I-5 116th Interchange

Economic Impacts and Benefits of Interchange Replacement

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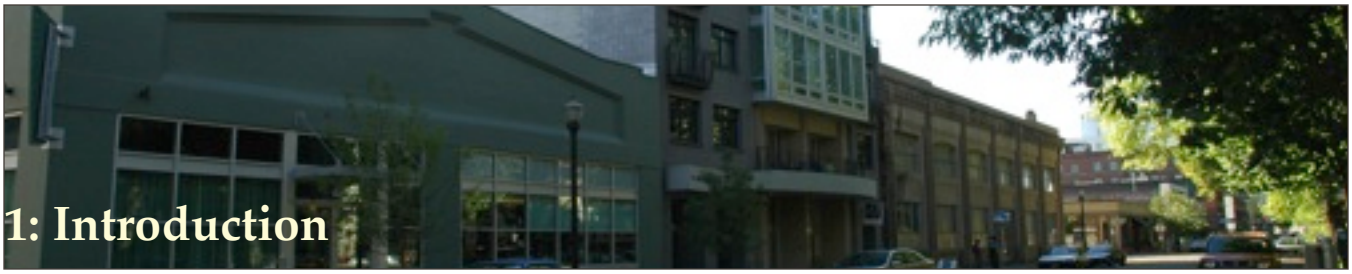


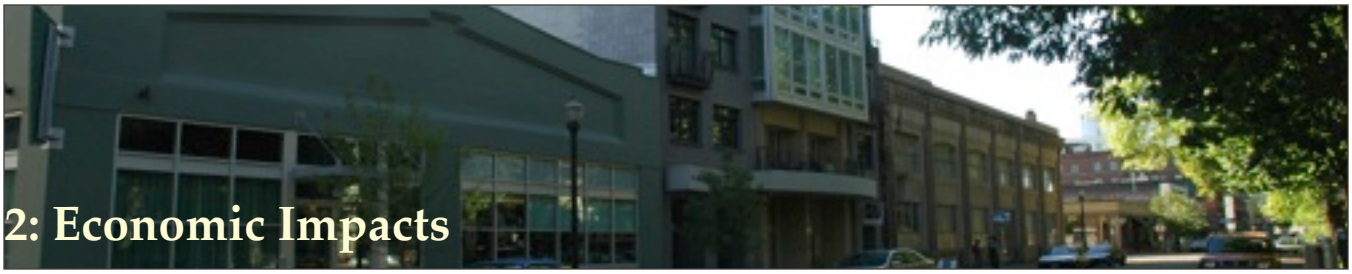
1: Introduction

The interchange on Interstate 5 at 116th Street, located in Snohomish County north of Marysville, Washington, currently gets very congested and occasionally traffic backs up into the main line of the interstate.

The Tulalip Tribes own land near the interchange, part of which has been developed. The still-undeveloped land could be successfully developed, but additional development is constrained by its potential effects on traffic at the 116th Street interchange.

Replacing the interchange at 116th would not only solve the traffic problems experienced today; it also would allow additional economic development in the area which would provide employment and income for residents of the region, including Tribal Members. We estimate the amount of additional employment and income in the first section of this report.

In addition to allowing economic development and generating the economic impacts associated with that development, replacing the existing interchange would generate economic benefits that may be compared directly to the cost of replacing the interchange. These economic benefits include the value of time saved by travelers, the value of reductions in emissions, the value of reductions in the number and severity of accidents, and the value of reduced vehicle operating costs.



2: Economic Impacts

The economic impacts (changes in levels of economic activity measured as changes in output, income, and employment) associated with the replacement of the 116th interchange derive from the future development of currently undeveloped land near the interchange. The underlying assumption is that the additional development would not be allowed with the current interchange in place because of traffic impacts, including impacts resulting from traffic backing up the on-ramps and into the main line of I-5.

We assumed that replacing the interchange would allow the development 675,000 square feet of retail space and four million square feet of light industrial and warehousing space. These assumptions are consistent with Tribal planning documents.

We further assumed that the retail space would employ 1.982 people per 1,000 square feet, the warehousing would employ 0.915, and the light industrial would employ 2.308. We also assumed that the four million square feet of light industrial and warehousing would consist of 1,437,000 square feet of light industrial and 2,563,000 square feet of warehousing space. Applying the jobs per thousand square feet to the numbers of square feet yields 1,338 retail jobs, 3,231 manufacturing jobs, and 2,341 warehousing jobs, for a total of 7,000 direct jobs. The total number of jobs and the assumed employees per square feet are consistent with Tribal planning documents. The split between light industrial and warehousing is implicit in the other assumptions.

