
2017	$8.98	$6.11	$35.90	$24.45	$179.52	$122.24
2018	$9.16	$6.05	$36.62	$24.21	$183.11	$121.06
2019	$9.34	$5.99	$37.35	$23.98	$186.77	$119.88
2020	$9.53	$5.94	$38.10	$23.74	$190.51	$118.72
2021	$9.72	$5.88	$38.86	$23.51	$194.32	$117.57
2022	$9.91	$5.82	$39.64	$23.28	$198.20	$116.42
2023	$10.11	$5.76	$40.43	$23.06	$202.17	$115.29
2024	$10.31	$5.71	$41.24	$22.83	$206.21	$114.17
2025	$10.52	$5.65	$42.07	$22.61	$210.34	$113.07
2026	$10.73	$5.60	$42.91	$22.39	$214.54	$111.97
2027	$10.94	$5.54	$43.77	$22.18	$218.83	$110.88
2028	$11.16	$5.49	$44.64	$21.96	$223.21	$109.80
2029	$11.38	$5.44	$45.53	$21.75	$227.67	$108.74
2030	$11.61	$5.38	$46.45	$21.54	$232.23	$107.68
Total discounted benefits		$117.57		$470.27		$2,351.37

Uncertainty parameters:

Low benefit estimate	$117.57
Midrange benefit estimate	$470.27
High benefit estimate	$2,351.37

Urban Land Redevelopment

The Project and the new intermodal facilities included within it will eliminate the need for several rail yards in the Front Range corridor. Most of these yards are near downtown Denver and potentially represent, if free of environmental restrictions, valuable tracts of re-developable land. Based on the construction of residential lofts near the south side of the facility and other redevelopment activities in the area, this redevelopment of the Pullman Yard appears highly plausible in the near future. In addition, the Burnham Yard, located along the Santa Fe corridor north of Alameda, also appears to have mixed use re-development potential.

Several other rail yards in the area have redevelopment potential. Although given their location within the City and their proximity to railroad tracks and associated noise, redevelopment would likely result in their continuing to be industrial sites. However, it is likely that some property value impacts would occur as the property transfers ownership.

This redevelopment generates two categories of impacts: (1) capital gains to the owners of the properties as they convert to a higher economic land use; (2) property tax impacts to the local government associated with increased valuation and higher property tax revenues. The former impact will likely accrue to the private sector (or public sector if CDOT or another agency acquires title to the properties), while the latter impact accrues to the local government.

Table 5-11 identifies rail yards that will likely be transferred out of railroad ownership with the completion of the Project. Associated with each yard is an estimate of the land area in question, its current land use, its current value per square foot, and overall current value. The current property values are those shown by the Denver County Assessor and represent the value from which the railroads are taxed.[3]

The middle portion of Table 5-11 contains assumptions about how this land may redevelop, including potential land use, estimated value per square foot, and revised values. The final portion of the table summarizes the one-time capital gain to the landowner and the property tax impact. Based on the assumptions shown, there is a one-time capital gain of approximately $31.9 million and an increase in annual property tax revenues of about $0.59 million per year.

> *It should be noted that the above calculations do not explicitly address potential environmental clean-up costs associated with the long-time railroad properties. A more detailed analysis would address this issue. Although there are no obvious contaminants present at these facilities, a Phase I evaluation of the hazards was not conducted. Further, the wide range of uncertainty surrounding the pre- and post-Project land values is also noted. Although these land value estimates adequately approximate the net increase in value on an order-of-magnitude basis, additional research on the volumes and location of developable properties in these areas of Denver is recommended.*

[3] Although railroad property is labeled as tax-exempt in the Denver and Arapahoe County assessors' databases, railroads indeed pay property tax. The taxable value and assessment are determined at the State level but administered at the County level.

Table 5-11
Urban Land Redevelopment

Tax rate (mils)	64.2
Ratio of assessed value to market value	29%

Railroad Yard	Approximate Area (acres)	Current Land Use	Estimated Value, $ per square foot	Current Value	Future Land Use	Estimated Value, $ per square foot	Revised Value	One Time Capital Gain	Local Property Tax Revenue, existing land use	Local Property Tax revenue, future land use	Increase in annual tax revenue
UP Pullmand Yard, 40th &York	68	Industrial	$ 2.30	$ 6,812,784	Mixed	$ 6.50	$ 19,253,520	$ 12,440,736	$ 126,840	$ 358,462	$ 231,622
UP Rolla	120	Industrial	$ 2.30	$ 12,022,560	Industrial	$ 3.00	$ 15,681,600	$ 3,659,040	$ 223,836	$ 291,960	$ 68,124
UP 36th and Wazee	30	Industrial	$ 2.30	$ 3,005,640	Industrial	$ 3.00	$ 3,920,400	$ 914,760	$ 55,959	$ 72,990	$ 17,031
UP Burnham	60	Industrial	$ 2.30	$ 6,011,280	Mixed	$ 6.00	$ 15,681,600	$ 9,670,320	$ 111,918	$ 291,960	$ 180,042
BN TOFC	55	Industrial	$ 2.30	$ 5,510,340	Industrial	$ 3.00	$ 7,187,400	$ 1,677,060	$ 102,592	$ 133,815	$ 31,224
BN Rennick	117	Industrial	$ 2.30	$ 11,721,996	Industrial	$ 3.00	$ 15,289,560	$ 3,567,564	$ 218,240	$ 284,661	$ 66,421
	450			$ 45,084,600			$ 77,014,080	$ 31,929,480	$ 839,385	$ 1,433,848	$ 594,463

Eastern Colorado Economic Development

Two types of economic benefits are considered for Eastern Colorado: (1) economic development benefits similar to those described for Western Colorado and the Front Range; and (2) benefits to the agricultural industry resulting from greater transportation efficiencies and overall lower grain shipping costs. The following two sections address each of these issues, respectively.

New Economic Growth from Better Rail Access

Estimating new economic growth in Eastern Colorado attributable to the Project has a speculative component similar to that of the Front Range. However, unlike the Front Range, there is a less diversified economy and the lack of a development model, such as the Alliance, to follow. Therefore, estimates of potential economic development were formed through a series of interviews with Eastern Colorado representatives. Those interviewed, and summaries of each interview, are included in Appendix B.

The interviews indicated that new economic development would likely be expansion or enhancements of industries already present in the region, including agricultural processing, animal slaughter, and light manufacturing. Further, these benefits would likely take some time to fully develop, possibly as long as 5 to 10 years. All those interviewed saw the Project as a benefit to the region without any downside risk. They did not see any negative impacts to the regions or specific industries possibly impacted by the Project, such as trucking.

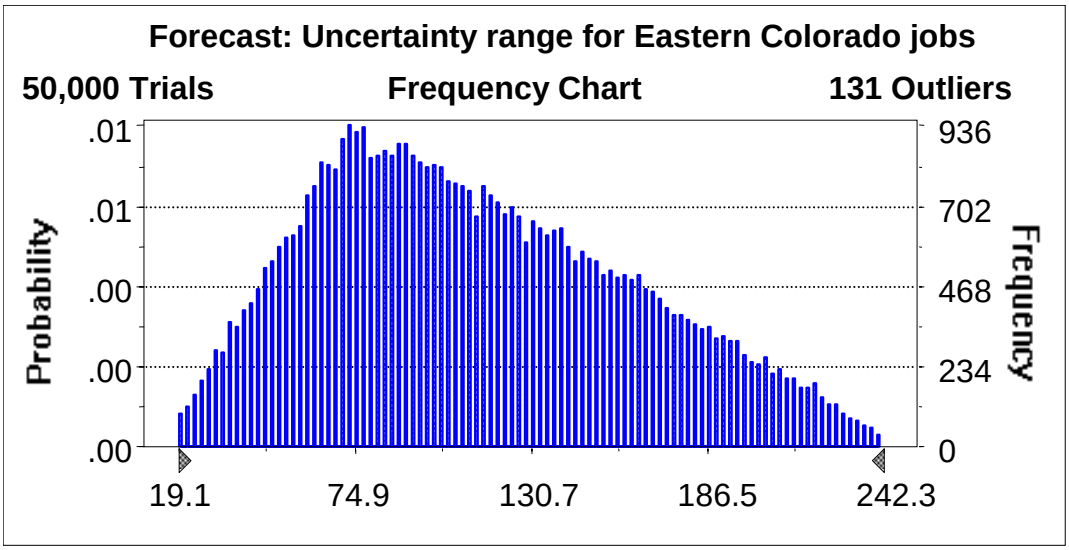
Assumptions

Low Scenario. It is assumed that the project can generate approximately 15 jobs in various industries in Eastern Colorado. The industries in which these jobs lie include heavy manufacturing (10%), wholesale trade (16%), flour milling (11%), animal food manufacturing (16%), animal slaughter (17%), and a range of other industries (30%).

Midrange Scenario. It is assumed that the Project will create approximately 75 jobs in Eastern Colorado, distributed across industries in the same manner as the Low Scenario.

High Scenario. Approximately 250 jobs are assumed directly created by the Project in Eastern Colorado. They are also distributed across industries in the same manner as the Low Scenario.

The following graphic summarizes the range of base job creation considered and the probabilities assigned to each.



Results

The creation of 15 new jobs in Eastern Colorado in the low scenario generates approximately 42 additional jobs in the region and State. This is shown in Table 5-12. About 21 of the additional jobs in support and ancillary industries are created in Eastern Colorado, with approximately 21 additional support jobs created in the remainder of the State. These jobs generate a total annual wage earning of approximately $2.0 million.

The increase in final demand and private proprietors' profits implied by the low scenario level of job creation is $5.2 million per year and $0.52 million per year, respectively. Approximately $0.2 million in additional tax revenues are also generated for both the State and the Federal government.

The results for the midrange and high scenarios are proportionate to those for the low scenario.

Table 5-13 shows how these benefits are allocated over time. As previously mentioned, the benefits are phased-in over a 5-year period, after which the benefits are assumed to grow at a rate of 2 percent per year.

