



The HNTB Companies
Infrastructure Solutions

BCA TECHNICAL MEMORANDUM

Pensacola Dam – State Highway 28
Widening and Rehabilitation Project
Oklahoma Department of Transportation

Executive Summary

The State Highway 28 (SH 28) Widening and Rehabilitation Project at the Pensacola Dam Project (Project) provides a benefit-cost ratio (**BCR**) of **1.07** and an **internal rate of return of 0.36 percent**.

At this rate, the proposed **total capital project cost of \$28.2 million** will produce a **positive net user benefit of about \$73.2 million** over 20 years.

The Project significantly improves safety as well as improving the structural stability of the Dam allowing traffic to remain on top of the bridge in the future. It helps to ensure the vital connection of the two communities on each side of the dam remain connected. Over the life of the Project, these investments will produce:

- **Improved Travel Time** **\$7.7 million net present value (NPV)**
- **Vehicle Operating Cost** **\$3.9 million (NPV)**
- **Increased Safety** **\$7.5 million (NPV)**
- **Reduced Emissions Damage** **\$0.5 million (NPV)**

The Benefit Cost Analysis (BCA) was prepared in accordance with the [2018 FHWA BCA Guidance for Discretionary Grant Programs](#) using total quantifiable project costs and benefits that are adjusted for inflation and then discounted to reflect the time value of money.

Methodology

In summary, the BCA was created by:

1. Identifying the Project's benefits and costs in terms of proposed improvements versus a no-build scenario;
2. Deriving current and forecasted use levels for the baseline and the "build case";
3. Denominating all benefits and costs in constant 2017 dollars;
4. Assuming an inflation rate of 3 percent annually;
5. Discounting dollar amounts by 7 percent to reflect the time value of money; and
6. Setting an appropriate analysis period of 20 years for the Project's development, construction and subsequent operational service.

