Appendix C – Economic Impact Analysis

I-29 Corridor Study: Economic Impact Analysis

Sponsored by
South Dakota Department of Transportation
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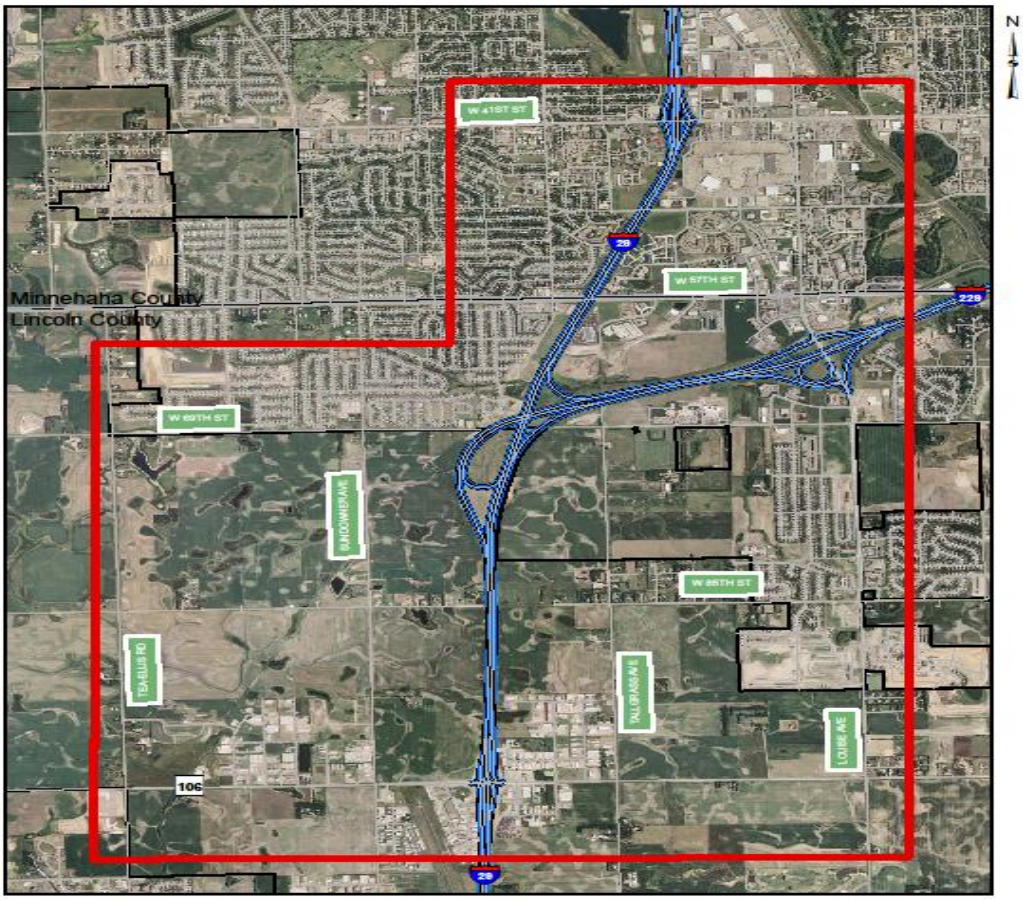
Impact of a New Interchange or Overpass in Minnehaha and Lincoln Counties, SD

Introduction/Background

The South Dakota Department of Transportation (SDDOT) contracted with the Business Research Bureau (BRB) at The University of South Dakota to determine the local and state economic impact of a new interchange located at the intersection of I-29 and 85th St. in Minnehaha County, South Dakota. To conduct the study, the BRB along with Regional Economic Models, Inc. (REMI) used TranSight, a multi-year economic impact analysis model that REMI has developed to measure the economic benefits of highway investment. Specifically, BRB/REMI built a two-region TranSight model, in which Region 1 is the combination of Minnehaha and Lincoln Counties and Region 2 is the rest of South Dakota. As requested by SDDOT, this report also includes an analysis of the economic impact of an overpass that could be constructed as an alternative to the interchange.

I-29 Corridor Study Area



Analysis of the Proposed Interchange

BRB/REMI Approach and Assumptions

The input factors for the TranSight model were developed by comparing travel demand data from a base scenario without the interchange to the alternative scenario that includes the interchange, as provided by the URS Corporation and the city of Sioux Falls. Attachment 1 (see page 30) contains the full set of traffic projections for the interchange; Table 1 below summarizes this data. The alternative overpass is addressed separately later in this report, with the corresponding traffic projections contained in Attachment 2. See Attachment 3 for detailed additional background information on the REMI TranSight model.

For this study the essential input figures for the model were the changes in average speed in network travel, computed by dividing total vehicle miles traveled (VMT) by total vehicle hours traveled (VHT), and the cost of construction starting in 2012. The average speed for each scenario was computed for the years 2015 and 2033 with a linear interpolation filling the remaining years.

Table 1 shows the projected travel demand and the average speed with various assumptions for 2015 and for 2033. The intent of the study is to isolate the effect of the interchange apart from other economic activity, such as the medical facilities and retail developments that are anticipated to develop in the area. However, the extent to which these developments occur and the traffic they generate are themselves linked to highway infrastructure. Table 1 shows anticipated traffic demand for 2015 in three situations: a "background" scenario, without the interchange and without any additional retail or medical facilities (essentially, the *status quo*); a "base" scenario, without the interchange and its dependent retail development, but with the medical facility; and the "interchange" scenario, with the retail development and medical facility. The table also shows two variations for 2033, one for the "base" scenario without the interchange and associated retail development, and another with the interchange and the associated retail development, with both cases assuming the medical facilities are built.

Table 1: Travel Projections (Source: URS and the City of Sioux Falls)

	2015			2033	
	Background	**Base**	**Interchange**	**Base**	**Interchange**
Total Vehicle Miles Traveled	7,172,998	7,243,097	7,644,505	11,309,500	11,764,631
Total Vehicle Hours Traveled	183,589	185,554	194,770	286,475	297,305
Average Speed (MPH)	39.07096	39.03498	39.24888	39.47814	39.57092

In 2015, the interchange would generate an estimated 0.45539% increase in network speed compared to the background scenario (from 39.07096 to 39.24888 miles per hour), and a 0.54797% increase in network speed compared to the base scenario (from 39.03498 to

39.24888 miles per hour). The interchange thus enhances travel speed by about one half of one percent in either case throughout the region, but the benefits are slightly higher for the base-to-interchange comparison because the base reflects the degradation in traffic flow that would occur if the medical facilities are developed without the interchange.

For 2033, traffic projections reflect the significant growth expected in the region, with both greater vehicle miles traveled and vehicle hours traveled. Speed of travel is projected to increase modestly overall in any case, and the presence of the interchange would be expected to increase travel speed by 0.23501% (from 39.47814 to 39.57092 miles per hour). While the interchange thus increases travel speed, the impact is not as large as in 2015, compared to either the background or base scenarios; this decreased positive impact is likely attributable to a "diminishing returns" principle at work, as a single intersection's role in a growing network will naturally decline.

For purposes of assessing the economic impact, the decision was made to compare the effects of the interchange in 2015 with the base scenario rather than the background scenario, since the medical research facilities are likely to be built regardless of the interchange or overpass. Since all traffic estimates for 2033 assume the presence of the medical facility, using the base scenario for 2015 also facilitated consistency in making base-to-interchange comparisons throughout.

Also, it was assumed that the funds necessary to build the interchange will come from normal SDDOT funding allocations for highway construction. However, these funds are not yet committed to this particular project and could be used elsewhere; this analysis does not consider alternative uses of these funds.

Table 2 shows the construction costs from 2012 to 2014:

Table 2: Construction Inputs to TranSight Model

	2012	2013	2014
Construction Costs (Mil $)	$8	$8	$8

Travel Demand Impacts

The model provides separate results for the two county region and state of South Dakota excluding these two counties. Tables 3 through 5 below summarize the results of the simulation. All results are presented in terms of absolute differences from the no-build scenario in Minnehaha and Lincoln Counties. Employment, population, and labor force figures for each year are projected current totals for that time and should not be added across time. Gross regional product (in real terms with 2000 as a base year) and income figures (in nominal or current dollars) represent additional production or income for that one year. Table 5 combines the two regions to show total statewide impact, although estimates in each table are rounded and may not sum precisely to the total shown in Table 5.

Table 3: Summary of Results for Minnehaha and Lincoln Counties

Variable	2012	2013	2014	2015	2016	2017	2018	2019
Total Employment	111	114	115	203	208	208	206	203
Total GRP (Mil Fixed 2000 $)	$5.05	$5.30	$5.46	$12.54	$13.08	$13.42	$13.59	$13.67
Personal Income (Mil Nom $)	$4.68	$5.36	$5.87	$10.03	$11.09	$11.89	$12.47	$12.92
Population	21	39	55	81	104	124	141	154
Labor Force	23	38	49	73	90	102	111	117

Variable	2020	2021	2022	2023	2024	2025	2026
Total Employment	199	194	190	185	180	174	169
Total GRP (Mil Fixed 2000 $)	$13.68	$13.66	$13.63	$13.55	$13.47	$13.35	$13.20
Personal Income (Mil Nom $)	$13.26	$13.55	$13.79	$13.99	$14.18	$14.33	$14.47
Population	166	175	182	188	192	195	196
Labor Force	121	123	124	124	123	122	120

Variable	2027	2028	2029	2030	2031	2032	2033
Total Employment	164	158	153	147	141	135	129
Total GRP (Mil Fixed 2000 $)	$13.04	$12.85	$12.65	$12.39	$12.13	$11.83	$11.50
Personal Income (Mil Nom $)	$14.59	$14.69	$14.79	$14.84	$14.89	$14.90	$14.88
Population	197	197	195	193	190	187	182
Labor Force	117	115	112	110	107	104	101

Table 4: Summary of Results for Rest of South Dakota

Variable	2012	2013	2014	2015	2016	2017	2018	2019
Total Employment	3	4	4	-2	-2	-2	-1	-1
Total GRP (Mil Fixed 2000$)	$0.14	$0.16	$0.19	-$0.12	-$0.11	-$0.09	-$0.07	-$0.06
Personal Income (Mil Nom$)	$0.35	$0.43	$0.49	$0.51	$0.57	$0.63	$0.66	$0.69
Population	2	4	5	6	7	8	9	9
Labor Force	2	4	5	5	6	6	7	7

Variable	2020	2021	2022	2023	2024	2025	2026
Total Employment	-1	-1	0	0	0	0	0
Total GRP (Mil Fixed 2000$)	-$0.06	-$0.04	-$0.03	-$0.03	-$0.01	-$0.01	$0.01
Personal Income (Mil Nom$)	$0.73	$0.75	$0.77	$0.78	$0.80	$0.81	$0.83
Population	10	10	11	11	11	12	12
Labor Force	7	7	7	7	7	7	7

Variable	2027	2028	2029	2030	2031	2032	2033
Total Employment	1	1	1	1	1	1	1
Total GRP (Mil Fixed 2000$)	$0.02	$0.03	$0.03	$0.04	$0.05	$0.06	$0.07
Personal Income (Mil Nom$)	$0.85	$0.85	$0.87	$0.88	$0.89	$0.90	$0.90
Population	12	12	12	12	12	12	12
Labor Force	7	7	7	7	7	7	7

Table 5: Summary of Results for All South Dakota

Variable	2012	2013	2014	2015	2016	2017	2018	2019
Total Employment	115	118	119	201	206	207	205	202
Total GRP (Mil Fixed 2000$)	$5.19	$5.46	$5.64	$12.41	$12.97	$13.33	$13.51	$13.61
Personal Income (Mil Nom$)	$5.03	$5.79	$6.36	$10.54	$11.66	$12.51	$13.13	$13.61
Population	23	43	60	87	111	132	149	164
Labor Force	25	42	54	78	96	109	118	124

Variable	2020	2021	2022	2023	2024	2025	2026
Total Employment	198	194	189	185	180	175	170
Total GRP (Mil Fixed 2000$)	$13.62	$13.63	$13.59	$13.53	$13.46	$13.34	$13.21
Personal Income (Mil Nom$)	$13.98	$14.29	$14.56	$14.77	$14.98	$15.14	$15.30
Population	176	185	193	199	203	206	208
Labor Force	128	130	131	131	130	129	127

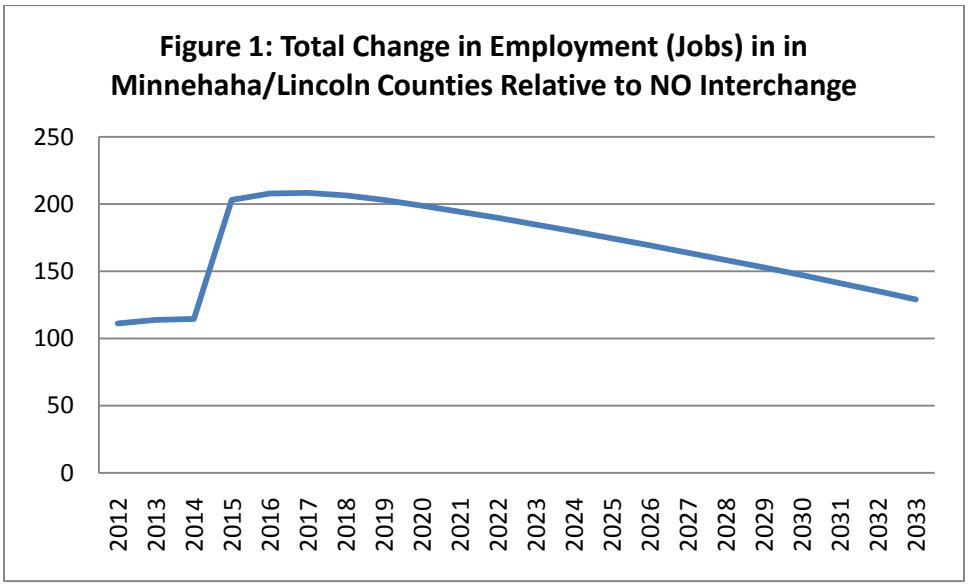
Variable	2027	2028	2029	2030	2031	2032	2033
Total Employment	164	159	154	148	142	136	130
Total GRP (Mil Fixed 2000$)	$13.06	$12.89	$12.67	$12.43	$12.18	$11.89	$11.57
Personal Income (Mil Nom$)	$15.43	$15.54	$15.66	$15.72	$15.78	$15.80	$15.78
Population	209	209	208	205	202	198	194
Labor Force	125	122	120	117	114	111	108

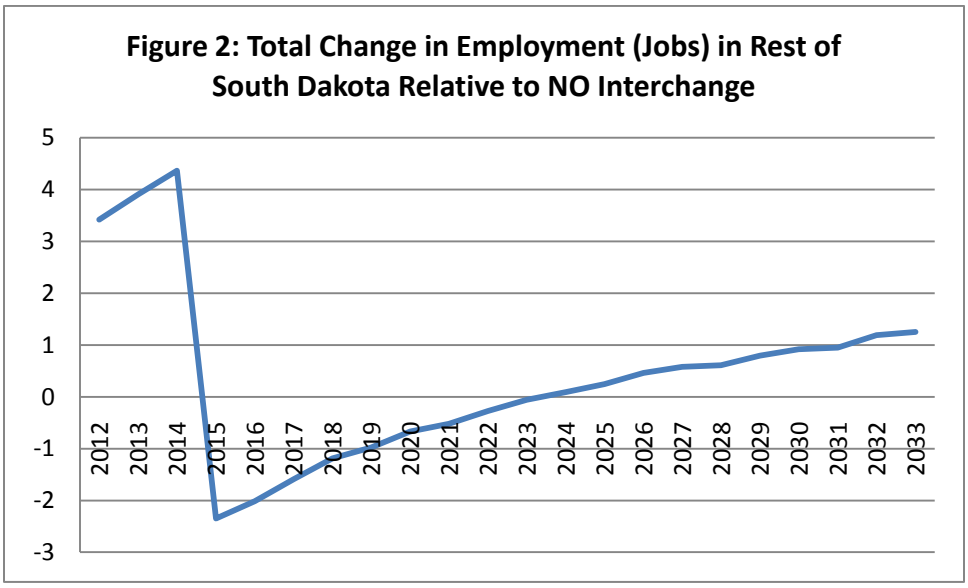
The initial three-year positive economic impact comes from the construction of the interchange. The economic impact starting in 2015 stems from efficiencies gained in transportation. The improvement in network speeds and consequently transportation time benefits the economy of Minnehaha and Lincoln Counties by reducing costs. These costs are a major component of the delivered price of both intermediate and final goods and services. Note that even though the changes in network speed are very small per vehicle, the cumulative effect based upon traffic counts is significant. The following discussion considers each component of the total economic impact reflected in Tables 3 – 5.