Table 5-12
Impacts to Eastern Colorado Economic Development

	Low Scenario	Midrange Scenario	High Scenario
Assumptions:			
Number of new jobs created, consisting of:	15	75	250
10% Heavy manufacturing	2	8	25
16% Wholesale Trade	2	12	40
30% Other jobs	5	23	75
11% Flour Milling	2	8	28
16% Animal Food Manufacturing	2	12	40
17% Animal Slaughter	3	13	43
Jobs are assumed phased-in over the 5-year period 2009-2013			
Increase in annual Final Demand for Front Range goods and services	$5.2	$26.0	$86.8
Approximate benefit to private industry	$0.52	$2.60	$8.68
Employment and earnings impacts			
Impacts to Eastern Colorado			
Direct jobs	15	75	250
Indirect and induced jobs	21	104	345
Total job creation	36	179	595
Wage earnings associated with these jobs ($1 mil/year)	$0.8	$4.0	$13.3
Impacts to the Remainder of Colorado			
Direct jobs	-	-	-
Indirect and induced jobs	21	104	345
Total job creation	21	104	345
Wage earnings associated with these jobs ($1 mil/year)	$1.2	$5.9	$19.5
Total Colorado impacts			
Direct jobs	15	75	250
Indirect and induced jobs	41	207	690
Total job creation	56	282	940
Wage earnings associated with these jobs ($1 mil/year)	$2.0	$9.8	$32.8
Tax impacts			
Federal taxes			
Personal tax	$0.1	$0.5	$1.5
Social sec. tax	$0.1	$0.4	$1.3
Corporate profits tax	$0.0	$0.0	$0.1
Indirect business taxes	$0.0	$0.1	$0.3
Subtotal increase in federal taxes (million/year)	$0.2	$0.9	$3.1
State and local taxes			
Personal tax	$0.0	$0.2	$0.5
Social Sec. Tax	$0.0	$0.0	$0.1
Indirect business taxes (inc. sales tax)	$0.1	$0.6	$2.0
Subtotal increase in Colorado tax revenues (million/year)	$0.2	$0.8	$2.6

Table 5-13
Private Benefits from Eastern Colorado, 2004-2030

Rate of growth	2.00%
Discount rate	3.00%

	Low		Midrange		High	
	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits
2004	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2006	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2008	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2009	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2010	$0.10	$0.09	$0.52	$0.44	$1.74	$1.45
2011	$0.21	$0.17	$1.04	$0.85	$3.47	$2.82
2012	$0.31	$0.25	$1.56	$1.23	$5.21	$4.11
2013	$0.42	$0.32	$2.08	$1.60	$6.94	$5.32
2014	$0.52	$0.39	$2.60	$1.94	$8.68	$6.46
2015	$0.53	$0.38	$2.65	$1.92	$8.85	$6.39
2016	$0.54	$0.38	$2.71	$1.90	$9.03	$6.33
2017	$0.55	$0.38	$2.76	$1.88	$9.21	$6.27
2018	$0.56	$0.37	$2.82	$1.86	$9.39	$6.21
2019	$0.57	$0.37	$2.87	$1.84	$9.58	$6.15
2020	$0.59	$0.37	$2.93	$1.83	$9.77	$6.09
2021	$0.60	$0.36	$2.99	$1.81	$9.96	$6.03
2022	$0.61	$0.36	$3.05	$1.79	$10.16	$5.97
2023	$0.62	$0.35	$3.11	$1.77	$10.37	$5.91
2024	$0.63	$0.35	$3.17	$1.76	$10.57	$5.85
2025	$0.65	$0.35	$3.24	$1.74	$10.79	$5.80
2026	$0.66	$0.34	$3.30	$1.72	$11.00	$5.74
2027	$0.67	$0.34	$3.37	$1.71	$11.22	$5.69
2028	$0.69	$0.34	$3.43	$1.69	$11.45	$5.63
2029	$0.70	$0.33	$3.50	$1.67	$11.68	$5.58
2030	$0.71	$0.33	$3.57	$1.66	$11.91	$5.52
Total discounted benefits		$6.92		$34.59		$115.31

Uncertainty parameters:

Low benefit estimate	$6.92	
Midrange benefit estimat	$34.59	$34.59
High benefit estimate	$115.31	

Benefits to Grain Producers

There are several factors that inhibit grain movement from northeastern Colorado counties south to markets in southern Colorado, Texas, and Mexico. In Eastern Colorado, there are several railroads that run in an east-west fashion, but none that run in a north-south direction across the length of the state. Therefore, before moving south, trains must move west into the crowded Denver area and then south, or east into Kansas City and then south. The added movement in unwanted directions adds time to grain deliveries, limits access to some markets, equates to higher transportation costs and increases the turnaround time on needed railroad equipment for future deliveries.

When transporting grain within the United States there are three options: truck, rail or barge. In Eastern Colorado there are only two options, truck and rail. Because acquiring rail equipment is time consuming and unreliable, truck transportation is the only alternative. It is well known in the grain industry that transporting large volumes by rail is much more cost effective than shipping the same amount of grain by truck, and cost savings result in increased revenues. Because northeastern Colorado is a major wheat and corn producing area, there will be some advantage to adding north-south moving rail traffic on which to ship grain. There also may be advantages to through moving trains transporting grain from northern states to Texas or the Gulf of Mexico. A more direct route will reduce mileage and remove congested areas, such as in Denver, from the route.

Twelve northeastern Colorado counties currently have an annual average production of approximately 58 million bushels of wheat and 89 million bushels of corn: Adams, Arapahoe, Elbert, Kit Carson, Lincoln, Logan, Morgan, Phillips, Sedgwick, Washington, Weld, and Yuma. Currently approximately 89 percent of this grain is moved on trucks and 11% transported by rail.[4]

Methods and Assumptions

To calculate the benefits to grain shippers in Eastern Colorado, some assumptions were made to estimate cost savings in grain transport, reductions in highway repair associated with hauling grain by truck, and the amount of grain that would be transferred from truck to rail. Associated with this transfer is a level of saving based on average costs per bushel, train capacities and truck capacities. Listed below are the major assumptions. A more detailed explanation of methods and assumptions can be found in Appendix C.

The potential transfer of grain from truck to rail is uncertain. For analysis purposes, a reasonable range of potential impacts were developed and described by three scenarios:

- Low scenario: an additional 0.5 trains per week (26 trains per year) carrying wheat and corn. This increase equates into a 29% increase in Eastern Colorado rail grain, and 14% of total production being moved by rail.
- Midrange scenario: an additional 1 train per week (52 trains per year) carrying wheat and corn. This increase equates into a 57% increase in Eastern Colorado rail grain, and 17% of total production being moved by rail.
- High scenario: an additional 2.0 trains per week (104 trains per year) carrying wheat and corn. This increase equates into a 115% increase in Eastern Colorado rail grain, and 24% of total production being moved by rail.

[4] Current distribution rates between rail and truck are from TranStats Commodity Flow Survey.

The three scenarios and associated assumptions are summarized in Table 5-14 under the "High, Midrange, and Low Assumptions."

Results

Reduction in Shipping Costs

With an approximate savings of 2.5 cents per mile by shipping on rail rather than by truck, producers in eastern Colorado will see some cost savings. Table 5-15 presents the calculations made to account for the annual grain transportation cost savings for each scenario. For the low scenario, the cost savings is approximately $550,000 per year. Over a twenty-year period this amounts to $7.3 million (in 2004 dollars). For the midrange scenario an average annual savings of approximately $1.1 million is estimated, resulting in a savings of $14.4 million (in 2004 dollars) over twenty years. With the high range, cost savings estimates amount to $2.2 million per year or $28.9 million over twenty years (in 2004 dollars). Scenario summaries are also included in Table 5-14 under the headings "Annual Savings in 2004 Dollars" and "Total Savings in 2004 Dollars from 2010 to 2030." Table 5-16 shows how these benefits are allocated over time.

Highway Maintenance

Transferring from truck transportation to rail transportation will result in changes in the number of grain trucks on the highways, which, in turn, can result in reduced maintenance needs to the highways and tax savings. Fewer grain trucks on the roads also means the collection of less diesel fuel taxes from grain hauling activities, but the maintenance cost savings counterbalance the reduction in tax revenues from truck transportation of grain.

The net savings (maintenance cost savings minus lost fuel tax revenues from grain hauling) in highway maintenance for the low scenario is approximately $400,000 per year. For the midrange scenario, savings reach $750,000 annually, and for the high scenario savings per year reach over $1.5 million. Over twenty years these highway maintenance savings amount to $5.1 million, $10 million, and $20 million (all in 2004 dollars) for the low, midrange, and high scenarios, respectively. These net highway maintenance savings are shown in Table 5-14 and allocated over time in Table 5-16.

It should be noted that although highway maintenance costs are considered here, they are not considered in other economic development components of this analysis. For instance, there may be significant but non-quantified increases in trucking activities associated with increased levels of economic commerce in the Front Range. These increases may lead to accelerated depreciation of Front Range roadways. They are considered for this Eastern Colorado region because they can more readily be quantified because of estimates of changes in truck numbers, and they comprise a significant portion of wear and tear on Eastern Colorado rural roadways.

Trucking Industry

It is not anticipated that very many, if any, truck jobs will be lost with the transfer of grain from truck to rail. Many of the truckers in eastern Colorado are owner-operators with one or two trucks such as farmers. Temporary displacements may occur initially, but the trucks will soon be redeployed somewhere else to be used for other purposes. The expected number of grain trucks replaced by rail for all scenarios is less than the standard deviation in number of grain trucks needed each year as production varies.

Grain production varies from year to year depending on the weather, yields, and other production factors. The number of trucks needed in any given year could deviate from the mean number of trucks needed by as many as 43,470 trucks. Table 5-14, heading "Truck Deviations Based on Cyclical Production Changes vs. Estimated Reduction in Trucks," shows the number of trucks being removed from the highways for each scenario compared to the standard deviation number of trucks.

Increased Tax Revenues

The cost savings created from shipping grain by rail instead of by truck would increase the operating revenues of the farm operations. This, consequently, would increase tax revenues to the State of Colorado and to the Federal government. The average net farm income for Colorado falls in the second federal tax bracket with a tax rate of 15%. The income tax rate for the State of Colorado is 4.63% for all income levels. Table 5-14, heading "Income Tax Revenues," summarizes the tax revenue gains for the state government and the federal government as a result of shipping cost reductions.

For the low scenario, Colorado can expect to gain additional income tax revenues of approximately $25,500, and the federal government will achieve almost $82,700 more in tax revenues. An extra $50,300 in tax revenues will be gained by the State in the midrange scenario, while the federal government will add an extra $162,800. The federal government will collect a supplementary $325,600 in the high scenario, and the State of Colorado will receive approximately $100,500 in income tax revenues.

