Benefit-Cost Analysis Report
March 2021

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1. Introduction

A benefit-cost analysis (BCA) was conducted for the SR-91 Segment 1 project as part of the 2021 RAISE grant application submittal. The Orange County Transportation Authority (OCTA) is the project applicant. The project proposes to improve traffic operations on State Route (SR)-91 from SR-55 to east of Lakeview Avenue (milepost 9.4 and milepost 10.8 respectively), and on SR-55 from south of SR-91 to SR-91 (milepost 17.4 to milepost 17.9) in Orange County, California. The proposed improvements include modifications to interchanges, connectors, ramps and intersections.

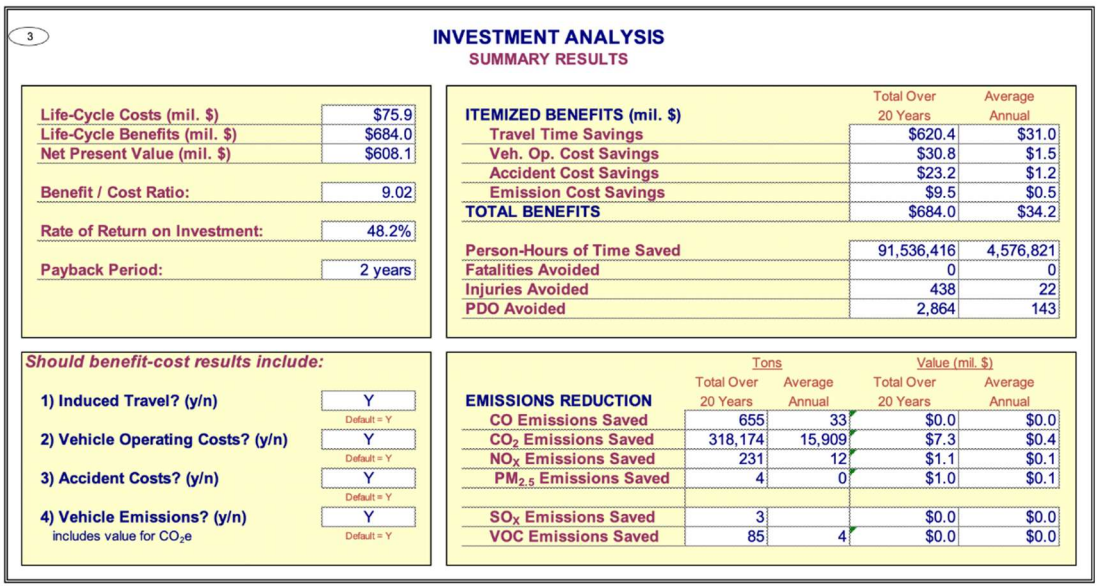
The BCA was conducted utilizing the California Life-Cycle Benefit/Cost Analysis Model for 2021 RAISE Applications (Cal-B/C Corridor) Version 7.1 dated February 2021. Cal-B/C Corridor is a post-processor, benefit-cost tool for preparing economic analyses of highway and transit projects. The model conducts benefit-cost analyses using the changes in vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) or person-miles traveled (PMT) and person-hours traveled (PHT) estimated in traffic and planning models. Cal-B/C Corridor is derived from the Cal-B/C Sketch model, but it has a flexible design to support a variety of inputs, including segment and speed bin data from regional travel demand and micro-simulation models. The Cal-B/C Corridor model uses the same assumptions and parameters and produces results fully comparable with Cal-B/C. The California Department of Transportation adjusted the parameters in Cal-B/C Corridor to coincide with the parameters included in the United States Department of Transportation's Benefit-Cost Analysis Guidance for Discretionary Grant Programs (February 2021).

The results of the BCA are summarized in Table 1 on the next page. The Benefit/Cost Ratio of 9.02 which indicates the project is highly cost-effective. Of the total itemized benefits of $684 million over 20 years, it is estimated that $50 million is attributed to freight benefits.

2. Current Baseline, Proposed Project, and Project Impacts

SR-91 during the peak periods operates under saturated conditions along the project segment. A bottleneck occurs on westbound SR-91 at the SR-91/SR-55 Interchange that queues back to the Lakeview Ave Off-ramp. Congestion also occurs from weaving and merging between ramps that has resulted in vehicle accidents.

