

# **Appendix C – Benefit-Cost Analysis Calculations**

# BUILD FY20 BCA SUMMARY - Re-BUILDing University Avenue: Gateway to Our Future, Lafayette, LA Phases 2 - 3

## ENTIRE PROJECT CORRIDOR BENEFIT COST ANALYSIS SUMMARY

	BCA	7%
<b>Benefits</b>	\$477,768,955	\$161,820,224
<b>Costs</b>	\$29,123,705	\$21,672,047
<b>B/C Ratio</b>	<b>16.40</b>	<b>7.47</b>

Total Project Costs		
Analysis Year	Capital Costs	7% Discount
2020	\$0	\$0
2021	\$71,583	\$66,900
2022	\$3,491,401	\$3,049,525
2023	\$2,550,460	\$2,081,935
2024	\$7,013,608	\$5,350,648
2025	\$9,987,812	\$7,121,172
2026	\$5,961,189	\$3,972,192
2027	\$47,652	\$29,675
2028	\$0	\$0
2029	\$0	\$0
2030	\$0	\$0
2031	\$0	\$0
2032	\$0	\$0
2033	\$0	\$0
2034	\$0	\$0
2035	\$0	\$0
2036	\$0	\$0
2037	\$0	\$0
2038	\$0	\$0
2039	\$0	\$0
2040	\$0	\$0
<b>ENTIRE PROJECT CORRIDOR TOTAL</b>	<b>\$29,123,705</b>	<b>\$21,672,047</b>

Total Project Benefits							
Undiscounted							
	Safety	State of Good Repair	Economic Competitiveness	Quality of Life	Environmental Competitiveness		
Analysis Year	Crash Savings	Operations and Maintenance Cost Savings	Auto Travel Time Savings	Bicycle Facility Benefits	Air quality	Subtotal	7% Discount
2020	\$29,123,705	\$0	(\$18,479,066)	\$2,183,133	(\$26,332)	\$12,801,440	\$12,801,440
2021	\$0	\$0	(\$19,326,820)	\$2,248,908	(\$28,091)	(\$17,106,003)	(\$15,986,919)
2022	\$0	\$0	(\$20,205,241)	\$2,316,665	(\$29,955)	(\$17,918,532)	(\$15,650,739)
2023	\$0	\$0	(\$21,115,300)	\$2,386,462	(\$31,931)	(\$18,760,768)	(\$15,314,375)
2024	\$0	\$0	(\$22,057,996)	\$2,458,363	(\$34,023)	(\$19,633,656)	(\$14,978,422)
2025	\$1,754,984	\$7,039	(\$11,229,494)	\$2,532,430	(\$8,381)	(\$6,943,422)	(\$4,950,564)
2026	\$1,790,084	\$7,179	(\$11,763,679)	\$2,608,729	(\$9,023)	(\$7,366,710)	(\$4,908,750)
2027	\$2,409,188	\$7,323	\$25,092,331	\$2,687,326	\$41,073	\$30,237,241	\$18,830,234
2028	\$2,457,372	\$2,010,972	\$26,176,154	\$2,768,292	\$43,704	\$33,456,493	\$19,471,983
2029	\$2,506,519	\$7,619	\$27,298,058	\$2,851,696	\$46,488	\$32,710,381	\$17,792,280
2030	\$2,556,650	\$7,057	\$28,459,229	\$2,937,614	\$49,435	\$34,009,984	\$17,288,951
2031	\$2,607,783	\$7,927	\$29,660,886	\$3,026,120	\$52,553	\$35,355,268	\$16,797,033
2032	\$2,659,938	\$8,085	\$30,904,283	\$3,117,293	\$55,851	\$36,745,450	\$16,315,419
2033	\$2,713,137	\$8,247	\$32,190,710	\$3,211,213	\$59,339	\$38,182,646	\$15,844,441
2034	\$2,767,400	\$8,412	\$33,521,494	\$3,307,962	\$63,028	\$39,668,296	\$15,384,049
2035	\$2,822,748	(\$2,265,817)	\$34,898,001	\$3,407,626	\$66,929	\$38,929,486	\$14,109,837
2036	\$2,879,203	\$8,752	\$36,321,633	\$3,510,293	\$71,052	\$42,790,933	\$14,494,769
2037	\$2,936,787	\$8,927	\$37,793,835	\$3,616,053	\$75,411	\$44,431,013	\$14,065,721
2038	\$2,995,522	\$9,105	\$39,316,093	\$3,725,000	\$80,017	\$46,125,738	\$13,646,941
2039	\$3,055,433	\$2,500,391	\$40,889,932	\$3,837,229	\$84,885	\$50,367,870	\$13,927,136
2040	\$3,116,542	\$9,473	\$42,516,924	\$3,952,839	\$90,028	\$49,685,806	\$12,839,756
<b>ENTIRE PROJECT CORRIDOR TOTAL</b>						<b>\$477,768,955</b>	<b>\$161,820,224</b>