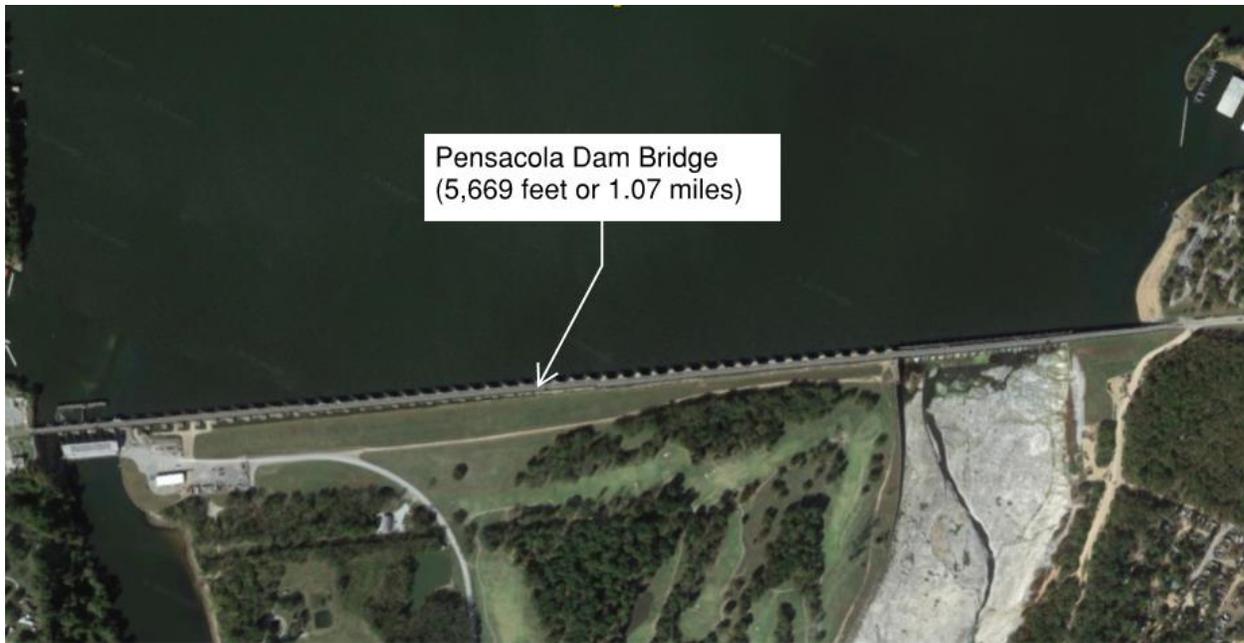
Project Overview

There are three existing bridges on State Highway 28 (SH 28) over Grand Lake O' the Cherokees. The proposed project includes rehabilitation of the bridge surface and substructure, widening the travel lanes to twelve feet wide, and adding one longitudinal beam line to support the downstream ends of a new slab and new parapet. The three bridges and their corresponding lengths are as follows:

- Pensacola Dam Bridge (5,669 feet or 1.07 miles)
- West Spillway Bridge (451 feet or .05 miles)
- East Spillway Bridge (410 feet or .078 miles)

The BCA prepared for this project accounts for anticipated capital costs as well as ongoing maintenance and operations costs. The BCA compares these costs with the total project benefits of a 20-year period as advised through the BCA Guidance Discretionary Grant Programs data (June 2018). Calculations for all figures as well as sources cited can be found within the BCA spreadsheets that are included with the BUILD grant submittal. While the BCA uses a 20-year time period, the improvements have an anticipated life-cycle of 75 years and will extend well past a 20-year period. The Project Area is shown in **Figure 1** on the following page.

Figure 1: Project Area



The proposed State Highway 28 (SH 28) Widening and Rehabilitation Project, consists of the following key improvements:

1. Safety

- a. The Pensacola Dam Roadway has two ten-foot lanes with curb and barrier immediately adjacent. The narrow roadway with barrier causes collisions and property damage. A high-level Highway Safety Analysis was completed, which showed that widening the lanes to twelve-foot as proposed in the project resulted in a 20 percent reduction in crashes annually.

2. Economic Competitiveness

- a. Travel time savings from the widening and rehabilitation are projected as the project area experiences extreme congestion, particularly on weekends during the summer months. The project team has determined that even with ongoing maintenance, the Pensacola Dam Roadway would close to traffic by the year 2040 if improvements are not completed. The diversion route travelers take to avoid congestion is more than 25 miles. The total travel time savings that occur from increasing average speed, reduction in travel time, and amount saved from not closing the bridge is a

net present value of \$7.7 million dollars.

- b. Savings in vehicle operating costs will also occur from the above and will result in a savings net present value of \$3.9 million dollars.

Table 1 outlines the proposed improvements discussed above in a detailed spreadsheet.