Table 5-14
Summary of Savings to Eastern Colorado Grain Producers

High, Midrange, and Low Assumptions

Inc. # of Trains/Wk.	Inc. # of Trains/Yr.	Inc. # of Wheat	Inc. # of Corn	Total Trains/Yr.	% of Total Production	% Increase # of Trains
2.0	104	43	61	195	23.6%	115%
1.0	52	21	31	143	17.3%	57%
0.5	26	11	16	117	14.3%	29%
0.0	0	0	0	91	11.0%	0%

Annual Savings in 2004 Dollars:

Inc. # of Trains/Wk.	% Change to Rail	Transport Savings	Highway Savings	Total Savings
2.0	12.6%	$ 2,170,775	$ 1,503,387	**$ 3,674,163**
1.0	6.3%	1,085,388	751,694	**$ 1,837,081**
0.5	3.2%	551,308	381,813	**$ 933,121**

Total Savings in 2004 Dollars from 2010 to 2030:

Inc. # of Trains/Wk.	% Change to Rail	Transport Savings	Highway Savings	Total Savings
2.0	12.6%	$ 28,865,095	$ 19,990,744	**$ 48,855,839**
1.0	6.3%	14,432,547	9,995,372	**$ 24,427,919**
0.5	3.2%	7,330,818	5,077,014	**$ 12,407,832**

Truck Deviations Based on Cyclical Production Changes vs. Estimated Reduction in Trucks

Inc. # of Trains/Wk.	Reduction Trucks/Yr.	Deviation in Trucks
2.0	20,781	43,470
1.0	10,391	43,470
0.5	5,278	43,470

Income Tax Revenues

Inc. # of Trains/Wk.	Transport Savings/Yr.	Federal Gains/Yr.	State Gains/Yr.	Total Tax Gains/Yr.
2.0	$ 2,170,775	$ 325,616	$ 100,507	$ 426,123
1.0	$ 1,085,388	$ 162,808	$ 50,253	$ 213,062
0.5	$ 551,308	$ 82,696	$ 25,526	$ 108,222

1. Average Farm Income = $ 29,489 per year.
2. Federal Tax Rate = 15%.
3. State Tax Rate = 4.63%.

Table 5-15
Benefits to the Grain Industry and Highway Cost Savings

	Current			Low			Midrange			High		
	Wheat	Corn	Total	Wheat	Corn	Total	Wheat	Corn	Total	Wheat	Corn	Total
Average Annual Production (bushels)	58,098,442	89,335,352	**147,433,794**	58,098,442	89,335,352	**147,433,794**	58,098,442	89,335,352		58,098,442	89,335,352	**147,433,794**
Colorado Commodity Flow by Truck (1)	89%	89%		85.8%	85.8%		82.7%	82.7%		76.4%	76.4%	
Colorado Commodity Flow by Rail (1)	11%	11%		14.2%	14.2%		17.3%	17.3%		23.6%	23.6%	
Average Bushels by Truck	51,707,613	79,508,463	**131,216,076**	49,848,463	76,649,732	**126,498,195**	48,047,411	73,880,336	**121,927,747**	44,387,210	68,252,209	**112,639,418**
Average Bushels by Rail	6,390,829	9,826,889	**16,217,717**	8,249,979	12,685,620	**20,935,599**	10,051,030	15,455,016	**25,506,046**	13,711,232	21,083,143	**34,794,375**
Bushels per Truck	850	925		850	925		850	925		850	925	
Number of Trucks	60,832	85,955	**146,788**	58,645	82,865	**141,510**	56,526	79,871	**136,397**	52,220	73,786	**126,006**
Truck Rates per Loaded Ton-Mile (2)	$ 0.0471	$ 0.0463		$ 0.0471	$ 0.0463		$ 0.0471	$ 0.0463		$ 0.0471	$ 0.0463	
Distance from Omar to Las Animas (miles)	175	175		175	175		175	175		175	175	
Cost to Truck Omar to Las Animas (per bu.)	$ 0.2471	$ 0.2270		$ 0.2471	$ 0.2270		$ 0.2471	$ 0.2270		$ 0.2471	$ 0.2270	
Cost per Truck	$ 210	$ 210		$ 210	$ 210		$ 210	$ 210		$ 210	$ 210	
Bushels per Unit Train (52 cars/4750 cubes)	171,600	183,820		171,600	183,820		171,600	183,820		171,600	183,820	
Number of Unit Trains	37	53	**91**	48	69	**117**	59	84	**143**	80	115	**195**
Rail Rates per Loaded Ton-Mile (3)	$ 0.0228	$ 0.0239		$ 0.0228	$ 0.0239		$ 0.0228	$ 0.0239		$ 0.0228	$ 0.0239	
Distance from Omar to Las Animas (miles)	175	175		175	175		175	175		175	175	
Cost to Rail Omar to Las Animas (per bu.)	$ 0.1195	$ 0.1171		$ 0.1195	$ 0.1171		$ 0.1195	$ 0.1171		$ 0.1195	$ 0.1171	
Cost per Unit Train	$ 20,507	$ 21,531		$ 20,507	$ 21,531		$ 20,507	$ 21,531		$ 20,507	$ 21,531	
Total Cost of Unit Trains	$ 763,726	$ 1,151,033	**$ 1,914,758**	$ 985,900	$ 1,485,879	**$ 2,471,779**	$ 1,201,132	$ 1,810,261	**$ 3,011,393**	$ 1,638,539	$ 2,469,489	**$ 4,108,027**
Total Cost of Trucks	$ 12,774,822	$ 18,050,570	**$ 30,825,392**	$ 12,315,503	$ 17,401,561	**$ 29,717,063**	$ 11,870,537	$ 16,772,833	**$ 28,643,370**	$ 10,966,252	$ 15,495,096	**$ 26,461,348**
Total Cost of Grain Shipment	**$ 13,538,548**	**$ 19,201,603**	**$ 32,740,151**	**$ 13,301,403**	**$ 18,887,440**	**$ 32,188,843**	**$ 13,071,669**	**$ 18,583,094**	**$ 31,654,763**	**$ 12,604,790**	**$ 17,964,585**	**$ 30,569,375**
Cost to Highway Maintance ($.45/mi)(4)	$ 0.45	$ 0.45		$ 0.45	$ 0.45		$ 0.45	$ 0.45		$ 0.45	$ 0.45	
Colorado Diesel Tax	$ 0.205	$ 0.205		$ 0.205	$ 0.205		$ 0.205	$ 0.205		$ 0.205	$ 0.205	
Diesel Efficiency (miles per gallon) (5)	5.6	5.6		5.6	5.6		5.6	5.6		5.6	5.6	
Total Highway Maintence Costs	$ 4,790,558	$ 6,768,964	**$ 11,559,522**	$ 4,618,314	$ 6,525,585	**$ 11,143,899**	$ 4,451,451	$ 6,289,812	**$ 10,741,264**	$ 4,112,344	$ 5,810,661	**$ 9,923,005**
Total Diesel Tax Revenues	$ 389,708	$ 550,650	**$ 940,358**	$ 375,696	$ 530,851	**$ 906,547**	$ 362,122	$ 511,671	**$ 873,793**	$ 334,536	$ 472,693	**$ 807,229**
Net Highway Savings	$ 4,400,850	$ 6,218,314	**$ 10,619,164**	$ 4,242,617	$ 5,994,734	**$ 10,237,351**	$ 4,089,329	$ 5,778,141	**$ 9,867,470**	$ 3,777,808	$ 5,337,968	**$ 9,115,777**
TOTAL NET SAVINGS						**$ 933,121**			**$ 1,837,081**			**$ 3,674,163**

1. Current distribution rates are from TranStats Commodity Flow Survey; New Rail Line distribution rates are estimated based on new capacity availability.
2. A rate of $1.20 is a standard asked shipping rate for grain freight per ton. It is considered to be fairly average or normal by grain industry players.
3. Calculated average rate using wheat and corn rates from various origins to various destinations as published in the USDA's Grain Transportation Report.
4. Weighted average cost to minor and principle arterials for combo 5-axle semi's. -- Personal communication with Denver Tolliver, Upper Great Plains Transportation Institute, February 21, 2004.
5. A default fuel efficiency value based on the performance of a truck having a loaded capacity of 28.5 tons. -- Indiana Rail Plan, Parsons.

Table 5-16
Benefits to the Grain Industry and Highway Cost Savings, 2004-2030

Rate of growth	2.00%
Discount rate	3.00%

	Low		Midrange		High	
	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits	Benefits by year	Discounted benefits
2004	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2005	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2006	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2007	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2008	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2009	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2010	$0.93	$0.78	$1.84	$1.54	$3.67	$3.08
2011	$0.95	$0.77	$1.87	$1.52	$3.75	$3.05
2012	$0.97	$0.77	$1.91	$1.51	$3.82	$3.02
2013	$0.99	$0.76	$1.95	$1.49	$3.90	$2.99
2014	$1.01	$0.75	$1.99	$1.48	$3.98	$2.96
2015	$1.03	$0.74	$2.03	$1.47	$4.06	$2.93
2016	$1.05	$0.74	$2.07	$1.45	$4.14	$2.90
2017	$1.07	$0.73	$2.11	$1.44	$4.22	$2.87
2018	$1.09	$0.72	$2.15	$1.42	$4.30	$2.85
2019	$1.12	$0.72	$2.20	$1.41	$4.39	$2.82
2020	$1.14	$0.71	$2.24	$1.40	$4.48	$2.79
2021	$1.16	$0.70	$2.28	$1.38	$4.57	$2.76
2022	$1.18	$0.70	$2.33	$1.37	$4.66	$2.74
2023	$1.21	$0.69	$2.38	$1.36	$4.75	$2.71
2024	$1.23	$0.68	$2.42	$1.34	$4.85	$2.68
2025	$1.26	$0.68	$2.47	$1.33	$4.94	$2.66
2026	$1.28	$0.67	$2.52	$1.32	$5.04	$2.63
2027	$1.31	$0.66	$2.57	$1.30	$5.14	$2.61
2028	$1.33	$0.66	$2.62	$1.29	$5.25	$2.58
2029	$1.36	$0.65	$2.68	$1.28	$5.35	$2.56
2030	$1.39	$0.64	$2.73	$1.27	$5.46	$2.53
Total discounted benefits		$14.91		$29.36		$58.71

Uncertainty parameters:		
Low benefit estimate	$14.91	
Midrange benefit estimate	$29.36	$29.36
High benefit estimate	$58.71	

New Construction Jobs

The Project carries a total cost of approximately $1.1 to $1.3 billion. For purposes of this analysis, the cost is assumed to be $1.2 billion spent over the 4-year period 2005 to 2008, for an average of $300 million per year. This level of expenditure will utilize a high number of construction workers and supporting labor force. This increase in regional earnings will stimulate spending on a wide range of goods and services, and also generate tax revenues through income taxes, sales taxes, and other taxes paid with these additional wages. Therefore, the Project should have a substantial beneficial impact on the Front Range and Eastern Colorado economies, where the bulk of expenditures will take place.

The magnitude of these construction benefits is uncertain and will be closely related to the source of construction funds. For instance, if a portion of Project construction were financed from outside the State, either through federal funds or from the private sector, there would be commensurate construction employment and earnings benefits associated with that portion. However, to the extent that Project costs are reimbursed by Colorado taxpayers, either though the State General Fund or specific taxes, the beneficial impact will not be as great. This is because the construction spending represents a transfer of funds already within the State rather than new monies flowing into it. The other benefits of the Project would still occur and, overall, the Project may still be a good public investment. However, the net construction employment benefits would be less because the Project pulls resources from other worthy projects and programs within the State, all of which have their own multiplier effects.

Assumptions

- The assumed Project cost of $1.2 billion is divided equally between the years 2005 to 2008.
- This portion is multiplied by 30 percent, representing an assumed level of outside financing (funding from public and private sources outside the state).
- The construction expenditures comprising the 30 percent outside financing (funding from public and private sources outside the state) are used as input to the IMPLAN input-output model to determine the level of employment and earnings impacts, using economic multipliers.
- The analysis is done in 2004 dollars for all four years.