**SAFETY - CRASH REDUCTION CALCULATIONS**

Analysis Year	Annual Cost of All Crashes No-Build Scenario E	Phase 2 Annual Cost of All Crash with Crash Modification Factors Applied (CMF # 1,2) A	Phase 3a Annual Cost of All Crash with Crash Modification Factors Applied (CMF # 3) B	Phase 3b Annual Cost of All Crash with Crash Modification Factors Applied (CMF# 2) C	Phase 3c Annual Cost of All Crash with Crash Modification Factors Applied (CMF# 2) D	Total Expected Cost of All Crashes on All Project Phases with Installed Countermeasures (A+B+C+D)	Expected Annual Savings of All Crashes with Installed Countermeasures E - (A+B+C+D)	NPV at 7% Discount
2020	\$3,690,204	\$0	\$0	\$0	\$0	\$3,690,204	\$0	\$0
2021	\$3,764,008	\$0	\$0	\$0	\$0	\$3,764,008	\$0	\$0
2022	\$3,839,288	\$0	\$0	\$0	\$0	\$3,839,288	\$0	\$0
2023	\$3,916,074	\$0	\$0	\$0	\$0	\$3,916,074	\$0	\$0
2024	\$3,994,396	\$0	\$0	\$0	\$0	\$3,994,396	\$0	\$0
2025	\$4,074,283	\$1,754,984	\$0	\$0	\$0	\$2,319,299	\$1,754,984	\$1,251,280
2026	\$4,155,769	\$1,790,084	\$0	\$0	\$0	\$2,365,685	\$1,790,084	\$1,192,809
2027	\$4,238,885	\$1,825,886	\$11,077	\$220,014	\$352,211	\$1,829,697	\$2,409,188	\$1,500,321
2028	\$4,323,662	\$1,862,403	\$11,299	\$224,414	\$359,256	\$1,866,290	\$2,457,372	\$1,430,213
2029	\$4,410,135	\$1,899,652	\$11,525	\$228,902	\$366,441	\$1,903,616	\$2,506,519	\$1,363,380
2030	\$4,498,338	\$1,937,645	\$11,755	\$233,480	\$373,770	\$1,941,689	\$2,556,650	\$1,299,671
2031	\$4,588,305	\$1,976,397	\$11,990	\$238,150	\$381,245	\$1,980,522	\$2,607,783	\$1,238,939
2032	\$4,680,071	\$2,015,925	\$12,230	\$242,913	\$388,870	\$2,020,133	\$2,659,938	\$1,181,044
2033	\$4,773,672	\$2,056,244	\$12,475	\$247,771	\$396,647	\$2,060,535	\$2,713,137	\$1,125,855
2034	\$4,869,146	\$2,097,369	\$12,724	\$252,727	\$404,580	\$2,101,746	\$2,767,400	\$1,073,245
2035	\$4,966,529	\$2,139,316	\$12,979	\$257,781	\$412,672	\$2,143,781	\$2,822,748	\$1,023,094
2036	\$5,065,859	\$2,182,103	\$13,238	\$262,937	\$420,925	\$2,186,657	\$2,879,203	\$975,286
2037	\$5,167,177	\$2,225,745	\$13,503	\$268,195	\$429,344	\$2,230,390	\$2,936,787	\$929,711
2038	\$5,270,520	\$2,270,259	\$13,773	\$273,559	\$437,931	\$2,274,998	\$2,995,522	\$886,267
2039	\$5,375,931	\$2,315,665	\$14,048	\$279,031	\$446,689	\$2,320,498	\$3,055,433	\$844,853
2040	\$5,483,449	\$2,361,978	\$14,329	\$284,611	\$455,623	\$2,366,908	\$3,116,542	\$805,374
<b>Entire Project Corridor Total Benefit</b>						<b>\$42,029,289</b>	<b>\$18,121,341</b>	

Phase 2: Represents safety improvements from raised median and roundabout installation from Walker Road to Wilshire Lane.

Phase 3: Represents safety improvements for multilane roundabout installations Wilshire Lane to Renaud Drive. Phase 3 has three components due to traffic analysis for each roundabout installation at three separate intersections.

**NOTES:**

- Crash data was obtained from the Louisiana Highway Safety Commission and Louisiana Department of Transportation and Development's joint crash database - CRASH1
- Louisiana Highway Safety Commission and the Louisiana Department of Transportation and Development Crash Coding System. Source: *Highway Safety Research Group, 2016*; [http://wwwsp.dotd.la.gov/Inside\\_LaDOTD/Divisions/Multimodal/Highway\\_Safety/Pages/Highway\\_Safety\\_Analysis\\_Toolbox.aspx](http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Highway_Safety/Pages/Highway_Safety_Analysis_Toolbox.aspx)
- A crash modification factor (CMF) of 0.53 for was obtained from the Crash Modification Factor Clearinghouse for the conversion of Two Way Left Turn Lanes into Raised Median (<http://www.cmfclearinghouse.org/detail.cfm?facid=7771>). Another CMF of 0.74 was obtained from the Crash Modification Factor Clearinghouse (<http://www.cmfclearinghouse.org/detail.cfm?facid=4196>) for conversion of signalized intersection into single or multi lane roundabout. The final CMF of 0.95 was obtained from the Crash Modification Factor Clearinghouse (<http://www.cmfclearinghouse.org/detail.cfm?facid=208>) for conversion of stop-controlled intersection into multi lane roundabout.
- CPI Factor and Mass Conversion Factor from \$/short Ton to \$/metric ton was derived from *Benefit-Cost Analysis (BCA) Guidance for Discretionary Grant Programs, January 2020* ([https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020\\_0.pdf](https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf)). This safety analysis was based on the entire corridor, but was broken into segments to correctly apply Crash Mitigation Factors as proposed and analyzed for each segment.

**Table 1 - Annual and Median Number of Crashes by Severity for Entire Project Corridor<sup>1</sup>**

Severity	2014	2015	2016	Median
	# of Crashes	# of Crashes	# of Crashes	
A - Fatality	0	0	1	0.33
B - Severe Injury	2	3	1	2.00
C - Moderate Injury	10	6	15	10.33
D - Complaint Injury	36	35	54	41.67
E - Property Damage Only	144	148	156	149.33

**Table 2 - Median Number of Crashes Over 3 Years by Severity by Project Phases\***

Severity	Phase 2	Willow	Phase 3a	Alcide	Phase 3b	I-	Phase 3c	I-
	St		Dominique		10 Eastbound		10 Westbound	
A - Fatality	0.33		0.00		0.00		0.00	
B - Severe Injury	1.00		0.00		0.33		0.67	
C - Moderate Injury	5.00		0.00		2.00		3.33	
D - Complaint Injury	21.00		0.00		8.67		12.00	
E - Property Damage Only	75.33		27.67		19.00		27.33	

**Table 3 - Louisiana-Specific Cost of Crashes<sup>2</sup>**

Severity	2018\$
A - Fatality	\$ 1,585,589
B - Severe Injury	\$ 410,536
C - Moderate Injury	\$ 120,440
D - Complaint Injury	\$ 26,134
E - Property Damage Only	\$ 6,971

