

The Department of Transportation conducts an analysis of costs and benefits for highway projects estimated to cost greater than \$25 million. The B/C ratios are just one factor considered when prioritizing highway projects. As part of a major project's development, consultants are typically used. Part of the design process includes the requirement to conduct the B/C analysis.

For Phase 1 of the Boulder City Freeway, the analysis completed in 2008 resulted in a life cycle B/C = 0.35. This analysis was a preliminary analysis. The benefits were estimated at \$49 million while the cost estimate was \$140 million. When the analysis was reviewed, a number of problems were identified. One problem with the analysis was that it didn't consider the imbalance between the length of the project and the complex interchange required to provide local access in the Railroad Pass area. This avoids acquiring properties in total because of impaired access. Another problem was with regard to traffic assignment and air quality. The traffic assignment was not balanced properly between the new freeway segment and the existing old alignment.

The Boulder City Freeway was incorporated into the Clark County Regional Transportation Plan (RTP) as a priority project. This was voted on by all local entities in Clark County. NDOT completed NEPA and a Record of Decision was received in December 2005. Then the project received a SAFETEA-LU Federal Earmark in the estimated amount of \$34 million. Boulder City requested that Phase 1 and 2 of the project be developed enough to identify right of way so Boulder City could begin the process of reserving or purchasing said right of way. NDOT used a portion of this earmark to advance the project to 30% design to identify the right of way. This process can take many years and must be completed for a phase before construction can begin. The federal money must be utilized towards this project; it cannot be used on any other project and can be subject to rescission by Congress. Additionally, because of the delay in fully funding the Freeway project, Boulder City requested a portion of the earmark be used on interim improvements in Boulder City proper. The remaining earmark is to purchase right of way.

Full funding is not available for the project and no construction is scheduled. As per the requirements of AB 595 passed in the 2007 Legislative Session, before the Department submits a proposal for a highway project to the State Transportation Board for approval (the annual and three year work programs), the Department will prepare a written analysis of the costs and benefits of the project. Phase 1 is in the Statewide Long Range Plan and not subject to Board approval or a final B/C analysis. It is not scheduled in the current Clark RTP to be constructed until 2020. Phase 2 is not in the Statewide Plan at all. When funding is identified and the project is scheduled to move into the 3-year plan, a new B/C analysis will be done.

Susan Martinovich
April 21, 2009

Nevada DOT Highway Project Cost-Benefit Analysis Report**Table 8 Highway Project Benefit-Cost Analysis Results Summary**

Project	Life Cycle Benefits/Total Costs Ratio (Excludes Transit and O&M)	Net Present Value of Benefits Costs at 7% Discount Rate (Excludes Transit and O&M)	Payback Period at 7% Discount Rate
I-15 GAP Interim without Express Lanes	\$3,647M/\$51M= 71.5	\$1,337M/\$46M= 28.9	3 Years
I-15 GAP Interim with Express Lanes	\$931M/\$51M= 18.3	\$341M/\$46M= 7.4	5 Years
U.S. 95 Northwest	\$2,594M/\$326M= 7.96	\$776M/\$214M= 3.63	8 Years
I-15 South	\$4,945M/\$664M= 7.45	\$1,479M/\$360M= 4.11	8 Years
I-15 North	\$3,004M/\$435M= 6.91	\$952M/\$284M= 3.39	9 Years
Project NEON	\$5,510M/\$1,108M*= 4.97	\$1,648M/\$835M*= 1.97	12 Years
I-515	\$5,216M/\$1,316M= 3.98	\$1,363M/\$704M= 1.94	12 Years
U.S. 395 Douglas County	\$402M/\$641M = 0.63	\$129M/\$362M= 0.36	>50 Years
Boulder City Bypass* (Phase 1)	-\$85M/\$268M = 0.35	-\$30M/\$163M = 0.17	Not Paid Back
Boulder City Bypass* (Phase 2)	-\$85M/\$268M = - 0.32	-\$30M/\$163M = - 0.18	Not Paid Back

Source: Parsons (using STEAM 2.0)

* Value under review for revision

Non-STEAM 2.0 spreadsheet calculations

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

OVERVIEW

The Boulder City Bypass (Phase 1) project would extend I-515 from its current terminus in Henderson to U.S. 95 in Boulder City on a new alignment. The project would also improve U.S. 93 to a four-lane freeway between the U.S. 93/U.S. 95 interchange and its tie into I-515. The existing traffic signalized intersection of U.S. 93 at Railroad Pass Hotel and Casino would be replaced by grade separated interchanges serving both U.S. 93 and I-515.