Results

Table 5-17 summarizes the employment, earnings, and tax impacts associated with 30 percent of construction spending coming from outside the State. For each of the four construction years, net new job creation in the construction industry totals 937 construction-related jobs and 789 supporting and ancillary jobs. These jobs create an annual increase in federal tax revenues of about $16.3 million per year and an increase in State and local tax revenues of about $6.5 million. These impacts apply only to the four years of construction.

Table 5-17

Employment Impacts From Project Construction

	2005	2006	2007	2008
Construction spending, dollars per year ($1,000,000)	$300.0	$300.0	$300.0	$300.0
Portion assumed financed by sources other than Colorado taxpay	30%	30%	30%	30%
Construction spending that results in new construction jobs	$90.0	$90.0	$90.0	$90.0
Colorado employment and earnings impacts				
Employment impacts				
Direct jobs	937	937	937	937
Indirect and induced jobs	789	789	789	789
Total job creation	1,726	1,726	1,726	1,726
Wage earnings associated with these jobs ($1 mil/year)	$57.0	$57.0	$57.0	$57.0
Tax impacts				
Federal taxes ($1mil/year)				
Personal tax	$8.1	$8.1	$8.1	$8.1
Social Tax	$6.7	$6.7	$6.7	$6.7
Corporate profits tax	$0.6	$0.6	$0.6	$0.6
Indirect business taxes	$1.0	$1.0	$1.0	$1.0
Subtotal increase in federal taxes (million/year)	$16.3	$16.3	$16.3	$16.3
State and local taxes ($1mil/year)				
Personal income tax	$2.0	$2.0	$2.0	$2.0
Social Sec. Tax	$0.1	$0.1	$0.1	$0.1
Indirect business taxes (inc. sales tax)	$4.4	$4.4	$4.4	$4.4
Subtotal increase in Colorado tax revenues (million/year)	$6.5	$6.5	$6.5	$6.5

Safety and Security

This section analyzes and determines the impacts to safety and security associated with this Project. Some of the impacts are both quantitative and qualitative, but some of the impacts are qualitative only. The areas of analysis in this section include vehicle-train incidents, pedestrian-train incidents, hazardous materials transport, and terrorism risk.

Vehicle-Train Accidents

Safety benefits are derived from diversion of train traffic outside of the Front Range, such as reductions in auto-train accidents. Despite the assumed 2% annual growth in AADT and increase in number of trains in the segment east of Front Range, the reduction of daily train counts in the segments leading to the city generates substantial safety benefits. The estimating equation is presented below:
Accident Cost Savings = Δ Accidents$_i$ * Accident Cost$_i$

where:

i	type of an accident (fatal, injury, property-damage-only);
Δ Accidents$_i$	sum of change in number of accidents over accident categories (i.e., change in number of property-damage-only + injury + fatal accidents between the base and alternate cases);
Accident Cost$_i$	the cost of an accident-by-accident category (i.e., cost of property-damage-only, injury, and fatal accident).

Table 5-18 shows the safety benefits associated with the potential reduction in the number of vehicle accidents associated with reducing the number of coal trains in the Front Range under the Build Option. Also included on Table 5-18 are the assumptions used in the calculation of vehicle accident related benefits. Roadway safety benefits accumulate to over $9.5 million (discounted to 2004 dollars) over the Project period.

Table 5-18
Benefits Associated with Reductions in Auto-Train Accidents, 2004-2030

Assumptions:
Cost of a fatal accident, median value = $3,800,000
Cost of an injury accident, median value = $1,000,000
Cost of an accident only causing property value = $50,000
Accident cost savings=sum of change in the # of accidents over accident categories* the cost of an accident by accident category

Rate of growth	2.00%
Discount rate	3.00%

	Annual safety benefits, $1 mil	Discounted benefit
2004	$0.00	$0.00
2005	$0.00	$0.00
2006	$0.00	$0.00
2007	$0.00	$0.00
2008	$0.00	$0.00
2009	$0.00	$0.00
2010	$0.70	$0.58
2011	$0.72	$0.58
2012	$0.74	$0.58
2013	$0.63	$0.49
2014	$0.65	$0.49
2015	$0.67	$0.49
2016	$0.69	$0.49
2017	$0.71	$0.49
2018	$0.73	$0.49
2019	$0.76	$0.49
2020	$0.78	$0.49
2021	$0.80	$0.49
2022	$0.66	$0.39
2023	$0.68	$0.39
2024	$0.70	$0.39
2025	$0.72	$0.39
2026	$0.74	$0.39
2027	$0.77	$0.39
2028	$0.79	$0.39
2029	$0.81	$0.39
2030	$0.84	$0.39
Total discounted benefits		$9.61

Pedestrian and Train Incidents

Incidents between pedestrians and freight trains are not common, but occasionally occur. The last reported pedestrian-train incident in the Front Range involving a freight train transpired in Adams County in 2000, as reported by the FRA Safety Database. There are, on more frequent occasions, incidents with light rail and pedestrians, but for this study, the focus is on the freight train incidents. With the Build Option the low chance of pedestrian-freight train incidents occurring will likely decrease to an even lower chance. Several of the fast through moving coal trains will be relocated to a much less populated and less pedestrian oriented area of the state.

Hazardous Materials Transport

The movement of hazardous materials (HAZMAT) occurs regularly by rail, maybe even on a daily basis. Most movement of HAZMAT goes undetected by the general public, but in the rare case of an accident with a train carrying HAZMAT, exposure could be deadly depending on the chemical or material being transported. With approximately 75 to 90 percent of the spent nuclear fuels and high level radioactive wastes expected to be transported by rail in the future[5] a less populated route than the current corridor running through the North Front Range communities, Denver, Colorado Springs, and Pueblo could be a potentially huge benefit. This Project would allow for an alternative route to move hazardous materials (HAZMAT). Along the proposed new route in Eastern Colorado, there are fewer people, less traffic, and fewer grade crossings. The reductions of these factors lower the accident potential and exposure rate of a train carrying HAZMAT.

An additional benefit of the Project is redundancy. In the event that a severe HAZMAT incident does occur, there would be an alternate track to reroute train traffic. Instead of an HAZMAT incident shutting off commerce to other areas of the country, the flow of goods and commodities could continue on the other north-south moving track in the state.

Terrorism Risk

After the events of September 11, 2001, terrorism is a concern of major transportation carriers across the country. Denver and the metro area have never been the target of such a great terrorist act, but the concentration of business and industry in the metro area and along the Front Range make it a viable target for terrorists. This project would help lessen the risk and impact of a terrorist attack occurring in the Denver area. First, the Project would move coal trains, a potential terrorist target, out of the Front Range area. Secondly, the Project would create a redundant route to move goods and commodities through the State of Colorado. Although a terrorist attack would be a tragedy to the city and the state, it would not shut down commerce in other parts of the country because an alternate route would be available to move freight under the Build Option.

Environmental Impacts

Impacts to the environment are important factors to consider when considering a new project of the magnitude of this Project. This section looks at the aspects of the natural environment, noise and vibration, air quality, energy usage, and visual appearances that may be impacted by the Project. Qualitative benefits and potential costs are presented with each topic. Where applicable, associated quantitative benefits are also presented.

This study is intended to be preliminary in nature and broad in terms of detail, since it may be an initial phase of what may become a more comprehensive analysis of the infrastructure improvements and their effects. This study is not an environmental study, nor is it intended to predetermine any outcome of any environmental study that may be in progress or later undertaken related to this proposal. Furthermore, nothing prepared on behalf of

[5] FRA, Safety Compliance Oversight Plan for Rail Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel, June 1998.

this study shall preclude federal, state or local agencies or officials from fulfilling their responsibilities under the National Environmental Policy Act (NEPA), as codified in 42 U.S.C., section 4321, et seq., or any of NEPA's implementing regulations.

Natural Environment

An inventory of the natural environment surrounding the potential build areas was conducted for two reasons: to determine if there were any fatal flaws and to determine if there would be extreme mitigation costs. A fatal flaw analysis is conducted to see if any threatened or endangered species or other important natural resources inhabit the area along the potential new rail line, which if present could prevent the Project from moving forward. The presence of a threatened or endangered species or another important resource may not prevent the building of the Project, but the mitigation costs could be so extreme in relation to the overall project costs that it could prohibit the Project from moving forward.

This analysis of the natural environment summarizes the results of a screening of archaeological and historic resources, Special Status Species, locations of known hazardous materials, wetlands, major rivers and creeks, and other water resources, and demographics conducted for the Project. This screening represents the culmination of initial activities including collection of existing data, and surface level research on the likely presence of key environmental features. The level of analysis limits the conclusions that can be drawn from this technical report. All statements made are based on the best available data, and are not meant to be used as a final environmental determination of resource impacts or potential mitigation measures. More information is included in Appendix D.

Archaeological and Historic Recourses

This section describes the applicable legal and regulatory requirements related to historic and archeological resources in the study area. A definitive corridor has not been established. Therefore, the study area for historic and cultural resources is a variable swath generally consisting of an area 10 to 15 miles on either side of a "line" drawn between Omar to Peoria, and between Aroya to Las Animas Junction, with additional research along the right-of-way and railroad property of the existing railroad facilities from approximately Peoria to Aroya. The study area along the existing railroad property was selected to account for potential disturbance by construction activities, the effects of noise and vibration, and visual impacts. The study area is within the counties of Adams, Arapahoe, Bent, Cheyenne, Kiowa, Lincoln, Morgan and Weld.

Inventory of Archaeological Resources

According to A Profile of the Cultural Resources of Colorado 2003, only Weld County has any Prehistoric Districts. These are Keota Stone Circles Archaeological District/Shull Tipi Rings located approximately 35 miles from Omar, and West Stoneham Archaeological District located approximately 47 miles from Omar.

Bent, Cheyenne, Elbert, Kiowa, and Lincoln have no officially eligible prehistoric sites. However, it is important to observe that the most recorded Paleonindian resources are in the eastern Plains counties including study area counties Cheyenne, Elbert and Kiowa. This lack is due to the limited amount of survey data from these regions. Distribution of archaeological sites also shows a concentration of Protohistoric sites and isolated finds in the eastern Plains counties including Kiowa County, which reflects the high concentration of Cheyenne and Arapaho Tribes that are known historically to have camped on tributaries of the Arkansas River.

Known archeological sites are not listed in this technical report, with the exception of the Archaeological Districts within Weld County that are unique for this study area, listed in Appendix D, but given the information cited in A Profile of the Cultural Resources of Colorado 2003, it is certain that such sites do exist in the study area and may become known as alternative routes if new tracks are selected and studied.

Inventory of Historic Resources

Historical resources have been recorded in all of Colorado's 64 counties and number in the thousands. The counties with the highest number of recorded historic resources are those in the Front Range including Denver, Boulder, Mesa and Pueblo. These counties or cities within them have performed historical surveys for planning and growth management. Thus, known sites within the study area appear to be limited when listed as they are in Appendix D. Only sites listed in the National Register of Historic Places and/or Colorado State Register Properties that occur within a potential corridor for the new tracks or upgrades to existing railroad property have been documented in this technical report. No National Historic Landmarks or World Heritage List sites are located in the study area counties.