**Table 4 - Crash Modification Factor by Project Phase**

Project Segment	CMF # - Table 10	CMF Calculation	Final CMF for Analysis
Phase 2	1,2	0.53 x .074	0.39
Phase 3	3	0.95	0.95
Phase 3	2	0.74	0.74
Phase 3	2	0.74	0.74

**Table 5 - Crash Modification Factor - Auto Crashes<sup>3</sup>**

CMF #	Countermeasure	Crash Modification Factors by Countermeasure				
		Fatalities	Severe Injury	Moderate Injury	Complaint Injury	PDO
1	Conversion of Two Way Left Turn Lanes into Raised Median	0.53	0.53	0.53	0.53	0.53
2	Conversion of Signalized Intersection into Single or Multi Lane Roundabout	0.74	0.74	0.74	0.74	0.74
3	Conversion of Stop-Controlled Intersection into Multi Lane Roundabout	0.95	0.95	0.95	0.95	0.95

**Table 6 - CPI Adjustment**

Convert 2017\$ to 2018\$	1.0244
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**Table 7 - Project Phases Description**

Phase 2 - Willow Street	Willow Street	Walker Road to Wilshire Lane
Phase 3a - Alcide Dominique	Alcide Dominique	Wilshire Lane to Hollywood Drive
Phase 3b - I-10 Eastbound	I-10 Eastbound	Hollywood Drive to I-10 Eastbound Ramp
Phase 3c - I-10 Westbound	I-10 Westbound	I-10 Eastbound Ramp to Renaud Drive

**Table 8 - Project Phasing Estimated Completion**

Phase 2	2025
Phase 3a	2027
Phase 3b	2027
Phase 3c	2027

**STATE OF GOOD REPAIR - OPERATION AND MAINTENANCE COSTS SAVINGS**

Analysis Year Beginning in Good Condition	Phase 2 and 3 Annual Roadway Operation and Maintenance Cost (No Build) <sup>3</sup> A	Phase 2 and 3 Annual Traffic Signal Operation and Maintenance Cost (No Build) <sup>3</sup> B	Phase 2 and 3 Annual Roadway Operation and Maintenance Cost (Build) <sup>4</sup> C	Phase 2 and 3 Annual Traffic Signal Operation and Maintenance Cost (Build) <sup>4</sup> D	Phase 2 and 3 Annual Roadway Operations and Maintenance Savings (Build) <sup>4</sup> (A - C)	Phase 2 and 3 Annual Traffic Signal Operation and Maintenance Savings (Build) <sup>4</sup> (B - D)	Phase 2 and 3 Total Savings (A - C) + (B - D)	NPV of Phase 2 and 3 Total Savings at 7% Discount (A - C) + (B - D)
2020	\$6,219	\$3,525	\$0	\$0	\$0	\$0	\$0	\$0
2021	\$6,344	\$3,595	\$0	\$0	\$0	\$0	\$0	\$0
2022	\$6,471	\$3,667	\$0	\$0	\$0	\$0	\$0	\$0
2023	\$6,600	\$3,740	\$0	\$0	\$0	\$0	\$0	\$0
2024	\$6,732	\$3,815	\$0	\$0	\$0	\$0	\$0	\$0
2025	\$6,867	\$3,891	\$2,747	\$973	\$4,120	\$2,919	\$7,039	\$5,018
2026	\$7,004	\$3,969	\$2,802	\$992	\$4,202	\$2,977	\$7,179	\$4,784
2027	\$7,144	\$4,049	\$2,858	\$1,012	\$4,287	\$3,036	\$7,323	\$4,560
2028	\$1,963,299	\$51,620	\$2,915	\$1,032	\$1,960,384	\$50,588	\$2,010,972	\$1,170,404
2029	\$7,433	\$4,212	\$2,973	\$1,053	\$4,460	\$3,159	\$7,619	\$4,144
2030	\$7,581	\$4,296	\$3,033	\$1,074	\$3,834	\$3,222	\$7,057	\$3,587
2031	\$7,733	\$4,382	\$3,093	\$1,096	\$4,640	\$3,287	\$7,927	\$3,766
2032	\$7,888	\$4,470	\$3,155	\$1,118	\$4,733	\$3,353	\$8,085	\$3,590
2033	\$8,046	\$4,559	\$3,218	\$1,140	\$4,827	\$3,420	\$8,247	\$3,422
2034	\$8,206	\$4,651	\$3,283	\$1,163	\$4,924	\$3,488	\$8,412	\$3,262
2035	\$8,371	\$4,744	\$2,255,213	\$23,718	(\$2,246,843)	(\$18,975)	(\$2,265,817)	(\$821,236)
2036	\$8,538	\$4,839	\$3,415	\$1,210	\$5,123	\$3,629	\$8,752	\$2,965
2037	\$8,709	\$4,935	\$3,483	\$1,234	\$5,225	\$3,701	\$8,927	\$2,826
2038	\$8,883	\$5,034	\$3,553	\$1,259	\$5,330	\$3,776	\$9,105	\$2,694
2039	\$2,441,115	\$64,184	\$3,624	\$1,284	\$2,437,491	\$62,900	\$2,500,391	\$691,379
2040	\$9,242	\$5,237	\$3,697	\$1,309	\$5,545	\$3,928	\$9,473	\$2,448
<b>Entire Project Corridor Total Savings</b>					<b>\$2,212,282</b>	<b>\$138,408</b>	<b>\$2,350,690</b>	<b>\$1,087,613</b>

- The 40-year road maintenance value were estimated by the LA Department of Transportation and Development for 5-Lane Jointed Concrete (JCP) Arterial in the following conditions all in 2012\$: fair - \$1,171,163.24; good - \$908,838.35; and, Very Good - \$804,161.14. Source: *Right Sizing the State Highway Systems, 2013*. [http://www.sp.dotd.la.gov/Inside\\_LaDOTD/Divisions/Multimodal/Road\\_Transfer/Documents/Right-Sizing the State Highway System.pdf](http://www.sp.dotd.la.gov/Inside_LaDOTD/Divisions/Multimodal/Road_Transfer/Documents/Right-Sizing%20the%20State%20Highway%20System.pdf); Roadway considered in fair condition in
- A Florida DOT study published in 2006 stated median reduce average maintenace costs by 40%. Source: [https://nacto.org/docs/usdg/university\\_course\\_on\\_bicycle\\_and\\_ped\\_trans\\_fhwa.pdf](https://nacto.org/docs/usdg/university_course_on_bicycle_and_ped_trans_fhwa.pdf)
- No Build condition keeps the current 5-Lane Joint Concrete Pavement (JCP) Arterial
- Build conditions converts 5-Lane JCP to 4-Lane JCP with raised median; elimination of 2 signaled intersections that are converted to roundabouts; introduction of roundabout at stop controlled intersections