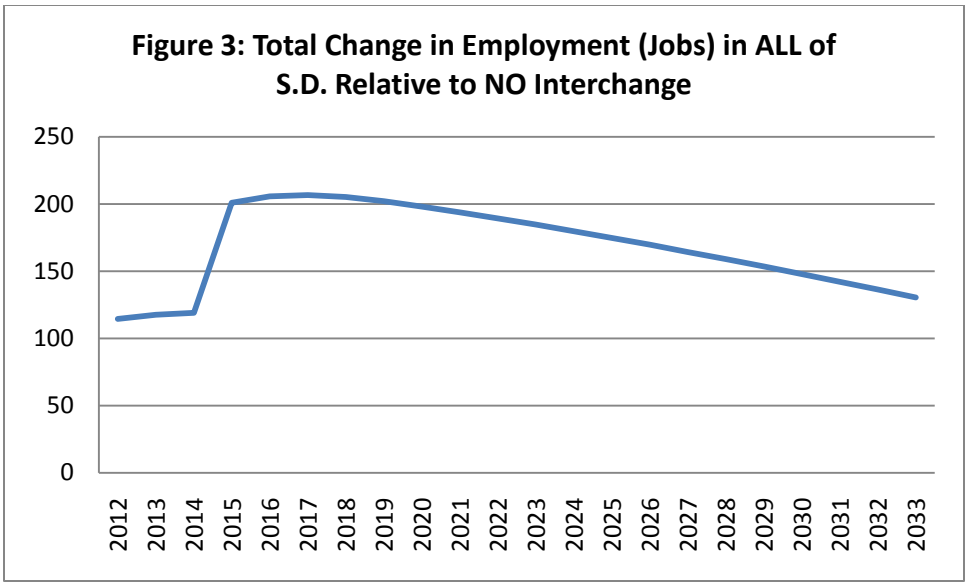
Employment

Increased competitiveness and consumer buying power accelerate the creation of jobs. Figures 1 – 3 respectively show the jobs created in the two county region, the rest of the state, and the state in total, as a result of the existence of the interchange. The employment figures show the number of additional jobs in existence for each year; these figures should not be added over years. Total change in employment peaks at 207 in 2017 and begins to decrease (while remaining positive) over time as the economy adjusts. The boost in employment is realized immediately as the interchange's effect is felt. Over time, the impact of the interchange relative to overall growth diminishes slightly, accounting for the modest decline in the figures beyond 2017. Finally, the model does not distinguish where the new labor force comes from, but only that there is an increase in both employment and total labor force.

As Figure 2 points out, there is a slight negative but essentially negligible economic effect on the rest of South Dakota in terms of jobs as a result of the interchange being built. (A note of caution: here and elsewhere, the vertical scale differs between the Region 1 and Region 2 diagrams, visually overstating the effect of the interchange in the "rest of the state" in the graphs.)

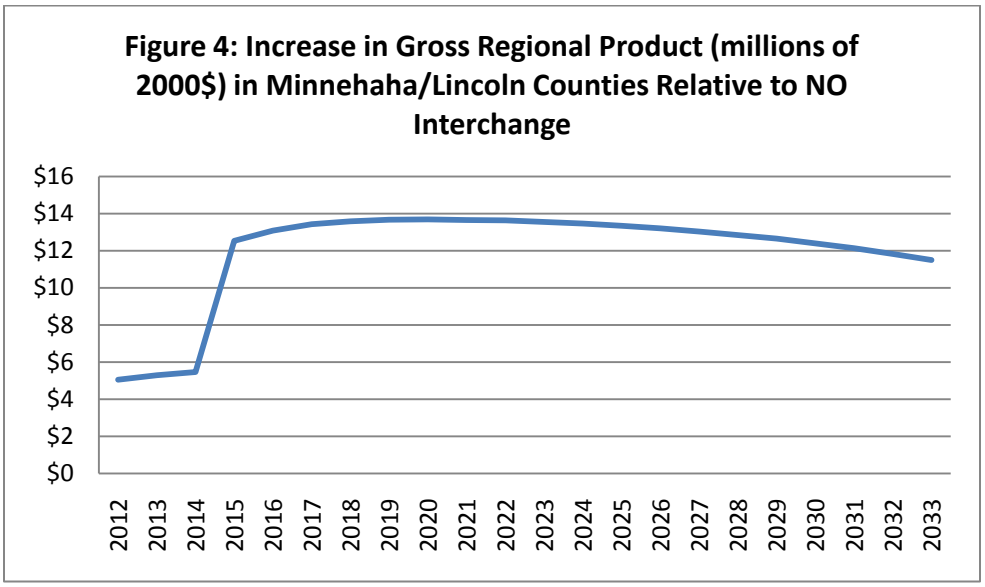


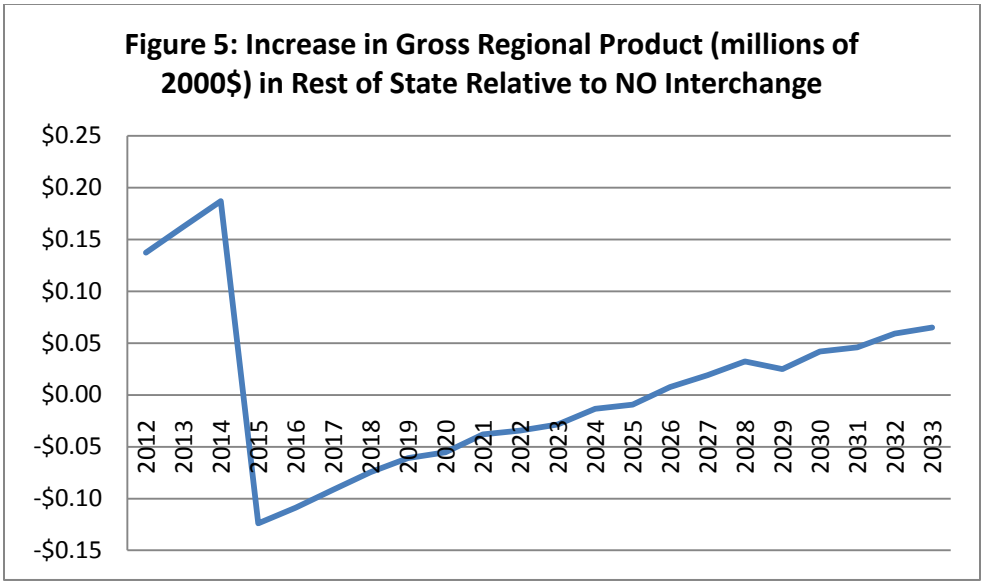


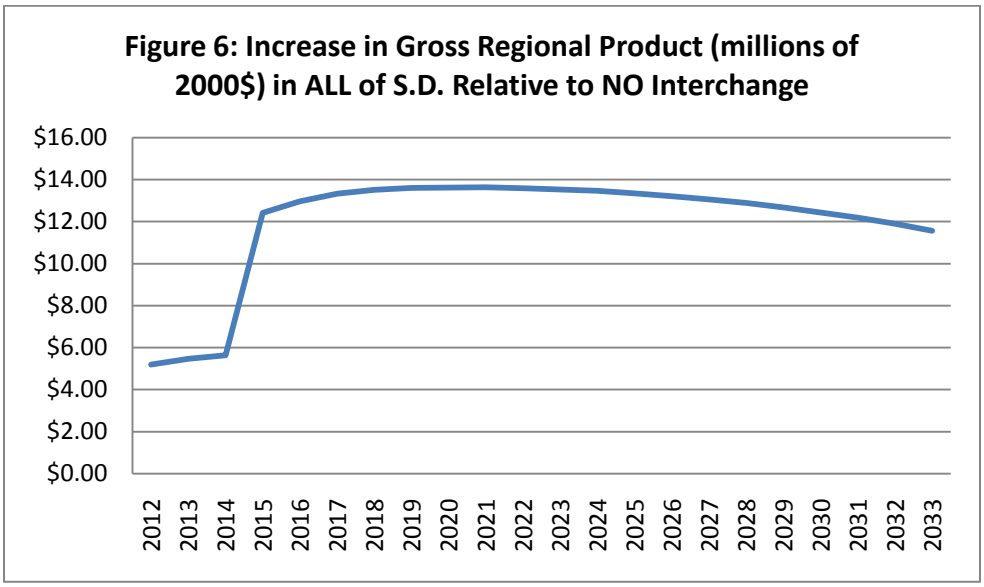


Gross Regional Product

With new employment comes an increase in the region's economic activity, or gross regional product (GRP). GRP is the best measure for understanding the economic value created in a region. The region's GRP increases by a cumulative $247 million from 2015 to 2033. Change in GRP peaks at $13.63 million over the baseline in 2021 and averages $13.00 million during this period. Figures 4 – 6 show the GRP effects for Lincoln and Minnehaha counties, the rest of the state, and the combined effect for the state as a whole.







Personal Income

It comes as no surprise that with more people and jobs, income in the region grows. Personal income, shown in Figures 7 – 9, is the income from all sources that is received by, or on behalf of, all the individuals who live in the area. As wages and salaries grow due to new employment and as the number of individuals grows due to migration, aggregate personal income also grows. This growth reinforces the other changes outlined above by creating new demand, consumption, jobs, and income. While continuing to rise until nearly the end of the analysis period, personal income averages $14.43 million annually over the baseline from 2015 to 2033.

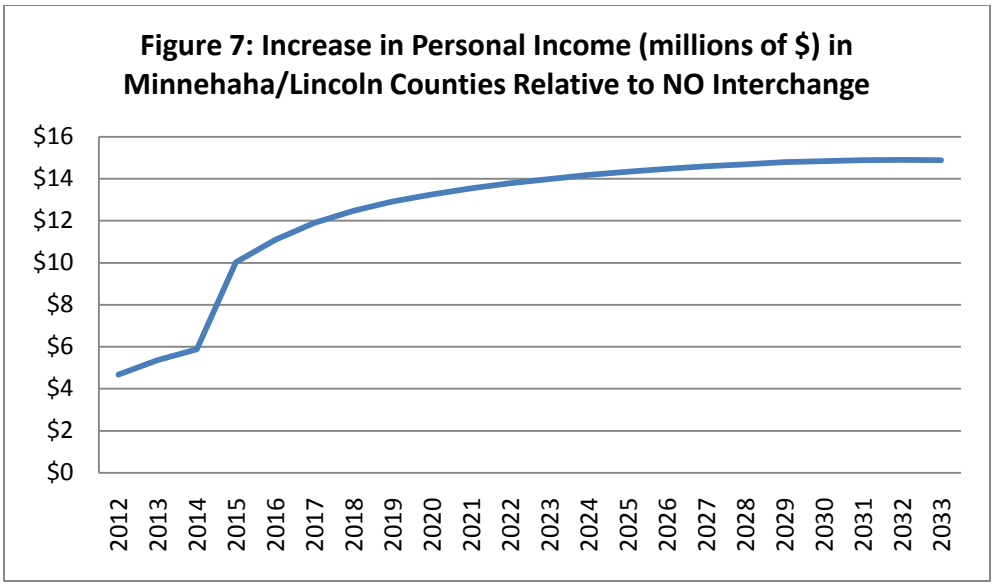


Figure 7: Increase in Personal Income (millions of $) in Minnehaha/Lincoln Counties Relative to NO Interchange
$16
$14
$12
$10
$8
$6
$4
$2
$0
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033