The project is currently in design as of October 2007. The estimated cost of the project is approximately \$140 million, including right-of-way and design costs. The Phase 1 project may be split into two projects to address funding availability.

This benefit/cost analysis considers the complete Phase 1 project as illustrated on the next page. Land use plans submitted by the Southern Nevada Regional Planning Coalition Land Use Working Group to the Southern Nevada Regional Transportation Commission for incorporation within the 2007 Planning Variable database are reflected in the analysis. As such, traffic growth on U.S. 93 and U.S. 95 assumes a continuation of trends observed by NDOT over the past 10 years; and reflects a growth in Boulder City's population from 15,800 as of 2006 to 20,000 by Year 2030. Land development proposals which are not entitled or permitted by currently adopted land use plans are not reflected within the analysis. These proposals include the 345-acre "Canamex Industrial Park" lying southwest of U.S. 93 at Railroad Pass; and 3,800 dwelling units proposed by Lawrence Canarelli lying on 700 acres west of U.S. 95 near Dutchman Pass.

Traffic volumes along U.S. 93/U.S. 95 at the west end of the project's limit are forecast to increase from 44,000 in 2005 to an annual average daily traffic volume of 70,000 in Year 2030. Traffic volumes along U.S. 95, between Searchlight and U.S. 95, are forecast to increase from 6,700 vehicles per day in 2005¹ to nearly 10,000 vehicles per day by 2030.

Given these traffic volume forecasts, the Boulder City Bypass (Phase 1) Benefit/Cost Analysis identified the following:

- Statewide transportation funding shortfalls may delay implementation of the Boulder City Bypass (Phase 2) project. Given the absence of a Phase 2 project, the I-515 extension to U.S. 95 could be expected to serve less than 10,000 vehicles per day from its day of opening to 2030.
- Given the low volume of traffic using the I-515 extension to U.S. 95, the net present value benefit/cost ratio for the overall Build Alternative (Phase 1) is relatively low (0.17). The cost of the complete Phase 1 project will never be paid back, given the absence of a Phase 2 project.
- Improving U.S. 93 between the west end of the project and the U.S. 93/U.S. 95 interchange, to include an interchange at Railroad Pass, may be cost effective. A separate benefit/cost analysis has not been undertaken for this initial portion of the Boulder City Bypass (Phase 1) which appears to offer independent utility.

¹ Volume adjusted to exclude trucks diverted to U.S. 95 from U.S. 93 following September 11, 2001.

Boulder City Bypass (Phase 1) Benefit/Cost Analysis



Boulder City Bypass Phase 1 (I-515 from Foothills Drive in Henderson to the U.S. 95 Interchange)

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Table 1a. Boulder City Bypass Measures of Effectiveness

	2016		
	No-Build	Build	Change
Travel Demand			
VMT (million VMT/year)	46.4	44.8	-1.6
Travel time (million person hours/year)	0.75	0.67	-0.08
Tons of Emissions (tons/year)			
VMT Related Emissions			
HC	28.8	28.1	-0.7
CO	228.7	232.0	3.3
NO _x	49.6	49.6	0.0
PM ₁₀	1.7	1.7	-0.1
Cold start emissions	No Change		
Greenhouse Gas Emissions			
Btu energy consumption (100 billion Btu/year)	2.9	5.0	2.1
CO ₂ emissions (1,000 tons/year)	22.8	38.7	15.9
Accidents			
Fatalities	0.4	0.3	-0.1
Injuries	45.9	38.9	-7.0
Property damage only	111.2	99.6	-11.6
Fuel Consumption			
Gallons (1,000 gallons/year)	2,618.2	2,546.7	-71.5
Source: Parsons			