Table 1: Summary Results of the Benefit-Cost Analysis



INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$75.9
Life-Cycle Benefits (mil. $)	$684.0
Net Present Value (mil. $)	$608.1
Benefit / Cost Ratio:	9.02
Rate of Return on Investment:	48.2%
Payback Period:	2 years

ITEMIZED BENEFITS (mil. $)	Total Over 20 Years	Average Annual
Travel Time Savings	$620.4	$31.0
Veh. Op. Cost Savings	$30.8	$1.5
Accident Cost Savings	$23.2	$1.2
Emission Cost Savings	$9.5	$0.5
TOTAL BENEFITS	$684.0	$34.2
Person-Hours of Time Saved	91,536,416	4,576,821
Fatalities Avoided	0	0
Injuries Avoided	438	22
PDO Avoided	2,864	143

Should benefit-cost results include:

1) Induced Travel? (y/n)	Y (Default = Y)
2) Vehicle Operating Costs? (y/n)	Y (Default = Y)
3) Accident Costs? (y/n)	Y (Default = Y)
4) Vehicle Emissions? (y/n) includes value for CO_2e	Y (Default = Y)

EMISSIONS REDUCTION	Tons: Total Over 20 Years	Tons: Average Annual	Value (mil. $): Total Over 20 Years	Value (mil. $): Average Annual
CO Emissions Saved	655	33	$0.0	$0.0
CO_2 Emissions Saved	318,174	15,909	$7.3	$0.4
NO_X Emissions Saved	231	12	$1.1	$0.1
$PM_{2.5}$ Emissions Saved	4	0	$1.0	$0.1
SO_X Emissions Saved	3		$0.0	$0.0
VOC Emissions Saved	85	4	$0.0	$0.0

The Build Alternative includes the following improvements[1]:

- SR-91/Lakeview Avenue Interchange: Existing westbound ramps would be replaced with tight diamond ramps; a drop ramp would be constructed for dedicated access to southbound SR-55 and the outside lanes along SR-91 would be shifted to the north through the interchange.
- Lakeview Avenue OC Bridge (Bridge Number 550475): Existing OC bridge would be replaced with a new bridge increasing the number of lanes from 4 to 6.
- SR-91/SR-55 Barrier Separation: A ¾-mile barrier will be constructed to separate westbound SR-91 from southbound SR-55 to eliminate the existing weaving and to reduce congestion related accidents.

Table 2 on the following page summarizes the problems the project will address, the proposed improvements, and project impacts.

3. Project Data & Cost Included in the Cal B/C Model

OCTA modeling staff conducted a micro-simulation analysis of Segment 1 project improvements to estimate the change in VMT and VHT for the Build and No Build scenarios for Opening Year 2030 and Horizon year 2050. AM and PM peak period data for westbound SR-91 was utilized for the analysis. The results are provided in Tables 3 through 6.

Table 2: Summary Matrix

[1] SR-91 Improvement Project Between SR-57 and SR-55 Initial Study/Environmental Assessment, Appendix A. Section 4(f)/6(f) Evaluation De Minimis *Finding*, p A-4 (pdf page 4). http://www.octa.net/SR91-55toLakeview/RAISE

Current Status/Baseline and Problem to be Addressed	Change to Baseline or Alternatives	Types of Impacts
Existing and projected SR-91 mainline peak period traffic demand exceeds capacity. Congestion due to weaving and merging has created bottlenecks along westbound SR-91 and accidents.	Replace Lakeview Avenue Bridge; Replace westbound ramps with tight diamond ramps; Barrier separate westbound SR-91 from Southbound SR-55; add a new drop for dedicated access to southbound SR-55 from Lakeview Avenue; and shift SR-91 outside lanes to the north through the SR-91/Lakeview Avenue Interchange.	Improve capacity, and reduce congestion and accidents; Reduce weaving and merging between ramps.