**Table 1 - Roadway Maintenance Activity Costs Per Mile**

	\$2012	\$2018	Schedule
Routine Maintenance	\$4,235	\$4,676	Annually
Seal Joints/Cracks	\$79,000	\$87,232	10 Years
Major Rehabilitation	\$1,141,000	\$1,259,892	20 Years

**Table 2 - Traffic Signal Maintenance Activity Costs Per Mile / Replacement Schedule Costs**

	\$2012	\$2018	Schedule
Routine Maintenance	\$2,400	\$2,650	Annually
Controller Replacement	\$30,000	\$33,126	10 Years

**Table 3 - CPI Factor**

Convert 2012\$ to 2018\$	1.1042
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**Table 4 - Inflation<sup>1</sup>**

Estimated Annual Inflation	2.00%
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**Table 5 - Project Mileage**

	Centerline Mileage Measurement
Phase 2 and 3	1.33
Entire Project Corridor	1.62
Constructed - No Signalization Due to Roundabouts	1.33

**Table 6 - Roadway Maintenance Reduction Due to Median<sup>2</sup>**

Maintenance Reduction Factor	40%
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**Table 7 - Project Phasing**

Phase 2	2025
Phase 3a - Alcide Dominique	2027
Phase 3b - I-10 Eastbound	2028
Phase 3c - I-10 Westbound	2029

**Table 8 - Percentage Reduction in Number of Signals**

Project Phase	Existing Signals	Built Condition Signals	Signal Reduction Factor
Entire Corridor	5	2	40.00%
Phase 2 and 3	4	1	25.00%

**ECONOMIC COMPETITIVENESS - Travel Time Savings Calculation**

Analysis Year	Year Number	Phase 2 Willow Street Daily Travel Time Savings (Hours)	Phase 2 Willow Street Monetized Yearly Rider Time Savings	Phase 3a Monetized Yearly Rider Time Savings	Phase 3a Monetized Yearly Rider Time Savings	Phase 3b Monetized Yearly Rider Time Savings	Phase 3b Monetized Yearly Rider Time Savings	Phase 3c Monetized Yearly Rider Time Savings	Phase 3c Monetized Yearly Rider Time Savings	Phase 3c Monetized Yearly Rider Time Savings	Entire Project Total Annual Travel Time Savings in Hours (Decrease in Vehicle Hours Delay)	Total Monetized Yearly Travel Time Savings	7% Discount
2020	0	(174,098.77)	(\$4,826,366)	(201,168.76)	(\$5,576,800)	(179,960.39)	(\$4,988,862)	(111,356.96)	(\$3,087,038)	(666,584.88)	(\$18,479,066)	(\$18,479,066)	
2021	1	(177,776.05)	(\$5,026,874)	(203,232.79)	(\$5,746,700)	(187,746.19)	(\$5,308,794)	(114,740.48)	(\$3,244,452)	(683,495.51)	(\$19,326,820)	(\$18,062,448)	
2022	2	(181,489.18)	(\$5,234,505)	(205,267.37)	(\$5,920,315)	(195,630.59)	(\$5,642,371)	(118,162.86)	(\$3,408,049)	(700,549.99)	(\$20,205,241)	(\$17,648,040)	
2023	3	(185,238.17)	(\$5,449,486)	(207,272.50)	(\$6,097,710)	(203,613.56)	(\$5,990,068)	(121,624.08)	(\$3,578,036)	(717,748.31)	(\$21,115,300)	(\$17,236,375)	
2024	4	(189,023.02)	(\$5,672,048)	(209,248.19)	(\$6,278,949)	(211,695.12)	(\$6,352,374)	(125,124.16)	(\$3,754,624)	(735,090.49)	(\$22,057,996)	(\$16,827,939)	
2025	5	192,843.72	\$5,902,431	(211,194.44)	(\$6,464,097)	(219,875.26)	(\$6,729,794)	(128,663.09)	(\$3,938,033)	(366,889.07)	(\$11,229,494)	(\$8,006,474)	
2026	6	196,700.29	\$6,140,880	(213,111.24)	(\$6,653,221)	(228,153.99)	(\$7,122,848)	(132,240.87)	(\$4,128,491)	(376,805.81)	(\$11,763,679)	(\$7,838,636)	
2027	7	200,592.71	\$6,387,647	214,998.59	\$6,846,386	236,531.29	\$7,532,070	135,857.51	\$4,326,228	787,980.10	\$25,092,331	\$15,626,243	
2028	8	204,520.99	\$6,642,993	216,856.50	\$7,043,660	245,007.19	\$7,958,015	139,512.99	\$4,531,485	805,897.67	\$26,176,154	\$15,234,760	
2029	9	208,485.13	\$6,907,187	218,684.97	\$7,245,111	253,581.66	\$8,401,251	143,207.33	\$4,744,510	823,959.09	\$27,298,058	\$14,848,335	
2030	10	212,485.13	\$7,180,502	220,483.99	\$7,450,807	262,254.72	\$8,862,364	146,940.52	\$4,965,555	842,164.35	\$28,459,229	\$14,467,229	
2031	11	216,520.99	\$7,463,223	222,253.56	\$7,660,819	271,026.36	\$9,341,960	150,712.56	\$5,194,884	860,513.47	\$29,660,886	\$14,091,673	
2032	12	220,592.70	\$7,755,642	223,993.69	\$7,875,215	279,896.59	\$9,840,660	154,523.45	\$5,432,766	879,006.43	\$30,904,283	\$13,721,871	
2033	13	224,700.27	\$8,058,058	225,704.38	\$8,094,067	288,865.39	\$10,359,107	158,373.19	\$5,679,479	897,643.24	\$32,190,710	\$13,358,000	
2034	14	228,843.71	\$8,370,780	227,385.62	\$8,317,445	297,932.79	\$10,897,961	162,261.79	\$5,935,308	916,423.90	\$33,521,494	\$13,000,213	
2035	15	233,023.00	\$8,694,126	229,037.41	\$8,545,423	307,098.76	\$11,457,905	166,189.24	\$6,200,547	935,348.41	\$34,898,001	\$12,648,641	
2036	16	237,238.14	\$9,028,421	230,659.76	\$8,778,072	316,363.32	\$12,039,638	170,155.54	\$6,475,501	954,416.76	\$36,321,633	\$12,303,394	
2037	17	241,489.15	\$9,374,003	232,252.67	\$9,015,466	325,726.46	\$12,643,885	174,160.69	\$6,760,481	973,628.97	\$37,793,835	\$11,964,560	
2038	18	245,776.02	\$9,731,217	233,816.13	\$9,257,679	335,188.19	\$13,271,388	178,204.69	\$7,055,808	992,985.02	\$39,316,093	\$11,632,213	
2039	19	250,098.74	\$10,100,417	235,350.14	\$9,504,785	344,748.49	\$13,922,916	182,287.55	\$7,361,814	1,012,484.92	\$40,889,932	\$11,306,407	
2040	20	254,457.32	\$10,481,971	236,854.71	\$9,756,859	354,407.39	\$14,599,257	186,409.25	\$7,678,837	1,032,128.67	\$42,516,924	\$10,987,181	
<b>Entire Project Corridor Total Benefit</b>			<b>\$102,010,220</b>		<b>\$72,654,001</b>		<b>\$108,993,265</b>		<b>\$57,204,482</b>	<b>8,467,416.96</b>	<b>\$340,861,968</b>	<b>\$81,091,743</b>	