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Table 1b. Boulder City Bypass Measures of Effectiveness

	2030		
	No-Build	Build	Change
Travel Demand			
VMT (million VMT/year)	58.9	56.9	-2.0
Travel time (million person hours/year)	0.95	0.85	-0.10
VMT Related Emissions			
HC	36.6	36.0	-0.6
CO	291.1	297.8	6.7
NO _x	63.5	65.4	1.8
PM ₁₀	2.2	2.2	0.0
Cold start emissions	No Change		
Greenhouse Gas Emissions			
Btu energy consumption (100 billion Btu/year)	3.7	6.2	2.5
CO ₂ emissions (1,000 tons/year)	28.6	48.6	20
Accidents			
Fatalities	0.5	0.4	-0.1
Injuries	58.0	49.5	-8.5
Property damage only	140.8	126.6	-14.2
Fuel Consumption			
Gallons (1,000 gallons/year)	3,339.3	3,359.1	19.8
Source: Parsons			

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Table 2a. Summary of Boulder City Bypass Build Alternative Benefits

Benefit Type	\$/Year In Year 2016
	October 2007
User Benefits	
In-vehicle travel time	\$1,006,723
Fuel costs	149,329
Non-fuel operating costs	7,028
Internal accident costs	906,719
Revenue Transfers	(41,234)
Reduction in External Costs	
Emissions	26,292
Global warming	(56,604)
Noise	2,658
Accident	160,003
Other mileage based	96,832
Total Benefits	\$2,257,741

Table 2b. Summary of Boulder City Bypass Build Alternative Benefits

Benefit Type	\$/Year In Year 2030
	October 2007
User Benefits	
In-vehicle travel time	\$1,257,924
Fuel costs	(46,537)
Non-fuel operating costs	(4,233)
Internal accident costs	1,112,408
Revenue Transfers	14,772
Reduction in External Costs	
Emissions	(96,148)
Global warming	(71,200)
Noise	3,561
Accident	196,299
Other mileage based	116,504
Total Benefits	\$2,483,350

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Table 3. Boulder City Bypass Life-Cycle Benefits and Costs

Year	Total Benefits	Total Costs	Net Present Value	Net Present Value Benefits	Net Present Value Costs
2007	-	\$ 4,700,000	1.000	-	\$ 4,700,000
2008	-	8,100,000	0.935	-	7,573,500
2009	-	45,000,000	0.873	-	39,285,000
2010	-	81,495,000	0.816	-	66,499,900
2011	\$ 2,177,167	-	0.763	\$ 1,661,200	-
2012	2,193,281	-	0.713	1,563,800	-
2013	2,209,396	-	0.666	1,471,500	-
2014	2,225,511	-	0.623	1,386,500	-
2015	2,241,626	-	0.582	1,304,600	-
2016	2,257,741	-	0.544	1,228,200	-
2017	2,273,856	-	0.508	1,155,100	-
2018	2,289,971	-	0.475	1,087,700	-
2019	2,306,086	-	0.444	1,023,900	-
2020	2,322,201	-	0.415	963,700	-
2021	2,338,316	-	0.388	907,300	-
2022	2,354,430	-	0.362	852,300	-
2023	2,370,545	-	0.339	803,600	-
2024	2,386,660	-	0.317	756,600	-
2025	2,402,775	-	0.296	711,200	-
2026	2,418,890	-	0.277	670,000	-
2027	2,435,005	-	0.258	628,200	-
2028	2,451,120	-	0.242	593,200	-
2029	2,467,235	-	0.226	557,600	-
2030	2,483,350	-	0.211	524,000	-
	\$46,605,162	\$139,295,000	-	\$19,850,200	\$118,058,400

Source: Parsons

Table 4. Boulder City Bypass Project Phasing Assumptions

Phase	Timeframe and Cost (2007 \$'s)	Project Elements
1	2007-2010 \$139.3M	• I-515 to U.S. 95

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Table 5. Summary of Boulder City Bypass Benefit-Cost Analysis Results

Life Cycle Benefits/Total Costs Ratio (Excludes Transit and O&M)

$\$46.6M/\$139.3M = 0.33$

**Net Present Value of Benefits Costs at 7% Discount Rate
(Excludes Transit and O&M)**

$\$19.85M/\$118.06M = 0.17$

Payback Period at 7% Discount Rate

Not paid back.