To estimate the impacts of this additional economic activity on Snohomish County and the Puget Sound Region, we applied the IMPLAN economic input-output model. The input-output model starts with the direct impacts and estimates the additional, indirect and induced impacts. Indirect impacts result from the businesses on the newly-developed land purchasing goods and services from other businesses within the region. Induced impacts result from employees of the direct and indirect businesses spending part of their wages within the region.

We modeled two regions: Snohomish County, and the larger, four-county Puget Sound Region (Snohomish, King, Pierce, and Kitsap Counties). The difference between the estimates represents the indirect and induced impacts that occur in the other three counties.

The impacts described below are long-run impacts as of the completion of the planned development. All dollar amounts are in year-2009 dollars. These estimates do not include short-run, construction-related impacts. In the years between the beginning and completion of development, impacts will be smaller than reported here.

Direct Impacts

The direct impacts were the same in both model runs and consisted of 7,000 direct jobs, all in Snohomish County. As described above, these consist of 1,338 jobs in the retail trade sector, 3,321 jobs in the manufacturing sector, and 2,314 jobs in the transportation and warehousing sector. Jobs are person-years of employment per year. These direct jobs correspond to $128 million per year in retail output, $1.2 billion in manufacturing output, and $401 million in transportation and warehousing output. Direct income to retail workers is $52 million per year, to manufacturing workers is $323 million, and to warehousing workers is $143 million.

Direct Impacts	Snohomish County		
Aggregate Industry Sector	Direct Output	Direct Income	Direct Jobs
Manufacturing	$1,205,264,128	$322,682,688	3,321
Retail trade	$128,160,392	$52,552,768	1,338
Transportation & warehousing	$401,251,040	$143,050,368	2,341
All Sectors	$1,734,675,560	$518,285,824	7,000

Indirect Impacts

Indirect impacts result from the directly-affected businesses purchasing goods and services from other businesses within the region. The indirect impacts amount to 3,129 additional jobs, $641 million in output, and $210 million in income within Snohomish County. An additional 668 jobs, $143 million in output, and $63 million in income would be generated in the other three counties in the Puget Sound Region. Indirect impacts occur, to differing degrees, in all economic sectors.

Indirect Impacts	Snohomish County		
Aggregate Industry Sector	Indirect Output	Indirect Income	Indirect Jobs
Ag, Forestry, Fish & Hunting	$1,218,226	$345,259	7
Mining	$6,008,266	$1,687,717	23
Utilities	$2,736,639	$448,781	4
Construction	$11,400,725	$4,187,668	75
Manufacturing	$322,345,600	$86,300,872	888
Wholesale Trade	$49,822,240	$19,069,006	276
Retail trade	$5,195,612	$2,339,715	65
Transportation & warehousing	$25,910,710	$10,620,663	190
Information	$17,652,782	$3,413,569	43
Finance & insurance	$30,177,066	$9,400,300	138
Real estate & rental	$39,217,596	$2,767,418	112
Professional, scientific & tech svcs	$46,269,500	$26,900,724	344
Management of companies	$22,050,022	$9,194,379	106
Administrative & waste services	$22,375,152	$11,386,894	327
Educational svcs	$186,284	$65,948	5
Health & social services	$10,268	$5,588	0
Arts, entertainment & recreation	$1,061,845	$369,905	19
Accomodation & food services	$8,623,097	$3,031,996	140
Other services	$8,960,998	$3,673,048	135
Government & non NAICs	$19,927,228	$14,452,782	231
All Sectors	$641,149,856	$209,662,231	3,129

Indirect Impacts, *Continued*

Indirect Impacts	Puget Sound Region		
Aggregate Industry Sector	Indirect Output	Indirect Income	Indirect Jobs
Ag, Forestry, Fish & Hunting	$7,269,856	$1,783,366	42
Mining	$8,926,341	$2,007,642	33
Utilities	$11,234,661	$1,096,291	12
Construction	$13,628,972	$5,250,909	85
Manufacturing	$325,823,712	$93,075,768	910
Wholesale Trade	$76,591,296	$29,698,812	361
Retail trade	$6,206,223	$2,544,891	66
Transportation & warehousing	$60,369,944	$21,522,542	352
Information	$20,040,026	$5,790,539	54
Finance & insurance	$36,863,208	$13,956,432	160
Real estate & rental	$45,045,864	$4,194,338	155
Professional, scientific & tech svcs	$49,455,680	$28,424,200	362
Management of companies	$38,393,828	$18,156,020	150
Administrative & waste services	$28,728,668	$14,923,311	371
Educational svcs	$317,662	$146,259	6
Health & social services	$18,597	$9,935	0
Arts, entertainment & recreation	$1,681,367	$673,951	27
Accomodation & food services	$11,173,356	$4,058,329	165
Other services	$16,137,569	$6,398,625	207
Government & non NAICs	$26,208,160	$19,447,952	278
All Sectors	$784,114,990	$273,160,112	3,797