Further investigation of the potential for prehistoric cultural resources should be initiated once specific project planning begins. Special attention should be given to potential disturbance in the vicinity of streams, creeks, rivers, lakes, and other areas proximate to resources that could have been used by prehistoric peoples. In addition, all towns through which the project would pass or that would be adjacent to the project have, or are likely to have, listed and unlisted but possibly eligible historic properties that may be affected. An assessment of the effects of the project on these properties would depend in part on the area of potential effect (APE) designated for the project when the project's alternatives are determined. In most cases, NRHP listed properties must be avoided by federally funded construction projects.

Special Status Plant and Animal Resources

This section describes the applicable legal and regulatory requirements related to special status plant and animal resources in the study area. A definitive corridor has not yet been established. Therefore, the study area for special status plant and animal resources includes the counties through which "lines" drawn between Omar to Peoria, and between Aroya to Las Animas Junction cross. While a line drawn southward from Omar to Peoria does not cross Weld County, it is included because Omar is located on the jurisdictional line between Morgan and Weld counties, and because it is possible that project alternatives could extend into Weld County. In addition, the proposed project includes improvements to existing railroad lines located in Elbert and Lincoln counties, therefore the study area is within the counties of Adams, Arapahoe, Bent, Cheyenne, Kiowa, Lincoln, Morgan and Weld.

Special Status species are those listed, or which are candidates for listing, as threatened or endangered under the federal Endangered Species Act, and the Colorado State endangered, threatened species, or species of concern. A federally endangered species is any species that is in danger of extinction throughout all or significant portions of its range. A federally threatened species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. A candidate species is any species for which sufficient information indicating that formal listing under the Endangered Species Act may be appropriate (http://midwest.fws.gov/endangered/glossary/index.html).

A state endangered species is any species or subspecies of native wildlife whose prospects for survival or recruitment within the state are in jeopardy as determined by the [Wildlife] Commission (Colorado Revised Statues 1994). A state threatened species is any species or subspecies of wildlife which, as determined by the [Wildlife] Commission, is not in immediate jeopardy of extinction, but is vulnerable because it exists in such small numbers or is so severely restricted throughout all or a significant portion of its range that it may become endangered (Colorado Revised Statues 1994). A state species of concern is a species not listed as threatened or endangered, but is of concern to wildlife managers within the Colorado Division of Wildlife. Appendix D lists all endangered or threatened species and state species of concern found within the study area.

Potential constraints or issues to the project involving threatened or endangered species will vary with the habitat and species affected. Issues of concern should be addressed on a habitat and/or species-specific basis once project alternatives have been developed.

Major Creeks and Rivers, Wetlands, and Other Surface Water Resources

This section briefly describes the applicable legal and regulatory requirements related to water resources in the study area. A definitive corridor has not been established, therefore, the study area for locations of major creeks and rivers, wetlands, and other surface waters for the Omar to Peoria section is a variable swath generally consisting of an area two to four miles on either side of a "line" drawn between Omar to Peoria, but tending to stay on the west side of the primary channels of Bijou Creek. Both Omar and Peoria are on the west side of this creek. The study area for the section from Aroya to Las Animas Junction, is a variable swath generally consisting of an area four miles on either side of a "line" drawn between Aroya and Las Animas Junction, except south of Adobe Reservoir when the study area narrows to a 4-mile wide swath directly north of Las Animas Junction in order to avoid John Martin Reservoir. As all construction activities will be done within the existing railroad property, no additional research along the right-of-way and railroad property of the existing railroad facilities from Peoria to Aroya was conducted. The study area includes land the counties of Adams, Arapahoe, Bent, Cheyenne, Kiowa, Morgan and Weld.

Water resources of the study area in this technical report were identified with minimal field reconnaissance using USFWS National Wetland Inventory maps, both electronic and paper. No floodplain studies or soil studies were conducted. No wetlands were delineated.

Wetlands, major creeks and rivers, and other surface waters in the study area were found to occur in Adams, Arapahoe, Bent, Cheyenne, Elbert, Kiowa, Lincoln, Morgan, and Weld counties. These creeks, rivers, and other surface waters are listed in detail in Appendix D.

All of the creeks and rivers in the study area have some associated wetlands. In addition, wetlands are scattered throughout the landscape in areas that are not adjacent to the creeks or rivers. Wetlands generally include swamps, marshes, and bogs. Federal similarly define wetlands as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances, do support a prevalence of vegetation typically adapted for life in saturated soil conditions. In parts of the study area that are intensively farmed or ranched, most of the wetlands have been "farmed." Appendix D has detailed listing of streams, wetlands, and water resources, as well as tables and maps associated with those listings.

Potential constraints or issues for this Project involving rivers, creeks, lakes or wetlands could include the possibility of increased runoff or accident spills adversely affecting sensitive stream systems and associated wetlands. Impacts to threatened or endangered aquatic species could also be a concern. As the project progresses, project specific wetland studies should be conducted. If it is determined that significant waters of the U.S. will be impacted by any proposed improvements to the existing rail lines or by any of the proposed new facilities, certain regulatory requirements must be met, such as the Section 404 permitting process.

Hazardous and Contaminated Materials Sites

This section briefly describes the applicable legal and regulatory requirements related to potentially hazardous materials in the study area. A definitive corridor has not been established. Therefore, the study area for locations of potentially hazardous materials is a variable swath generally consisting of an area 10 to 15 miles on either side of a "line" drawn between Omar to Peoria, and between Aroya to Las Animas Junction, with additional research along the right-of-way and railroad property of the existing railroad facilities from Peoria to Aroya. The study area along the existing railroad property was selected to account for potential disturbance by construction

activities. The study area is within the counties of Adams, Arapahoe, Bent, Cheyenne, Kiowa, Lincoln, Morgan and Weld.

Using all of the sources listed in Appendix D, known hazardous and contaminated materials sites in the study area were found to occur in Bent, Cheyenne, Elbert, Kiowa, Lincoln, Morgan, and Weld counties. Unknown hazardous materials sites may be encountered during future phases of this project. The sites found are described in detail in Appendix D.

Constraints posed by these sites depend to a great extent upon the types and locations of the project's improvements to existing facilities and proposed new facilities. Disturbing these sites could result in groundwater and/or airborne contamination of the surrounding area. Any railroad improvement affecting these sites would require compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980. It is recommended that an investigation of abandoned landfills, leaking underground storage tanks, the Emergency Response Notification System (ERNS), and other hazardous material databases be conducted in conjunction with project specific planning.

Demographics

Executive Order 12989, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, requires federal agencies to incorporate consideration of environmental justice into the NEPA evaluation process. The purpose of the Order is to ensure that low-income and minority households and minority business enterprises do not suffer a disproportionate share of adverse environmental impacts resulting from federal actions that are not offset by project benefits. The Order also requires that these communities have adequate access to and opportunity for participation in project planning.

The US Department of Transportation defines "minorities" in its guidelines on implementation of the Environmental Justice Order, and the EPA offers additional guidance. The Colorado Department of Transportation (CDOT) is responsible for the allocation of resources that come to Colorado transportation projects from federal programs. Thus, CDOT strives to integrate Environmental Justice into its programs and planning activities.

As a first level of analysis, the percent of minority populations within a given census tract was compared to the percent of minority populations for the State of Colorado (http://dola.colorado.gov/demog/QTables/). Then, the percent of low-income households within a census tract was compared to the percent of low-income households in the county where the census tract is located. The comparisons and details of analysis are described in Appendix D.

Future studies based on route alternatives will determine the location of Environmental Justice populations and whether any would be disproportionately affected by the alternative. More detailed analyses of the potential impacts of railroad improvements on minority and low-income communities should occur during specific project planning.

It should be noted that the Project has the potential for creating net social benefits that will benefit all racial, ethnic, and income groups. Reducing the number of trains passing through low to moderate income neighborhoods in the Denver area will have positive safety, noise, air quality, property value, and mobility impacts. Further, to the extent that the Project can promote economic development and increased employment, all will benefit.

Other Resources and Potential Constraints

Land use, socioeconomic factors, geology and soils, and groundwater resources are also important environmental issues that have not been covered in other sections, but which may become issues as the project progresses.

These resources or issues are introduced here to bring awareness to areas that will require further analysis in the future.

A definitive corridor has not been established, but the other resources and potential constraints occur or could occur between Omar to Peoria, and between Aroya to Las Animas Junction, with additional areas along the right-of-way and railroad property of the existing railroad facilities from Peoria to Aroya. The study area is within the counties of Adams, Arapahoe, Bent, Cheyenne, Kiowa, Lincoln, Morgan and Weld. Detailed descriptions of these other resources and potential constraints are in Appendix D.

Noise and Vibration

Sounds that disrupt normal activities, or otherwise diminish the quality of the environment are considered noise. Excessive noise has the potential to disrupt routine activities, and can affect overall quality of life, especially in residential areas. In general, most residents become highly irritated or annoyed when noise interferes significantly with activities such as sleep, interpersonal or telephonic conversation, noise-sensitive work, watching television or listening to the radio or recorded music. In addition, some land uses, such as outdoor concert or pavilions or recreational sports venues, are inherently incompatible with high noise levels.

Train traffic produces both noise and vibration effects that have the potential for disturbing sensitive receptors located in close proximity to sources such as schools, churches, recreational facilities and housing. Freight trains typically generate higher noise levels and greater vibration effects than passenger trains because they are heavier and require additional locomotives and cars.

Rail vehicles in motion generate noise. Diesel locomotives generate diesel engine exhaust noise, air turbulence noise, and gear noise. Additional noise is generated by the interaction of the wheels with the rails. The interaction of steel wheels and rails generates three types of noise: (1) rolling noise due to continuous rolling contact, (2) impact noise when a wheel encounters a discontinuity in the running surface, such as a rail joint, turnout or crossover, and (3) squeal generated by friction on tight curves.

Ground-borne vibration is also a potential concern for people who live near rail lines. Train wheels rolling on the rails create vibration energy that is transmitted through the track support system and transit support structures, which in turn excites the adjacent ground and creates vibration waves that propagate through soil and rock. These vibrations then can impact and vibrate the walls and floors of nearby structures. The vibration of floors and walls can cause the rattling of windows and dishes, as well as create an audible rumble.

Relocating rail traffic away from developed urban areas has the potential to reduce noise and vibration levels in areas located adjacent to the existing rail lines. The extent of actual reductions would depend on existing noise levels, as well as the contributing factors to existing noise levels (i.e., roadway traffic, airport noise and general urban noise levels). Screening level analysis per FTA guidelines (Transit Noise and Vibration Impact Assessment, Federal Transit Administration, April 1995) was used to evaluate noise impacts for existing conditions, as well as 2030 No Build and Build Options relative to freight rail traffic relocation. More information on noise and vibration analysis is in Appendix D.