Phase 2: Represents safety improvements from raised median and roundabout installation from Walker Road to Wilshire Lane.

Phase 3: Represents safety improvements for multilane roundabout installations Wilshire Lane to Renaud Drive. Phase 3 has three components due to traffic analysis for each roundabout installation at three separate intersections.

1) Source: Analysis performed by Vectura Consulting using TransCAD and SIDRA modeling software for peak hour. See Appendix for details.

2) User benefits were valued according to Table A-3 and A-4 of the Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020 ([https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020\\_0.pdf](https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf)); Average Vehicle Occupancy provided by Acadiana Metropolitan Planning Organization's Transportation Demand Model

**Table 7 - Peak Traffic Intersection Delay (Seconds/Veh) Trendline Variables for Phases Prior to Construction**

	2020 Existing Conditions (No Build) A	2040 Existing Conditions (No Build) A	2020 Total Vehicles During Peak Hour C	2040 Total Vehicles During Peak Hour C	Analysis Begin Year	Analysis End Year
Phase 2 - Willow Street	47.2	59.7	4,256	4,918	2020	2040
Phase 3a - Alcide Domanique	49.8	64.9	4,661	4,211	2020	2040
Phase 3b - I-10 Eastbound	49.7	84.7	4,178	4,828	2020	2040
Phase 3c - I-10 Westbound	34.1	49.4	3,768	4,354	2020	2040

**Table 1 - Daily Delay Reduction (Travel Time Savings) Build vs. No-Build<sup>1</sup>**

Location	2020 PEAK TRAFFIC INTERSECTION DELAY (SECONDS/VEH)			VEHICLE DELAY REDUCTION (SAVINGS)			
	Existing Conditions (No Build) A	Roundabout Installed (Build) B	Delay Savings in Seconds per Vehicle (A - B)	Total Vehicles During Peak Hour C	Total Delay Savings in Seconds (A - B) x C	Convert Seconds into Hours ((A - B) x C) / 3600	Total Daily Time Savings (((A - B) x C) / 3600) x 12
Phase 2 - Willow Street	47.2	9.3	37.90	4256	161,302.40	44.8	538
Phase 3a - Alcide Domanique	49.8	2.5	47.30	4661	220,465.30	61.2	735
Phase 3b - I-10 Eastbound	49.7	1.5	48.20	4178	201,379.60	55.9	671
Phase 3c - I-10 Westbound	34.1	7.1	27.00	3768	101,736.00	28.3	339
<b>TOTAL</b>	<b>180.8</b>	<b>20.4</b>	<b>160.4</b>	<b>16863</b>	<b>684883.3</b>	<b>190.2453611</b>	<b>2283</b>

Location	2040 PEAK TRAFFIC INTERSECTION DELAY (SECONDS/VEH)			VEHICLE DELAY REDUCTION (SAVINGS)			
	Existing Conditions (No Build) A	Roundabout Installed (Build) B	Delay Savings in Seconds per Vehicle (A - B)	Total Vehicles During Peak Hour C	Total Delay Savings in Seconds (A - B) x C	Convert Seconds into Hours ((A - B) x C) / 3600	Total Daily Time Savings (((A - B) x C) / 3600) x 12
Phase 2 - Willow Street	59.7	18.5	41.20	4918	202,621.60	56.28	675
Phase 3a - Alcide Domanique	64.9	21.1	43.80	4211	184,441.80	51.23	615
Phase 3b - I-10 Eastbound	84.7	3.4	81.30	4828	392,516.40	109.03	1308
Phase 3c - I-10 Westbound	49.4	14.4	35.00	4354	152,390.00	42.33	508
<b>TOTAL</b>	<b>258.7</b>	<b>57.4</b>	<b>201.3</b>	<b>18311</b>	<b>931,969.80</b>	<b>258.8805</b>	<b>3106</b>