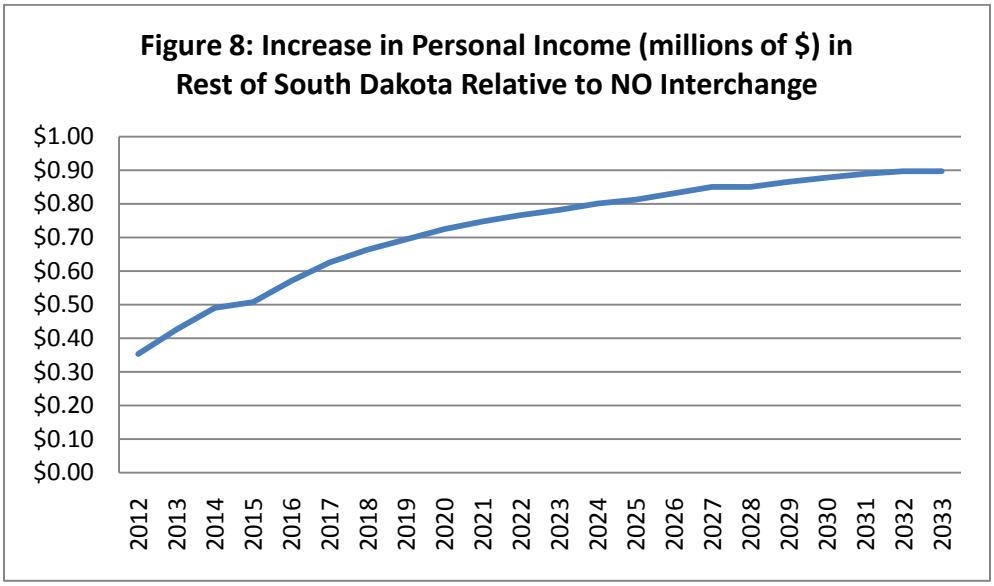


Figure 8: Increase in Personal Income (millions of $) in Rest of South Dakota Relative to NO Interchange
$1.00
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
2012
2013
2014
2015
2016
2017
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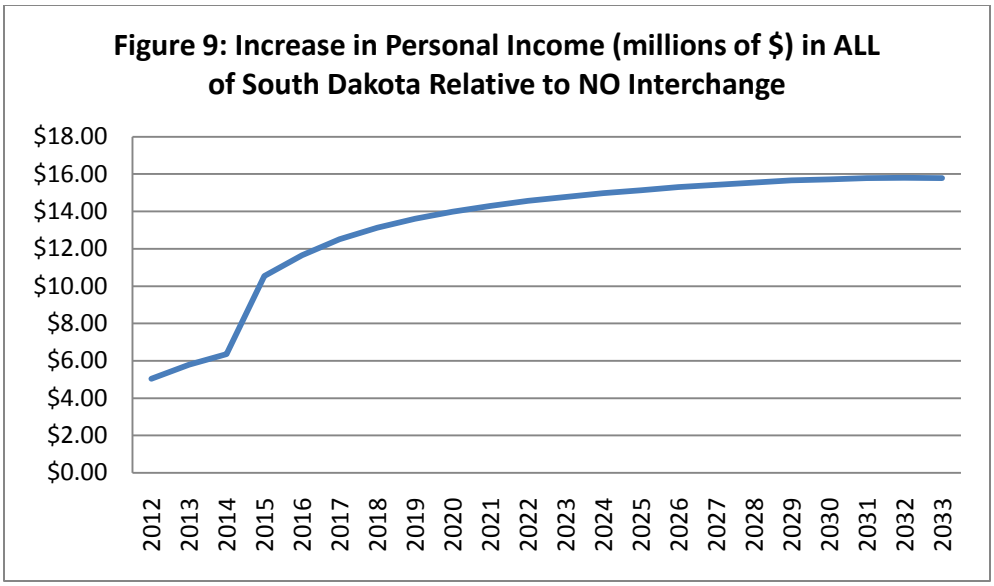
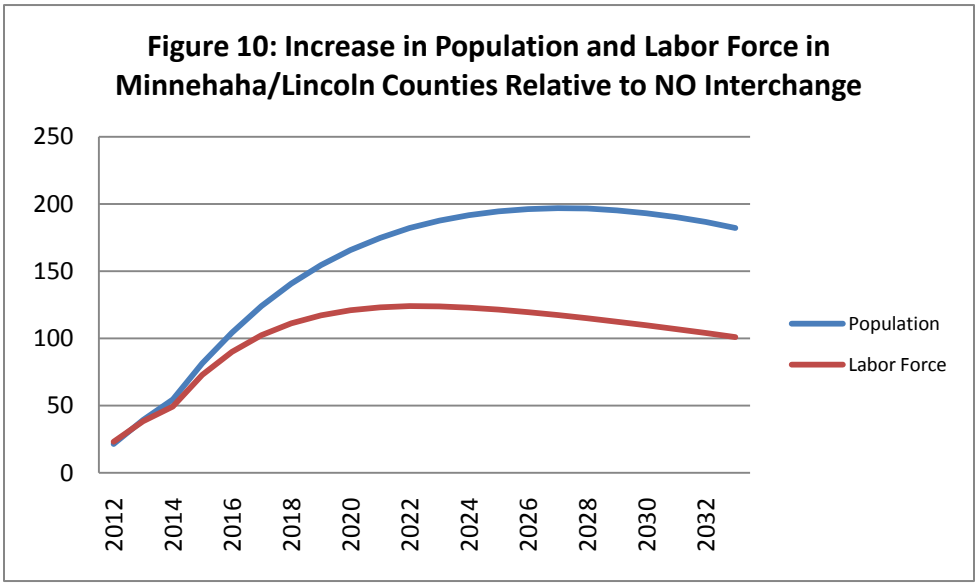
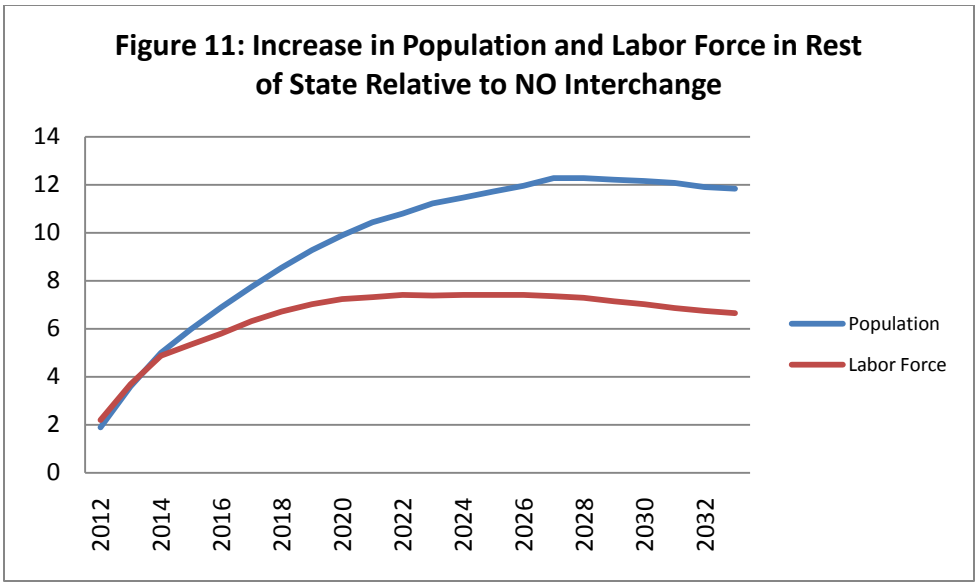
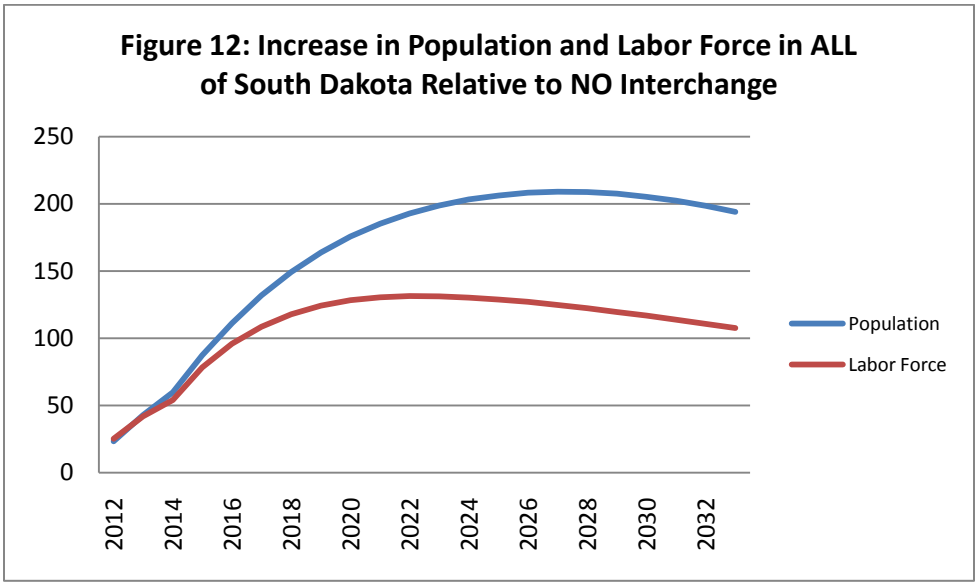


Population and Labor Force

As the region grows, improved economic opportunity draws new people from other parts of the country to the area. Figures 10 – 12 show how the population and labor force grow as a result of economic migration due to the interchange. The labor force is the subset of the population that is 16 years of age or over and either employed or seeking employment. This group makes up the impetus behind population growth by moving not only themselves but also their families.







Benefit/Cost

To assess benefits relative to costs, a net present value (NPV) computation was performed. Benefits were measured by GRP over the 22 year time period from 2012 to 2033 as reported above, and costs (C) were measured for the 3 year construction period from 2012 to 2014 as reported in Table 2. All amounts beyond 2012 were discounted by the 30-year U.S. Treasury bond yields of 4.644% (reflected by r in the equation below) as reported on June 8, 2009, in the Wall Street Journal. Using this method, the net present value of the interchange project is estimated to be $141.24 million, stated as a net increase in Gross Regional Product over and above construction costs, viewed from a 2012 time perspective. Expressed mathematically:

$$NPV = \sum_{t=0}^{21} \frac{GRP_t}{(1+r)^t} - \sum_{t=0}^{2} \frac{C_t}{(1+r)^t} = \$141.24\ million$$

Interchange Summary

The best way to determine whether the investment in this interchange is a good decision is to compare it to other uses of public money and evaluate the relative return on investment. That analysis is beyond the scope of this work. However, the results of this study show that the net present value of the interchange is positive and significant. In short:

New Jobs (at peak in 2017)	207
Maximum one year increase in Gross Regional Product (2024-5):	$13.63 million
Maximum one year increase in personal Income (2032):	$15.80 million
Increase in population (at peak from 2027-8):	209
Increase in Labor Force (at peak from 2022-3):	131
Net Present Value of Interchange:	$141.24 million

Analysis of the Proposed Overpass

BRB/REMI Approach and Assumptions

The methodology for the analysis of the 85th Street overpass is the same as that for the interchange. The input factors for the TranSight model were developed by comparing travel demand data from a base scenario without the overpass to the alternative scenario that includes the overpass, as provided by the URS Corporation and the city of Sioux Falls. Attachment 2 (see page 32) contains the full set of traffic projections for the overpass, with variations including an alternative overpass at 69th St., and overpasses at both 69th and 85th Streets. For purposes of this economic impact analysis, only the 85 St. overpass is studied in detail; Table 6 below summarizes this data.

Again, the essential input figures for the model were the changes in average speed in network travel, computed by dividing total vehicle miles traveled (VMT) by total vehicle hours traveled (VHT), and the cost of construction starting in 2013. The average speed for each scenario was computed for the years 2015 and 2033 with a linear interpolation filling the remaining years.

As with the interchange, the intent of the study is to isolate the effect of the overpass apart from other economic activity, such as the medical facilities and retail developments that are anticipated to develop in the area. Table 6 shows anticipated traffic demand for 2015 in three situations: the background and base scenario as reported in the previous analysis of the interchange, and the 85th St. overpass scenario, with the medical facilities and the dependent retail incorporated. The table also shows two variations for 2033, the base scenario without the overpass and associated retail development, and overpass and the associated retail development, again with both cases assuming the medical facilities are built.

Table 6: Travel Projections (Source: URS and the City of Sioux Falls)

	2015			2033	
	Background	**Base**	**Overpass**	**Base**	**Overpass**
Total Vehicle Miles Traveled	7,172,998	7,243,097	7,635,012	11,309,500	11,753,529
Total Vehicle Hours Traveled	183,589	185,554	195,143	286,475	298,884
Average Speed (MPH)	39.07096	39.03498	39.12522	39.47814	39.32472

Table 6 predicts that in 2015, the overpass would generate a 0.13887% increase in network speed compared to the status quo (from 39.07096 to 39.12522 miles per hour), and a 0.23116% increase in network speed compared to the base scenario (from 39.03498 to 39.12522 miles per hour). The overpass thus enhances travel speed by less than a quarter of one percent in either case throughout the region.

A surprising result is immediately clear from examining the projections for 2033: the presence of an overpass is actually projected to cause average network speed to decrease over time compared to the base measure of having no overpass. The overpass is projected to reduce speed by 0.38862% in 2033 (from 39.47814 to 39.32472 miles per hour). Including the 85th Street overpass in the roadway network initially results in an increase in the ratio of vehicle miles traveled (VMT) to vehicle hours traveled (VHT), which is characteristic of a travel benefit. Over the later portion of the study period, congestion is forecasted to increase, which results in reductions in the average travel speed beginning in 2022 and continuing through the end of the planning period (2033). As the travel model assumes a travel path bias of taking shorter mileage routes between origin and destinations, even if a slightly shorter travel time path exists, the higher level of congestion along the shortest travel distance path created by adding the overpass connections results in a lower overall travel speed relative to the no-build scenario. The lower average travel speed results in a decrease in the efficiency of the network which translates to a negative economic impact effect.

As with the interchange analysis, both the 2015 and 2033 economic impact calculations are done comparing the base case to the scenario with the overpass.

Building an overpass takes less time than an interchange; for purposes of comparing similar years of functionality (2015 – 2033), the overpass was assumed to be constructed in 2013 - 2014. Table 7 shows the construction costs for the overpass:

Table 7: Construction Inputs to TranSight Model

	2013	2014
Construction Costs (Mil $)	$4.25	$4.25

Travel Demand Impacts

The model provides separate results for the two county region and state of South Dakota excluding these two counties. Tables 8 through 10 below summarize the results of the simulation. All results are presented in terms of absolute differences from the no-build scenario in Minnehaha and Lincoln Counties. Employment, population, and labor force figures for each year are projected current totals for that time and should not be added across time. Gross regional product (in real terms with 2000 as a base year) and income figures (in nominal or current dollars) represent additional production or income for that one year. Table 10 combines the two regions to show total statewide impact.

Table 8: Summary of Results for Minnehaha and Lincoln Counties

Variable	2013	2014	2015	2016	2017	2018	2019
Total Employment	58	60	86	78	67	55	42
Total GRP (Mil Fixed 2000$)	$2.70	$2.83	$5.29	$4.89	$4.33	$3.63	$2.84
Personal Income (Mil Nom$)	$2.55	$2.91	$4.22	$4.21	$3.98	$3.56	$2.98
Population	11	21	32	40	46	48	48
Labor Force	12	20	30	35	37	37	34

Variable	2020	2021	2022	2023	2024	2025	2026
Total Employment	28	14	0	-15	-30	-45	-60
Total GRP (Mil Fixed 2000$)	$1.97	$1.04	$0.04	-$1.02	-$2.13	-$3.30	-$4.53
Personal Income (Mil Nom$)	$2.29	$1.48	$0.58	-$0.43	-$1.54	-$2.73	-$4.04
Population	46	42	37	29	21	11	0
Labor Force	30	24	18	10	3	-6	-15

Variable	2027	2028	2029	2030	2031	2032	2033
Total Employment	-76	-91	-108	-124	-141	-158	-176
Total GRP (Mil Fixed 2000$)	-$5.83	-$7.20	-$8.64	-$10.17	-$11.77	-$13.46	-$15.24
Personal Income (Mil Nom$)	-$5.45	-$6.98	-$8.65	-$10.45	-$12.41	-$14.54	-$16.86
Population	-11	-24	-38	-52	-68	-84	-101
Labor Force	-24	-33	-43	-53	-63	-74	-85

Table 9: Summary of Results for Rest of South Dakota

Variable	2013	2014	2015	2016	2017	2018	2019
Total Employment	2	2	-1	-1	0	0	0
Total GRP (Mil Fixed 2000$)	$0.07	$0.09	-$0.06	-$0.04	-$0.03	-$0.01	$0.01
Personal Income (Mil Nom$)	$0.19	$0.24	$0.21	$0.22	$0.21	$0.20	$0.17
Population	1	2	2	2	3	3	3
Labor Force	1	2	2	2	2	2	2

Variable	2020	2021	2022	2023	2024	2025	2026
Total Employment	0	0	1	1	1	1	1
Total GRP (Mil Fixed 2000$)	$0.01	$0.02	$0.03	$0.04	$0.05	$0.06	$0.07
Personal Income (Mil Nom$)	$0.14	$0.10	$0.06	$0.01	-$0.05	-$0.11	-$0.18
Population	3	3	2	2	1	1	0
Labor Force	2	1	1	1	0	0	-1

Variable	2027	2028	2029	2030	2031	2032	2033
Total Employment	1	1	1	1	1	1	1
Total GRP (Mil Fixed 2000$)	$0.08	$0.09	$0.09	$0.09	$0.10	$0.11	$0.12
Personal Income (Mil Nom$)	-$0.25	-$0.35	-$0.43	-$0.53	-$0.63	-$0.74	-$0.87
Population	0	-1	-2	-3	-4	-5	-6
Labor Force	-1	-2	-2	-3	-4	-4	-5

Table 10: Summary of Results for All South Dakota

Variable	2013	2014	2015	2016	2017	2018	2019
Total Employment	60	62	85	77	67	55	42
Total GRP (Mil Fixed 2000$)	$2.78	$2.92	$5.24	$4.86	$4.30	$3.62	$2.85
Personal Income (Mil Nom$)	$2.74	$3.15	$4.43	$4.43	$4.19	$3.76	$3.15
Population	12	22	34	43	48	51	51
Labor Force	13	22	32	38	40	39	36