Property Value Benefits Resulting from Noise Reduction

There are expected property value increases in residential areas in the Front Range communities resulting from the reduction of added train noise. For this analysis, a land use inventory was prepared for a 750 foot screening corridor, to either side of potentially impacted rail segments. A total of all of the residential property in the Front Range area was calculated to determine the total potential for property value increases.

A range of potential property value increases was created. The low scenario suggests that there will be no property value changes associated with the reduction of approximately 20 coal trains from the Front Range. In the midrange scenario it is assumed that the reduction of about 20 coal trains will create a 5 percent increase in residential property values. In the high scenario, realization of a 15 percent increase in property value is expected to occur with reduction of nearly 20 coal trains from the Front Range.

Using the most likely scenario, the midrange scenario, relocating 20 trains out of the crowded Denver area is expected to result in a one-time capital gain to approximately 14,600 property owners of about $87 million dollars. This property value increase translates into increased property tax revenues to the respective counties for years to come. Approximately $1.5 million in additional property tax revenues are gained from the improved property values. Table 5-19 shows the assumptions and calculations used to identify the potential property value increases and tax gains from the reduction of trains from the Front Range.

Table 5-19

Property Value Changes Due to Changes in Train Noise

Assumed value of residences within 750' noise corridor	$	120,000
Assessed value (29% of assume value)	$	34,800
Mill Levy		64.20
Taxes per Property	$	2,200
Approx. Residences per Acre		4

				Property value impacts			Property tax revenue impacts			
	Acres of residential land use within 750' of rail line	Approximate number of residences	Property value within the 750' corridor ($1 mil)	Low scenario: 0% change in property value	Midrange: 5% increase in property value	High: 15% increase in property value	Annual property tax revenues generated in this corridor ($1mil)	Low scenario: 0% change in property value	Midrange: 5% increase in property value	High: 15% increase in property value
Areas experiencing reduction in the number of coal trains /1	3,652	14,610	$ 1,753	$ -	$ 87.7	$ 263.0	$ 32.1	$ -	$ 1.6	$ 4.8
Areas experiencing increases in the number of coal trains /2	133	534	$ 19	$ -	$ (0.9)	$ (2.8)	$ 1.2	$ -	$ (0.1)	$ (0.2)
Net change				$ -	$ 86.7	$ 260.2	$ 33.3	$ -	$ 1.5	$ 4.6

/1 These areas include many of the urban areas of the Front Range: Greeley and the U.S 85 corridor; the Denver metro area; I-25 corridor between Denver and Colorado Springs; Colorado Springs; and Pueblo

/2 These areas include urban areas from I-76 south along the new rail line to Peoria; Limon; and Las Animas.

Air Quality Benefits

Relocating freight trains from the Front Range to Eastern Colorado would help improve the air quality along the Front Range by reducing emissions from locomotives. There are five pollutants of concern that are generated by locomotives: NOx, CO, VOCs, PM-10s, and SO2. Because many of the counties in the Front Range are Non-attainment or Maintenance status, the reduction of these five pollutants would help improve the air quality status of those counties.

Locomotive emission rates were generated using the fleet average of Tier 0 locomotives in the year 2001 (per Table 4 of EPA Publication EPA420-F-97-051, December, 1997). In 2005, the reduction from 2001 emissions is assumed to occur at the same rate as forecasted in Table 9 (of the same EPA publication) to estimate NOx, CO, VOC, and PM10 emissions. SO2 emissions are based on a mass-balance of sulfur in fuel, assumed to be 0.25% by weight.

For every ton of pollutant generated there is a corresponding societal cost that quantifies the underlying increase in health care costs associated with each additional ton of the respective pollutant. For this study, the midrange cost per ton of NOx, VOCs, and PM-10s is $5,000. CO has a midrange cost of $500 per ton associated with its emission, and SO2 costs approximately $200 per ton in the midrange (low range and high range costs can be found in Table 5-20). These values are based on EPA's Best Available Control Technology (BACT) economic analyses. Typically, the threshold for most pollutants has been that if a technology cost more than $5,000 per ton of pollutant removed, the technology was not justifiable because it was considered too expensive. If it cost less than $5,000 per ton removed/controlled, then a permit applicant was expected to install the technology. In recent years, there have been cases where substantially higher $/ton values ($10,000 or more) have been considered acceptable. This is a subjective judgment, and varies by state, EPA region, and by the level of concern with respect to current air quality in a given area. Also, please note that these $5,000-$10,000/ton figures apply in areas that are "attainment" with respect to the pollutant in question. In a "nonattainment" area, the applicant must obtain enforceable offsets (emissions decreases) for any significant emissions increase, and also must put on the top of the line controls, regardless of cost. Table 5-20 has the yearly and total discounted air emissions savings from reducing the number of locomotives in the Front Range.

In its review of this technical report, the Denver Regional Council of Governments (DRCOG) made several comments of note regarding air quality. Their comments are as follows:

- EPA Tier-2 emission rates should have been used to estimate changes in locomotive emissions.
- DRCOG noted that SO2 is not a major issue along the Front Range and that benefits attributed to its reduction should not be credited.
- Recent events indicate that areas in the Eastern Plains may, in fact, be considered non-attainment areas with respect to 8-hour ozone levels. EPA has recommended that Morgan, Larimer, Weld, and Morgan Counties be included in Colorado's urban, non-attainment counties. Governor Owens has counter-proposed that portions of Weld, Morgan, and Elbert Counties be excluded. Although the final ruling on these counties is weeks away, the point is that Eastern Colorado may not have the air quality assimilative capacity as previously thought. If this is the case, there may be minimal air quality benefit resulting from the Project – the Project would mostly transfer pollutants from one non-attainment area (Front Range) to another (Eastern Colorado).

The first two comments are well-taken and should be incorporated into subsequent analyses of the air quality issues associated with the Project. They will have some measurable impact on the quantitative estimate of air

quality benefit, but would not substantially affect its order-of-magnitude. However, the final comment, if occurring, would reduce the net air quality impact to near zero. The only net air quality benefit afforded by the Project in this case would be attributable to the reduction in train mileage and operational cost savings.

For the time being, and until the entire counties of Morgan, Weld, and Elbert are considered non-attainment with respect to ozone, the air quality benefits to the Front Range will be considered net benefits. If, at some point in the future, counties in Eastern Colorado are considered non-attainment, these benefits will have to be revisited and possibly revised.

Reduction in delays at crossings and speed smoothing in the Front Range resulting from the Project help reduce emissions from automobiles and improve air quality. The decrease in delay and speed smoothing are both the result of train traffic diversion east of the Front Range. The equation to estimate environmental benefits associated with automobile emissions is shown below:

Emission Cost Savings = (Δ Highway Vehicle Emissions$_i$ + Δ Locomotive Emissions$_i$) * Emission Costs$_i$

where:

Δ Highway Vehicle Emissions$_i$	change in vehicle emissions between the base and alternate cases by emission type (hydrocarbon, carbon monoxide, and nitrous oxide emissions);
Δ Locomotive Emissions$_i$	change in locomotive emissions between the base and alternate cases by emission type (hydrocarbon, carbon monoxide, and nitrous oxide);
Emission Costs$_i$	dollar cost of one ton of emissions by emission type (hydrocarbon, carbon monoxide, and nitrous oxide).

Table 5-21 shows the total and discounted annual benefits associated with the reduction in emissions from automobiles in the Front Range.

Based on the above assumptions (and additional calculation assumptions listed on Table 5-20 and 5-21), the combined total benefit associated with reducing locomotive and auto emissions along the Front Range ranges from approximately $129 million to about $500 million. This is based on the period of analysis 2004 through 2030.

Table 5-20
Front Range Benefits Resulting from Reduced Locomotive Emissions, 2004-2030

			Factor (grams/gallon of fuel) /4	Low Scenario $/ton /1	Midrange Scenario $/ton /2	High Scenario $/ton /3
Rate of growth	1.59%	NOx	134.2	$ 2,765	$ 5,000	$ 9,550
Discount rate	3.00%	CO	18.4	$ 64	$ 500	$ 1,800
		VOC	7	$ 2,040	$ 5,000	$ 5,500
		PM10	4.4	$ -	$ 5,000	$ 14,250
		SO2	16.1	$ -	$ 200	$ 6,200

	Trains per year	Fuel Efficiency	Track mileage along Front Range	Gallons per year	NOx	CO	VOC	PM10	SO2	Low Scenario Value	Midrange Scenario Value	High Scenario Value	Disc. Low Scenario Value	Disc. Midrange Scenario Value	Disc. High Scenario Value
2004	16	22.80	134	17,597,952	2,603.27	356.93	135.79	85.35	312.31	$0	$0	$0	$0	$0	$0
2005	16	22.80	134	17,877,399	2,644.61	362.60	137.95	86.71	317.27	$0	$0	$0	$0	$0	$0
2006	17	22.80	134	18,161,283	2,686.60	368.36	140.14	88.09	322.31	$0	$0	$0	$0	$0	$0
2007	17	22.80	134	18,449,675	2,729.26	374.21	142.36	89.48	327.43	$0	$0	$0	$0	$0	$0
2008	17	22.80	134	18,742,646	2,772.60	380.15	144.62	90.91	332.63	$0	$0	$0	$0	$0	$0
2009	17	22.80	134	19,040,270	2,816.63	386.18	146.92	92.35	337.91	$0	$0	$0	$0	$0	$0
2010	18	22.80	134	19,342,620	2,861.36	392.32	149.25	93.81	343.28	$8,241,410	$15,786,931	$32,318,198	$6,902,051	$13,221,306	$27,065,982
2011	18	22.80	134	19,649,771	2,906.79	398.55	151.62	95.30	348.73	$8,372,279	$16,037,619	$32,831,395	$6,807,429	$13,040,052	$26,694,928
2012	18	22.80	134	19,961,799	2,952.95	404.88	154.03	96.82	354.27	$8,505,227	$16,292,288	$33,352,741	$6,714,105	$12,861,283	$26,328,961
2013	18	22.80	134	20,278,783	2,999.84	411.30	156.47	98.36	359.89	$8,640,285	$16,551,002	$33,882,365	$6,622,059	$12,684,965	$25,968,012
2014	19	22.80	134	20,600,799	3,047.48	417.84	158.96	99.92	365.61	$8,777,489	$16,813,823	$34,420,400	$6,531,276	$12,511,064	$25,612,010
2015	19	22.80	134	20,927,930	3,095.87	424.47	161.48	101.50	371.41	$8,916,871	$17,080,818	$34,966,979	$6,441,737	$12,339,547	$25,260,889
2016	19	22.80	134	21,260,255	3,145.03	431.21	164.05	103.12	377.31	$9,058,466	$17,352,053	$35,522,237	$6,353,426	$12,170,381	$24,914,582
2017	20	22.80	134	21,597,857	3,194.97	438.06	166.65	104.75	383.30	$9,202,310	$17,627,595	$36,086,312	$6,266,325	$12,003,534	$24,573,022
2018	20	22.80	134	21,940,820	3,245.71	445.02	169.30	106.42	389.39	$9,348,438	$17,907,512	$36,659,344	$6,180,419	$11,838,975	$24,236,145
2019	20	22.80	134	22,289,229	3,297.25	452.08	171.99	108.11	395.57	$9,496,887	$18,191,875	$37,241,476	$6,095,690	$11,676,672	$23,903,886
2020	21	22.80	134	22,643,171	3,349.61	459.26	174.72	109.82	401.85	$9,647,693	$18,480,752	$37,832,852	$6,012,123	$11,516,594	$23,576,183
2021	21	22.80	134	23,002,733	3,402.80	466.55	177.49	111.57	408.23	$9,800,893	$18,774,217	$38,433,619	$5,929,701	$11,358,710	$23,252,971
2022	21	22.80	134	23,368,005	3,456.83	473.96	180.31	113.34	414.72	$9,956,526	$19,072,342	$39,043,925	$5,848,410	$11,202,991	$22,934,191
2023	22	22.80	134	23,739,077	3,511.73	481.49	183.17	115.14	421.30	$10,114,631	$19,375,202	$39,663,923	$5,768,233	$11,049,407	$22,619,781
2024	22	22.80	134	24,116,041	3,567.49	489.13	186.08	116.97	427.99	$10,275,246	$19,682,870	$40,293,766	$5,689,155	$10,897,928	$22,309,681
2025	22	22.80	134	24,498,992	3,624.14	496.90	189.04	118.82	434.79	$10,438,412	$19,995,424	$40,933,611	$5,611,161	$10,748,526	$22,003,833
2026	23	22.80	134	24,888,024	3,681.69	504.79	192.04	120.71	441.69	$10,604,169	$20,312,941	$41,583,616	$5,534,236	$10,601,172	$21,702,177
2027	23	22.80	134	25,283,233	3,740.15	512.81	195.09	122.63	448.71	$10,772,557	$20,635,501	$42,243,943	$5,458,366	$10,455,838	$21,404,657
2028	23	22.80	134	25,684,718	3,799.54	520.95	198.19	124.58	455.83	$10,943,620	$20,963,182	$42,914,755	$5,383,536	$10,312,496	$21,111,216
2029	24	22.80	134	26,092,578	3,859.88	529.22	201.34	126.55	463.07	$11,117,399	$21,296,067	$43,596,220	$5,309,732	$10,171,120	$20,821,797
2030	24	22.80	134	26,506,915	3,921.17	537.63	204.53	128.56	470.42	$11,293,938	$21,634,238	$44,288,506	$5,236,940	$10,031,682	$20,536,347
					86,915	11,917	4,534	2,850	10,427	$203,524,747	$389,864,253	$798,110,182	**$ 126,696,110**	**$ 242,694,242**	**$ 496,831,255**