Induced Impacts

Induced impacts result from employees of directly- and indirectly-affected businesses spending their The induced impacts amount to 3,547 additional jobs, $455 million in output, and $164 million in income within Snohomish County. An additional 833 jobs, $129 million in output, and $56 million in income would be generated in the other three counties in the Puget Sound Region. Induced impacts occur, to differing degrees, in all economic sectors.

Induced Impacts	Snohomish County		
Aggregate Industry Sector	Induced Output	Induced Income	Induced Jobs
Ag, Forestry, Fish & Hunting	$180,895	$51,268	1
Mining	$377,841	$106,135	1
Utilities	$1,307,044	$166,581	2
Construction	$3,781,613	$1,389,047	25
Manufacturing	$76,933,328	$21,977,006	215
Wholesale Trade	$19,923,164	$7,625,407	110
Retail trade	$57,910,316	$26,078,476	704
Transportation & warehousing	$7,375,631	$3,023,232	54
Information	$11,116,473	$2,707,273	24
Finance & insurance	$43,893,784	$13,673,124	201
Real estate & rental	$77,962,352	$5,501,470	223
Professional, scientific & tech svcs	$15,986,724	$9,687,073	119
Management of companies	$2,434,778	$1,015,249	12
Administrative & waste services	$7,928,158	$4,034,703	116
Educational svcs	$5,261,190	$1,862,554	144
Health & social services	$47,559,824	$25,880,460	536
Arts, entertainment & recreation	$5,748,128	$2,002,421	100
Accomodation & food services	$25,111,274	$8,829,460	408
Other services	$11,491,205	$4,710,162	174
Government & non NAICs	$32,649,476	$23,679,950	379
All Sectors	$454,933,197	$164,001,049	3,547

Induced Impacts, *continued*

Induced Impacts	Puget Sound Region		
Aggregate Industry Sector	Induced Output	Induced Income	Induced Jobs
Ag, Forestry, Fish & Hunting	$873,855	$214,365	5
Mining	$648,654	$145,890	2
Utilities	$5,819,056	$989,377	6
Construction	$4,320,017	$1,664,397	27
Manufacturing	$82,512,600	$22,090,914	227
Wholesale Trade	$33,287,914	$12,907,621	157
Retail trade	$67,419,424	$27,645,652	730
Transportation & warehousing	$16,684,255	$5,948,118	97
Information	$14,000,270	$3,212,090	43
Finance & insurance	$48,637,132	$18,414,046	211
Real estate & rental	$84,814,992	$7,897,346	293
Professional, scientific & tech svcs	$17,809,214	$9,820,936	130
Management of companies	$4,875,529	$2,305,584	19
Administrative & waste services	$10,046,058	$5,218,496	130
Educational svcs	$8,344,039	$3,841,785	162
Health & social services	$80,065,936	$42,773,460	817
Arts, entertainment & recreation	$8,761,861	$3,512,064	141
Accomodation & food services	$30,880,814	$11,216,371	457
Other services	$19,982,232	$7,923,053	257
Government & non NAICs	$44,057,380	$32,693,094	468
All Sectors	$583,841,231	$220,434,657	4,380

