ANNUALIZED BENEFIT-COST COMPARISON
I-95 @ SR 1 INTERCHANGE IMPROVEMENTS

Project Cost:	**$174,000,000**	(2014 dollars)
	$ 15,169,320	Annualized over 20 years through 2033 with 7% interest
Project Benefits:	**(per year between 2014 and 2033)**	
	$ 24,998,475	**Delay Cost Savings*** (based on the user's value of time)
	$ 4,940,134	**Operating Cost Savings** (based on reduced fuel consumption)
	$461,786	**Carbon Emissions Cost Savings** (based on reduced CO2 emissions)
	$283,185	**Crash Cost Savings** (based on crash reduction factors)
	$ 30,683,579	**Total Yearly Benefits**
Benefit / Cost Ratio:	**2.02**	

*Note: Comprised of 3 components

1. Peak period travel time savings on new Ramps A & B
2. Peak period travel time savings on I-95
3. Off-peak travel time savings on Ramp A

Design Year (2030) CORSIM Travel Time Summary

			Travel Time		
Traffic Movement	**Peak**	**Dist.**	**No Build**	**Build**	**Savings**
SR 1 NB to I-95 NB	AM	4 mi.	10 min	4 min	6 min/veh
I-95 SB to SR 1 SB	PM	4 mi.	16 min	10 min	6 min/veh

Notes:

"No Build" reflects current conditions as of Summer 2009 (5th Lane Project Complete)

"Build" reflects preferred alternative for SR 1 Interchange Improvements

Note: This page calculates the delay cost benefit due to the reduced peak hour congestion on the directional ramps

Movement	2008 Peak Volume	2030 Peak Volume	Factor Peak to Yearly	Time Savings (hr)	Autos Value of Time	Trucks Value of Time	Truck Percentage	Composite Value of Time
SR 1 NB to I-95 NB	2050	3250	625	0.1	$ 16.00	$ 24.00	10%	$ 16.80
I-95 SB to SR 1 SB	1750	3015	625	0.1				$ -

	Year	SB Hourly Vol	NB Hourly Vol	SB Annual Vol	NB Annual Vol	Total Annual Vol on Ramps	Time Savings per veh (hr)	Cost Savings (Auto)*	Cost Savings (Truck)*		
Analysis period	2014	2,095	2,377	1,309,375	1,485,795	2,795,170	0.10	$ 4,443,975	$ 740,663		
	2015	2,153	2,432	1,345,313	1,519,886	2,865,199	0.10	$ 4,646,418	$ 774,403		
	2016	2,210	2,486	1,381,250	1,553,977	2,935,227	0.10	$ 4,855,181	$ 809,197		
	2017	2,268	2,541	1,417,188	1,588,068	3,005,256	0.10	$ 5,070,436	$ 845,073		
	2018	2,325	2,595	1,453,125	1,622,159	3,075,284	0.10	$ 5,292,359	$ 882,060		
	2019	2,383	2,650	1,489,063	1,656,250	3,145,313	0.10	$ 5,521,130	$ 920,188		
	2020	2,440	2,705	1,525,000	1,690,341	3,215,341	0.10	$ 5,756,936	$ 959,489		
	2021	2,498	2,759	1,560,938	1,724,432	3,285,369	0.10	$ 5,999,965	$ 999,994		
	2022	2,555	2,814	1,596,875	1,758,523	3,355,398	0.10	$ 6,250,413	$ 1,041,736		
	2023	2,613	2,868	1,632,813	1,792,614	3,425,426	0.10	$ 6,508,479	$ 1,084,746		
	2024	2,670	2,923	1,668,750	1,826,705	3,495,455	0.10	$ 6,774,367	$ 1,129,061		
	2025	2,728	2,977	1,704,688	1,860,795	3,565,483	0.10	$ 7,048,287	$ 1,174,715		
	2026	2,785	3,032	1,740,625	1,894,886	3,635,511	0.10	$ 7,330,455	$ 1,221,742		
	2027	2,843	3,086	1,776,563	1,928,977	3,705,540	0.10	$ 7,621,090	$ 1,270,182		
	2028	2,900	3,141	1,812,500	1,963,068	3,775,568	0.10	$ 7,920,417	$ 1,320,070		
	2029	2,958	3,195	1,848,438	1,997,159	3,845,597	0.10	$ 8,228,670	$ 1,371,445		
	2030	3,015	3,250	1,884,375	2,031,250	3,915,625	0.10	$ 8,546,085	$ 1,424,347		
	2031	3,073	3,305	1,920,313	2,065,341	3,985,653	0.10	$ 8,872,904	$ 1,478,817		
	2032	3,130	3,359	1,956,250	2,099,432	4,055,682	0.10	$ 9,209,378	$ 1,534,896		
	2033	3,188	3,414	1,992,188	2,133,523	4,125,710	0.10	$ 9,555,762	$ 1,592,627		
	TOTAL (2014-2033)	52,825	57,909	33,015,625	36,193,182	69,208,807		**$ 135,452,710**	**$ 22,575,452**	**$ 158,028,161**	total savings over 20 year period
										$ 7,901,408	average savings per year