Table 1: Proposed Improvements

20 Year BENEFITS						
Analysis Year	Economic Competitiveness		Environmental	Safety	Total	7% Discount
	Travel Time Savings	Operations Savings	Reduced Pollutants	Crash Savings		
2017	\$0	\$0	\$0	\$0	\$0	\$0
2018	\$0	\$0	\$0	\$0	\$0	\$0
2019	\$0	\$0	\$0	\$0	\$0	\$0
2020	\$0	\$0	\$0	\$0	\$0	\$0
2021	\$0	\$0	\$0	\$0	\$0	\$0
2022	\$266,974	(\$30)	\$8,393	\$684,600	\$959,937	\$684,422
2023	\$272,617	(\$120,454)	\$823	\$805,300	\$958,285	\$638,546
2024	\$278,381	(\$122,987)	\$841	\$805,300	\$961,534	\$598,795
2025	\$284,236	(\$125,566)	\$859	\$802,100	\$961,629	\$559,677
2026	\$290,290	(\$128,241)	\$877	\$998,500	\$1,161,426	\$631,739
2027	\$296,458	(\$130,967)	\$896	\$802,100	\$968,487	\$492,330
2028	\$302,685	(\$133,694)	\$916	\$938,900	\$1,108,807	\$526,786
2029	\$309,112	(\$136,522)	\$936	\$938,900	\$1,112,426	\$493,931
2030	\$315,646	(\$139,400)	\$956	\$1,138,500	\$1,315,702	\$545,970
2031	\$322,379	(\$142,381)	\$977	\$881,000	\$1,061,975	\$411,852
2032	\$329,171	(\$145,368)	\$998	\$937,800	\$1,122,601	\$406,882
2033	\$336,112	(\$148,414)	\$1,020	\$1,070,300	\$1,259,018	\$426,473
2034	\$343,246	(\$151,562)	\$1,042	\$1,138,500	\$1,331,225	\$421,432
2035	\$350,522	(\$154,767)	\$1,064	\$1,138,500	\$1,335,320	\$395,073
2036	\$357,948	(\$158,035)	\$1,088	\$1,138,500	\$1,339,501	\$370,383
2037	\$365,516	(\$161,362)	\$1,111	\$949,600	\$1,154,866	\$298,439
2038	\$373,284	(\$164,802)	\$1,135	\$1,009,200	\$1,218,817	\$294,360
2039	\$381,158	(\$168,253)	\$1,160	\$1,146,000	\$1,360,065	\$306,985
2040	\$11,854,339	\$11,707,724	\$1,126,080	\$1,271,000	\$25,959,143	\$5,476,000
2041	\$12,108,419	\$12,134,409	\$1,161,497	\$1,142,800	\$26,547,125	\$5,233,676
Total	\$29,738,491	\$21,409,329	\$2,312,669	\$19,737,400	\$73,197,889	\$19,213,750

Project Beneficiaries

The Project will benefit the Bridge’s primary users – residents, rural and urban workers. For these users this bridge is their primary means of travel to access local, high-quality jobs and service and light-industry/warehousing businesses.

Improving the Bridge results in easier and more reliable connectivity between employees and places of employment – creating greater economic opportunity for both the work force and businesses seeking to attract and retain talent within and outside the region.

Additionally, there are benefits stemming from reducing emissions, decreasing congestion, and improving travel time reliability, all positively impacting the quality of life for residents in the region.

Project Benefits

The Project will provide substantial benefits by improving safety, level of service, travel time performance, emissions and economic vitality for the surrounding area. These benefits are quantified in the following subsections.

Safety Benefit

The Project produces **safety savings of \$7.5 million (NPV)** by **reducing the number of collisions by 20 percent annually**. SH 28 is narrow, and the proposed widening will aid in this reduction in collisions. Crash data, by year, are reflected below in ***Tables 2 and 3***.



Table 2: Safety Benefits (No Build)

Year	ADT	No Build Scenario									Total Cost
		Est. # of Collisions	Est. # of Vehicles	Est. # of People	PDO (Vehicle)	PDO (People)	Injury Type Per Individual				
							Pos. Injury	Injury	Incapacitating Injury	Fatality	
2017	2,600	27	50	84	33	30	9	22	0	0	\$3,563,000
2018	2,655	28	52	87	34	31	9	22	0	0	\$3,570,500
2019	2,711	28	52	87	34	31	9	22	0	0	\$3,570,500
2020	2,769	29	54	91	35	32	9	24	0	0	\$3,828,000
2021	2,827	29	54	91	35	32	9	24	0	0	\$3,828,000
2022	2,887	30	56	94	37	33	10	24	0	0	\$3,903,700
2023	2,948	31	58	97	38	34	10	25	0	0	\$4,036,200
2024	3,010	31	58	97	38	34	10	25	0	0	\$4,036,200
2025	3,074	32	60	101	39	35	10	26	0	0	\$4,168,700
2026	3,139	33	62	104	40	36	11	27	0	0	\$4,365,100
2027	3,205	33	62	104	40	36	11	27	0	0	\$4,365,100
2028	3,273	34	64	108	42	37	11	28	0	0	\$4,501,900
2029	3,342	35	65	109	43	38	11	28	0	0	\$4,509,400
2030	3,413	36	67	113	44	40	12	29	0	0	\$4,709,000
2031	3,485	36	67	113	44	40	12	29	0	0	\$4,709,000
2032	3,559	37	69	116	45	41	12	30	0	0	\$4,841,500
2033	3,634	38	71	119	46	42	12	31	0	0	\$4,974,000
2034	3,711	39	73	123	48	43	13	32	0	0	\$5,174,700
2035	3,790	40	75	126	49	44	13	33	0	0	\$5,307,200
2036	3,870	40	75	126	49	44	13	33	0	0	\$5,307,200
2037	3,952	41	77	129	50	45	13	33	0	0	\$5,314,700
2038	4,035	42	79	133	51	46	14	34	0	0	\$5,511,100
2039	4,121	43	80	134	53	47	14	35	0	0	\$5,647,900
2040	4,208	44	82	138	54	48	14	36	0	0	\$5,780,400
2041	4,297	45	84	141	55	49	15	36	0	0	\$5,851,800
Total											\$ 115,374,800