/1 HLB Decision Economics, Inc.
/2 Average of values from low and high range values
/3 EPA Best Available Control Technology (BACT) thresholds
/4 Emission factors are based on EPA's estimates for the fleet average of Tier 0 locomotives in the year 2001

Table 5-21

Additional Air Quality Benefits, 2004-2030

Savings in automobile air emissions by reducing delay times at crossings.

Assumptions:

Cost of VOC emissions = $2040/ton

Cost of NOx emissions = $2765/ton

Cost of CO emissions = $64.45/ton

Emission cost savings = change in highway emissions * emission costs

Rate of growth	2.00%
Discount rate	3.00%

	Benefits by year	Discounted benefits
2004	$0.00	$0.00
2005	$0.00	$0.00
2006	$0.00	$0.00
2007	$0.00	$0.00
2008	$0.00	$0.00
2009	$0.00	$0.00
2010	$0.12	$0.10
2011	$0.12	$0.10
2012	$0.13	$0.10
2013	$0.13	$0.10
2014	$0.13	$0.10
2015	$0.14	$0.10
2016	$0.14	$0.10
2017	$0.15	$0.10
2018	$0.15	$0.10
2019	$0.16	$0.10
2020	$0.16	$0.10
2021	$0.17	$0.10
2022	$0.17	$0.10
2023	$0.18	$0.10
2024	$0.18	$0.10
2025	$0.19	$0.10
2026	$0.19	$0.10
2027	$0.20	$0.10
2028	$0.20	$0.10
2029	$0.21	$0.10
2030	$0.22	$0.10
Total discounted benefits		$2.11

Energy Usage Reductions

In addition to reduced fuel usage by locomotives (considered above in Railroad Operating Efficiencies), there are additional Project fuel savings by automobiles associated with decreasing the idle times grade crossings and speed smoothing.

There are five principal cost components associated with operating a vehicle. These are: fuel consumption, oil consumption, maintenance and repair, tire-wear, and roadway related vehicle depreciation. Each component is a unique function of vehicle class, vehicle speed, grade level and surface condition.

To estimate the vehicle operating cost savings savings, vehicle miles traveled reduction is multiplied by operating cost factor derived from estimates from the American Automobile Association and Runzheimer International, *Your Driving Costs*, 1998 Edition. The operating cost factor used in our estimation is $0.85 per mile for trucks eliminated and $0.191 per mile for autos, resulting from speed smoothing. These factors are estimated based on 1999 dollars, a midsize car and an average vehicle mileage of 15,000 miles per year.

Highway vehicle operating cost savings are estimated as reductions in fuel and oil consumption. These savings are generated from the reductions in hours of delay, following the traffic diversion east of the Front Range. The estimating equation can be written as:

$$\textit{Vehicle Operating Cost Savings} = \Delta\, \textit{Consumption}_i * \textit{Consumption Costs}_i$$

where:

$\Delta\, \textit{Consumption}_i$	change in fuel consumption between the base and alternate cases by fuel type (fuel, oil);
$\textit{Consumption Costs}_i$	cost of a gallon of fuel, by fuel type (fuel, oil)

Table 5-22 show the savings over time, 2004 to 2030. The estimated energy use savings over the Project period is $21 million dollars, or approximately $1.2 million annually.

Table 5-22
Additional Energy Usage Savings, 2004-2030
Savings in automobile energy usage by reducing delay times at crossings.

Assumptions:
Base year gasoline fuel cost = $1.59/gallon
Base year diesel fuel cost = $1.434/gallon
Base year oil cost = $3.76/quart
Vehicle operating cost savings = change in consumption between build and no build * consumption costs

Rate of growth	2.00%
Discount rate	3.00%

	Benefits by year	Discounted benefits	
2004	$0.00	$0.00	
2005	$0.00	$0.00	
2006	$0.00	$0.00	
2007	$0.00	$0.00	
2008	$0.00	$0.00	
2009	$0.00	$0.00	
2010	$1.19	$1.00	
2011	$1.23	$1.00	
2012	$1.27	$1.00	
2013	$1.30	$1.00	
2014	$1.34	$1.00	
2015	$1.38	$1.00	
2016	$1.43	$1.00	
2017	$1.47	$1.00	
2018	$1.51	$1.00	
2019	$1.56	$1.00	
2020	$1.60	$1.00	
2021	$1.65	$1.00	
2022	$1.70	$1.00	
2023	$1.75	$1.00	
2024	$1.81	$1.00	
2025	$1.86	$1.00	
2026	$1.92	$1.00	
2027	$1.97	$1.00	
2028	$2.03	$1.00	
2029	$2.09	$1.00	
2030	$2.16	$1.00	
Total discounted benefits		$21.00	21.00

Visual Benefits to the Front Range

Many people associate the presence of freight trains and intermodal yards with a negative appearance. By building the Project, freight trains will be moved out of the congested Front Range area and intermodal yards will be relocated to areas east of the Denver metro region. Citizens and visitors may perceive this as an improvement to the living conditions and appearance of the Front Range. High numbers of unsightly coal trains or cluttered, industrial-looking rail yards will not be as visible to citizens of the Front Range communities. The reduction of trains and rail yards will provide for a less inhibited view of the mountains and more appealing neighborhoods. It may give citizens and visitors to the area the perception of a cleaner city.

With the Project, the coal trains and rail yards will not be destroyed, just moved. In Eastern Colorado areas to where much of the coal traffic will be diverted, there are many fewer people and visitors to look at the coal trains. In fact, the proposed corridor for the Project goes through very sparsely populated areas. Around the proposed sites for the intermodal facilities, there are relatively few housing developments and residential areas that might have degraded views and negative visual impacts.

Quality of Life

As with any major construction project, people are concerned about the impact that the Project will have on their current quality of life. No one wants to sacrifice the way they live for a project that does not have net benefits to their lives. This Project is expected to have a net quality of life improvement to all involved. In the Front Range, the reduction of some of the coal train traffic and intermodal yards will improve the community livability. Noise disturbances will decline, visual appearances will improve, air quality will improve, traffic delays will decrease, and the transit-oriented development will be facilitated. The Project is also expected to bring economic development, jobs, and improved local freight service along with it.

In Eastern Colorado, the location of the potential new line, the Project is expected to have a net positive impact on the communities. Although there will be added noise, visual, and air quality impacts, those impacts will likely be outweighed by the economic development, jobs, and viability the Project brings to the area. The citizens of Eastern Colorado will have improved freight services and the opportunity to increase commerce to the area.

Passenger Rail Facilitation Benefit

An underlying assumption throughout this study has been that passenger rail will be developed as per the plans of the various agencies, such as RTD, whether the Project moves forward or not. The benefit that the Project provides Front Range passenger rail is reduced cost. With the Project, existing railroad right-of-way (ROW) can be utilized for passenger rail, saving millions in ROW acquisition costs and roadbed development.

Technical Memorandum 7 (Passenger Rail Facilitation) concludes that passenger rail development costs will be reduced by approximately $203 with the Project. Table 5-23 illustrates how this $203 million in total cost-savings, or benefit, would be allocated over the period 2004 to 2030. It is assumed that these savings accrue during the period 2005 to 2008. The present value of these benefits is approximately $177.6 million.

Table 5-23
Cost Savings for Future Passenger Rail

Rate of growth	2.00%
Discount rate	3.00%

	Benefits by year	Discounted benefits
2004	$0.00	$0.00
2005	$0.00	$0.00
2006	$0.00	$0.00
2007	$50.70	$46.40
2008	$50.70	$45.05
2009	$50.70	$43.73
2010	$50.70	$42.46
2011	$0.00	$0.00
2012	$0.00	$0.00
2013	$0.00	$0.00
2014	$0.00	$0.00
2015	$0.00	$0.00
2016	$0.00	$0.00
2017	$0.00	$0.00
2018	$0.00	$0.00
2019	$0.00	$0.00
2020	$0.00	$0.00
2021	$0.00	$0.00
2022	$0.00	$0.00
2023	$0.00	$0.00
2024	$0.00	$0.00
2025	$0.00	$0.00
2026	$0.00	$0.00
2027	$0.00	$0.00
2028	$0.00	$0.00
2029	$0.00	$0.00
2030	$0.00	$0.00
Total discounted benefits		$177.64

Summary and Conclusions

Summary

Table 5-24 provides a summary of the benefits discussed is the previous sections, for the midrange scenario. The initial column shows the net present value of the benefit in question; the second converts this total value to an annual equivalent benefit by amortizing the net present value over the period 2004 to 2030 at a 3 percent rate of discount. These two measures of benefits are then summed across the benefit categories. Although only the midrange scenario is presented here, results for the low and high scenarios are incorporated into an uncertainty analysis contained in a subsequent section.

