Targhee Pass Environmental Assessment

May 2020

Appendix A

Benefit-Cost Memorandum

Memorandum

RE: Estimation of Annualized Cost and Benefit-Cost Ratios of Safety Improvements for Targhee Pass Environmental Assessment Alternatives

Prepared by: Idaho Transportation Department District 6

Date: October 4, 2018

To inform the comparison of alternatives being considered in the Environmental Assessment, the Idaho Department of Transportation (ITD) District 6 estimated the annualized cost and benefit of roadway safety improvements and wildlife-vehicle collision reduction safety improvements. Project funding is through the Restoration Program and does not require benefit-cost analysis for funding.

"Benefits" in this analysis are limited to the estimated cost benefit of crash reduction and do not capture broader benefits of meeting objectives of the Corridor Plan (ITD, 2006) for addressing roadway structural deficiencies and traffic flow and supporting all aspects of ITD mission (safety, mobility, economic opportunity).

The attached spreadsheet provides a basic safety benefit-cost calculation for alternatives using crash data for the period 2012-2016. Crash data came from Idaho's statewide crash database. Crashes estimated to cost more than $1,500 are reported by law enforcement to the ITD Office of Highway Safety. The database consists only of crashes investigated by law enforcement officers.

Roadway safety improvements contributing to reduced probability of crashes include addition of a passing lane, shoulder widening, change in the horizontal alignment, and resurfacing. ITD utilizes a standardized method of evaluating safety benefits of these highway design elements (attached worksheet); ITD's safety evaluation of these roadway improvements provides an estimated crash-reduction factor of 60 percent.

The improvements contributing to the reduction in wildlife-vehicle collisions have a range of efficacy used to estimate the crash-reduction factor for each alternative. Conservative values for the efficacy for alternatives 2, 3, and 4 were used, ranging from 0.50 to 0.83. Standard warning signs or variable message signs (Alternatives 1 & 5) have a low expected efficacy; 0.10 was used in this analysis.

Federal regulation regarding the use of benefit-cost analysis in NEPA documents (40 CFR 1502.23) is quoted below. In terms of relevance of the benefit-cost estimation there is not a substantive difference in the benefit-cost ratio for any of the alternatives; therefore, the benefit-cost ratios (BCRs) do not inform a distinction between the alternatives. The BCR for roadway safety improvements (the same for all alternatives) is 0.15. The BCR's for wildlife-vehicle collision reduction measures are all very low (0.13 to 0.19), well below the break-even point of

1.0. Reasons for low benefit-cost ratios are the low number of crashes overall and relatively low costs of property damage per crash.

Among other factors, this analysis does not account for potential increase in frequency of wildlife-vehicle collisions with increased future traffic volume, and also does not include future discounting of costs. ITD also did not include the unreported accidents from law enforcement and reported carcass information from the Idaho Fish and Wildlife Information System. However, the results are not sensitive to the wildlife-related annual crash rate or efficacy of measures. This is due to the overall low magnitude of crashes, low cost per crash, and comparatively high cost of mitigation measures.

For a simple look at sensitivity of the BCRs to crash rates and costs per crash, the Alternative 2 wildlife design elements would become cost effective at a wildlife-related annual crash rate of 29 crashes per year (vs. current value: 3.8), or at a cost per crash of $151,000 (vs. current value: $21,212), with all other factors constant. Similarly results for wildlife-related BCRs are not sensitive to the efficacy, so potentially achievable higher efficacy rates would not substantially increase the BCRs. Again, this is due to the relatively low crash rates and cost per crash. Another ITD-funded study of wildlife safety solutions (Cramer, 2016) also found benefit-cost ratios lower than 1.0 for wildlife crossings for the Targhee Pass segment (Alternative 2).

This analysis also provides annualized costs of the alternatives, which do differ by alternative for the wildlife safety improvements.

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40 CFR 1502.23 (Use of cost-benefit analysis, National Environmental Policy Act):
"If a cost-benefit analysis relevant to the choice among environmentally different alternatives is being considered for the proposed action, it shall be incorporated by reference or appended to the statement as an aid in evaluating the environmental consequences. To assess the adequacy of compliance with section 102(2)(B) of the Act the statement shall, when a cost-benefit analysis is prepared, discuss the relationship between that analysis and any analyses of unquantified environmental impacts, values, and amenities. For purposes of complying with the Act, the weighing of the merits and drawbacks of the various alternatives need not be displayed in a monetary cost-benefit analysis and should not be when there are important qualitative considerations. In any event, an environmental impact statement should at least indicate those considerations, including factors not related to environmental quality, which are likely to be relevant and important to a decision."