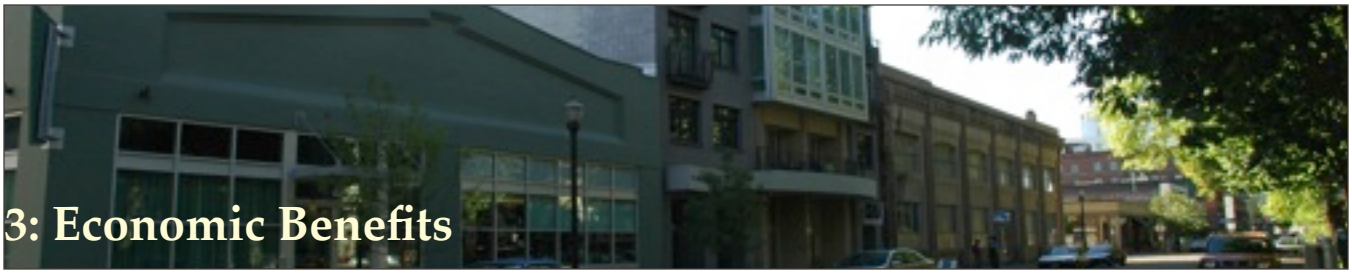
Total Impacts

Total impacts are the sum of direct, indirect, and induced impacts. For Snohomish County, total impacts are 13,676 jobs, $2.8 billion in output, and $892 million in income. For the Puget Sound Region, total impacts are 15,177 jobs, $3.1 billion in output, and $1.0 billion in income. The Puget Sound Region includes Snohomish County, so the impacts on the larger region include the impacts on Snohomish County.

Total Impacts	Snohomish County		
Aggregate Industry Sector	Total Output	Total Income	Total Jobs
Ag, Forestry, Fish & Hunting	$1,399,122	$396,526	8
Mining	$6,386,106	$1,793,852	25
Utilities	$4,043,683	$615,363	6
Construction	$15,182,338	$5,576,714	100
Manufacturing	$1,604,543,056	$430,960,566	4,424
Wholesale Trade	$69,745,404	$26,694,413	386
Retail trade	$191,266,320	$80,970,959	2,107
Transportation & warehousing	$434,537,381	$156,694,263	2,585
Information	$28,769,255	$6,120,842	66
Finance & insurance	$74,070,850	$23,073,424	339
Real estate & rental	$117,179,948	$8,268,887	335
Professional, scientific & tech svcs	$62,256,224	$36,587,797	463
Management of companies	$24,484,800	$10,209,628	118
Administrative & waste services	$30,303,310	$15,421,597	443
Educational svcs	$5,447,473	$1,928,502	149
Health & social services	$47,570,092	$25,886,048	536
Arts, entertainment & recreation	$6,809,973	$2,372,326	119
Accomodation & food services	$33,734,371	$11,861,456	547
Other services	$20,452,203	$8,383,209	309
Government & non NAICs	$52,576,704	$38,132,732	610
All Sectors	$2,830,758,613	$891,949,104	13,676

Total Impacts, *continued*

Total Impacts	Puget Sound Region		
Aggregate Industry Sector	Total Output	Total Income	Total Jobs
Ag, Forestry, Fish & Hunting	$8,143,710	$1,997,730	47
Mining	$9,574,995	$2,153,533	35
Utilities	$17,053,717	$2,085,668	18
Construction	$17,948,989	$6,915,306	112
Manufacturing	$1,613,600,440	$437,849,370	4,459
Wholesale Trade	$109,879,210	$42,606,433	518
Retail trade	$201,786,039	$82,743,311	2,134
Transportation & warehousing	$478,305,239	$170,521,028	2,791
Information	$34,040,296	$9,002,629	97
Finance & insurance	$85,500,340	$32,370,478	370
Real estate & rental	$129,860,856	$12,091,684	448
Professional, scientific & tech svcs	$67,264,894	$38,245,136	493
Management of companies	$43,269,357	$20,461,604	169
Administrative & waste services	$38,774,726	$20,141,807	500
Educational svcs	$8,661,701	$3,988,043	168
Health & social services	$80,084,533	$42,783,395	817
Arts, entertainment & recreation	$10,443,228	$4,186,015	168
Accomodation & food services	$42,054,170	$15,274,700	622
Other services	$36,119,801	$14,321,678	464
Government & non NAICs	$70,265,540	$52,141,046	746
All Sectors	$3,102,631,781	$1,011,880,593	15,177



3: Economic Benefits

The economic benefits reported here are the value, in dollars, of the benefits that would be produced by the proposed upgrade to the 116th interchange. The value of benefits may be compared directly to the cost of the project, and if they exceed the cost the project is cost-beneficial.

Most of the benefits will accrue to users of the facility. The largest source of user benefits will be savings in travel time. Other sources of benefits include safety, which accrue primarily to users, but also to everyone else who pays insurance premiums, and, in the case of fatalities, to the families and friends of the users who would have been killed. The benefits of reduced greenhouse gas emissions accrue throughout the world.

The proposed facility also would produce benefits in the form of reduced operating costs to users, primarily through reduced fuel consumption. We do not estimate operating cost benefits here; we expect they would be positive, but not a large dollar amount.