Table 3: AM Peak Period 2030 No Build & Build VMT and VHT

2030 WB No Build				2030 WB Build			
Speed Bin (MPH)	Speed Bin ID	AM Period VMT	AM Period VHT	Speed Bin (MPH)	Speed Bin ID	AM Period VMT	AM Period VHT
0-5	1	-	-	0-5	1	-	-
5-10	2	27,142	3,429	5-10	2	-	-
10-15	3	5,572	442	10-15	3	-	-
15-20	4	8,602	465	15-20	4	-	-
20-25	5	2,646	130	20-25	5	-	-
25-30	6	-	-	25-30	6	2,852	98
30-35	7	4,792	143	30-35	7	-	-
35-40	8	3,529	96	35-40	8	471	13
40-45	9	541	12	40-45	9	13,760	323
45-50	10	-	-	45-50	10	6,316	132
50-55	11	1,298	24	50-55	11	9,012	168
55-60	12	60,885	1,047	55-60	12	76,662	1,320
60-65	13	6,608	109	60-65	13	13,973	231
65-70	14	-	-	65-70	14	-	-
70-75	15	-	-	70-75	15	-	-
>75	16	-	-	>75	16	-	-
TOT		**121,615**	**5,897**	**TOT**		**123,046**	**2,285**

Table 4: PM Peak Period 2030 No Build & Build VMT and VHT

2030 WB No Build				2030 WB Build			
Speed Bin (MPH)	Speed Bin ID	PM Period VMT	PM Period VHT	Speed Bin (MPH)	Speed Bin ID	PM Period VMT	PM Period VHT
0-5	1	-	-	0-5	1	-	-
5-10	2	25,106	3,172	5-10	2	-	-
10-15	3	5,154	409	10-15	3	-	-
15-20	4	7,957	430	15-20	4	-	-
20-25	5	2,448	120	20-25	5	-	-
25-30	6	-	-	25-30	6	2,638	91
30-35	7	4,433	132	30-35	7	-	-
35-40	8	3,264	89	35-40	8	436	12
40-45	9	500	11	40-45	9	12,728	299
45-50	10	-	-	45-50	10	5,842	122
50-55	11	1,201	22	50-55	11	8,336	155
55-60	12	56,319	968	55-60	12	70,912	1,221
60-65	13	6,112	101	60-65	13	12,925	214
65-70	14	-	-	65-70	14	-	-
70-75	15	-	-	70-75	15	-	-
>75	16	-	-	>75	16	-	-
TOT		**112,494**	**5,455**	**TOT**		**113,818**	**2,114**

Table 5: AM Peak Period 2050 No Build & Build VMT and VHT

2050 WB No Build				2050 WB Build			
		AM Period				AM Period	
Speed Bin	Speed Bin ID	VMT	VHT	Speed Bin	Speed Bin ID	VMT	VHT
0-5	1	-	-	0-5	1	-	-
5-10	2	32,494	4,313	5-10	2	-	-
10-15	3	11,377	1,010	10-15	3	6,808	534
15-20	4	10,195	556	15-20	4	-	-
20-25	5	1,824	86	20-25	5	726	32
25-30	6	12,595	446	25-30	6	-	-
30-35	7	-	-	30-35	7	-	-
35-40	8	1,493	44	35-40	8	11,909	326
40-45	9	-	-	40-45	9	8,535	201
45-50	10	1,740	37	45-50	10	5,103	112
50-55	11	740	14	50-55	11	7,806	151
55-60	12	44,640	772	55-60	12	67,346	1,159
60-65	13	3,573	60	60-65	13	16,408	271
65-70	14	-	-	65-70	14	-	-
70-75	15	-	-	70-75	15	-	-
>75	16	-	-	>75	16	-	-
TOT		**120,671**	**7,338**	**TOT**		**124,641**	**2,786**