Variable	2020	2021	2022	2023	2024	2025	2026
Total Employment	29	15	0	-14	-29	-44	-59
Total GRP (Mil Fixed 2000$)	$1.98	$1.06	$0.07	-$0.97	-$2.08	-$3.24	-$4.47
Personal Income (Mil Nom$)	$2.43	$1.58	$0.64	-$0.42	-$1.59	-$2.85	-$4.22
Population	49	45	39	31	22	12	1
Labor Force	32	26	19	11	3	-6	-15

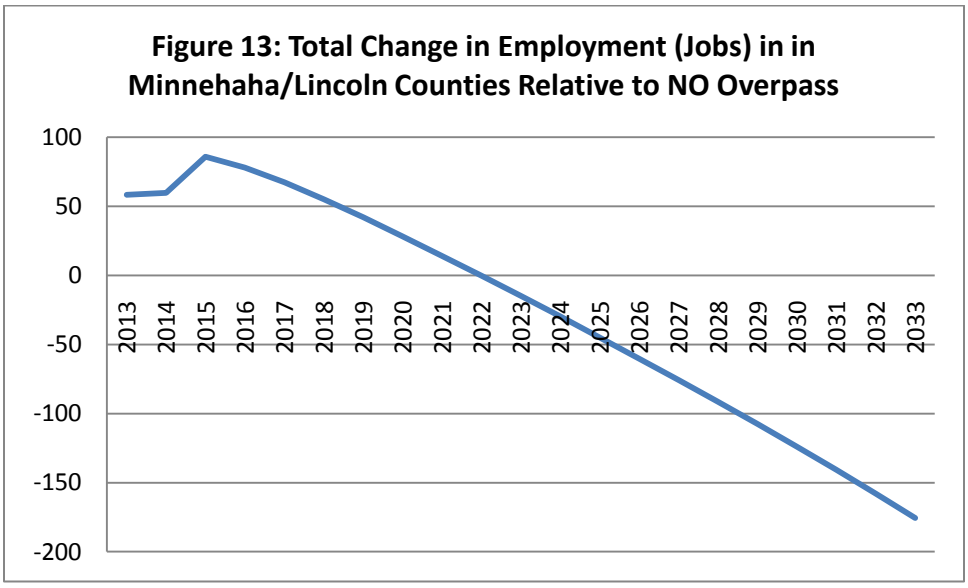
Variable	2027	2028	2029	2030	2031	2032	2033
Total Employment	-75	-90	-106	-123	-140	-157	-174
Total GRP (Mil Fixed 2000$)	-$5.75	-$7.12	-$8.56	-$10.08	-$11.67	-$13.35	-$15.12
Personal Income (Mil Nom$)	-$5.71	-$7.33	-$9.08	-$10.98	-$13.05	-$15.28	-$17.74
Population	-12	-25	-40	-55	-72	-89	-107
Labor Force	-25	-35	-46	-56	-67	-78	-90

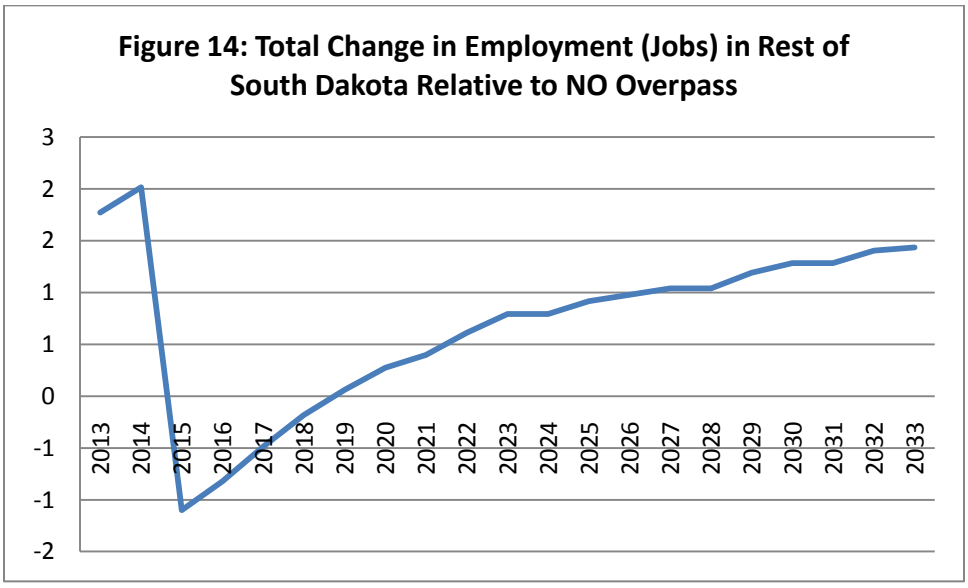
The initial two year positive economic impact comes from the construction of the overpass. The economic impact starting in 2015 stems from efficiencies gained in transportation. An improvement in network speeds and transportation time benefits the economy of Minnehaha and Lincoln Counties by reducing costs. These costs are a major component of the delivered price of both intermediate and final goods and services. However, as noted earlier, the traffic projections provided by the URS Corporation and the City of Sioux Falls suggest that traffic speed will decrease eventually with the construction of the overpass, leading to a negative economic impact. To some extent, this outcome must understate the actual economic impact, because the rationale for decreased speed due to congestion originates in the overpass being a preferred route for many travelers. The reason for preferring the route is likely that it reduces distance traveled, despite the slower traffic speed. However, the TranSight model, in keeping with standard analytical techniques for this type of inquiry, derives impact from travel speed, not from distance directly.

Employment

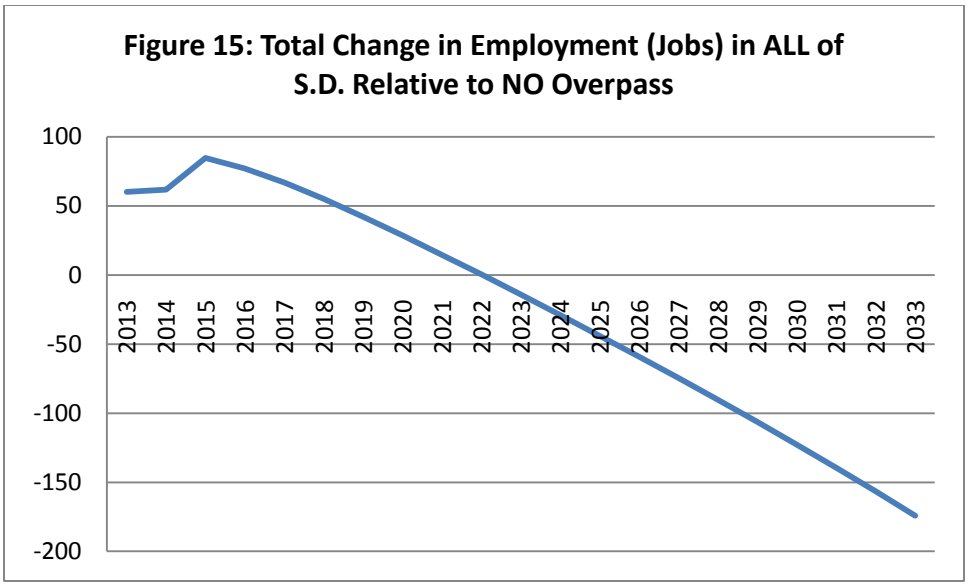
Figures 13 – 15 show the jobs created as a result of the existence of the overpass. Total change in employment peaks at 85 in 2015 and begins to decrease (becoming negative after 2022) over time as the economy adjusts. The employment numbers show the number of additional jobs in existence for each year; these figures should not be added over years. The boost in employment is realized almost immediately as the effect of the overpass is felt. Over time, the impact of the overpass relative to overall growth diminishes significantly. Finally, the model

does not distinguish where the new labor force comes from, but only that there is an increase in both employment and total labor force.



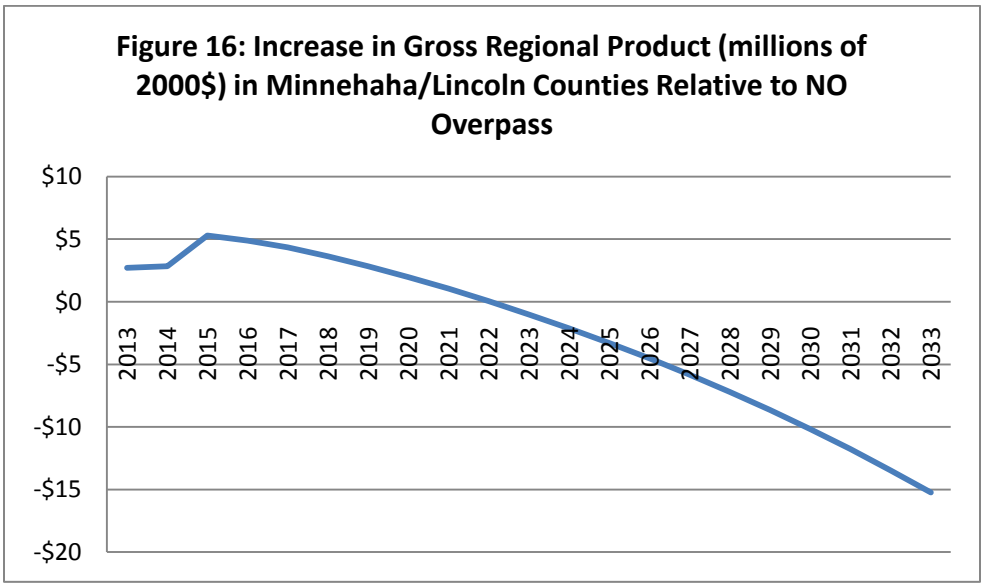


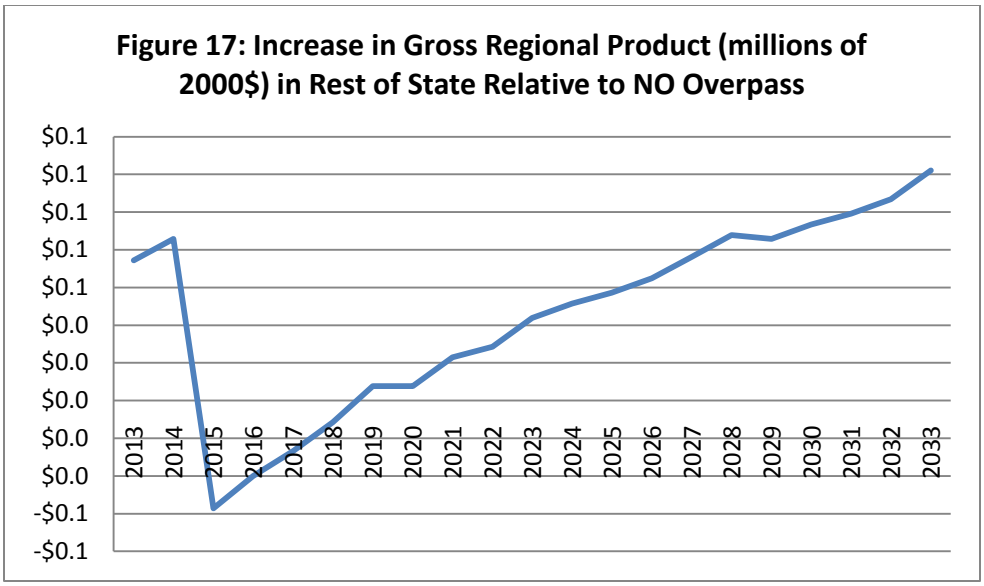
As Figure 14 illustrates, there is an essentially negligible economic effect on the rest of South Dakota in terms of jobs as a result of the overpass being built.

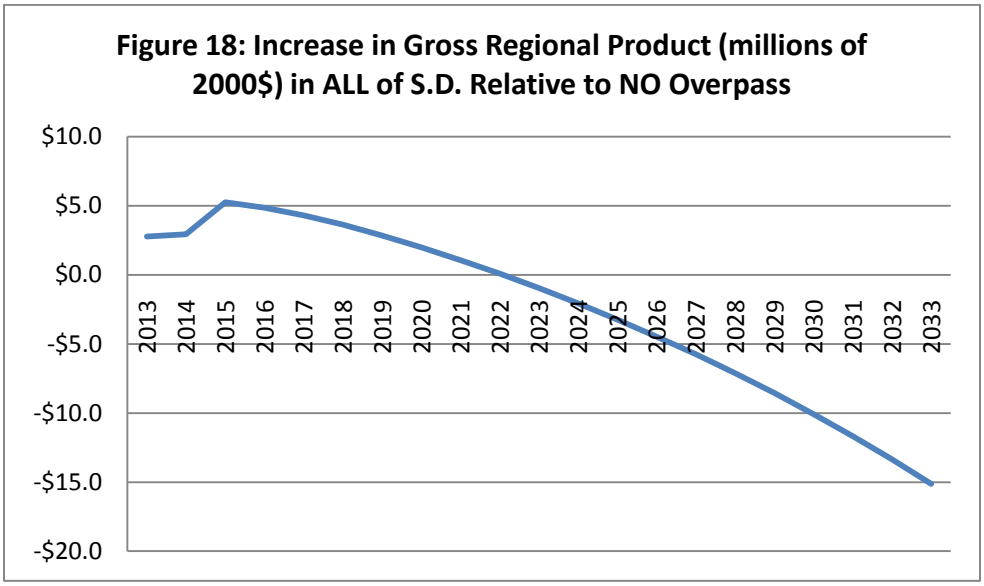


Gross Regional Product

The region's GRP decreases by a cumulative $58 million over the analysis period, 2015 – 2033 due to construction of the overpass. The change to GRP peaks at $5.24 million over the baseline in 2015 and becomes negative after 2022. Figures 16 – 18 show the GRP effects for Lincoln and Minnehaha counties, the rest of the state, and the combined effect for the state as a whole.







Personal Income

Change in personal income, shown in Figures 19 – 21, includes the income from all sources that is received by, or on behalf of, all the individuals who live in the area. Personal income peaks at $4.43 million compared to the baseline in 2015 – 2016 and declines thereafter, becoming negative in 2023.