**Table 2 - Annual Delay Reduction/Traffic (Travel Time Savings) Build vs. No-Build**

Location	2020 Total Daily Time Savings A	Work Days (Per Year) B	2020 Annual Travel Time Savings in Hours (A x B)	2040 Total Daily Time Savings C	Work Days (Per Year) D	2040 Annual Travel Time Savings in Hours (C x D)
Phase 2 - Willow Street	538	260	139,880	675	260	175,500
Phase 3a - Alcide Domanique	735	260	191,100	615	260	159,900
Phase 3b - I-10 Eastbound	671	260	174,460	1308	260	340,080
Phase 3c - I-10 Westbound	339	260	88,140	508	260	132,080
<b>TOTAL</b>	<b>2283</b>	<b>1040</b>	<b>593,580</b>	<b>3,106</b>	<b>1,040</b>	<b>807,560</b>

**Table 3 - Annualized Travel Time Savings**

Location	2020 Annual Daily Time Savings	2040 Total Daily Time Savings	Project Analysis Begin Year	Project Analysis End Year
Phase 2 - Willow Street	139,880	175,500	2020	2040
Phase 3a - Alcide Domanique	191,100	159,900	2020	2040
Phase 3b - I-10 Eastbound	174,460	340,080	2020	2040
Phase 3c - I-10 Westbound	88,140	132,080	2020	2040

**Table 4 - Annual Work Days Per Year**

Number of Work Weeks A	Number of Work Days Per Week B	Number of Work Days Per Year (A x B)
52	5	260

**Table 5 - Value of Time<sup>2</sup>**

Value of Travel Time Savings (\$2018)	Average Vehicle Occupancy	Value of Time for Occupancy (\$2018)
\$16.60	1.67	\$27.72

**Table 6 - Project Phasing Planned Improvement Operational Date**

Location	Planned Year Roundabout Operational
Phase 2 - Willow Street	2025
Phase 3a - Alcide Domanique	2027
Phase 3b - I-10 Eastbound	2027
Phase 3c - I-10 Westbound	2027

**ENVIRONMENTAL SUSTAINABILITY - AIR QUALITY**

Analysis Year	Decrease in Annual Vehicle VHT	Decrease in NOx (g)	Decrease in VOC (g)	Decrease in NOx (metric tons)	Decrease in VOC (metric tons)	Monetized Decrease in NOx	Monetized Decrease in VOC	Monetized Yearly Emissions Savings (no carbon)	7% Discount
2020	(666,584.88)	(2,343,046)	(1,788,447)	(2.3430)	(1.7884)	(\$22,195)	(\$4,137)	(\$26,332)	(\$26,332)
2021	(683,495.51)	(2,402,487)	(1,833,818)	(2.4025)	(1.8338)	(\$23,214)	(\$4,327)	(\$28,091)	(\$26,253)
2022	(700,549.99)	(2,462,433)	(1,879,576)	(2.4624)	(1.8796)	(\$24,269)	(\$4,523)	(\$29,955)	(\$26,164)
2023	(717,748.31)	(2,522,885)	(1,925,719)	(2.5229)	(1.9257)	(\$25,362)	(\$4,727)	(\$31,931)	(\$26,065)
2024	(735,090.49)	(2,583,843)	(1,972,248)	(2.5838)	(1.9722)	(\$26,494)	(\$4,938)	(\$34,023)	(\$25,956)
2025	(174,045.34)	(611,769)	(466,964)	(0.6118)	(0.4670)	(\$6,398)	(\$1,193)	(\$8,381)	(\$5,976)
2026	(180,105.52)	(633,071)	(483,223)	(0.6331)	(0.4832)	(\$6,754)	(\$1,259)	(\$9,023)	(\$6,013)
2027	787,980.10	2,769,750	2,114,151	2.7698	2.1142	\$30,139	\$5,617	\$41,073	\$25,578
2028	805,897.67	2,832,730	2,162,223	2.8327	2.1622	\$31,441	\$5,860	\$43,704	\$25,436
2029	823,959.09	2,896,216	2,210,682	2.8962	2.2107	\$32,788	\$6,111	\$46,488	\$25,287
2030	842,164.35	2,960,208	2,259,527	2.9602	2.2595	\$34,183	\$6,371	\$49,435	\$25,130
2031	860,513.47	3,024,705	2,308,758	3.0247	2.3088	\$35,626	\$6,640	\$52,553	\$24,967
2032	879,006.43	3,089,708	2,358,374	3.0897	2.3584	\$37,120	\$6,919	\$55,851	\$24,799
2033	897,643.24	3,155,216	2,408,377	3.1552	2.4084	\$38,665	\$7,207	\$59,339	\$24,624
2034	916,423.90	3,221,230	2,458,765	3.2212	2.4588	\$40,263	\$7,505	\$63,028	\$24,443
2035	935,348.41	3,287,750	2,509,540	3.2877	2.5095	\$41,916	\$7,813	\$66,929	\$24,258
2036	954,416.76	3,354,775	2,560,700	3.3548	2.5607	\$43,626	\$8,131	\$71,052	\$24,068
2037	973,628.97	3,422,306	2,612,247	3.4223	2.6122	\$45,395	\$8,461	\$75,411	\$23,873
2038	992,985.02	3,490,342	2,664,179	3.4903	2.6642	\$47,223	\$8,802	\$80,017	\$23,674
2039	1,012,484.92	3,558,885	2,716,497	3.5589	2.7165	\$49,113	\$9,154	\$84,885	\$23,471
2040	1,032,128.67	3,627,932	2,769,201	3.6279	2.7692	\$51,068	\$9,518	\$90,028	\$23,265
<b>Entire Project Corridor Total Benefit</b>								<b>\$712,055</b>	<b>\$200,114</b>

1) Source: Analysis performed by Acadiana MPO using TransCAD modeling software. Annual amounts assume 260 working days per year.

2) Source: Emissions rates for increased VHT are based on rates for idling vehicles. Rates of Nox and VOC are from the Environmental Protection Agency's *Idling Vehicle Emissions for Passenger Cars, Light-Duty Trucks, and Heavy-Duty Truck*, accessed at <http://www.epa.gov/otaq/consumer/420f08025.pdf>. The rate for CO2 emissions is from the Argonne National Laboratory report *Which Is Greener: Idle, or Stop and Restart?* accessed at [http://www.afdc.energy.gov/uploads/publication/which\\_is\\_greener.pdf](http://www.afdc.energy.gov/uploads/publication/which_is_greener.pdf).