Table 6: PM Peak Period 2050 No Build & Build VMT and VHT

2050 WB No Build				2050 WB Build			
		PM Period				PM Period	
Speed Bin	Speed Bin ID	VMT	VHT	Speed Bin	Speed Bin ID	VMT	VHT
0-5	1	-	-	0-5	1	-	-
5-10	2	32,364	4,296	5-10	2	-	-
10-15	3	11,331	1,006	10-15	3	6,781	532
15-20	4	10,154	554	15-20	4	-	-
20-25	5	1,817	86	20-25	5	723	32
25-30	6	12,545	444	25-30	6	-	-
30-35	7	-	-	30-35	7	-	-
35-40	8	1,487	44	35-40	8	11,861	325
40-45	9	-	-	40-45	9	8,501	200
45-50	10	1,733	37	45-50	10	5,083	112
50-55	11	737	14	50-55	11	7,775	150
55-60	12	44,461	769	55-60	12	67,077	1,154
60-65	13	3,559	60	60-65	13	16,342	270
65-70	14	-	-	65-70	14	-	-
70-75	15	-	-	70-75	15	-	-
>75	16	-	-	>75	16	-	-
TOT		**120,188**	**7,309**	**TOT**		**124,142**	**2,775**

Table 7 on the next page summarizes the accident data used in the analysis. The data in the orange-shaded columns were added to the Cal-B/C Corridor model. Accident rates were obtained from the project environmental document for sections located on SR-91 within the Project Limits.[2] Traffic volumes (ADT) were obtained from the project Traffic Study for SR-91 sections within the Project Limits[3], and the crash reduction factors were obtained from the Federal Highway Administration.[4] Segment length (miles) was estimated using the Google Earth Pro measuring tool.

[2] Caltrans, SR-91 Improvement Project Between SR-57 and SR-55, Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impact (Environmental Document), Table 1-5, pdf page 33.

[3] Caltrans, Traffic Study Report, SR-91 Improvements Between SR-57 and SR-55, July 2018, Exhibit 17, pdf page 31. http://www.octa.net/SR91-55toLakeview/RAISE

[4] Source: http://www.cmfclearinghouse.org/collateral/FHWA_Desktop_Reference_Guide.pdf

Table 7: Accident Data

				2030 No Build		2030 Build		2050 No Build		2050 Build						
Direction	From	To	Miles	ADT	VMT	ADT	VMT	ADT	VMT	ADT	VMT	Fatal Accident Rate Per MVM	Injury Accident Rate Per MVM	PDO Accident Rate Per MVM	Total Accident Rate Per MVM	Crash Reduction Factor
SR-91 Eastbound	SR-91/SR-55 IC	East of Lakeview	0.35	146,900	51,415	148,000	51,800	153,900	53,865	155,500	54,425	0.000	0.06	0.28	0.34	20
SR-91 Eastbound	East of Lakeview	Lakeview	0.36	132,300	47,628	132,700	47,772	139,600	50,256	140,300	50,508	0.000	0.12	0.18	0.30	20
SR-91 Eastbound	Lakeview	West of Lakeview	0.69	123,300	85,077	123,500	85,215	130,100	89,769	130,400	89,976	0.000	0.26	0.34	0.60	45
SR-91 Westbound	SR-91/SR-55 IC	East of Lakeview	0.35	145,000	50,750	146,900	51,415	148,300	51,905	150,900	52,815	0.000	0.13	0.72	0.85	20
SR-91 Westbound	East of Lakeview	Lakeview	0.36	132,000	47,520	132,600	47,736	137,000	49,320	137,800	49,608	0.000	0.16	0.61	0.77	20
SR-91 Westbound	Lakeview	West of Lakeview	0.69	128,300	88,527	128,400	88,596	133,900	92,391	134,000	92,460	0.000	0.67	1.40	2.07	45

Project cost by phase is summarized in Table 8. The project cost format for the Cal-B/C Corridor model is provided in Table 9. Project support and Right-of-Way costs were added in Year 1. Construction was divided by 3 (equal to the number of years to construct the project) and entered in Years 1, 2 and 3.

Table 8: Project Cost (Segment 1) by Phase

Phase	**Cost**
Environmental	$ 2,130,000
Design	$ 8,523,940
R/W Capital	$ 5,525,160
R/W Support	$ 1,105,420
Construction	$ 69,981,650
Construction Support	$ 13,646,030
Total	$ 100,912,200

Table 9: Project Cost (Segment 1) Cal-B/C Corridor Model Format

Phase	**Cost**	***Notes***
Project Support	$ 24,299,970	*Includes Environmental, Design, and Construction Support*
R/W	$ 6,630,580	*Includes R/W Capital and R/W Support*
Construction Yr.1	$ 23,327,217	*Total Construction cost divided by 3*
Construction Yr.2	$ 23,327,217	*Total Construction cost divided by 3*
Construction Yr.3	$ 23,327,217	*Total Construction cost divided by 3*
Total	$ 100,912,200	