Based on the planned improvements, 20 years of crashes were quantified to determine the number of crashes that could be corrected by creating a more traditional interchange geometry. The Highway Safety Manual resource of the Crash Modification Factor (CMF) Clearinghouse was utilized to identify the potential crash savings. The CMFs used as part of the calculation accounted for the widening of the bridge.

Table 3: Safety Benefits (Build)

Year	ADT	Build Scenario									Potential Cost Savings	Potential Cost Savings (NPV)	
		Est. # of Collisions	Est. # of Vehicles	Est. # of People	PDO (Vehicle)	PDO (People)	Injury Type Per Individual						Total Cost
							Pos. Injury	Injury	Incapacitating Injury	Fatality			
2017	2,600	22	41	69	27	24	7	18	0	0	\$2,890,200		
2018	2,655	22	41	69	27	24	7	18	0	0	\$2,890,200		
2019	2,711	23	43	72	28	25	7	19	0	0	\$3,022,700		
2020	2,769	23	43	72	28	25	7	19	0	0	\$3,022,700		
2021	2,827	24	45	76	29	26	8	20	0	0	\$3,219,100		
2022	2,887	24	45	76	29	26	8	20	0	0	\$3,219,100	\$684,600	\$488,110
2023	2,948	25	47	79	31	27	8	20	0	0	\$3,230,900	\$805,300	\$536,605
2024	3,010	25	47	79	31	27	8	20	0	0	\$3,230,900	\$805,300	\$501,500
2025	3,074	26	49	82	32	29	8	21	0	0	\$3,366,600	\$802,100	\$466,830
2026	3,139	26	49	82	32	29	8	21	0	0	\$3,366,600	\$998,500	\$543,118
2027	3,205	27	50	84	33	30	9	22	0	0	\$3,563,000	\$802,100	\$407,747
2028	3,273	27	50	84	33	30	9	22	0	0	\$3,563,000	\$938,900	\$446,065
2029	3,342	28	52	87	34	31	9	22	0	0	\$3,570,500	\$938,900	\$416,883
2030	3,413	28	52	87	34	31	9	22	0	0	\$3,570,500	\$1,138,500	\$472,437
2031	3,485	29	54	91	35	32	9	24	0	0	\$3,828,000	\$881,000	\$341,667
2032	3,559	30	56	94	37	33	10	24	0	0	\$3,903,700	\$937,800	\$339,902
2033	3,634	30	56	94	37	33	10	24	0	0	\$3,903,700	\$1,070,300	\$362,548
2034	3,711	31	58	97	38	34	10	25	0	0	\$4,036,200	\$1,138,500	\$360,420
2035	3,790	32	60	101	39	35	10	26	0	0	\$4,168,700	\$1,138,500	\$336,841
2036	3,870	32	60	101	39	35	10	26	0	0	\$4,168,700	\$1,138,500	\$314,805
2037	3,952	33	62	104	40	36	11	27	0	0	\$4,365,100	\$949,600	\$245,395
2038	4,035	34	64	108	42	37	11	28	0	0	\$4,501,900	\$1,009,200	\$243,735
2039	4,121	34	64	108	42	37	11	28	0	0	\$4,501,900	\$1,146,000	\$258,667
2040	4,208	35	65	109	43	38	11	28	0	0	\$4,509,400	\$1,271,000	\$268,113
2041	4,297	36	67	113	44	40	12	29	0	0	\$4,709,000	\$1,142,800	\$225,299
Total											\$ 92,322,300	\$ 19,737,400	\$ 7,576,687