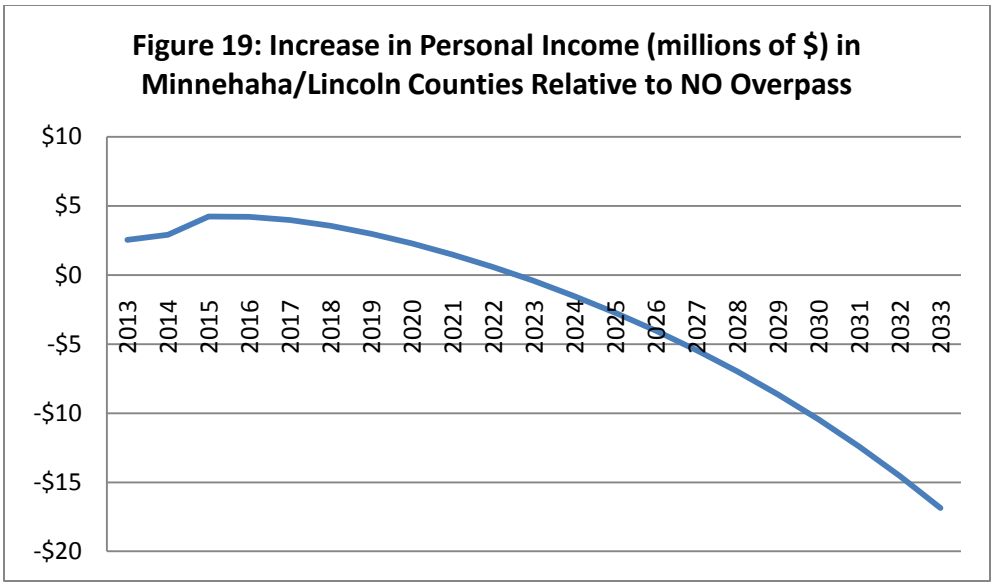


Figure 19: Increase in Personal Income (millions of $) in Minnehaha/Lincoln Counties Relative to NO Overpass
$10
$5
$0
-$5
-$10
-$15
-$20
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033

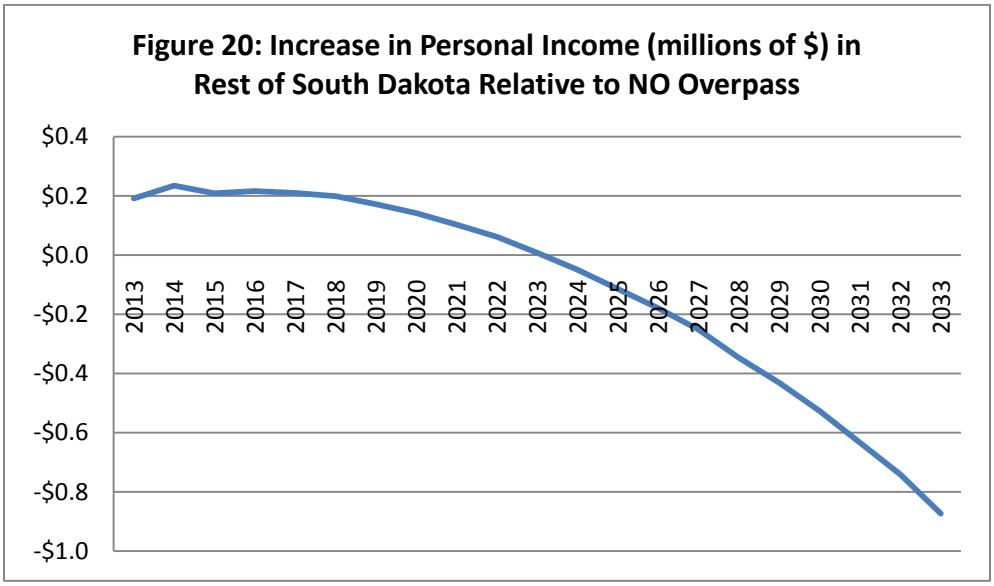
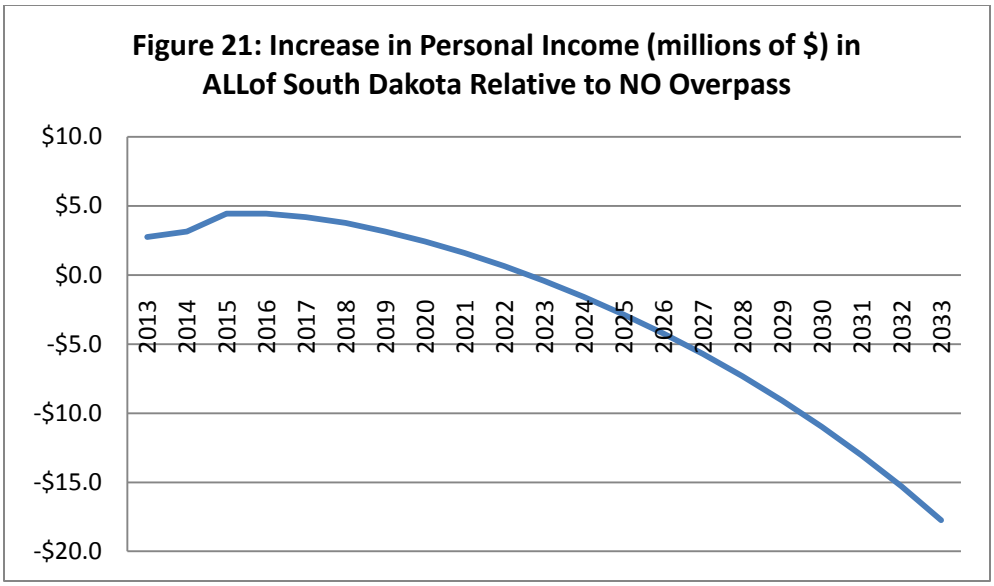
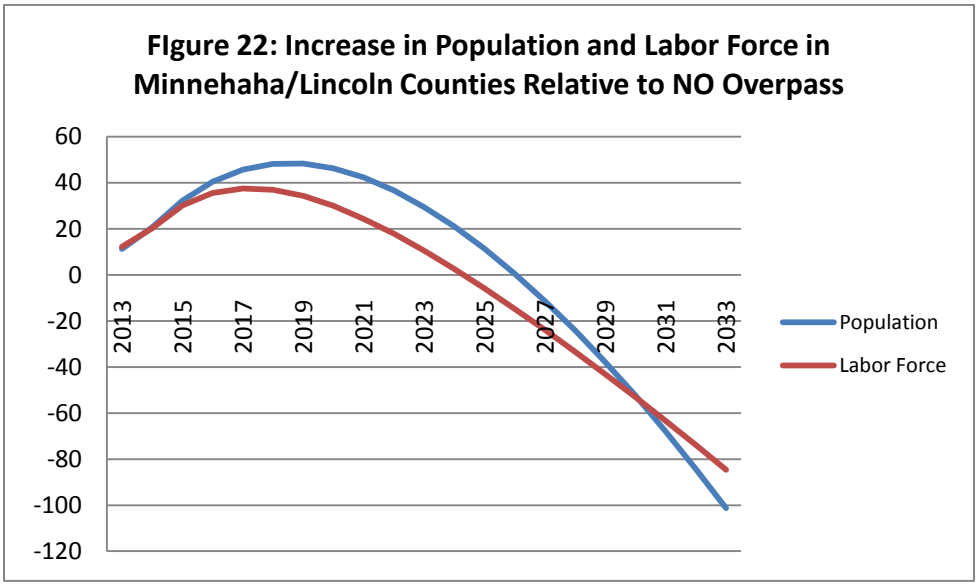


Figure 20: Increase in Personal Income (millions of $) in Rest of South Dakota Relative to NO Overpass
$0.4
$0.2
$0.0
-$0.2
-$0.4
-$0.6
-$0.8
-$1.0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033



Population and Labor Force

Figures 22 – 24 show how the population and labor force change as a result of economic migration. The labor force is the subset of the population that is 16 years of age or over and either employed or seeking employment.



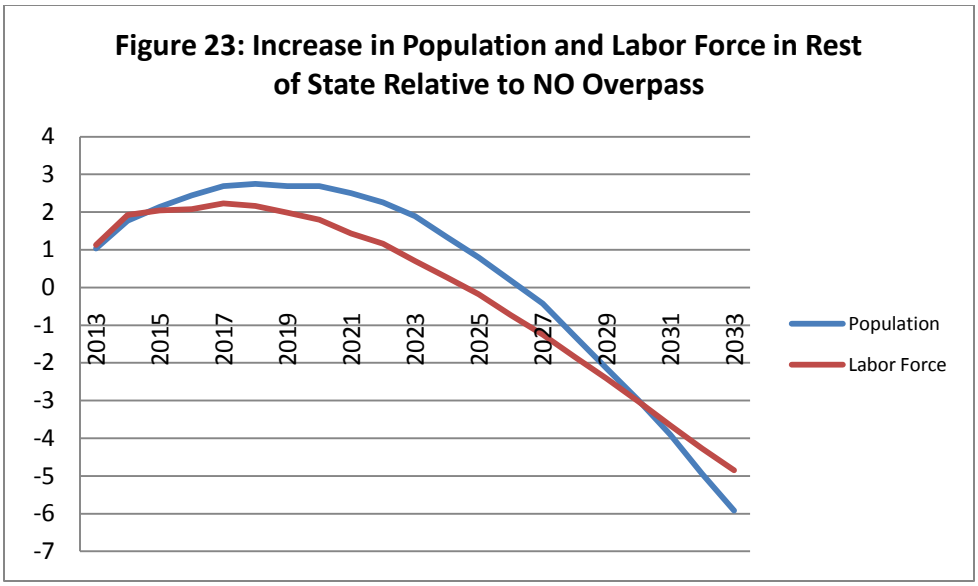


Figure 23: Increase in Population and Labor Force in Rest of State Relative to NO Overpass
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
Population
Labor Force

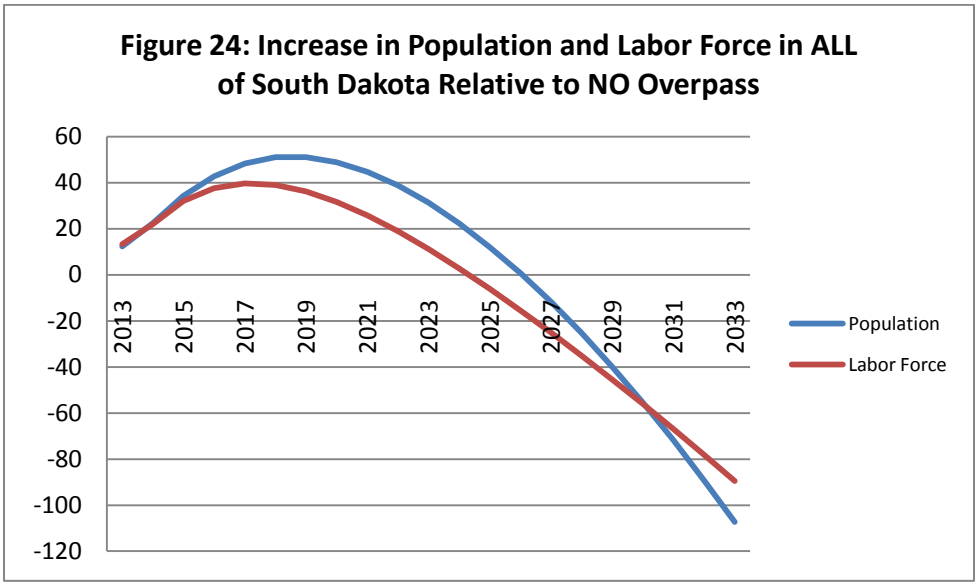


Figure 24: Increase in Population and Labor Force in ALL of South Dakota Relative to NO Overpass
60
40
20
0
-20
-40
-60
-80
-100
-120
2013
2015
2017
2019
2021
2023
2025
2027
2029
2031
2033
Population
Labor Force

Overpass Summary

The best way to determine whether the investment in this overpass is a good decision is to compare it to other uses of public money and evaluate the relative return on investment. The results of this study show that the net present value of the overpass is negative, using the same technique described for the interchange previously. In short:

New Jobs (at peak in 2017)	85
Maximum one year increase in Gross Regional Product (2015):	$5.24 million
Maximum one year increase in personal Income (2015-6):	$4.43 million
Increase in population (at peak from 2018-9):	51
Increase in Labor Force (at peak from 2017):	40
Net Present Value of Interchange:	- $20.47 million

Conclusions and Recommendations

The Business Research Bureau utilized the traffic demand forecasts provided by the URS Corporation and the City of Sioux Falls to estimate the economic impact of an interchange or an overpass at the intersection of I-29 and 85th Street near the Minnehaha and Lincoln county line. The study investigated the impact on the two-county region (Minnehaha and Lincoln counties) and on the rest of the state. All of the analysis employed the results of the TranSight model developed by Regional Economic Models, Inc. The analysis assumed that construction would begin in either 2012 or 2013 and that the interchange or overpass would be available for use in 2015. The time horizon for consideration of the economic impact extended to 2033.

The significant findings include:

- An interchange at I-29 and 85th Street will create over 200 jobs at peak impact and generate an estimated $141 million of Gross Regional Product in net present value terms.
- An overpass at I-29 and 85th Street will initially create nearly 100 jobs at peak impact, but diminished effects due to congestion and decreased traffic speeds cause the initial gains to dissipate within a few years. Given the time horizon of the analysis, the net present value of the overpass is estimated to be negative.

It seems clear that the interchange provides significantly more positive and longer lasting economic impact than the overpass. Most of the benefit of the overpass is enjoyed shortly after construction, but forecasted traffic congestion and the resulting reduction in average travel speed will likely eliminate the net gains within a few years. In contrast, the net benefits to an interchange are larger and are sustained throughout the duration of the time period studied.

Attachment 1 (Source: URS Corporation and City of Sioux Falls)

Interchange

1. 2015 Background - Represents the level of development assumed by 2015 without the Sanford and various retail developments that are dependent on the interchange. This alternative does not include the interchange, but does include roadway improvements to provide access to development areas opened up between now and 2015 that presently do not have much or any roadway infrastructure. This alternative assumes that the developments in the study area that were specifically discussed with land owners as part of this study are actually completed. The incremental growth in the remainder of the region reflects of an interpolation between the base level of development (2000) and the 2033 horizon. Full build-out of the study area developments other than Sanford and the retail areas to the south of Sanford was assumed because all of the developers stated their implementation plan assumed a less than 5 year horizon and their decision was not dependent on the interchange.

2. 2015 Base - Reflects the 2015 Background plus Sanford. This alternative does not include the retail developments and does not include the I-29/85th Street interchange concept.

3. 2015 Interchange - Starts with 2015 Base and adds the interchange-dependent retail south of Sanford and the I-29/85th Street interchange concept.

4. 2033 Base - This alternative assumes the regional development for 2033 less the interchange-dependent retail south of the Sanford site. Similar to the 2015 Base, the 2033 Base does not include the I-29/85th Street interchange concept.

5. 2033 Interchange - 2033 regional development levels including the Sanford development and the retail development to the south of Sanford with the interchange in place.

The tables have been divided into the following trip orientations:

- Internal-to-Internal (I-I) - These trips have an origin and a destination within the modeling limits.
- Internal-to-external or External-to-Internal (I-E - Trips with either an origin or a destination inside the model area, but not both.
- External-to-External (E-E) - Trips with both their origin and destination outside the model area (through trips - these do not stop in the region).