User Delay Benefits

To estimate user delay benefits, ECONorthwest relied on Synchro model runs from Gibson Traffic Consultants that simulate the operation of the interchange in the peak hour of a typical weekday. Synchro models were run for the existing interchange and the proposed interchange in 2012, 2030, and 2040. These model runs estimate the number of seconds it takes a vehicle to traverse each link along their path through the interchange. For each link, we multiplied the difference in travel time between the without- and with-improvement cases by the number of vehicles on that link and converted the result from seconds to hours. Because the number of vehicles was the same in both cases, no additional calculations were necessary to determine the value to those who used only the improved facility.

We then added up the hours over all links to get the hours of user delay benefits in the PM peak hour of a typical weekday. Those savings were 71.46 hours in 2012, 441.53 hours in 2030, and 1305.86 hours in 2040. Because of the non-linear relationship between traffic volume and delay from congestion, the hours of delay increase faster than traffic volumes.

Average daily traffic at the interchange is approximately 12 times peak-hour traffic. Using the formula from the AASHTO User Benefit Analysis for Highways Manual for extrapolating delay from the peak hour to the entire day, we obtained a peak-hour-to-day factor of 2.56. Again, because of the non-liner relationship between delay and volume, a much larger proportion of the delay occurs in the peak hour than of the traffic volume. We assumed, based on observed heavy weekend

volumes, that annual delay would be 300 times the typical weekday delay. Applying these factors, we get 54,966 hours of delay in 2012, 339,635 hours in 2030, and 1,004,512 hours in 2040.

To get from hours of benefit to dollars, we need to make assumptions about how users of the facility value their time. The Puget Sound Regional Council (PSRC) maintains a travel-demand model for the region that incorporates values of time for various classes of road users and that have been calibrated to accurately predict travelers' trade-offs. Those range from $9.57 per hour for commuting for the lowest-income quartile of workers to $33.33 for the highest-income quartile. Non-commute trips are valued at $15.68 per hour. These rates are all in year-2000 dollars. We assumed that vehicle occupancy during congested times would be 1.1 persons per vehicle, a little lower than the regional average of 1.15. Taking a weighted average, based on the mixture of trip purposes during the congested times and assuming that the users of the interchange have the same distribution of incomes as the rest of the region (one quarter in each quartile), adjusting for occupancy, and converting to year-2009 dollars, we came up with an assumed overall average value of time per vehicle of $28.60 in year-2009 dollars.

For years between the years for which the model was run, user delay benefits (in hours) were interpolated assuming a constant rate of growth in benefits between modeled years. Between 2012 and 2030, benefits grew at 10.65% per year and between 2030 and 2040, benefits grew at 11.45% per year.

As noted above, we assume that in 2009, the overall weighted average value of time for vehicles using the interchange during congested times is $28.60 per vehicle hour in year-2009 dollars. We do not model inflation. Instead, we use real values of time and a real (inflation-free) discount rate. The value of time is expected to increase over time independent of inflation. This is a phenomenon that has been observed consistently over decades and reflects both real increases in productivity and the increased busyness of people's lives. We assume that the real value of time will increase by one half of one percent per year. We multiply each year's user delay benefits (in hours) by the adjusted real value of time to get the value of user delay benefits for that year in year-2009 dollars.

To compare the stream of benefits to the cost of the interchange improvements that produce those benefits, we need to reduce the benefits to present value. We do that using two different real discount rates and present the results of each. The first rate we use is 2.70%, from OMB Circular A-94, Appendix C, which is updated each year. This circular is referenced in the Federal Register Notice regarding TIGER Grants and is consistent with current economic conditions. It corresponds to a nominal discount rate of approximately 5.3%, which is close to the borrowing cost for State transportation agencies. The other real discount rate we use is 7.0%, which is mentioned directly in the Federal Register Notice regarding TIGER Grants and is not reflective of current economic conditions.

The present value, in 2009, of user delay benefits is $162.8 million when discounted at a 2.7% real discount rate and $68.5 million when discounted at a 7.0% real discount rate.