3) Derived from *Benefit-Cost Analysis (BCA) Guidance for Discretionary Grant Programs, January 2020* ([https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020\\_0.pdf](https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf)) .

4) CPI Factor and Mass Conversion Factor from \$/short Ton to \$/metric ton was derived from *Benefit-Cost Analysis (BCA) Guidance for Discretionary Grant Programs, January 2020* ([https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020\\_0.pdf](https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf)).

**Table 1 - Peak Traffic Intersection Delay In Hours (Seconds/Veh) Trendline Variables for Phases Prior to Construction**

	2020 Existing Conditions (No Build) A	2040 Existing Conditions (No Build) A	2020 Total Vehicles During Peak Hour C	2040 Total Vehicles During Peak Hour C	Analysis Begin Year	Analysis End Year
Phase 2 - Willow Street	47.2	59.7	4256	4918	2020	2040
Phase 3a - Alcide Domonique	49.8	64.9	4661	4211	2020	2040
Phase 3b - I-10 Eastbound	49.7	84.7	4178	4828	2020	2040
Phase 3c - I-10 Westbound	34.1	49.4	3768	4354	2020	2040

**Table 2- Idling Pollution Emission by Mode (g/VHT) <sup>2</sup>**

Mode	NOx	VOC
Automobile	3.515	2.683

**Table 3- Value of Emissions <sup>3</sup> - Converted to \$/Metric Ton**

Emission Type	2018\$ per Metric Ton
Nitrogen Oxides (NOx)	\$ 9,473
Volatile Organic Compounds (VOC)	\$ 2,313

**Table 4 - CPI Factor <sup>4</sup>**

Convert 2007\$ to 2018\$	1.1939
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**Table 4a - Mass Conversion Factor <sup>4</sup>**

Metric Ton Conversion Factor	1.1015
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**QUALITY OF LIFE BENEFITS OF BICYCLE FACILITIES**

Analysis Year	Existing Daily Cyclists - Commuter	New Daily Cyclists - Commuter	Existing Daily Cyclists - Recreational	New Daily Cyclists - Recreational	QUALITY OF LIFE BENEFITS				Undiscounted Total Benefit	MPV of Total Benefit at 7% Discount
					Mobility Benefit	Health Cost Savings	Recreation Benefit	Reduced Auto Use (Congestion) Benefit		
2020	24	72	70	173	\$1,052,225	\$47,203	\$950,141	\$133,564	\$2,183,133	\$2,183,133
2021	24	73	71	175	\$1,083,927	\$48,626	\$978,767	\$137,588	\$2,248,908	\$2,101,783
2022	24	74	71	177	\$1,116,584	\$50,091	\$1,008,256	\$141,734	\$2,316,665	\$2,023,465
2023	24	74	72	178	\$1,150,225	\$51,600	\$1,038,634	\$146,004	\$2,386,462	\$1,948,064
2024	25	75	73	180	\$1,184,880	\$53,154	\$1,069,926	\$150,403	\$2,458,363	\$1,875,474
2025	25	76	74	182	\$1,220,579	\$54,756	\$1,102,162	\$154,934	\$2,532,430	\$1,805,588
2026	25	77	74	184	\$1,257,353	\$56,406	\$1,135,368	\$159,602	\$2,608,729	\$1,738,306
2027	25	77	75	186	\$1,295,235	\$58,105	\$1,169,575	\$164,411	\$2,687,326	\$1,673,532
2028	26	78	76	187	\$1,334,259	\$59,856	\$1,204,813	\$169,364	\$2,768,292	\$1,611,171
2029	26	79	77	189	\$1,374,458	\$61,659	\$1,241,112	\$174,467	\$2,851,696	\$1,551,134
2030	26	80	77	191	\$1,415,869	\$63,517	\$1,278,505	\$179,723	\$2,937,614	\$1,493,334
2031	26	80	78	193	\$1,458,527	\$65,430	\$1,317,025	\$185,138	\$3,026,120	\$1,437,688
2032	27	81	79	195	\$1,502,470	\$67,402	\$1,356,705	\$190,716	\$3,117,293	\$1,384,115
2033	27	82	80	197	\$1,547,738	\$69,432	\$1,397,580	\$196,462	\$3,211,213	\$1,332,539
2034	27	83	80	199	\$1,594,369	\$71,524	\$1,439,688	\$202,381	\$3,307,962	\$1,282,885
2035	28	84	81	201	\$1,642,405	\$73,679	\$1,483,063	\$208,479	\$3,407,626	\$1,235,081
2036	28	85	82	203	\$1,691,888	\$75,899	\$1,527,746	\$214,760	\$3,510,293	\$1,189,058
2037	28	85	83	205	\$1,742,863	\$78,186	\$1,573,775	\$221,230	\$3,616,053	\$1,144,750
2038	28	86	84	207	\$1,795,373	\$80,541	\$1,621,190	\$227,896	\$3,725,000	\$1,102,093
2039	29	87	85	209	\$1,849,465	\$82,968	\$1,670,035	\$234,762	\$3,837,229	\$1,061,026
2040	29	88	85	211	\$1,905,187	\$85,468	\$1,720,350	\$241,835	\$3,952,839	\$1,021,489
<b>Entire Project Corridor Total Benefit</b>					<b>\$30,215,881</b>	<b>\$1,355,500</b>	<b>\$27,284,416</b>	<b>\$3,835,452</b>	<b>\$62,691,249</b>	<b>\$32,195,707</b>