2015 VMT and VHT Comparison by Interchange and Development Scenario

Trip Component	2015 Background (no Interchange, no Retail, no Sanford)			2015 Base (with Sanford, no Interchange, no Retail)			2015 Interchange (with Retail and Sanford)		
	VMT	VHT	Trips	VMT	VHT	Trips	VMT	VHT	Trips
I-I	5,003,146	144,860	936,392	5,063,859	146,653	944,384	5,374,658	154,136	1,000,716
I-E	1,625,765	30,243	83,226	1,635,151	30,415	83,704	1,725,780	32,128	88,417
E-E	544,087	8,486	15,011	544,087	8,486	15,011	544,067	8,506	15,011
Total	7,172,998	183,589	1,034,629	7,243,097	185,554	1,043,099	7,644,505	194,770	1,104,144

2033 VMT and VHT Comparison by Interchange and Development Scenario

Trip Component	2033 Base (no Interchange, no Retail)			2033 Interchange (with Retail)		
	VMT	VHT	Trips	VMT	VHT	Trips
I-I	8,182,955	230,250	1,326,312	8,540,519	239,203	1,382,363
I-E	2,465,005	45,968	124,058	2,562,591	47,823	129,010
E-E	661,540	10,257	18,239	661,521	10,279	18,239
Total	11,309,500	286,475	1,468,609	11,764,631	297,305	1,529,612

DELTA TABLE

Trip Component	Change - 2015 Background to 2015 Base			Change - 2015 Base to 2015 Interchange		
	VMT	VHT	Trips	VMT	VHT	Trips
I-I	60,713	1,793	7,992	310,799	7,483	56,332
I-E	9,386	172	478	90,629	1,713	4,713
E-E	0	0	0			
Total	70,099	1,965	8,470	401,408	9,216	61,045

DELTA TABLE

Trip Component	Change - 2015 Base to 2033 Base			Change - 2015 Interchange to 2033 Interchange			Change 2033 Base to 2033 Interchange		
	VMT	VHT	Trips	VMT	VHT	Trips	VMT	VHT	Trips
I-I	3,119,096	83,597	381,928	3,165,861	85,067	381,647	357,564	8,953	56,051
I-E	829,854	15,553	40,354	836,811	15,695	40,593	97,586	1,855	4,952
E-E	117,453	1,771	3,228	117,454	1,773	3,228			
Total	4,066,403	100,921	425,510	4,120,126	102,535	425,468	455,131	10,830	61,003

Attachment 2 (Source: URS Corporation and City of Sioux Falls)

Overpass only

2015 VMT and VHT Comparison by Arterial Crossing and Development Scenario

2015 Scenario	Trip Component	2015 No Retail by Scenario			2015 with Retail by Scenario		
		VMT	VHT	Trips	VMT	VHT	Trips
69th Crossing	I-I	5,040,198	144,304	943,966	5,369,731	154,117	1,000,217
	I-E	1,632,971	30,340	83,671	1,726,214	32,127	88,419
	E-E	544,067	8,486	15,011	544,067	8,496	15,011
	Total	7,217,236	183,129	1,042,647	7,640,011	194,740	1,103,647
85th Crossing	I-I	5,040,827	144,769	944,035	5,364,383	154,492	1,000,294
	I-E	1,633,354	30,371	83,679	1,726,562	32,156	88,420
	E-E	544,067	8,486	15,011	544,067	8,496	15,011
	Total	7,218,249	183,626	1,042,725	7,635,012	195,143	1,103,725
69th + 85th Crossing	I-I	5,034,267	144,099	943,915	5,357,887	153,678	1,000,167
	I-E	1,632,983	30,337	83,671	1,726,203	32,122	88,420
	E-E	544,067	8,486	15,011	544,067	8,496	15,011
	Total	7,211,317	182,922	1,042,598	7,628,157	194,296	1,103,598

2033 VMT and VHT Comparison by Arterial Crossing and Development Scenario

2033 Scenario	Trip Component	2033 No Retail by Scenario			2033 with Retail by Scenario		
		VMT	VHT	Trips	VMT	VHT	Trips
69th Crossing	I-I	8,181,711	230,233	1,326,183	8,516,531	240,089	1,382,215
	I-E	2,464,876	45,961	124,043	2,564,246	47,827	129,012
	E-E	661,543	10,258	18,239	661,541	10,270	18,239
	Total	11,312,130	286,559	1,468,466	11,742,318	298,186	1,529,466
85th Crossing	I-I	8,180,682	230,125	1,326,059	8,527,564	240,771	1,382,091
	I-E	2,464,571	45,955	124,043	2,564,424	47,840	129,012
	E-E	661,541	10,260	18,239	661,541	10,272	18,239
	Total	11,309,594	286,415	1,468,342	11,753,529	298,884	1,529,342
69th + 85th Crossing	I-I	8,176,675	229,899	1,326,063	8,516,531	240,089	1,382,091
	I-E	2,464,556	45,955	124,040	2,564,246	47,827	129,012
	E-E	661,543	10,258	18,239	661,541	10,270	18,239
	Total	11,302,774	286,112	1,468,342	11,742,318	298,186	1,529,342

Attachment 3 (Source: Regional Economic Models, Inc.)

Detailed TranSight Description

This section first describes the mechanism by which TranSight receives and processes its input. Following this are subsections that describe the various costs and benefits that are incorporated into TranSight's assessment of a transportation project.

Model Input

The inputs to the modeling process stem from three sources:

- output from travel-demand model simulations
- project-specific information
- nationwide studies by government agencies and localized studies specific to the regions being modeled (as available)

Although transportation models vary significantly in structure and content, they all produce estimates of vehicle miles traveled (VMTs), vehicle hours traveled (VHTs), and vehicle trips under different scenarios involving modifications to one or more elements of the transportation network. Models that handle multiple modes of transportation will produce VMT and VHT by mode, as well as vehicle trips for each defined highway and public transit mode. Other models may report miles and hours traveled within each of several geographic areas, which can be incorporated into TranSight's multi-regional framework. Because transportation-model outputs often vary (for example, highway VMTs may be subdivided across different road types, vehicle types, and/or times of day), TranSight was designed with sufficient flexibility to handle a diverse range of data dimensions, which allows REMI to customize the model for individual clients. Much of this variation is due to differences across the various travel-demand models, but various transportation departments or other users may configure the same modeling package differently. Please see Appendix B for details on how TranSight transforms each travel-demand model's output into the VMT, VHT, and vehicle trip figures used in the analysis of transportation improvements.

Since the highway travel data are derived directly from individual scenario runs of your travel-demand model, they are not editable from within TranSight. However, since transit mode data are typically not included in travel-demand model output, TranSight allows users to directly enter and modify VHT, VMT, and trips by transit mode. Additionally, TranSight permits some degree of flexibility in how the data are applied to the forecast timeframe and across the specified regions. First, entering a "Phase in from" year and "Phase in to" year establishes a time period during which VMT, VHT, and vehicle trips gradually ramp from their baseline values toward the adjusted levels predicted by the travel demand model. The default assumption is that this progression is linear, so the costs and benefits that depend on miles and hours traveled are steadily realized over time. However, you may also specify a customized, non-linear phase-in process by entering the percentage of project benefits realized during each year of the

forecast. Depending upon the project's specification, the start year of transportation benefits might occur during the construction phase (such as a light-rail extension in which stations are activated incrementally) or might be deferred until the culmination of construction (such as a new artery that remains unusable until completion).

For multi-regional models, TranSight also spreads VMTs, VHTs, and trips among every possible pairing of defined regions. TranSight regions can correspond to states, counties, user-specified subcounty areas, or aggregations thereof, provided that travel-demand data is available for each desired region. While the travel-data tables display the number of vehicle miles and hours traveled within each region, they often provide no indication of the percentage of trips that originate in one region and terminate in another. This information is necessary as a basis for quantifying the improvements in commuter, transportation, and accessibility costs that result from the decrease in "effective distance" achieved by the transportation upgrade. The concept of effective distance essentially captures the distance decay effect through which the frequency of trips between regions A and B is inversely related to the distance between them.

Even though the vast majority of trips begin and end within the same region, cross-regional trips involve a greater number of hours and miles per trip. If the travel-demand model produces region-to-region breakdowns of hours, miles and trips, these data are directly transferred into TranSight to calculate the change in effective distance between each pair of regions. If the transportation model is not equipped to yield such information, TranSight applies available information on miles or hours of regional trips to develop a percentage allocation of total system VMTs and VHTs to each pair of regions (including different values for A to B versus B to A, to reflect asymmetric traffic flows). You can adjust these pre-set percentages or introduce changes over time to capture expected shifts in traffic patterns over the forecast time period (perhaps due to predicted spatial disparities in economic or residential development).

Among inputs not derived from travel demand models or public transit data, many parameters (such as pollutant emission rates and accident costs) are assigned default values from national sources such as the Institute of Transportation Studies and Federal Highway Administration, although the client can revise these with locality-specific estimates. While in certain cases the national figures are reasonable proxies for localized regions, the geographic variability of other factors such as accident rates and fuel prices makes local customization more vital. You must enter other TranSight inputs, such as those characterizing construction expenses and project financing, because of their specificity to the simulation.

Costs and Benefits

Each of the following subsections focuses on a direct effect, describing the cost calculation performed by TranSight and the manner in which the cost enters the Policy Insight analysis. Note that one or more of these costs may be excluded from the simulation prior to running TranSight, at the user's discretion. For

greater discussion of the theoretical underpinnings of modeling these costs in TranSight, please consult Appendix A.

Construction Costs

Governments incur the costs of building, financing, and maintaining a transportation upgrade over the lifetime of the project. While the construction process represents an expense from the government's perspective, it also represents demand that stimulates increased employment and production of intermediate inputs by the private sector. Both of these aspects are included in TranSight's modeling framework. In TranSight, the user enters projected construction costs and projected operation and maintenance (O&M) costs by mode in dollar form for each of the forecast years, in accordance with the annual work schedule of the transportation upgrade under consideration. The operation and maintenance costs heavily depend upon the nature of the undertaking. Public transit requires significant operating costs and replacement of depreciated equipment, as contrasted with road improvements that may only require periodic pavement and shoulder maintenance.

TranSight translates these expenditures into demand policy variables within Policy Insight. First, contracts with construction firms to implement the transportation project are reflected in increased final demand for the construction industry, which naturally flows through into sales, employment, demand for intermediate inputs (based on the I-O table), and other variables. TranSight also passes operations and maintenance spending into final demand for construction. The model uses endogenous trade-flow shares (based on a gravity-model approach) to allocate this demand to increased sales by the construction industry in both the specified region and other defined regions, including residual regions comprising the "rest of US" and the "rest of world."

Finance

Governments may utilize a number of different mechanisms to finance transportation projects. The instruments they choose (whether a single funding source or a "cocktail" of sources) can have varying effects on the region's economy, depending on market characteristics and the demand responsiveness of the individuals bearing the burden of the tax or spending changes. From a regional fiscal-balancing standpoint, some sources (such as previously budgeted transportation spending and federal highway grants) can be regarded as essentially costless. In contrast, targeted tax hikes, spending reallocations, and bonds directly alter the government's bottom line, in addition to producing indirect fiscal effects through inducing dynamic behavioral responses by households and firms. To perform a comprehensive assessment of a project's impact, it is imperative to balance the economic benefits the project generates with the costs (both direct and indirect) borne by the region's taxpayers and businesses. TranSight is designed with such a holistic perspective in mind.

TranSight enables you to invoke several different sources of funding for the transportation project under consideration. Any of four taxes—sales, residential property, fuel, and income taxes—may be hiked relative to their baseline levels. These increases are entered as changes in amounts collected (i.e.,

incrementing total tax receipts by a specified dollar amount). The tax changes can vary by region (for multi-regional models) and year to capture their real-world timing and geographic incidence.

On the spending side, when project-related outlays (excluding those funded by federal money) exceed the budgeted allotment for transportation construction, obtaining the additional funds from other budget categories carries an opportunity cost. To capture this, TranSight enables you to input the reductions in non-dedicated government spending (i.e., not budgeted for transportation) necessitated by funding the project. These reductions may be entered on a yearly basis for both the state and local levels, since funding may be shared across the two levels of government. They can also vary by region (in multi-regional models) since financial responsibilities for large projects may be apportioned differentially across regions. In case the spending takes the form of annual payments against a bond, TranSight provides a built-in calculator that can convert the bond's parameters (amount, interest rate, and maturity) into annualized payment obligations.

When entering spending figures, you should omit any project expenditures drawn from the existing transportation budget. TranSight assumes that those funds would have been spent on other transportation-related projects, making them costless for any specific transportation project from a governmental accounting perspective. Similarly, the user should exclude from the analysis any federal grants allocated to the project since they are viewed as exogenous and non-transferable (hence, there is no opportunity cost associated with applying them to the transportation upgrade). Land acquisition costs are excluded from construction spending because economic value stems from improvements to land, not from portfolio transactions involving land. However, these acquisition costs must be included in the financial tabulation to the extent that the associated funding derives from non-dedicated, non-federal sources.

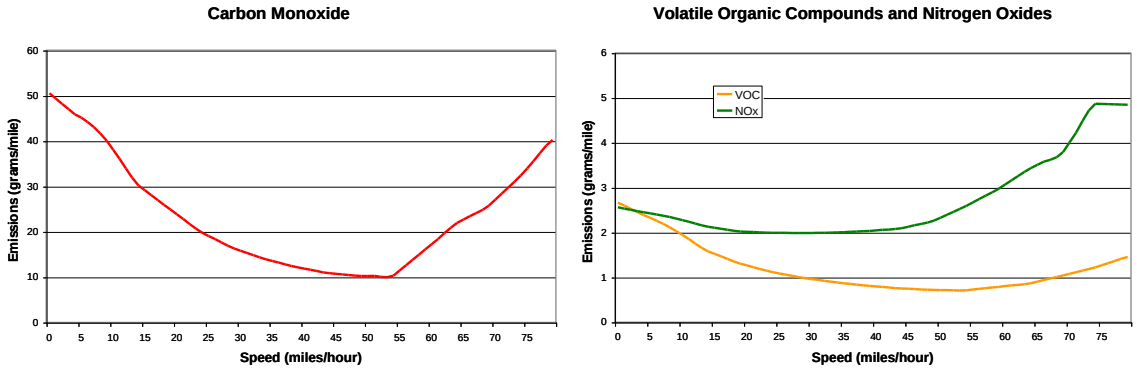
TranSight transfers all project financing instruments into Policy Insight in the form of the most suitable economic policy variables, where the tax and spending changes they represent produce indirect effects on the region's economy and population. Changes in TranSight tax variables map to Policy Insight policy variables as follows: income tax as "personal taxes," sales tax as the "inflation-reduced consumer purchasing power," property tax as the "consumer price" for housing, and fuel tax as the "consumer price" for gasoline and oil. The non-dedicated government spending diverted to transportation construction is modeled as reduced general government expenditure at the state and local levels, consistent with the state/local breakdown entered in TranSight.

Emissions Costs

While transit upgrades can reduce emissions by drawing motor vehicles off the road, highway enhancements typically induce increased traffic, which causes greater emissions of harmful pollutants. In TranSight, changes in emissions costs are computed from three sets of inputs. First, for each of five primary pollutants (carbon monoxide, nitrogen oxides, sulfur oxides, particulate matter, and volatile organic compounds), TranSight specifies rates per vehicle-mile. We assume constant emissions rates for transit modes, but for motor vehicles (autos and trucks) we assume variable rates for each potential

vehicle speed from 0 to 80 miles/hour. The emissions rate for some motor vehicle pollutants depends on travel speed, and declines up to a certain threshold speed, at which point emissions begin to increase (see Figure 2 below). For other pollutants, the emissions rate remains fairly constant over all speeds. The rates are differentiated across each mode of transport.

TranSight uses motor vehicle emissions rates obtained from two prominent models developed by the EPA: PART5 (for SOx and PM) and MOBILE6b (for CO, NOx, and VOCs). These models rely on assumptions regarding the age distribution of the US motor vehicle fleet, fuel characteristics, locally relevant operating conditions, and the effects of inspection and maintenance programs to establish average emission rates for each multiple-of-five speed between 10 and 65 mph. To derive rates for all speeds from 0 to 80 mph, the process of Lagrange interpolation was applied to the EPA's rates. Figure 2 illustrates for three of the five pollutants (CO, NOx, and VOCs) how emission rates progressively improve and then worsen as travel speed increases. For the remaining two pollutants under consideration (SOx and PM), emissions rates remain constant over all speeds at the levels estimated by the EPA. Given the likelihood of tightening emissions regulations, technological improvements, and gradual conversions from internal combustion to electric engines, TranSight enables the user to enter differing (likely lower) emissions rates for each forecast year.