Section 102(2)(B) of the National Environmental Policy Act (42 USC 4332) indicates that all agencies of the Federal Government shall:
"identify and develop methods and procedures . . . which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations."

Cited References:

Cramer, P.C. *Safety solutions for wildlife-vehicle collisions on Idaho's U.S. 20 and S.H. 87*. Idaho Transportation Department Research Report, Rigby, Idaho, 2016.

[ITD] Idaho Transportation Department. *U.S. 20 Corridor Plan Ashton to Montana State Line Final Report*. HDR Engineering, Inc., Boise, ID, 2006.

Alternative	1	2	3	4	5
COST roadway safety improvements					
Roadway improvement ($1,000)	$3,000	$14,500	$14,500	$14,500	$14,500
Improvement life	0	20	20	20	20
Annual cost based on 20-year life	N/A	$725	$725	$725	$725
BENEFIT roadway safety improvements					
Number of crashes per year (2010-2016 average)		8.6	8.6	8.6	8.6
Cost per crash per year		21.211628	21.211628	21.211628	21.211628
Total cost (crash x cost)		182.420001	182.420001	182.420001	182.420001
Crash reduction factor (CRF)		0.60	0.60	0.60	0.60
Annual benefit value, crash reduction (CRF/Total cost)	N/A	$109	$109	$109	$109
Benefit-Cost Ratio, roadway safety improvements	N/A	0.15	0.15	0.15	0.15
COST Wildlife safety improvements					
Ongoing Maintenance ($1,000/Year)*	$5	$50	$25	$75	$5
Wildlife Improvement ($1,000)**	$385	$13,128	$2,949	$7,252	$385
Life of improvement	10	30	10	20	10
Annual cost based on individual lifes	$43.50	$487.60	$319.90	$437.60	$43.50
BENEFIT Wildlife safety improvements					
Number of crashes per year, wildlife-related	3.8	3.8	3.8	3.8	3.8
Cost per crash per year	21.211628	21.211628	21.211628	21.211628	21.211628
Total cost (crash x cost)	80.604186	80.6041864	80.6041864	80.6041864	80.6041864
Crash reduction factor (CRF)	0.10	0.83	0.50	0.80	0.10
Annual benefit value, crash reduction (CRF/Total cost)	$8	$67	$40	$64	$8
Benefit-Cost Ratio, Wildlife safety improvements	0.19	0.14	0.13	0.15	0.19
Cummulative Benefit-Cost Ratio	N/A	0.15	0.14	0.15	0.15

*Maintenance costs estimated per year. The relatively high maintenance costs for alternative 4 is attributed the high cost of maintaining the fence as well as an Animal Detection System (ADS). In addition, the maintenance total includes the cost of replacing the ADS system once during the 20 year life span at $250,000, or $12,500 per year.
**Wildlife Improvement costs come from ITD estimates from 1/10/2018.

Each alternative assumed a different life span for the improvement. To compare the costs of improvements that would have different life spans, (bridge 30 years, ADS 10 years) benefit/cost ratios are being evaluated on a per year cost.

Costs assumed beyond 30 years for the life of improvement or the benefits realized in the future years have not been discounted to present value. The life of improvements have been adjusted to help account for some of this; for example, life of bridge structure was reduced from 50 years to 30 years.

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SAFETY EVALUATION

I. PROJECT DATA

	DISTRICT	ROUTE	SEG CODE	B.M.P.	E.M.P.	LENGTH	AADT	TYPE RDWY
EXIST. RDWY	6	US 20	2070	402.27	406.30	4.03	3.2	59

LOCATION		PROPOSED IMPROVEMENT			
			COST (1000)		
		LIFE	CONST	R/W	TOTAL
IMPROVEMENT	Reconstruction	20	20000	0	20000

US 20 from SH 87 to Montana State Line

II. ACCIDENT SUMMARY - SIGNIFICANCE

MO.	YR.	TOTAL	FATAL	INJURY	I + F	PDO	SV	MV	WET	DRY		
12	2016	4	0	2	2	2	3	1	3	1		
12	2015	5	0	1	1	4	5	0	1	4		
12	2014	6	0	2	2	4	6	0	2	4		
12	2013	10	0	2	2	8	10	0	7	3		
12	2012	18	0	2	2	16	16	2	10	8		
TOTAL------		43	0	9	9	34	40	3	23	20	0	0