*assumes a 2% / year cost of living increase from 2009 throuh 2033

Design Year (2030) CORSIM Travel Time Summary

			Travel Time		
Traffic Movement	**Peak**	**Dist.**	**No Build**	**Build**	**Savings**
I-95 NB	AM	3 mi.	3 min	3 min	0 min/veh
I-95 SB	PM	3.5 mi.	13 min	4 min	9 min/veh

Notes:

"No Build" reflects current conditions as of Summer 2009 (5th Lane Project Complete)

"Build" reflects preferred alternative for SR 1 Interchange Improvements

Note: This page calculates the delay cost benefit due to the reduced peak hour congestion on the mainline

Movement	2008 Peak Volume	2030 Peak Volume	Factor Peak to Yearly	Time Savings (hr)	Autos Value of Time	Trucks Value of Time	Truck Percentage	Composite Value of Time
I-95 NB - N/A	0	0	625	0	$ 16.00	$ 24.00	10%	$ 16.80
I-95 SB	6120	7330	625	0.15				$ -

	Year	SB Hourly Vol	NB Hourly Vol	SB Annual Vol	NB Annual Vol	Total Annual Vol Through	Time Savings per veh (hr)	Cost Savings (Auto)*	Cost Savings (Truck)*		
Analysis period	2014	6,450	-	4,031,250	-	4,031,250	0.15	$ 9,613,784	$ 1,602,297		
	2015	6,505	-	4,065,625	-	4,065,625	0.15	$ 9,889,677	$ 1,648,279		
	2016	6,560	-	4,100,000	-	4,100,000	0.15	$ 10,172,760	$ 1,695,460		
	2017	6,615	-	4,134,375	-	4,134,375	0.15	$ 10,463,211	$ 1,743,869		
	2018	6,670	-	4,168,750	-	4,168,750	0.15	$ 10,761,211	$ 1,793,535		
	2019	6,725	-	4,203,125	-	4,203,125	0.15	$ 11,066,946	$ 1,844,491		
	2020	6,780	-	4,237,500	-	4,237,500	0.15	$ 11,380,605	$ 1,896,768		
	2021	6,835	-	4,271,875	-	4,271,875	0.15	$ 11,702,384	$ 1,950,397		
	2022	6,890	-	4,306,250	-	4,306,250	0.15	$ 12,032,482	$ 2,005,414		
	2023	6,945	-	4,340,625	-	4,340,625	0.15	$ 12,371,103	$ 2,061,851		
	2024	7,000	-	4,375,000	-	4,375,000	0.15	$ 12,718,456	$ 2,119,743		
	2025	7,055	-	4,409,375	-	4,409,375	0.15	$ 13,074,754	$ 2,179,126		
	2026	7,110	-	4,443,750	-	4,443,750	0.15	$ 13,440,217	$ 2,240,036		
	2027	7,165	-	4,478,125	-	4,478,125	0.15	$ 13,815,069	$ 2,302,511		
	2028	7,220	-	4,512,500	-	4,512,500	0.15	$ 14,199,538	$ 2,366,590		
	2029	7,275	-	4,546,875	-	4,546,875	0.15	$ 14,593,861	$ 2,432,310		
	2030	7,330	-	4,581,250	-	4,581,250	0.15	$ 14,998,276	$ 2,499,713		
	2031	7,385	-	4,615,625	-	4,615,625	0.15	$ 15,413,031	$ 2,568,838		
	2032	7,440	-	4,650,000	-	4,650,000	0.15	$ 15,838,376	$ 2,639,729		
	2033	7,495	-	4,684,375	-	4,684,375	0.15	$ 16,274,570	$ 2,712,428		
	TOTAL (2014-2033)	139,450	-	87,156,250	-	87,156,250		**$ 253,820,312**	**$ 42,303,385**	**$ 296,123,697**	total savings over 20 year period
										$ 14,806,185	average savings per year