Emissions rates for various speeds (source: EPA's PART5 and MOBILE6b)

The second matrix of inputs represents the cost per gram of each of the five pollutants under consideration, which, like the emission rates, can vary from year to year. TranSight is packaged with default emissions costs that are based on a study by McCubbin and Delucchi, who quantify the health effects of vehicle pollution per VMT in the average urban area and the nation as a whole.1 These costs are used for both motor vehicle and public transit modes, as the health impacts of a gram of pollutant are identical regardless of the source. The user may modify these cost parameters based on conditions endemic to the region being modeled; for example, emissions costs tend to be higher in congested urban areas since pollutants tend to have more potent health effects nearer the source. The final set of inputs is simply total vehicle miles traveled under the baseline and alternative (i.e., with the

[1] McCubbin, Donald, and Mark Delucchi, "The Social Cost of the Health Effects of Motor Vehicle Air Pollution." Report 11 from *The Annualized Social Cost of Motor-Vehicle Use in the United States*. Institute of Transportation Studies. University of California-Davis. 1996.

transportation project in place) scenarios, disaggregated by mode of travel. Combining the three inputs produces total emissions cost figures for each of the five pollutants, as illustrated in the following equation. TranSight performs this calculation separately for each mode specified in the model.

$$\Delta EC = \sum_j ER_j \times CPG_j \times (VMT_{alt} - VMT_{base})$$

where

ΔEC = Change in total emissions cost ($)

ERj = Emissions rate for pollutant j (gram/mile)

CPGj = Emissions cost per gram for pollutant j ($/gram)

VMTalt = Vehicle miles traveled under the alternative scenario

VMTbase = Vehicle miles traveled under the baseline scenario

The change in emissions cost relative to baseline levels enters into Policy Insight as a non-pecuniary amenity that accrues to workers and their dependents.2 These costs then proceed to influence private decision-making by households in accordance with the tenets of the new economic geography, as articulated by Fujita et al.3 and applied to regional macroeconomic modeling by Fan, Treyz and Treyz.4 This theory emphasizes the geographic location decisions of firms, demonstrating how improved access to intermediate inputs and a diversely skilled labor force can provide incentives for industries to cluster and agglomerate. But in addition to these business effects, households may be motivated to migrate closer to cities, where access to a broader array of consumer goods and potential employers may counterbalance disamenities such as higher crime rates, traffic, and air pollution. As a consequence, a transportation project that effectively reduces emissions costs may stimulate in-migration to urban regions, and Policy Insight will capture this dynamic over the course of the forecast period.

Safety Costs

Upgrading a highway or transit line can improve safety on the transportation network, but to the extent that usage increases, the frequency of accidents can increase. Since the number of accidents is directly proportionate to vehicle miles traveled, the transportation model's role in assessing net VMT changes is pivotal for TranSight's computation of cost impacts. TranSight permits annual mode-specific rates for each of three accident consequences: fatalities, injuries, and property damage only (PDO). The model is pre-packaged with default highway accident rates based on national averages reported by the Federal Highway Administration; the user can modify these rates if local-specific data are available. For transit

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[2] Lieu, Sue and G. I. Treyz, "Estimating the Economic and Demographic Effects of an Air Quality Management Plan: The Case of Southern California." *Environment and Planning*, 24 (1992): 1799-1811.

[3] Fujita, Masahisa, Paul Krugman, and Anthony J. Venables, *The Spatial Economy: Cities, Regions, and International Trade*. Cambridge, MA: MIT Press, 1999.

[4] Fan, Wei, Frederick Treyz, and George Treyz "An Evolutionary New Economic Geography Model." *Journal of Regional Science* 4 (2000): 671-695.

modes, the model includes default accident rates that are derived from nationwide US Department of Transportation data.5

TranSight also provides default cost-per-accident figures for each transportation mode, broken down by accident consequence. These are based on National Safety Council figures that incorporate wage and productivity losses, medical and administrative expenses, motor vehicle damage, and a willingness to pay to reduce safety risks.6 Additionally, a different set of costs can be entered for each forecast year, for example, to reflect rising insurance premiums or health care costs. The cost calculation mirrors that performed for emissions costs, taking the following form for each mode:

$$\Delta SC = \sum_{j} AR_j * CPA_j * (VMT_{alt} - VMT_{base})$$

where

ΔSC = Change in total safety cost ($)

ARj = Accident rate for accident consequence j (accident/mile)

CPAj = Safety cost per accident for accident consequence j ($/accident)

VMTalt = Vehicle miles traveled under the alternative scenario

VMTbase = Vehicle miles traveled under the baseline scenario

As with emissions costs, changes in safety costs are transferred into Policy Insight as adjustments to the non-pecuniary amenities that impact individual welfare. Even for people not involved in accidents, the prevailing local accident rate along with associated insurance and medical costs can influence the relative attractiveness of living and/or working in a particular region. Changes in these variables may stimulate migration into or out of the region. But the migratory impact of safety costs might conceivably be outweighed by other factors set in motion by the transportation project; for example, a new highway might make driving less safe, but it also improves access to attractive commodities and employers, which might trigger in-migration despite the attendant risks. By computing the magnitude of all these costs, TranSight can predict how they balance out to yield a net impact on economic migration and other economic factors.

Operating Costs

Increased travel stimulated by a highway upgrade forces increased out-of-pocket spending on vehicle operation and maintenance. In TranSight, vehicle operating expenditures represent an opportunity cost in the form of foregone spending on other consumption goods and services. TranSight comes packaged with default pre-tax fuel prices based on recent region-specific historical trends (as reported by the Energy Information Administration), and both federal and state excise tax rates applicable in the

[5] Bureau of Transportation Statistics, *National Transportation Statistics 2001*.

[6] National Safety Council, *Estimating the Cost of Unintentional Injuries*.

modeling region. You can modify these prices and tax rates for each region in each forecast year, in case you anticipate a particular time trend, tax change, or geographic variation.

The total post-tax fuel price is applied to a miles-per-gallon figure that is appropriate to the average speed prevailing on the region's transportation network. TranSight contains a table of speed-specific mpg parameters (for speeds from 0 to 80 mph), which allows for variation in gas mileage from year to year. While tightening fuel efficiency regulations and improving technology should increase average mpg over time, the increasing prevalence of trucks and sport-utility vehicles may dampen this trend somewhat. Finally, TranSight multiplies per-mile fuel spending by the change in VMTs predicted by the selected transportation model, to compute total expenditures on gasoline. The fuel cost parameters can vary by motor vehicle type (i.e., cars versus trucks) in order to reflect three important phenomena: the price differential between regular gasoline and diesel fuel, the difference in the federal excise tax on regular versus diesel, and the considerably different fuel efficiency exhibited by cars and trucks over the range of possible average network speeds.

The change in fuel expenditures is computed for each vehicle mode as follows:

$$\Delta FE_i = (FP_i + FEDTAX + STATETAX_i) * \frac{1}{MPG_s} * (VMT_{alt} - VMT_{base})$$

where

ΔFEi = Change in fuel expenditures for region i ($)

FPi = Pre-tax fuel price for region i ($/gallon)

FEDTAX = Federal excise tax ($/gallon)

STATETAXi = State excise tax for region i ($/gallon)

MPGs = Typical fuel efficiency at speed s (miles/gallon)

VMTalt = Vehicle miles traveled under the alternative scenario

VMTbase = Vehicle miles traveled under the baseline scenario

In addition to these fuel-related expenditures, TranSight contains a non-fuel operating cost parameter that captures maintenance and repair costs associated with vehicle "wear-and-tear." As with fuel costs, non-fuel operating costs can differ between cars and trucks; default values based on analogous parameters in other travel demand models are included in TranSight. The change in non-fuel expenditures is calculated for each vehicle mode as follows:

$$\Delta NFE_i = NF_i * (VMT_{alt} - VMT_{base})$$

where

ΔNFEi = Change in non-fuel expenditures for region i ($)

NFi = Non-fuel spending per mile for region i ($/mile)

In Policy Insight, the change in fuel costs is modeled as a change in Consumer Spending on Gasoline and Oil, while the change in non-fuel operating costs is captured as a change in Consumer Spending on Transportation services. In both cases, the spending change has an equal and opposite effect on household expenditures on other goods and services. For example, decreased expenditures on gas or auto maintenance due to declining vehicle miles traveled allows for shifting of personal disposable income toward other consumption commodities. The reallocation of the savings by consumer category is proportionate to baseline consumer spending on those categories of goods and services. By providing households more latitude on how to spend their income, projects that reduce vehicle operating costs ultimately benefit consumers in the model.

Value of Time

Time spent in transit has an opportunity cost in terms of the more desirable or productive activities foregone by the traveler. In this respect, a transportation network improvement benefits individuals to the extent that it reduces average travel time per trip. For each mode, TranSight bases the value of leisure time saved by the transportation upgrade on the resulting reduction in hours per vehicle-trip multiplied by the average vehicle occupancy rate. Accounting for vehicle occupancy rates is critical since all passengers reap the benefits of shortened travel times. It is particularly important when examining substitution between public transit and motor vehicles, since transit vehicles naturally have considerably higher passenger capacity. The average time savings are then multiplied by the portion of trips under the alternative simulation conducted for leisure purposes. For convenience, TranSight is packaged with default leisure percentages7 and vehicle occupancy rates8 culled from federal surveys.

Finally, these total time savings are multiplied by a dollar valuation of leisure hours, which is benchmarked to 50% of the average wage rate to be consistent with methodology recommended by the U.S. Department of Transportation. REMI tailors this figure to the modeled region's wage and applies it to both peak and off-peak hours, which again accords with standard DOT procedure despite overlooking time-differential rates of congestion.9 The same dollar valuation is applied to leisure time in all modes, since there is no justification for valuing leisure time spent in buses or trains differently than leisure time in cars. Mathematically, TranSight calculates the savings in leisure time for each mode as follows:

$$\Delta LT_i = \left(\frac{VHT_i^{alt}}{trips_i^{alt}} - \frac{VHT_i^{base}}{trips_i^{base}}\right) * trips_i^{alt} * VOR_i * \%L_i * VL_i$$

where

ΔLTi = Change in leisure time value for mode i ($)

[7] *Highlights of the 2001 National Household Travel Survey*, Bureau of Transportation Statistics, U.S. Department of Transportation, BTS-0305, 2003.

[8]; *Summary of Travel Trends: 1995 Nationwide Personal Transportation Survey*, Federal Highway Administration, U.S. Department of Transportation, 1999; *2001 National Transit Database*.

[9] *The Value of Saving Travel Time: Departmental Guidance for Conducting Economic Evaluation*. U.S. Department of Transportation. April 19, 1997.

VHT_i^j = Vehicle hours traveled on mode i under scenario j

$trips_i^j$ = Vehicle trips on mode i under scenario j

VORi = Vehicle occupancy rate for mode i (persons/vehicle)

%Li = Percentage of trips for leisure purposes on mode i

VLi = Value of leisure time on mode i ($/hour)

As with other cost changes described above, these time savings enter Policy Insight in the form of increased non-pecuniary amenities to individuals. Even though leisure travel time reductions produced by transportation projects rarely translate into direct financial benefits for households, they do enhance the comparative attractiveness of a region, which is likely to stimulate in-migration. People will be drawn to an area that has diminished its transportation network congestion in relation to neighboring areas, all else being equal. Improved commuting efficiency may also entice workers by providing access to a greater cross-section of potential employment opportunities, thereby further encouraging inward migration.

The Transportation Cost Matrices

Transportation upgrades can reduce the "effective distance" between two locations by facilitating a more efficient flow of labor and goods between them. Within the TranSight framework, the effective distance implicitly enters the calculation in three distinct matrices: commuter costs, transportation costs, and accessibility costs. The commuter cost matrix reflects changes in commuting time (measured in hours per commuter trip) between and within modeling regions, which result from completion of the transportation improvement. Since infrastructure expansions should unambiguously reduce travel time by increasing route and mode options, these savings can be translated into an economic impact based on the change in network-wide travel speed and the resulting reduction in average commute time. These savings are assumed to accrue entirely to firms.

TranSight derives the region-to-region changes in commuter time from transportation model output of changes in the VHT/trip ratio for each mode. Since the cost matrix expects a single coefficient value, TranSight calculates a weighted average of time savings across all modes, where each mode's weight is its percentage of total system vehicle hours traveled. Finally, this average time savings is divided by 8 hours to scale them to the length of a typical workday. Note that the commuting time changes with respect to the baseline simulation can vary across forecast years, to allow for dynamic response to the transportation improvement over time. The model calculates commuter cost savings for each combination of regions i and j (with i=j implying within-region savings) via the following formula. It should be noted that the transportation cost change is calculated relative to a baseline value of 1, with a positive ΔCC actually representing an increase in commuter costs and a negative value indicating a cost decline.

$$\Delta CC_{ij} = 1 + \frac{1}{8} * \sum_k \%H_k * \left[\frac{VHT_i^{alt}}{trips_i^{alt}} - \frac{VHT_i^{base}}{trips_i^{base}} \right]$$

where

ΔCCij = Change in commuter costs between regions i and j (hours)

%Hk = Percent of VHT between i and j traveled on mode k

VHT_k^{base} = Vehicle hours traveled between i and j on mode k: base scenario

$trip_k^{base}$ = Vehicle trips traveled between i and j on mode k: base scenario

VHT_k^{alt} = Vehicle hours traveled between i and j on mode k: alternative scenario

$trip_k^{alt}$ = Vehicle trips traveled between i and j on mode k: alternative scenario

Whereas the commuter cost matrix captures time savings for off-the-clock work-related trips, the transportation cost matrix displays time savings for on-the-clock business travel and transport of goods. As with commuter costs, transportation costs can vary among regions as well as across forecast years. Thus, a new or expanded highway connecting two regions may have substantial impacts on transport costs between them, but also smaller secondary effects on costs between other regions as traffic patterns shift in response to the new alternative. The intertemporal differences can capture the cumulative impact of business development that occurs along the new highway or near a new public transit station, which may steadily increase congestion and thereby increase average travel times.

TranSight contains two alternative approaches to quantifying transportation cost savings. The first derives from the difference between the alternative and baseline scenarios in the ratio of VMT to VHT. This approach captures the offset between shorter travel times and additional miles traveled, both of which are likely consequences of an upgraded transportation infrastructure. In other words, the principal driver of cost savings is the change in average travel velocities on the region's road network, which reduces the effective distance between sellers and their markets. TranSight computes the transportation cost savings parameters as follows. Because the baseline values are in the numerator, a cost change parameter greater than 1 implies a cost increase relative to the baseline case, whereas ΔTCij less than 1 suggests cost savings to the commercial and industrial sectors due to the transportation project. Thus, the value of 1 would indicate that the transportation improvement has a neutral impact on transportation costs, with the degree of deviation from 1 being associated with the magnitude of the cost effect. The formula applies exclusively to miles and hours of road-based travel, under the simplifying assumption that goods and services are not transported on public transit modes such as light rail and buses.

$$\Delta TC_{ij} = \frac{(VMT_{ij}^{base} / VHT_{ij}^{base})}{(VMT_{ij}^{alt} / VHT_{ij}^{alt})}$$

where

VMT_{ij}^{base} = Vehicle miles traveled between i and j: base scenario

VHT_{ij}^{base} = Vehicle hours traveled between i and j: base scenario

VMT_{ij}^{alt} = Vehicle miles traveled between i and j: alternative scenario

VHT_{ij}^{alt} = Vehicle hours traveled between i and j: alternative scenario

The second approach involves tabulating the economic costs per trip incurred by commercial truck deliveries of goods and services under the baseline and adjusted scenarios. Using truck VMTs and VHTs from each simulation, TranSight computes three key elements of delivery costs: driver wages, fuel, and wear-and-tear. These calculations are based on default parameters for average hourly driver wage, gasoline price, fuel efficiency, and vehicle wear-and-tear per mile that can be modified as desired. After dividing total transportation cost by the number of trips for normalization purposes, TranSight takes the ratio of the resulting costs per trip between the adjusted and baseline scenarios. This approach reflects a conception of transportation costs as the quantifiable costs of delivery, as illustrated in the formula below:

$$\Delta TC_{ij} = \frac{(Wage * VHT_{ij}^{alt} + FP * (1/MPG) * VMT_{ij}^{alt} + NF * VMT_{ij}^{alt}) / Trip_{ij}^{alt}}{(Wage * VHT_{ij}^{base} + FP * (1/MPG) * VMT_{ij}^{base} + NF * VMT_{ij}^{base}) / Trip_{ij}^{base}}$$

where

VMT_{ij}^{S} = Vehicle miles traveled between i and j: scenario S

VHT_{ij}^{S} = Vehicle hours traveled between i and j: scenario S

$Trip_{ij}^{S}$ = Vehicle trips traveled between i and j: scenario S

Wage = Average wage of commercial truck drivers ($/hour)

FP = Diesel fuel price ($/gallon)

MPG = Typical truck fuel efficiency (miles/gallon)

NF = Non-fuel spending per mile ($/mile)

The final cost matrix bridges business and consumer interests by reflecting the value of increased accessibility to intermediate inputs and consumer goods afforded by the upgraded transportation system. While widened roads may only marginally improve accessibility, other infrastructure upgrades such as new bus routes, highways, or commuter rail lines may yield notable decreases in accessibility costs. In particular, expansions of network capacity facilitate greater flow of inputs to production, which augments the variety of available goods and thereby enhances regional productivity, particularly for industries with heavy dependence on intermediate inputs and transportation.