AVE. SEVERITY % FOR THIS ROAD TYPE--------	46.8	53.2
EXPECTED I+F AND PDO ACCIDENTS----------	20.1	22.9
DIFFERENCE (DEVIATION FROM EXPECTED)---	-11.1	
STATISTICALLY SIGNIFICANT?----------	YES(-)	
CONFIDENCE LEVEL----------	80%	

- ○ SPOT INTERSECTION (INCLUDE X STREET)
- ○ SPOT NON-INTERSECTION
- ◉ SEGMENT (ALL ACCIDENTS)

III. TRAFFIC DATA

1	2	3	4	5	6	7	8	9	10	11	12
AADT (1000)					TOTAL NO. OF			TOTAL TRAVEL			
			CROSS	VCF			ACC/YR	MV/YR	MVM/YR	ACC/MV	ACC/MVM
PRES.	FUT.	AVE.	STREET	(3÷1)	YEARS	ACC.	(7 ÷ 6)	.365(1+4)	(9 x MI.)	(8 ÷ 9)	(8 ÷ 10)
3.2	4.865	4.03		1.26	5	43	8.60	1.17	4.71	-	1.83

IV. REDUCTION FACTOR

1	2	3	4	5	6
		BASE RATE	EXPECTED	D.R.	CALC.
ACC/MVM	R.F.	ACC/MV(M)	ACC/MV(M)	MV(M)	R.F.
				1-(>3 OR 4)	(5 ÷ 1)
1.83	0.599	0.95	0.73	0.88	0.48

V. SAFETY INDEX CALCULATION (METHOD I)

1	2		3	4							
	ACC.		BEFORE ACC. COST ($1000)								
	TYPE	NO.	COST	TOTAL	5	6	7	8	9	10	11
	I+F	9	85.1	765.9							
	PDO	34	4.3	146.2	$/ACC.	ACC./YR	VCF	LIFE	1.00-CRF	$ BEFORE	$ AFTER
YES(+)											
YES(-)		43	32.71	912.1	21.211628	8.6	1.26	20	0.520	4597.55	3686.434
NO											

SAFETY INDEX = (BOX 10 - BOX 11) ÷ TOTAL COST =	911.12	÷ 20000.00	=	0.05
ANNUAL SAFETY BENEFIT = (BOX 10 - BOX 11) ÷ (BOX 8) =	911.12	÷ 20	=	$45,556

COMPUTED BY: Derek Noyes DATE: 10/04/18 PROJECT NO.: A(014)054

CHECKED BY: _____ DATE: _____ KEY NUMBER: 14054

PDO = Property Damage Only
SV = Single Vehicle
MV = Multiple Vehicle

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(REVERSE SIDE)

SAFETY EVALUATION
-SUPPLEMENTAL-

VI. ACCIDENT COSTS (METHOD II)

1	2	3	4		5	6	7
BEFORE ACCIDENTS					EXPECTED ACCIDENTS		
TYPE	NO.	COST	TOTAL		NO.	COST	TOTAL
I + F							
PDO							
TOTAL							

VII. SAFETY INDEX CALCULATION (METHOD II)

1	2	3	4	5	6	7
BEFORE	EXPECTED				BEFORE	EXPECTED
$/ACC	$/ACC	ACC/YR	VCF	LIFE	COST	COST
SAFETY INDEX = (BOX 6 - BOX 7) ÷ TOTAL COST =				÷	=	
ANNUAL SAFETY BENEFIT = (BOX 6 - BOX 7) ÷ (BOX 5) =				÷	=	

COMMENTS:

Reduction Factors:

Passing Lane RF=0.2

Add Shoulder RF=0.2

Change Horizontal Alignment RF=0.3

Resurfacing RF=0.2(W)

Total Accidents = 43

Total Wet/Icy Accidents = 23

Resurfacing = 0.2x23 = 4.6

43-4.6=38.4

Passing Lane = 0.2*38.4 = 7.68

38.4-7.68=30.72

Add Shoulder = 0.2*30.72 = 6.114

30.72-6.114=24.606

Change Horizontal Alignment = 0.3*24.606 = 7.3818

Total Reduction = 4.6+7.68+6.114+7.3818 = 25.7758

Total Reduction Factor = 25.7758/43 = 59.9%