The Maintenance Cost analysis was divided into five project improvement groups to estimate the difference in cost to maintain the project area for the No Build and Build scenarios: Lakeview Avenue Bridge Replacement; SR-91 Westbound Lakeview Avenue Off-Ramp; New Lakeview Avenue Bridge Drop Ramp to Southbound SR-55; SR-91

Westbound Lakeview Avenue On-Ramp; and SR-91 Westbound Lanes Shifted North through the Lakeview Avenue Interchange. Existing facilities not affected by the project were not included as maintenance costs for these facilities would not change with the project. Maintenance cost per lane mile was obtained from Table 22 of the Caltrans 2019 State of the Pavement Report[5] and from the Reason Foundation 25th Annual Report.[6] Listed below are the maintenance cost/lane mile assumptions used to estimate the maintenance costs.

Assumptions:

	Cost/Lane Mile
Annual Maintenance - Roads (No Build and Build)[6]	$31,733
Annual Maintenance - Bridges (No Build and Build)[6]	$82,650
No Build (Year 1) requires Major Rehabilitation[5]	$1,981,000
No Build (Year 7) requires H.M.1. (Preventive & Corrective Maint.)[5]	$184,000
No Build (Year 17) requires C.A.P.M. [5]	$394,000
Build (Year 8) requires H.M.1. (Preventive & Corrective Maint.) [5]	$184,000
Build (Year 18) requires C.A.P.M. [5]	$394,000

As reflected in the analysis, maintenance costs are lower for newly constructed facilities (Build scenario) than for existing facilities (No Build scenario). Tables 10a, 10b and 10c display the estimated maintenance cost for each of the five improvement groups over a 20-year period. Table 10c includes the combined total maintenance costs for the three tables. Negative figures represent maintenance cost savings attributed to the new facilities. Lane miles were derived from maps included in the environmental document.[7]

[5] Source: https://dot.ca.gov/programs/maintenance/pavement/pavement-management

[6] Source: Reason Foundation, 25th Annual Report: Maintenance Disbursements per Mile for California, November 19, 2020. https://reason.org/policy-study/25th-annual-highway-report/capital-bridge-disbursements-per-mile/

[7] Environmental Document, pdf pp 75 – 83. http://www.octa.net/SR91-55toLakeview/RAISE

Table 10a: Maintenance Cost Estimates (table 1 of 3)

Year	Lakeview Avenue Bridge Replacement[1]					SR-91 Westbound Lakeview Avenue Off-Ramp[2]				
	No Build		Build		Cost/(Benefit)	No Build		Build		Cost/(Benefit)
	Lane Miles	Cost	Lane Miles	Cost		Lane Miles	Cost	Lane Miles	Cost	
1	0.91	$1,800,909	1.36	$112,705	($1,688,205)	0.31	$619,063	0.35	$11,119	($607,944)
2	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
3	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
4	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
5	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
6	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
7	0.91	$167,273	1.36	$112,705	($54,568)	0.31	$57,500	0.35	$11,119	($46,381)
8	0.91	$75,136	1.36	$250,909	$175,773	0.31	$9,917	0.35	$64,470	$54,553
9	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
10	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
11	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
12	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
13	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
14	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
15	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
16	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
17	0.91	$358,182	1.36	$112,705	($245,477)	0.31	$123,125	0.35	$11,119	($112,006)
18	0.91	$75,136	1.36	$537,273	$462,136	0.31	$9,917	0.35	$138,049	$128,133
19	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202
20	0.91	$75,136	1.36	$112,705	$37,568	0.31	$9,917	0.35	$11,119	$1,202

[1]Lakeview Avenue Bridge Replacement: For the No Build scenario, 4 existing lanes at 1,200 feet/lane totals 4,800 feet or 0.91 mile; For the Build scenario, there are a total of 6 lanes at 1,200 feet/lane that totals 7,200 feet or 1.36 miles.