Source: Parsons

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Daily AADT	2016			2030		
	No-Build	Build	Change	No-Build	Build	Change
Roadway Segment						
West Study Limit to US 93/95 I/C	55,000	47,100	-7,900	70,000	60,250	-9,750
US 93/95 I/C to East Study Limit	7,900	800	-7,100	9,750	1,000	-8,750
West Study Limit to East Study Limit	n/a	7,100	7,100	n/a	8,750	8,750
Totals	62,900	55,000	-7,900	79,750	70,000	-9,750
Annual VMT						
Autos	44,043,221	42,518,768		55,831,687	54,018,878	
Trucks	2,338,698	2,275,748		3,026,160	2,929,061	
Total (Million Miles)	46.4	44.8	-1.6	58.9	56.9	-1.9
Annual Travel Time						
Autos	711,005	636,391	-74,614	900,827	808,509	-92,318
Trucks	37,758	34,085	-3,673	48,824	43,836	-4,988
Total (Million Hours)	0.75	0.67	-0.08	0.95	0.85	-0.10
Time Benefit Value	\$9,670,162	\$8,663,439	-\$1,006,723	\$12,279,388	\$11,021,413	-\$1,257,974

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Accidents	2016			2030		
	No-Build	Build	Change	No-Build	Build	Change
Fatalities						
Arterial	0.0982	0.0099		0.1212	0.0124	
Freeway	0.2764	0.2926		0.3518	0.3721	
Total Fatalities	0.4	0.3		0.5	0.4	
Internal Value	\$1,353,543	\$1,093,298	-\$260,245	\$1,709,010	\$1,389,392	-\$319,618
External Value	\$238,860	\$192,935	-\$45,926	\$301,590	\$245,187	-\$56,403
Injuries						
Arterial	10.1058	1.0234		12.4723	1.2792	
Freeway	35.8086	37.9137		45.5745	48.2085	
Total Injuries	45.9	38.9		58.0	49.5	
Internal Value	\$3,738,941	\$3,170,758	-\$568,182	\$4,726,927	\$4,029,934	-\$696,994
External Value	\$659,789	\$559,525	-\$100,264	\$834,133	\$711,139	-\$122,994
Property Damage						
Arterial	18.9297	1.9169		23.3626	2.3962	
Freeway	92.2706	97.6949		117.4353	124.2225	
Total PDOs	111.2	99.6		140.8	126.6	
Internal Value	\$751,269	\$672,978	-\$78,291	\$951,231	\$855,435	-\$95,795
External Value	\$132,551	\$118,737	-\$13,813	\$167,831	\$150,929	-\$16,902
Total Accident Internal Value	5,843,753	4,937,034	-\$96,719	7,387,168	6,274,761	-1,112,408
Total Accident External Value	1,031,200	871,197	-160,003	1,303,554	1,107,255	-196,299