Travel Time and Vehicle Operating Cost Benefit

Travel time and vehicle operating cost savings from the widening and rehabilitation are projected as the project area experiences extreme congestion, particularly on weekends during the summer months. The widening is expected to ease this congestion somewhat, but due to the extreme congestion experienced in the project area during holidays and summertime weekends, 20 percent of traffic on those days would choose to take a diversion route around the project. In addition, the project team has determined that even with ongoing maintenance, the Pensacola Dam Roadway would close to traffic by the year 2040 if the rehabilitation is not completed. Therefore, in a future with the dam closed to traffic, all drivers reap travel time savings from forgoing the diversion route. Because the diversion route is quite long (more than 25 miles) it was assumed only 80 percent of today’s traffic would choose to make the trip under this scenario. Also, once the dam is closed to traffic, the other travel time benefits due to reduced diversion stop. The speed on the dam is posted at 45 mph, but based upon the speed study conducted in early July 2018 the average speed is 35 mph. This results in

a travel time savings to all vehicles crossing the bridge as the widened lanes will allow vehicles to travel at the posted speed limit. The Project will produce **travel time savings with a discounted benefit value of \$7.7 million (NPV)**. The Project will also produce **vehicle operating cost savings with a discounted benefit value of \$3.9 million (NPV)**.



Table 4 below shows the improvement in travel time savings from the Project on an annual basis as a summary of the calculations and the cumulative benefit.

Table 4: Travel Time Savings

Year	No-Build				Build				Reduction in VHT		VHT Benefit	Discount	
	Traffic Volumes		Vehicle Hours Travelled		Traffic Volumes		Vehicle Hours Travelled		Passenger Vehicles	Trucks			
	Passenger Vehicles	Trucks	Passenger Vehicles	Trucks	Passenger Vehicles	Trucks	Passenger Vehicles	Trucks					
2017	2,340	260	56,127	6,236									
2018	2,389	266	57,302	6,380									
2019	2,440	271	58,529	6,501									
2020	2,492	277	59,762	6,643									
2021	2,544	283	61,022	6,788									
2022	2,598	289	62,313	6,932	2,598	289	48,467	5,391	13,846	1,540	\$266,974	\$203,673.34	
2023	2,653	295	63,634	7,076	2,653	295	49,494	5,504	14,140	1,572	\$272,617	\$194,371.81	
2024	2,709	301	64,985	7,221	2,709	301	50,545	5,616	14,441	1,605	\$278,381	\$185,496.85	
2025	2,767	307	66,369	7,364	2,767	307	51,622	5,727	14,748	1,636	\$284,236	\$177,007.74	
2026	2,825	314	67,761	7,532	2,825	314	52,704	5,858	15,057	1,674	\$290,290	\$168,951.14	
2027	2,884	321	69,185	7,701	2,884	321	53,812	5,989	15,374	1,711	\$296,458	\$161,253.55	
2028	2,946	327	70,669	7,844	2,946	327	54,965	6,101	15,704	1,743	\$302,685	\$153,869.94	
2029	3,008	334	72,161	8,013	3,008	334	56,125	6,232	16,036	1,781	\$309,112	\$146,856.70	
2030	3,072	341	73,690	8,180	3,072	341	57,314	6,362	16,376	1,818	\$315,646	\$140,150.56	
2031	3,136	349	75,230	8,372	3,136	349	58,511	6,512	16,718	1,861	\$322,379	\$133,775.81	
2032	3,203	356	76,832	8,539	3,203	356	59,757	6,642	17,074	1,898	\$329,171	\$127,658.14	
2033	3,271	363	78,469	8,708	3,271	363	61,030	6,773	17,439	1,935	\$336,112	\$121,822.54	
2034	3,340	371	80,121	8,900	3,340	371	62,315	6,922	17,806	1,978	\$343,246	\$116,269.21	
2035	3,411	379	81,815	9,091	3,411	379	63,632	7,070	18,183	2,020	\$350,522	\$110,966.30	
2036	3,483	387	83,545	9,283	3,483	387	64,977	7,220	18,568	2,063	\$357,948	\$105,903.85	
2037	3,557	395	85,318	9,474	3,557	395	66,355	7,369	18,962	2,106	\$365,516	\$101,068.35	
2038	3,631	404	87,105	9,692	3,631	404	67,746	7,538	19,359	2,154	\$373,284	\$96,463.65	
2039	3,709	412	88,963	9,882	3,709	412	69,190	7,686	19,773	2,196	\$381,158	\$92,054.58	
2040	3,787	421	90,851	10,099	3,787	421	70,648	7,854	20,202	2,242	\$389,446	\$87,854.34	
2041	3,867	430	92,763	10,336	3,867	430	72,141	8,022	20,622	2,284	\$398,154	\$83,854.34	
											Total	\$29,738,491	\$7,767,528