*assumes a 2% / year cost of living increase from 2009 throuh 2033

Travel Time Summary

			Off Peak Travel Time		
Traffic Movement	**Peak**	**Dist.**	**No Build**	**Build**	**Savings**
I-95 SB to SR 1 SB	PM	4 mi.	5.4 min	4.6 min	0.8 min/veh

Notes:

"No Build" reflects current conditions as of Summer 2009 (5th Lane Project Complete)

"Build" reflects preferred alternative for SR 1 Interchange Improvements

Note: This page calculates the delay cost benefit due to the reduced off peak travel time resulting from elimination of the SB to SB loop ramp (shorter distance and higher speed on flyover ramp)

Movement	2008 ADT	2030 ADT	Factor Peak to Yearly	Time Savings (hr)	Autos Value of Time	Trucks Value of Time	Truck Percentage	Composite Value of Time
SB I-95 to SB SR 1	16000	27550	N/A	0.014	$ 16.00	$ 24.00	10%	$ 16.80

	Year	SB Hourly Vol	SB ADT	SB Annual Vol	SB Annual PM Peak Vol	Total Annual Vol Off Peak	Time Savings per veh (hr)	Cost Savings (Auto)*	Cost Savings (Truck)*		
Analysis period	2014	N/A	19,150	6,989,750	1,309,375	5,680,375	0.014	$ 1,264,353	$ 210,726		
	2015	N/A	19,675	7,181,375	1,345,313	5,836,063	0.014	$ 1,324,987	$ 220,831		
	2016	N/A	20,200	7,373,000	1,381,250	5,991,750	0.014	$ 1,387,540	$ 231,257		
	2017	N/A	20,725	7,564,625	1,417,188	6,147,438	0.014	$ 1,452,065	$ 242,011		
	2018	N/A	21,250	7,756,250	1,453,125	6,303,125	0.014	$ 1,518,616	$ 253,103		
	2019	N/A	21,775	7,947,875	1,489,063	6,458,813	0.014	$ 1,587,248	$ 264,541		
	2020	N/A	22,300	8,139,500	1,525,000	6,614,500	0.014	$ 1,658,019	$ 276,336		
	2021	N/A	22,825	8,331,125	1,560,938	6,770,188	0.014	$ 1,730,985	$ 288,497		
	2022	N/A	23,350	8,522,750	1,596,875	6,925,875	0.014	$ 1,806,207	$ 301,034		
	2023	N/A	23,875	8,714,375	1,632,813	7,081,563	0.014	$ 1,883,745	$ 313,957		
	2024	N/A	24,400	8,906,000	1,668,750	7,237,250	0.014	$ 1,963,662	$ 327,277		
	2025	N/A	24,925	9,097,625	1,704,688	7,392,938	0.014	$ 2,046,022	$ 341,004		
	2026	N/A	25,450	9,289,250	1,740,625	7,548,625	0.014	$ 2,130,891	$ 355,149		
	2027	N/A	25,975	9,480,875	1,776,563	7,704,313	0.014	$ 2,218,337	$ 369,723		
	2028	N/A	26,500	9,672,500	1,812,500	7,860,000	0.014	$ 2,308,428	$ 384,738		
	2029	N/A	27,025	9,864,125	1,848,438	8,015,688	0.014	$ 2,401,235	$ 400,206		
	2030	N/A	27,550	10,055,750	1,884,375	8,171,375	0.014	$ 2,496,832	$ 416,139		
	2031	N/A	28,075	10,247,375	1,920,313	8,327,063	0.014	$ 2,595,291	$ 432,549		
	2032	N/A	28,600	10,439,000	1,956,250	8,482,750	0.014	$ 2,696,691	$ 449,448		
	2033	N/A	29,125	10,630,625	1,992,188	8,638,438	0.014	$ 2,801,108	$ 466,851		
	TOTAL (2014-2033)	N/A	482,750	176,203,750	33,015,625	143,188,125		**$ 39,272,261**	**$ 6,545,377**	**$ 45,817,638**	total savings over 20 year period
										$ 2,290,882	average savings per year

*assumes a 2% / year cost of living increase from 2009 throuh 2033

Design Year (2030) CORSIM Fuel Consumption Summary

		Build vs. No Build Gallons Saved	Resulting Reduction CO_2 Tons
2030	AM	657.5415146	6.460656909
2030	PM	1806.497789	17.74969665
2030	Daily	4219.245383	41.45608487
2030	Yearly	1540024.565	15131.47098