Assumptions underlying the midrange scenario result in a total benefit of approximately $2.29 billion over the period 2004 to 2030, or approximately $128 million per year. These benefits accrue to a combination of private and public interests. For private interests, the benefits are based on the additional profit generated by the net increase in economic development afforded by the Build Option. For public interests, they consist of reductions in travel time, increased pubic safety, improved air quality, property value increases, and an improved quality of life for most Coloradoans. Further, the public also benefits from increased employment opportunities and increased tax revenues stemming from the Build Option.

The middle columns of Table 5-24 show the net increase in demand for goods and services originating in Colorado and job creation in Colorado. These values are based on assumptions regarding possible economic development consequences of the Build Option. The assumptions ranged from the level of additional coal production, new job creation on the Front Range, and new job creation in Eastern Colorado. Admittedly, there is a speculative component to these estimates. This is because there are relatively few historical examples to draw upon that mimic all of the circumstances characterizing this analysis. In response to these uncertainties, a wide range of possible outcomes is considered in the following uncertainty analysis. A credible and widely accepted economic input-output model was used to translate the underlying assumptions into increases in final demand, changes in total employment and earnings, and changes in tax revenues. From these results, for the midrange scenario, it is apparent that final demand for Colorado goods and services increases by approximately $438 to $738 million per year -- the higher figure during construction and the lower post-construction -- and creates approximately 4,200 to 6,000 full-time equivalent jobs, again depending on whether it's the construction period or not.

The final columns describe the possible tax revenue implications. Depending on whether one considers the construction period or not, federal tax revenues should increase approximately $47 to $64 million per year and State and local tax revenues should increase by $27 to $33 million per year. Although these increases in revenue certainly benefit the respective jurisdictions, the increases do not necessarily represent net benefits in this case. This is because a portion of the benefit is already included in the before tax profit estimates associated with increased economic development, and because the jurisdictions will likely experience some increase in costs that will partially offset these revenue increases. In addition, some Federal tax revenues may not show a nation-wide net change because increases in production of some goods and services in Colorado may be offset my decreases in other regions.

Table 5-24
Summary of Potential Net Benefits
Midrange Scenario

	Refer to Table:	Total net benefit, present value ($1 mil)	Annualized net benefit ($1 mil/year) /1	Net Increase in demand for Colorado goods and services ($1 mil/year)	Net increase in jobs	Annual increase in federal tax revenues	Annual increase in State and local tax revenues
Transportation Net Benefits							
Railroad operating efficiency gains	5-1, 5-2	$693.89	$ 38.82				
Avoided capital costs for new grade-separated crossings	5-5	$51.89	$ 2.90				
Reductions in travel delay at railroad crossings	5-6	$332.40	$ 18.59				
Reduced number of train-auto accidents	5-18	$9.61	$ 0.54				
Economic Development and Land Use Benefits							
Western Colorado							
Coal industry	5-7, 5-8	$118.06	$ 6.60	$60.00	558	$8.21	$9.73
Front Range							
New economic growth from better rail facilities	5-9, 5-10	$470.27	$ 26.31	$352.00	3,400	$38.00	$14.20
Redevelopment of urban rail yards	5-11	$31.93	$ 1.79				$0.59
Eastern Colorado							
New economic growth from better rail access	5-12, 5-13	$34.59	$ 1.93	$26.03	282	$0.92	$0.77
Benefits to grain producers	5-14, 5-15, 5-16	$29.36	$ 1.84	$0.00	-	$0.16	$0.05
New Construction Jobs (assumes 30% of Project is out-of-state financed) /2	5-17			$300.00	1,726	$16.32	$6.48
Safety and Security Net Benefit							
Environmental Net Benefit							
Air quality benefits	5-20, 5-21	$244.81	$ 13.69				
Property value benefits due to noise reduction	5-19	$86.73	$ 4.85				$1.55
Energy reductions for autos	5-22	$21.00	$ 1.17				
Quality of Life							
Capital cost savings to future passenger rail	5-23	$178.25	$ 9.97				
Totals		$ 2,302.79	$ 129.01	$ 738.03	5,966	$63.61	$33.37
Totals, excluding temporary construction benefits				$ 438.03	4,240	$47.29	$26.89

/1 Annualized net benefits are the total net present value benefits amortized over the period 2004-2030 at a 3% rate of discount
/2 Benefits associated with construction jobs and their associated tax revenues will last only for the construction period, assumed to be 2006-09.

Sensitivity of the Results to Uncertainty

Many of the estimated benefits contain a high degree of uncertainty. This was explicitly recognized throughout the analysis for some of the higher-valued dollar benefits through the development of low, midrange, and high estimates of critical assumptions. To address these uncertainties, a Monte Carlo simulation was utilized to evaluate the statistical properties of a very large number of possible combinations of the low, midrange, and high variables.

For purposes of conducting the Monte Carlo analysis, a triangular statistical distribution was developed for those uncertain variables with low, midrange, and high estimates. Since a triangular distribution requires low, most likely, and high estimates of the variable in question, there is one-to-one correspondence with the estimates and the requirements of this distribution.

A high number of combinations of the variables was considered, approximately 50,000. The results themselves form the statistical distribution shown in Figure 5-4. Figure 5-4 shows that a benefit level of $2,400 million, or $2.4 billion, is most frequently estimated, but benefits may range from $1.8 billion to $4.2 billion.

Figure 5-4 Frequency distribution associated with total benefits

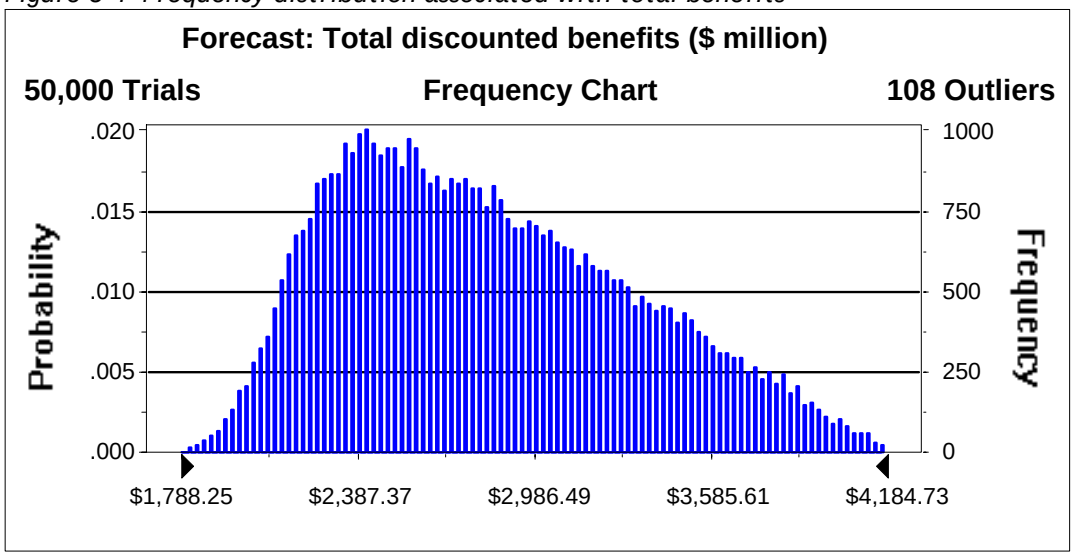
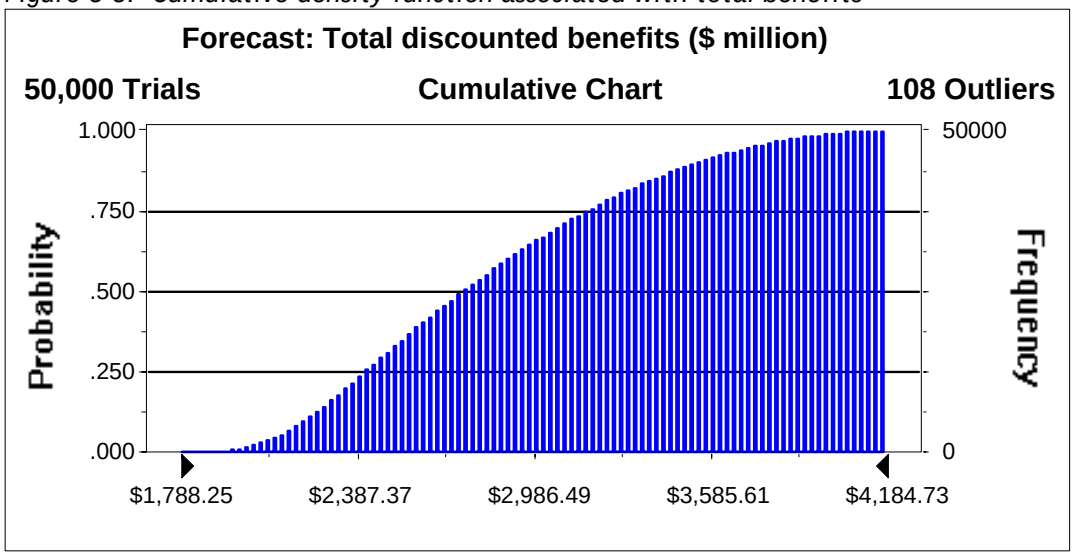


Figure 5-5 shows the cumulative density function associated with the above frequency distribution. It shows the cumulative probability that the benefits will be above or below certain levels. For instance, one can see that there is a cumulative probability of about 25 percent that benefits will be below about $2.4 billion and a 75 percent probability that benefits lie above $3.1 billion.

Figure 5-5. Cumulative density function associated with total benefits



Finally, observing the percentiles associated with various levels of benefit indicates that there is a 90 percent probability that benefits are above $4.4 billion and an 80 percent probability that they are above $3.3 billion.

Total discounted benefits ($ million)

Percentile	*Value*
100%	$1,690.33
90%	$2,226.36
80%	$2,366.29
70%	$2,491.59
60%	$2,619.43
50%	$2,761.75
40%	$2,912.76
30%	$3,085.42
20%	$3,292.39
10%	$4,427.71

Conclusions

Potential benefits associated with the Project are high, especially due to its economic development potential for the Front Range and the rest of Colorado. In a sense, the Project offers something for each portion of the State.

With Project expenditures estimated to be $1.2 billion, it is apparent that benefits should exceed costs with a relatively high degree of certainty. However, since these benefits accrue to a wide range of private and public interests, the nature of the cost allocation methods and the ultimate financial responsibility of the Project are not identified.

Appendix A
(Included in a separate file)

Appendix B
(Included in a separate file)

Appendix C
(Included in a separate file)

Appendix D
(Included in a separate file)

Appendix E
(Included in a separate file)