As with the preceding two cost matrices, accessibility costs are entered for each pair of modeled regions in each forecast year. TranSight contains two approaches to measuring these costs, which are difficult to quantify by nature of their intangibility. The first assumes that accessibility costs explain the residual bias toward local purchases that cannot be accounted for by the transportation cost differential between local suppliers and their more distant competition. From this perspective, accessibility further shrinks the effective distance beyond what transportation costs might suggest, which can be measured in terms of increased speed on the network. Thus, accessibility cost changes are merely a scaled-down additive counterpart to the transportation cost changes calculated via the formula above. The second approach assumes that increased accessibility results from a greater number of delivery trips within a given time period, which allows firms to access a more diverse array of potential inputs to production. This interpretation is embodied in the equation below, which draws upon road vehicle data exclusively (under the assumption that public transit does not serve as a channel for transporting intermediate inputs):

$$\Delta AC_{ij} = \frac{(Trip_{ij}^{base} / VHT_{ij}^{base})}{(Trip_{ij}^{alt} / VHT_{ij}^{alt})}$$

where

$Trip_{ij}^{base}$ = Vehicle trips between i and j: base scenario

VHT_{ij}^{base} = Vehicle hours traveled between i and j: base scenario

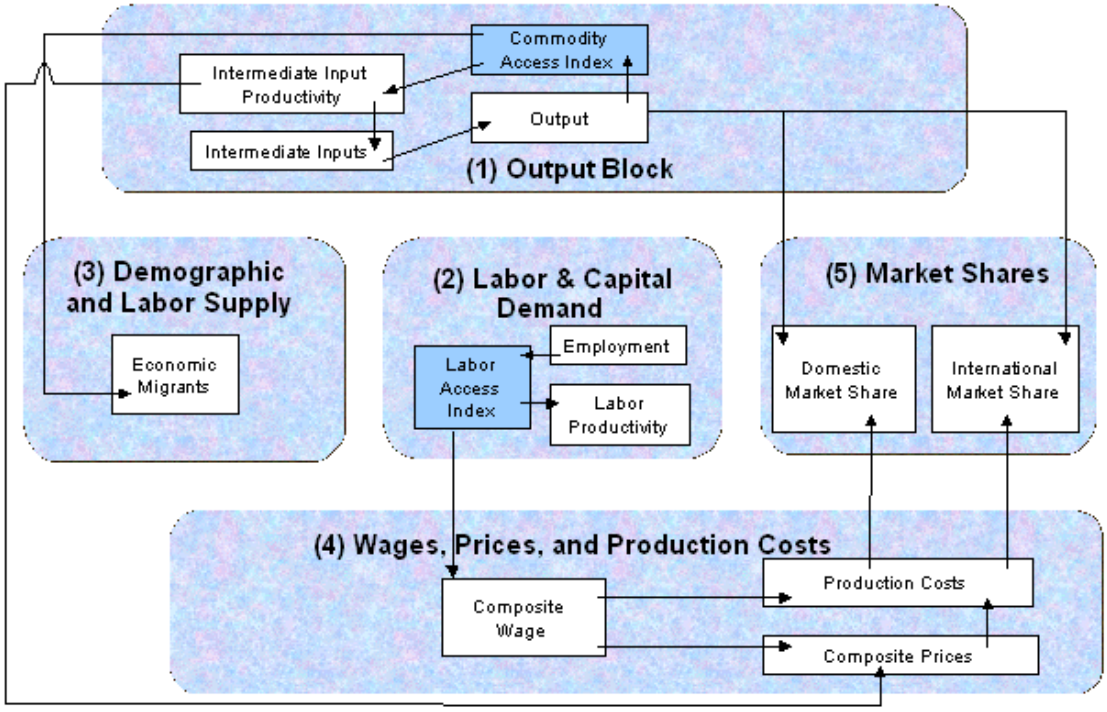
$Trip_{ij}^{alt}$ = Vehicle trips between i and j: alternative scenario

VHT_{ij}^{alt} = Vehicle hours traveled between i and j: alternative scenario

As these three matrices already have counterparts in Policy Insight, TranSight passes them directly into Policy Insight, where they impact economic and demographic trends through different channels. Reduced commuting times are assumed to improve labor productivity, since firms can access more suitable employees from the widened labor pool, while individuals can find jobs that are better matches for their specific attributes. This ultimately decreases production costs, while influencing economic

migration by altering relative wage rates by region. Decreases in transportation costs lower the delivered prices of products, which are computed as the sum of the commodity's cost at its origin and the distance-related cost of transferring the commodity to its destination. These price changes translate into lower input costs for producers and into benefits for consumers. Finally, improved accessibility costs diminish production costs due to improved access to well-suited factor inputs, and also indirectly influence the location decisions of households via the economic migration module.

All of these effects cascade into other macroeconomic variables because of the interlinkages built into the model, as illustrated in Figure 3 below. As a consequence of affecting commodity and labor access indices, transportation projects can have secondary effects on regional wages, employment, delivered prices, and market shares, among other variables. Importantly, an improvement in a region's transportation infrastructure can yield localized benefits in costs and productivity which can increase its competitive position vis-à-vis surrounding regions. But at the same time, the project can create spillover effects in those neighboring regions, particularly on labor and capital inputs that are drawn from those areas.



Economic Impact Analysis Update

I-29 / 85th Street Interchange

Sioux Falls, SD

December 20, 2021

Conducted by:
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Background

The approved 2040 Comprehensive Plan for the City of Sioux Falls established the need to acquire and develop an average of 944 acres for commercial, office, and residential development per year to meet its growth needs over the 20-year horizon. Approximately 500 acres of this planned growth is in the I-29 and 85th Street proposed interchange study area. Through coordination with local land developers in the area, the City's land development approval process assumes that adequate transportation system infrastructure will be constructed in the I-29/85th Street Study Area. It also assumes that without support from a functional transportation network, development at the scale currently proposed will not be feasible, clearly indicating the need for improvements. To meet this need, transportation system improvements should demonstrate a positive local economic benefit, especially relative to the cost of any infrastructure needed to provide that benefit. A commonly used metric for quantifying the economic benefits of an infrastructure improvement project is the impact on gross regional product. A project's expected Net Present Value (NPV) can be calculated that considers the estimated gross regional product anticipated over the project lifecycle compared to the cost of construction.

In 2009, the South Dakota Department of Transportation (SDDOT) and the University of South Dakota (USD) conducted the I-29 Corridor Study Economic Impact Analysis to support the Interchange Justification Report (IJR) of the proposed I-29 and 85th Street Interchange. The purpose of this report is to update the 2009 economic analysis that provided NPV evidence of the lack of roadway infrastructure, specifically the need for I-29 direct access, at the heart of the 500-acre growth area, to adequately serve planned economic development. The update will be used to help define the project’s current Purpose and Need Statements, to be documented in the project’s Environmental Assessment (EA).

The 2009 study evaluated the impacts of both a proposed interchange and a proposed overpass. As the project has developed, the overpass option has not been moved forward for consideration as it does not meet expected traffic operations requirements. As such, this update evaluates the economic impacts and traffic flow improvements associated with only the proposed interchange.

The 2009 study conducted this analysis using estimated construction costs, travel demand model data, and a REMI TranSight model. The REMI TranSight tool was utilized to understand the impacts of the proposed projects on the regional economy. The updated analysis has the same intended use.

The REMI TranSight model used for the original study is now out of date and no longer available for use in updating the economic impacts. Given this, HDR updated the original analysis by accounting for changes in travel demand model data, costs, and economic values since the original analysis. Proposed developments in the area have changed slightly since the original study, but the approach for the updated takes advantage of the fact that transportation projects impact similar policy variables in the REMI TranSight model regardless of their specific nature, and thus the impacts of proposed development can be compared through modification of input variables.

The original analysis considers two types of economic impacts – short-term construction impacts (assuming that funding was not spent elsewhere) and longer-term transportation efficiency improvements (from the travel demand model data). Both of these impacts are included in the revised analysis.

Revised Analysis

Project development on the I-29 and 85th Street Interchange has advanced since the original study, resulting in updates to construction cost and modeled travel demand data. Additionally, the passing of time results in inflation, so all monetary values need to be converted to 2021 dollars to allow for direct comparison.

To evaluate the short-term impacts associated with construction spending, it was necessary to update the capital costs of the project. The original study used an estimated capital cost of $24 million[1] (in 2009 dollars), spread evenly over three years. Adjusted for inflation utilizing the Producer Price Index (PPI)[2], this equates to $50.04 million in 2021 dollars. The most recent construction cost estimate is $38.73 million (in 2019 dollars), or $49.39 million in 2021 dollars. These funds are expected to be spent as shown in Table 1.

Table 1: Construction Inputs (in millions of 2021 dollars)

	2022	2023	2024	Total
Construction Costs	$5.33	$13.22	$30.84	$49.39

The other economic impacts, measured as a change in gross regional product (GRP) over the longer term, are associated with travel efficiencies enabled by the new interchange. These values are calculated based on changes in vehicle operating conditions as estimated in the travel demand model.

As with the original study, the intent of the updated analysis is to isolate the impacts of the highway infrastructure investment from the economic development impacts, which have been noted to be planned regardless of the infrastructure upgrades. As in the original study, traffic projections were generated assuming planned developments move forward, and roadway volumes reflect demand in the area. While the project-specific data, network capacity and accessibility values have changed since the 2009 study, these changes are captured in the updated travel demand data used as inputs to estimate the economic impacts.

The original travel demand model outputs – vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) – for the No Build and Build scenarios were updated to match the values included in the interchange justification report (IJR). These values are presented in Table 2.

[1] Note that economic impact analysis does not consider right-of-way acquisition costs, and thus these expenses have been excluded from the capital cost estimates.
[2] Federal Reserve, Economic Data – PPI, Construction Materials available at https://fred.stlouisfed.org/series/WPUSI012011

Detailed traffic data can be found in the alternative analysis, operational performance, and evaluation matrix in Section 7 of the IJR.

Table 2: Updated Travel Projections (consistent with IJR)

	2025		2045	
	Base	Interchange	Base	Interchange
Total Vehicle-Miles Traveled	2,028,169,867	2,031,318,813	3,037,698,040	3,047,144,880
Total Vehicle-Hours Traveled	66,481,133	65,958,880	101,547,680	99,980,920
Average Speed (MPH)	30.5	30.8	29.9	30.5

The updated analysis adds operating and maintenance (O&M) costs in the model that were not included in the original study. O&M costs were estimated based on the size of the new infrastructure, and typical maintenance cycles and costs for asphalt and structures. Overall, the annual average O&M costs were estimated to be $1.21 million in 2021 dollars.[3]

Results

The key metric evaluated for this update was the net present value (NPV), which was calculated as the difference between the discounted GRP and the discounted costs. Results are presented both including and excluding O&M costs for simplicity of comparison with the initial study.

Net Present Value

The NPV computation uses an updated economic impact for all of South Dakota consistent with the original study. Benefits are measured by GRP over a 21-year period from 2022 to 2043 as reported, and costs reflect the summation of the construction costs reported in Table 1 and the O&M costs. All amounts beyond 2022 are discounted by a 4% real discount rate.[4] For consistency with the original study, the Appendix shows alternate results using a 4.644% discount rate, which is reflective of the 30-year U.S. Treasury bond yields at the time of the original study.

With a 4% discount rate, the net present value of the interchange project is estimated to be $845.98 million. Expressed mathematically, this is:

$$NPV = \sum_{t=0}^{21} \frac{GRP_t}{(1+r)^t} - \sum_{t=0}^{2} \frac{C_t}{(1+r)^t} = \$845.98\, million\ (r = 4\%)$$

[3] O&M costs were estimated using material unit cost data and replacement frequency for deck, slabs and overlays provided by SDDOT and estimated based on the additional lane-miles of infrastructure to be added in the build scenario as estimated by the project engineering team.

[4] Agencies have a variety of policies on discount rates and many state agencies choose their own discount rates. USDOT follows guidance from the Office of Management and Budget (OMB). In Circular A-4, OMB recommends using a 7% discount rate for regulatory analysis and an alternate rate of 3% for the social rate of time preference. Most state agencies use a discount rate between 3% and 7%. The 4% discount rate was chosen as a middle value that has been adopted by several states such as Nevada and California.

Comparison to Original Study

Table 3 summarizes the NPV for the current analysis and compares the results to the previous study. Note that results in the first column differ from those in the original study, because they have been adjusted to account for a 4% discount rate. The results of the updated analysis show a positive net present value that has increased since 2009. Note that results in the table may not sum due to rounding.

Table 3: NPV Results (4% Discount Rate)

	2009 Study Excluding O&M (in Mil 2009$)	2009 Study Excluding O&M (in Mil 2021$)	2021 Study Excluding O&M (in Mil 2021$)	2021 Study Including O&M (in Mil 2021$)
Discounted GRP	$174.35	$258.80	$900.48	$906.13
Discounted Costs	$23.09	$48.14	$44.76	$60.14
NPV (Mil $)	**$151.27**	**$210.66**	**$855.72**	**$845.98**

The change in the overall net present value since the original study can be attributed to several key factors:

- *Increase in capital costs:* higher capital costs result in a greater initial economic impact due to the increased spending.
- *Increase in incremental speed improvements:* the travel demand model results in the IJR show a greater incremental improvement in travel time than anticipated in the original study. While the overall average speeds are slower, the improvement in speed leads to greater transportation efficiencies that contribute to longer term benefits.
- *Inclusion of O&M costs:* often, the influx of spending due to O&M costs increases the overall benefits, but the initial study found that the economic impact of each dollar of capital expenditure returned less than a dollar in economic impact. As a result, the net present value decreases slightly when accounting for the long-term O&M costs.

Appendix

Table A-1 shows the results of the analysis compared to the original study using the original discount rate of 4.644%. The original study utilized values for the 30-year Treasury rate at the time. Per OMB Circulars A4 and A94, these values are not recommended to be utilized for public infrastructure investment. Thus, current values have not been considered and the results of the current study utilizing the same data as the original study are presented here for context only. Results in the table may not sum due to rounding.

Table A-1: NPV Results (4.644% Discount Rate)

	2009 Study Excluding O&M (in Mil 2009$)	2009 Study Excluding O&M (in Mil 2021$)	2021 Study Excluding O&M (in Mil 2021$)	2021 Study Including O&M (in Mil 2021$)
Discounted GRP	$164.18	$243.71	$827.86	$833.11
Discounted Costs	$22.95	$47.86	$44.08	$58.38
NPV (Mil $)	**$141.24**	**$195.85**	**$783.78**	**$774.72**