Table 5 below shows the improvement in vehicle operating cost savings from the Project on an annual basis as a summary of the calculations and the cumulative benefit.

Table 5: Vehicle Operating Cost Savings

Year	No-Build				Build				Reduction in VMT		VHT Benefit	Discount	
	Traffic Volumes		Vehicle Miles Travelled		Traffic Volumes		Vehicle Miles Travelled		Passenger Vehicles	Trucks			
	Passenger Vehicles	Trucks	Passenger Vehicles	Trucks	Passenger Vehicles	Trucks	Passenger Vehicles	Trucks					
2017	2,340	260	1,964,430	218,270									
2018	2,389	266	2,005,570	223,308									
2019	2,440	271	2,048,514	227,519									
2020	2,492	277	2,091,683	232,502									
2021	2,544	283	2,135,769	237,588									
2022	2,598	289	2,180,959	242,609	2,598	289	2,181,021	242,616	-52	-7	(\$30)	(\$22)	
2023	2,653	295	2,227,190	247,652	2,653	295	2,472,977	274,982	-245,787	-27,330	(\$120,454)	(\$80,264)	
2024	2,709	301	2,274,481	252,720	2,709	301	2,525,476	280,608	-250,995	-27,888	(\$122,987)	(\$76,590)	
2025	2,767	307	2,322,936	257,731	2,767	307	2,579,268	286,171	-256,332	-28,440	(\$125,566)	(\$73,080)	
2026	2,825	314	2,371,654	263,610	2,825	314	2,633,351	292,698	-261,697	-29,088	(\$128,241)	(\$69,755)	
2027	2,884	321	2,421,495	269,522	2,884	321	2,688,681	299,260	-267,185	-29,739	(\$130,967)	(\$66,577)	
2028	2,946	327	2,473,406	274,543	2,946	327	2,746,307	304,835	-272,901	-30,292	(\$133,694)	(\$63,517)	
2029	3,008	334	2,525,645	280,441	3,008	334	2,804,298	311,382	-278,653	-30,941	(\$136,522)	(\$60,617)	
2030	3,072	341	2,579,159	286,293	3,072	341	2,863,705	317,879	-284,547	-31,585	(\$139,400)	(\$57,846)	
2031	3,136	349	2,633,048	293,027	3,136	349	2,923,527	325,354	-290,479	-32,327	(\$142,381)	(\$55,218)	
2032	3,203	356	2,689,098	298,882	3,203	356	2,985,749	331,853	-296,651	-32,971	(\$145,368)	(\$52,688)	
2033	3,271	363	2,746,410	304,784	3,271	363	3,049,371	338,405	-302,961	-33,621	(\$148,414)	(\$50,273)	
2034	3,340	371	2,804,255	311,491	3,340	371	3,113,585	345,850	-309,329	-34,360	(\$151,562)	(\$47,981)	
2035	3,411	379	2,863,498	318,166	3,411	379	3,179,348	353,261	-315,851	-35,095	(\$154,767)	(\$45,790)	
2036	3,483	387	2,924,079	324,898	3,483	387	3,246,599	360,733	-322,520	-35,836	(\$158,035)	(\$43,698)	
2037	3,557	395	2,986,110	331,603	3,557	395	3,315,457	368,177	-329,347	-36,574	(\$161,362)	(\$41,699)	
2038	3,631	404	3,048,694	339,210	3,631	404	3,384,930	376,621	-336,236	-37,411	(\$164,802)	(\$39,802)	
2039	3,709	412	3,113,706	345,874	3,709	412	3,457,098	384,018	-343,392	-38,144	(\$168,253)	(\$37,977)	
2040	3,787	421	3,180,281	352,502	3,787	421	3,529,941	392,423	-350,660	-38,897	(\$171,724)	(\$36,208)	
2041	3,867	430	3,248,526	359,125	3,867	430	3,604,347	399,855	-358,821	-39,644	(\$175,225)	(\$34,558)	
											Total	\$21,409,329	\$3,898,573