	Year	Yearly Gallons Saved	Fuel Cost Savings	Yearly Reduction in CO_2	Emissions Savings
Analysis period	2014	1262429.511	$ 3,575,298	12403.96805	$409,330.95
	2015	1278209.88	$ 3,692,389	12559.01765	$414,447.58
	2016	1294187.503	$ 3,813,315	12716.00537	$419,628.18
	2017	1310364.847	$ 3,938,201	12874.95544	$424,873.53
	2018	1326744.407	$ 4,067,177	13035.89238	$430,184.45
	2019	1343328.713	$ 4,200,377	13198.84104	$435,561.75
	2020	1360120.321	$ 4,337,940	13363.82655	$441,006.28
	2021	1377121.825	$ 4,480,007	13530.87438	$446,518.85
	2022	1394335.848	$ 4,626,728	13700.01031	$452,100.34
	2023	1411765.046	$ 4,778,253	13871.26044	$457,751.59
	2024	1429412.109	$ 4,934,741	14044.6512	$463,473.49
	2025	1447279.761	$ 5,096,353	14220.20934	$469,266.91
	2026	1465370.758	$ 5,263,259	14397.96195	$475,132.74
	2027	1483687.892	$ 5,435,631	14577.93648	$481,071.90
	2028	1502233.991	$ 5,613,648	14760.16069	$487,085.30
	2029	1521011.916	$ 5,797,495	14944.66269	$493,173.87
	2030	1540024.565	$ 5,987,363	15131.47098	$499,338.54
	2031	1559274.872	$ 6,183,449	15320.61436	$505,580.27
	2032	1578765.808	$ 6,385,957	15512.12204	$511,900.03
	2033	1598500.38	$ 6,595,097	15706.02357	$518,298.78
	Total (2014 - 2033)	28484169.95	98802677.22	279870.4649	9235725.343

Fuel Cost Savings		Emissions Savings	
$98,802,677	total over 20 yrs	**$9,235,725**	total over 20 yrs
$4,940,134	average per yr	**$461,786**	average per yr

Assumptions		
625	Factor - AM Peak to Yearly	
625	Factor - PM Peak to Yearly	
8788	g CO_2 per gal of gasoline	Source:
10084	g CO_2 per gal of diesel	http://www.epa.gov/otaq/climate/420f05001.htm
10.00%	% trucks	
907600	grams/ton	
1.25%	yearly growth in traffic vols	
$33	cost savings per metric ton of CO_2 reduction	
$2.56	Cost of Fuel (2009) for Autos; Regular Gasoline	
$2.66	Cost of Fuel (2009) for Trucks; Diesel	
2%	Assumed inflation (per year)	
$ 4.11	Estimated cost of Fuel (2033) for Autos; Regular Gasoline	
$ 4.27	Estimated Cost of Fuel (2033) for Trucks; Diesel	

Note: This page calculates the operating cost benefit and the carbon emissions benefit due to the reduced fuel consumption.

	Year	Annual Crash Reduction	Injury Crash Reduction	Property Damage Only Reduction	Yearly Crash Savings
Analysis period	2014	37	7	30	$251,017
	2015	38	8	30	$254,155
	2016	38	8	31	$257,332
	2017	39	8	31	$260,548
	2018	39	8	31	$263,805
	2019	40	8	32	$267,103
	2020	40	8	32	$270,441
	2021	41	8	33	$273,822
	2022	41	8	33	$277,245
	2023	42	8	33	$280,710
	2024	42	8	34	$284,219
	2025	43	9	34	$287,772
	2026	43	9	35	$291,369
	2027	44	9	35	$295,011
	2028	44	9	35	$298,699
	2029	45	9	36	$302,433
	2030	45	9	36	$306,213
	2031	46	9	37	$310,041
	2032	47	9	37	$313,916
	2033	47	9	38	$317,840
	TOTAL (2014-2033)	840	168	672	$5,663,691

Assumptions	
$23,700	Cost Savings from Injury Crash Reductions
$2,500	Cost Savings from Property Damage Crash Reductions
	Source:
	NHTSA - The Economic Impact of Motor Vehicle Crashes

Note: This page calculates the crash cost benefit due to the anticipacted crash reduction factors.

Crash Reduction Savings

$5,663,691	total over 20 yrs
$283,185	average per yr