[2]SR-91 Westbound Lakeview Avenue Off-Ramp: For the No Build scenario, one 1,200 ft lane plus a second lane at 450 ft that totals 1,650 feet or 0.31 miles. For the Build scenario, one 1,650 ft lane plus two more lanes at 350 ft each for a total of 1,850 feet or 0.35 miles.

Table 10b: Maintenance Cost Estimates (table 2 of 3)

Year	New Lakeview Avenue Bridge Drop Ramp to southbound SR-55[3]					SR-91 Westbound Lakeview Avenue On-Ramp[4]				
	No Build		Build		Cost/(Benefit)	No Build		Build		Cost/(Benefit)
	Lane Miles	Cost	Lane Miles	Cost		Lane Miles	Cost	Lane Miles	Cost	
1	0.00	$0	0.48	$15,205	$15,205	0.40	$787,898	0.43	$13,523	($774,375)
2	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
3	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
4	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
5	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
6	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
7	0.00	$0	0.48	$15,205	$15,205	0.40	$73,182	0.43	$13,523	($59,659)
8	0.00	$0	0.48	$88,167	$88,167	0.40	$12,621	0.43	$78,409	$65,788
9	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
10	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
11	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
12	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
13	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
14	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
15	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
16	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
17	0.00	$0	0.48	$15,205	$15,205	0.40	$156,705	0.43	$13,523	($143,182)
18	0.00	$0	0.48	$188,792	$188,792	0.40	$12,621	0.43	$167,898	$155,277
19	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902
20	0.00	$0	0.48	$15,205	$15,205	0.40	$12,621	0.43	$13,523	$902

[3]New Lakeview Avenue Bridge Drop Ramp to southbound SR-55: Two 1,090 ft lanes plus a third lane at 350 ft for a total of 2,530 ft. or 0.48 miles.

[4]SR-91 Westbound Lakeview Avenue On-Ramp: For the No Build scenario, two 1,050 ft lanes for a total of 2,100 feet or 0.40 miles. For the Build scenario, two 1,125 ft lanes for a total of 2,250 feet or 0.43 miles.

Table 10c: Maintenance Cost Estimates (table 3 of 3)

Year	Shift SR-91 Westbound Lanes to the north through the Interchange[5]				Cost/(Benefit)	Total Cost/(Benefit)
	No Build		Build			
	Lane Miles	Cost	Lane Miles	Cost		
1	1.53	$1,981,000	1.53	$48,681	($1,932,319)	($4,987,637)
2	1.53	$48,681	1.53	$48,681	$0	$54,877
3	1.53	$48,681	1.53	$48,681	$0	$54,877
4	1.53	$48,681	1.53	$48,681	$0	$54,877
5	1.53	$48,681	1.53	$48,681	$0	$54,877
6	1.53	$48,681	1.53	$48,681	$0	$54,877
7	1.53	$282,273	1.53	$48,681	($233,591)	($378,995)
8	1.53	$48,681	1.53	$282,273	$233,591	$617,872
9	1.53	$48,681	1.53	$48,681	$0	$54,877
10	1.53	$48,681	1.53	$48,681	$0	$54,877
11	1.53	$48,681	1.53	$48,681	$0	$54,877
12	1.53	$48,681	1.53	$48,681	$0	$54,877
13	1.53	$48,681	1.53	$48,681	$0	$54,877
14	1.53	$48,681	1.53	$48,681	$0	$54,877
15	1.53	$48,681	1.53	$48,681	$0	$54,877
16	1.53	$48,681	1.53	$48,681	$0	$54,877
17	1.53	$604,432	1.53	$48,681	($555,751)	($1,041,211)
18	1.53	$48,681	1.53	$604,432	$555,751	$1,490,088
19	1.53	$48,681	1.53	$48,681	$0	$54,877
20	1.53	$48,681	1.53	$48,681	$0	$54,877

[5]Shift SR-91 Westbound Lanes to the north through the Interchange: For the No Build and Build scenarios, four 2,025 ft lanes for a total of 8,100 feet or 1.53 miles.