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Fuel Consumption	2016			2030		
	No-Build	Build	Change	No-Build	Build	Change
Autos						
Arterial	141,152	14,115		174,088		17,879
Freeway	1,709,933	1,809,914		2,173,921		2,299,514
Auto Subtotal (1,000 gal/yr)	1,851.1	1,824.0	-27.1	2,348.0	2,317.4	-30.6
Trucks						
Arterial	100,147	12,519		125,183		125,183
Freeway	666,941	710,125		866,157		916,573
Truck Subtotal (1,000 gal/yr)	767.1	722.6	-44.4	991.3	1,041.8	50.4
Total (1,000 gal/yr)	2,618.2	2,546.7	-71.5	3,339.3	3,359.1	19.8
Fuel Value						
Autos (\$2.004/gal.)	\$3,709,574	\$3,655,355		\$4,705,409		\$4,644,057
Trucks (\$2.14/gal.)	\$1,641,568	\$1,546,458		\$2,121,469		\$2,229,358
Total	\$5,351,143	\$5,201,813	-\$149,329	\$6,826,878	\$6,873,415	\$46,537
Revenue Transfers						
Auto (\$0.522/gal)	\$966,266	\$952,143		\$1,225,661		\$1,209,680
Truck (\$0.61/gal)	\$467,924	\$440,813		\$604,718		\$635,471
Total	\$1,434,190	\$1,392,956	-\$41,234	\$1,830,378	\$1,845,151	\$14,772
Non-Fuel Operating Costs						
Auto (\$0.061/mile)	\$112,916	\$111,266		\$143,229		\$141,361
Truck (\$0.121/mile)	\$92,818	\$87,440		\$119,952		\$126,052
Total	\$205,734	\$198,706	-\$7,028	\$263,181	\$267,413	\$4,233

boulder City Bypass (Phase 1) Benefit/Cost Analysis

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

Cost of Emission (\$/yr)	2016		2030			
	No-Build	Build	Change	No-Build	Build	Change
HC (\$7,407/ton)	\$213,325	\$208,163	-\$5,161	\$270,978	\$266,767	-\$4,211
CO (\$127/ton)	\$29,043	\$29,466	\$423	\$36,971	\$37,819	\$848
NOx (\$51,635/ton)	\$2,560,185	\$2,561,359	\$1,174	\$3,280,968	\$3,375,812	\$94,844
PM ₁₀ (\$422,985/ton)	\$726,941	\$704,214	-\$22,728	\$929,827	\$934,495	\$4,668
Total Emissions Cost	\$3,529,494	\$3,503,201	-\$26,292	\$4,518,744	\$4,614,893	\$96,148
Greenhouse Gas Emissions						
Btu Energy Consumption (100 billion Btu/yr)						
Autos						
Trucks						
Btu Total (100 billion/yr)	2.9	5.0	2.1	3.7	6.2	2.5
CO ₂ Emissions (1,000 tons/yr)						
Autos						
Trucks						
CO₂ Total (1,000/yr)	22.8	38.7	15.9	28.6	48.6	20.0
Greenhouse Gas Costs						
CO ₂ Emissions (\$3.56 per ton)	\$81,168	\$137,772	\$56,604	\$101,816	\$173,016	\$71,200
Noise Costs						
Autos	\$44,043	\$42,519	\$55,832	\$54,019		
Trucks	\$42,097	\$40,963	\$54,471	\$52,723		
Total Noise Cost	\$86,140	\$83,482	-\$2,658	\$110,303	\$106,742	-\$3,561
Other Mileage-Based Cost						
Autos	\$2,686,636	\$2,593,645	\$3,405,733	\$3,295,152		
Trucks	\$142,661	\$138,821	\$184,596	\$178,673		
Total Other Mileage-Based Cost	\$2,829,297	\$2,732,465	-\$96,832	\$3,590,329	\$3,473,824	-\$116,504

Boulder City Bypass (Phase 1) Benefit/Cost Analysis

AADT. No Build Traffic Volumes and Speeds

Segment	1999	2005 ¹	Average Speed	2016 ²	Average Speed	2030 ³	Average Speed
West Study Limit to U.S. 93/95 Interchange	38,300	44,000	63 mph	55,000	63 mph	70,000	63 mph
U.S. 93/95 Interchange to Veterans Memorial Drive	32,000	36,000	55 mph	45,500	55 mph	60,250	53 mph
U.S. 93/95 Interchange to SR 165	6,300	6,700	52 mph	7,900	52 mph	9,750	52 mph

¹ Adjusted to include trucks diverted to U.S. 95 following 9/11

² Trucks = 2,772 of all segment volumes on U.S. 93

³ Trucks = 3,600 of all segment volumes on U.S. 93