Emissions Benefit

The Project produces emission reductions by cutting congestion and travel delays, resulting in **emissions damage savings of \$0.5 million NPV over 20 years.**



Based on the travel time savings cited previously, the reduction in damage costs from pollutant emissions due to reduction in fuel consumption were estimated using the [NCHRP Synthesis 409](#) methodology to calculate the reduction in fuel consumption based on the total vehicle miles traveled, total delay, total stops and cruise speed.

The reduction in fuel consumption was then converted to the amount of emission (in grams) of each type of pollutant - Volatile Organic Compounds (VOCs), Nitrogen Oxides (NOx) and Particulate Matter (PM2.5) - by its emission production factor (grams/gallon),

and then converted to a cost of environmental damage. **Table 6** below shows the value of the emission improvement.

Table 6: Emission Reduction Savings

Year	Estimated Annual Delay Reduction (hours)	Reduction in Fuel Consumption (gallons)	Carbon Dioxide Pollutant Emissions (grams)	Volatile Organic Compounds Pollutant Emissions (grams)	Nitrogen Oxides Pollutant Emissions (grams)	Particulate Matter Pollutant Emissions (grams)	Sulfur Dioxide Pollutant Emissions (grams)	Cost Savings for Reduced Damage of Pollutant Emissions	Cost Savings for Reduced Damage of Pollutant Emissions (NPV)	
2017										
2018										
2019										
2020										
2021										
2022	15,386	11,274	100,192,828	182,640	153,328	3,076	-	\$8,393	\$5,984	
2023	15,712	1,105	9,819,825	17,900	15,028	301	-	\$823	\$548	
2024	16,045	1,129	10,035,547	18,294	15,358	308	-	\$841	\$524	
2025	16,384	1,153	10,248,684	18,682	15,684	315	-	\$859	\$500	
2026	16,731	1,178	10,471,922	19,089	16,025	321	-	\$877	\$477	
2027	17,085	1,204	10,698,072	19,501	16,372	328	-	\$896	\$456	
2028	17,447	1,230	10,932,291	19,928	16,730	336	-	\$916	\$435	
2029	17,817	1,257	11,173,903	20,369	17,100	343	-	\$936	\$416	
2030	18,194	1,284	11,414,699	20,808	17,468	350	-	\$956	\$397	
2031	18,579	1,312	11,661,532	21,258	17,846	358	-	\$977	\$379	
2032	18,972	1,340	11,912,370	21,715	18,230	366	-	\$998	\$362	
2033	19,374	1,370	12,173,048	22,190	18,629	374	-	\$1,020	\$345	
2034	19,784	1,399	12,436,037	22,669	19,031	382	-	\$1,042	\$330	
2035	20,203	1,430	12,707,173	23,164	19,446	390	-	\$1,064	\$315	
2036	20,631	1,461	12,984,761	23,670	19,871	399	-	\$1,088	\$301	
2037	21,068	1,493	13,268,125	24,186	20,305	407	-	\$1,111	\$287	
2038	21,513	1,525	13,549,396	24,699	20,735	416	-	\$1,135	\$274	
2039	21,969	1,558	13,847,775	25,243	21,192	425	-	\$1,160	\$262	
2040	683,224	1,512,610	13,442,565,827	24,504,283	20,571,497	412,640	-	\$1,126,080	\$237,543	
2041	697,856	1,560,185	13,865,362,772	25,274,995	21,218,514	425,618	-	\$1,161,497	\$228,985	
								Total	\$2,312,669	\$479,119