Additionally, the Average Vehicle Occupancy figure of 1.64 was obtained from the OCTAM traffic model for year 2030 (the AVO for 2050 is 1.63). The 5% truck volume figure was calculated from truck traffic data for the project segment provided in the environmental document.[8]

4. Estimated Life-Cycle Benefits and Costs

The next two tables present the Final Calculations from the Cal-B/C Corridor model. Table 11 presents the Net Present Value calculation, and Table 12 presents the Internal Rate of Return on Investment and Payback Period summary.

[8] Environmental Document, Chapter 2, Table 2.2.6-5, pdf page 377. http://www.octa.net/SR91-55toLakeview/RAISE

Table 11: Net Present Value Calculation

Year	PRESENT VALUE OF USER BENEFITS (location 1) Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
Construction Period							
2024					$0	$44,290,500	($44,290,500)
2025					$0	$17,796,222	($17,796,222)
2026					$0	$16,631,983	($16,631,983)
2027					$0	$0	$0
2028					$0	$0	$0
2029					$0	$0	$0
2030					$0	$0	$0
2031					$0	$0	$0
Project Open							
2027	$48,361,802	$2,413,433	$2,016,990	$783,205	$53,575,431	($3,323,473)	$56,898,904
2028	$46,209,688	$2,316,746	$1,889,212	$755,254	$51,170,900	$34,175	$51,136,725
2029	$44,132,178	$2,407,277	$1,769,520	$789,243	$49,098,218	$31,939	$49,066,279
2030	$41,977,765	$2,226,388	$1,657,403	$754,452	$46,616,008	$29,849	$46,586,158
2031	$39,833,968	$2,083,521	$1,552,382	$720,256	$44,190,128	$27,897	$44,162,232
2032	$37,791,010	$1,949,819	$1,454,009	$687,608	$41,882,446	$26,072	$41,856,374
2033	$35,844,871	$1,824,693	$1,361,863	$656,436	$39,687,864	($168,278)	$39,856,142
2034	$33,991,627	$1,707,479	$1,275,551	$434,824	$37,409,481	$256,395	$37,153,086
2035	$32,227,453	$1,597,902	$1,194,704	$415,027	$35,435,086	$21,282	$35,413,804
2036	$30,548,626	$1,516,726	$1,118,975	$401,529	$33,585,856	$19,890	$33,565,966
2037	$28,951,531	$1,420,195	$1,048,042	$383,395	$31,803,162	$18,589	$31,784,573
2038	$27,432,657	$1,330,418	$981,600	$366,097	$30,110,772	$17,373	$30,093,399
2039	$25,988,607	$1,246,498	$919,367	$349,626	$28,504,098	$16,236	$28,487,862
2040	$24,616,090	$1,167,417	$861,075	$333,872	$26,978,454	$15,174	$26,963,280
2041	$23,311,927	$1,093,075	$806,475	$318,749	$25,530,226	$14,181	$25,516,045
2042	$22,073,049	$1,023,464	$755,334	$304,302	$24,156,149	$13,254	$24,142,895
2043	$20,896,496	$958,086	$707,433	$290,458	$22,852,472	($235,015)	$23,087,487
2044	$19,779,415	$892,937	$662,566	$276,374	$21,611,292	$314,329	$21,296,963
2045	$18,719,061	$836,131	$620,542	$263,843	$20,439,576	$10,819	$20,428,757
2046	$17,712,791	$782,541	$581,181	$251,738	$19,328,251	$10,111	$19,318,140
Total	$620,400,613	$30,794,747	$23,234,222	$9,536,288	**$683,965,869**	**$75,869,503**	**$608,096,366**

91,536,416	Person-Hours of Time Saved

tons	$ PV	
655	$0	CO Saved
318,174	$7,341,535	CO_2 Saved
231	$1,134,557	NO_X Saved
4	$1,013,916	PM_{10} Saved
4		$PM_{2.5}$ Saved
3	$46,279	SO_X Saved
85	$0	VOC Saved