User Delay Benefits, *continued*

Year	Annual Delay Benefits (vehicle hours)	Value of Benefits (2009 dollars)	Present Value (as of 2009) at 2.70%	Present Value (as of 2009) at 7.00%
2012	54,966	1,571,797	1,451,060	1,283,055
2013	60,818	1,747,844	1,571,162	1,333,422
2014	67,293	1,943,609	1,701,205	1,385,766
2015	74,458	2,161,300	1,842,011	1,440,165
2016	82,386	2,403,373	1,994,472	1,496,700
2017	91,157	2,672,559	2,159,552	1,555,453
2018	100,863	2,971,894	2,338,295	1,616,514
2019	111,602	3,304,757	2,531,833	1,679,971
2020	123,484	3,674,901	2,741,390	1,745,919
2021	136,632	4,086,502	2,968,291	1,814,456
2022	151,179	4,544,205	3,213,972	1,885,683
2023	167,275	5,053,171	3,479,989	1,959,707
2024	185,085	5,619,144	3,768,023	2,036,636
2025	204,792	6,248,507	4,079,897	2,116,586
2026	226,596	6,948,362	4,417,585	2,199,673
2027	250,722	7,726,602	4,783,222	2,286,023
2028	277,417	8,592,008	5,179,123	2,375,762
2029	306,953	9,554,343	5,607,793	2,469,024
2030	339,635	10,624,462	6,071,942	2,565,947
2031	378,536	11,900,556	6,622,432	2,686,112
2032	421,892	13,329,920	7,222,829	2,811,905
2033	470,214	14,930,963	7,877,659	2,943,589
2034	524,070	16,724,306	8,591,857	3,081,440
2035	584,095	18,733,046	9,370,804	3,225,746
2036	650,996	20,983,053	10,220,372	3,376,810
2037	725,558	23,503,307	11,146,963	3,534,949
2038	808,661	26,326,265	12,157,559	3,700,494
2039	901,282	29,488,287	13,259,777	3,873,791
2040	1,004,512	33,030,096	14,461,924	4,055,204
All			162,832,992	68,536,502

Greenhouse Gas Benefits

Using the same Synchro model runs, Parametrix estimated the amount by which greenhouse gas emissions (carbon dioxide) would be reduced by replacing the interchange, which would increase vehicle speeds to more efficient levels, and reduce stopping, idling, and accelerating. Greenhouse gas emissions would be reduced by 919 metric tonnes in 2012, 7,871 tonnes in 2030, and 14,555 tonnes in 2040. Parametrix used a different method for interpolation, separately taking into account weekend and weekday emissions.

Annual reductions in emissions were valued at $33 per metric tonne ($30 per US ton) in year-2009 dollars and discounted to present value using the same discount rates as in the user delay benefits analysis.

The present value, in 2009, of emissions benefits is $3.7 million when discounted at a 2.7% real discount rate and $1.7 million when discounted at a 7.0% real discount rate.

Year	Net CO2 Reduction (tonnes per year)	Value of CO2 Reduction (2009 dollars)	Present Value (as of 2009) at 2.70%	Present Value (as of 2009) at 7.00%
2012	919	30,337	28,006	24,764
2013	1,306	43,082	38,727	32,867
2014	1,692	55,827	48,864	39,804
2015	2,078	68,572	58,442	45,692
2016	2,464	81,318	67,483	50,641
2017	2,850	94,063	76,007	54,745
2018	3,237	106,808	84,037	58,096
2019	3,623	119,553	91,592	60,775
2020	4,009	132,298	98,691	62,854
2021	4,395	145,043	105,354	64,401
2022	4,781	157,789	111,599	65,477
2023	5,168	170,534	117,442	66,136
2024	5,554	183,279	122,901	66,429
2025	5,940	196,024	127,992	66,400
2026	6,326	208,770	132,730	66,091
2027	6,713	221,515	137,131	65,538
2028	7,099	234,260	141,208	64,775
2029	7,485	247,005	144,976	63,831
2030	7,871	259,751	148,449	62,733
2031	8,540	281,807	156,820	63,608
2032	9,208	303,863	164,648	64,099
2033	9,876	325,919	171,957	64,254
2034	10,545	347,976	178,767	64,114
2035	11,213	370,032	185,101	63,718
2036	11,881	392,088	190,977	63,099
2037	12,550	414,144	196,417	62,288
2038	13,218	436,201	201,439	61,314
2039	13,887	458,257	206,061	60,200
2040	14,555	480,313	210,301	58,969
All			3,744,120	1,707,711

Total Economic Benefits

The present value of economic benefits is the sum of the present values of the individual benefit types.

Some types of benefits, such as user operating cost benefits, were not estimated and are not included in the total reported here. We expect those benefits to be positive, but not large.

Benefit Source	at 2.7%	at 7.0%
User delay benefits	162,832,992	68,536,502
Emissions benefits	3,744,120	1,707,711
Safety benefits	???	???
Total benefits	166,577,112	70,244,213