Project Cost

The Project’s total capital cost is projected to be \$28.2 million in 2017 dollars per federal guidance. This estimate includes total project delivery costs (construction, design, survey, environmental analysis, material testing, and other project management costs).

It also assumes a construction period from 2020 through 2021. Annual project costs are shown in **Table 7**, which includes its Net Present Value (NPV) based on a discount rate of 7 percent.

At the end of the 20-year analysis period, the facility will have a discounted residual value of \$17.9 million as calculated using the FHWA-recommended 20-year project life expectancy and dividing that by the overall time before the bridge will need to be replaced. The number is then multiplied by the project cost in today's dollars.

Table 7: Project Costs

20 Year Costs				
Year	Percent Project Cost Paid	Project Cost	O&M	Project Cost (NPV)
2017		\$0	\$0	\$0
2018		\$0	\$0	\$0
2019		\$0	\$0	\$0
2020	30%	\$8,460,000	\$0	\$6,905,880
2021	70%	\$19,740,000	\$0	\$15,059,551
2022		\$0	\$6,000	\$4,278
2023		\$0	\$6,000	\$3,958
2024		\$0	\$6,000	\$3,736
2025		\$0	\$6,000	\$3,492
2026		\$0	\$6,000	\$3,264
2027		\$0	\$6,000	\$3,050
2028		\$0	\$6,000	\$2,851
2029		\$0	\$6,000	\$2,664
2030		\$0	\$6,000	\$2,490
2031		\$0	\$6,000	\$2,327
2032		\$0	\$8,000	\$2,900
2033		\$0	\$8,000	\$2,710
2034		\$0	\$8,000	\$2,533
2035		\$0	\$8,000	\$2,367
2036		\$0	\$8,000	\$2,212
2037		\$0	\$8,000	\$2,067
2038		\$0	\$8,000	\$1,932
2039		\$0	\$8,000	\$1,806
2040		\$0	\$8,000	\$1,688
2041		(\$20,680,000)	\$8,000	(\$4,075,415)
Total	100%	\$7,520,000	\$140,000	\$17,942,381

Benefits Summary

The State Highway 28 (SH 28) Widening and Rehabilitation Project has a Benefit-Cost Ratio of 1.07. This ratio was derived by dividing total discounted benefits by total discounted costs over a 20-year period. **Table 8**, shown below, and other figures used throughout this technical memo were derived based on [FHWA 2018 BCA Guidance](#).



Table 8: Benefits Summary

Project	Capital Costs	Project Costs (NPV)	Total Net Benefit	Total Net Benefit (NPV)	Benefit-Cost Ratio
2019 BCA SUMMARY - SH 28 Pensacola Dam	\$28,200,000	\$17,942,380	\$73,197,889	\$19,213,750	1.07