0	Fatalities Avoided
438	Injuries Avoided
2,864	PDO Avoided

Table 12: Internal Rate of Return on Investment and Payback Period

Year	USER BENEFITS IN CONSTANT DOLLARS (location 1) Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
Construction Period								
2024					$0	$54,257,767	($54,257,767)	
2025					$0	$23,327,217	($23,327,217)	
2026					$0	$23,327,217	($23,327,217)	
2027					$0	$0	$0	
2028					$0	$0	$0	
2029					$0	$0	$0	
2030					$0	$0	$0	
2031					$0	$0	$0	
Project Open								
2027	$72,578,025	$3,621,913	$3,026,958	$1,175,379	$80,402,275	($4,987,637)	$85,389,912	$85,389,912
2028	$74,202,662	$3,720,188	$3,033,661	$1,212,772	$82,169,283	$54,877	$82,114,406	$167,504,318
2029	$75,827,298	$4,136,150	$3,040,364	$1,356,067	$84,359,879	$54,877	$84,305,002	$251,809,320
2030	$77,174,409	$4,093,123	$3,047,067	$1,387,029	$85,701,629	$54,877	$85,646,752	$337,456,071
2031	$78,359,445	$4,098,602	$3,053,771	$1,416,854	$86,928,671	$54,877	$86,873,794	$424,329,865
2032	$79,544,481	$4,104,080	$3,060,474	$1,447,313	$88,156,348	$54,877	$88,101,471	$512,431,337
2033	$80,729,516	$4,109,559	$3,067,177	$1,478,421	$89,384,674	($378,995)	$89,763,669	$602,195,005
2034	$81,914,552	$4,114,760	$3,073,881	$1,047,858	$90,151,050	$617,872	$89,533,178	$691,728,184
2035	$83,099,588	$4,120,245	$3,080,584	$1,070,162	$91,370,579	$54,877	$91,315,702	$783,043,886
2036	$84,284,623	$4,184,696	$3,087,287	$1,107,830	$92,664,437	$54,877	$92,609,560	$875,653,446
2037	$85,469,659	$4,192,648	$3,093,991	$1,131,844	$93,888,142	$54,877	$93,833,265	$969,486,710
2038	$86,654,695	$4,202,543	$3,100,694	$1,156,432	$95,114,364	$54,877	$95,059,487	$1,064,546,198
2039	$87,839,731	$4,213,080	$3,107,397	$1,181,712	$96,341,920	$54,877	$96,287,043	$1,160,833,240
2040	$89,024,766	$4,221,995	$3,114,100	$1,207,459	$97,568,320	$54,877	$97,513,443	$1,258,346,684
2041	$90,209,802	$4,229,855	$3,120,804	$1,233,458	$98,793,919	$54,877	$98,739,042	$1,357,085,725
2042	$91,394,838	$4,237,716	$3,127,507	$1,259,981	$100,020,041	$54,877	$99,965,164	$1,457,050,890
2043	$92,579,873	$4,244,705	$3,134,210	$1,286,845	$101,245,633	($1,041,211)	$102,286,844	$1,559,337,734
2044	$93,764,909	$4,232,993	$3,140,914	$1,310,160	$102,448,976	$1,490,088	$100,958,888	$1,660,296,621
2045	$94,949,945	$4,241,162	$3,147,617	$1,338,307	$103,677,031	$54,877	$103,622,154	$1,763,918,775
2046	$96,134,980	$4,247,190	$3,154,320	$1,366,292	$104,902,782	$54,877	$104,847,905	$1,868,766,680
Total	$1,695,737,797	$82,567,204	$61,812,778	$25,172,174	**$1,865,289,952**	**$97,435,473**	**$1,767,854,479**	**$1,868,766,680**
					Total Construction Costs			**$100,912,201**

Years After Construction Begins	ANNUAL RETURNS ON INVESTMENT
2024	($54,257,767)
2025	($23,327,217)
2026	($23,327,217)
2027	$85,389,912
2028	$82,114,406
2029	$84,305,002
2030	$85,646,752
2031	$86,873,794
2032	$88,101,471
2033	$89,763,669
2034	$89,533,178
2035	$91,315,702
2036	$92,609,560
2037	$93,833,265
2038	$95,059,487
2039	$96,287,043
2040	$97,513,443
2041	$98,739,042
2042	$99,965,164
2043	$102,286,844
2044	$103,622,154
2045	$103,677,031
2046	$104,902,782
2047	$0
2048	$0
2049	$0
2050	$0
2051	$0
Internal Rate of Return	**48.18%**
Payback Period	**2 years**