- 1) GIS buffer analysis using block-level data from ESRI Business Analyst Source: *U.S. Census Bureau, Census 2010 SF1; ESRI forecasts for 2017; ESRI converted 2000 data into 2010 geography*
- 2) Ridership is assumed to grow at a rate the same as population growth. Source: Annual Population Figures - Louisiana Department of Treasury
- 3) Source: 2011-2015 ACS 5-Year Estimate
- 4) Estimate from the Transportation Research Board's (TRB) *National Cooperative Highway Research Program (NCHRP) Report 552: Guidelines for Analysis of Investments in Bicycle Facilities*.
- 5) Acadiana Metropolitan Planning Organization, 2040 Travel Demand Model, TransCAD
- 6) Bicycle demand and benefit calculations based on a methodology described in the National Cooperative Highway Research Program's (NCHRP) Report 552: Guidelines for Analysis of Investments in Bicycle Facilities (2006). ([http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_552.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_552.pdf)) A ramp-up period of four years was assumed before the facilities would see use consistent with the estimated full level of demand.
- 7) CPI Factor value according to Table A-7 of the Benefit-Cost Analysis Guidance for Discretionary Grant Programs, January 2020 ([https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020\\_0.pdf](https://www.transportation.gov/sites/dot.gov/files/2020-01/benefit-cost-analysis-guidance-2020_0.pdf))

**Table 1 - 2017 Population Near Project Area<sup>1</sup>**

Pop. Within Project Census Tracts	Population
Total Population	7,992

**Table 2 -Relevant City of Lafayette Population Characteristics**

Annual population growth rate <sup>2</sup>	0.993%
Population over 18 years old <sup>3</sup>	72.8%
Commute to work on bicycle <sup>3</sup>	0.8%
Adults who commute <sup>4</sup>	50%
Average Trip Length (miles) <sup>5</sup>	8.0

**Table 3 - New and Existing Bicyclists<sup>6</sup>**

	Commuters	Recreational	All Bicyclists
Existing daily cyclists (2018)	23	69	92
New daily cyclists (2018)	71	170	241
Daily Total (2018)	94	239	333

**Table 4 - Mobility Benefit Calculations<sup>6</sup>**

Commuting days per year	260
Trips per day	2
Willingness to travel (minutes)	30.00
Value of time (2018\$ per minute)	\$ 0.25

**Table 5 - Health Savings Calculations<sup>6</sup>**

Annual savings per new commuter (2006\$)	\$ 128
Annual savings per new commuter (2018\$)	\$ 157

**Table 6 - Recreation Benefit Calculations<sup>6</sup>**

Daily value of recreation (2006\$)	\$ 10.00
Daily value of recreation (2018\$)	\$ 12.26
Annual Recreational Days	365

**Table 7 - Reduced Auto Use (Congestion) Benefit Calculations<sup>6</sup>**

Savings per mile (2018\$)	\$ 0.41
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**Table 8 - CPI Factor**

Convert 2006\$ to 2018\$	1.2260
Convert 2013\$ to 2018\$	1.0852

**CAPITAL COST AND RESIDUAL PROJECT VALUE**

Analysis Year	FY20 BUILD Grant Capital Costs	
	Capital Cost	7% Discount
2020	\$0	\$0
2021	\$71,583	\$66,900
2022	\$3,491,401	\$3,049,525
2023	\$2,550,460	\$2,081,935
2024	\$7,013,608	\$5,350,648
2025	\$9,987,812	\$7,121,172
2026	\$5,961,189	\$3,972,192
2027	\$47,652	\$29,675
2028	\$0	\$0
2029	\$0	\$0
2030	\$0	\$0
2031	\$0	\$0
2032	\$0	\$0
2033	\$0	\$0
2034	\$0	\$0
2035	\$0	\$0
2036	\$0	\$0
2037	\$0	\$0
2038	\$0	\$0
2039	\$0	\$0
2040	\$0	\$0
<b>TOTALS</b>	<b>\$29,123,705</b>	<b>\$21,672,047</b>

**Table 1 - Years of Construction <sup>1</sup>**

	<i>Project Phase 2</i>	<i>Project Phase 3</i>
Begin Project & Environmental	2021	2021
End Environmental	2021	2023
Engineering	2022	2023
Begin Construction	2023	2024
End Construction (All segments operational)	2025	2027

**Table 2 - Pre-Construction Costs (2018\$)**

	<i>Entire Project Phases 2</i>	<i>Entire Project Phase 3</i>
Environmental	\$ 25,610.00	\$ 51,220.00
Survey & Engineering	\$ 545,470.46	\$ 1,319,797.01
ROW	\$ 886,919.87	\$ 73,290.96

**Table 3 - Construction Costs (2018\$)**

	<i>Entire Project Phases 2</i>	<i>Entire Project Phase 3</i>
Construction	\$ 4,247,609.55	\$ 8,267,460.15
Contingency (20%)	\$ 1,561,867.64	\$ 2,473,300.14
Construction Related Costs	\$ 1,888,162.81	\$ 3,024,534.85

**Table 4 - Utility Costs (2018\$)**

	<i>Entire Project Phases 2</i>	<i>Entire Project Phase 3</i>
Utility Relocation	\$ 2,103,728.33	\$ 2,654,732.60

<b>PHASE TOTALS</b>	<b>\$ 11,259,368.66</b>	<b>\$ 17,864,335.72</b>	<b>\$ 29,123,705</b>
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**Table 5 - Capital Cost Distribution**

Cost Category	2020	2021	2022	2023	2024	2025	2026	2027	Total Costs (2017\$)
Environmental	\$ -	\$ 10,975.71	\$ 21,951.43	\$ 23,092.90	\$ 20,809.95	\$ -	\$ -	\$ -	\$ 76,830
Survey & Engineering	\$ -	\$ 60,607.60	\$ 484,862.86	\$ 289,569.40	\$ 791,878.21	\$ 238,349.40	\$ -	\$ -	\$ 1,865,267
Utility Relocation	\$ -	\$ -	\$ 2,097,666.83	\$ -	\$ 2,660,794.09	\$ -	\$ -	\$ -	\$ 4,758,461
Right-of-Way	\$ -	\$ -	\$ 886,919.87	\$ -	\$ 73,290.96	\$ -	\$ -	\$ -	\$ 960,211
Construction	\$ -	\$ -	\$ -	\$ 1,327,377.99	\$ 1,592,853.58	\$ 5,640,842.64	\$ 3,953,995.49	\$ -	\$ 12,515,070
Contingency (20%)	\$ -	\$ -	\$ -	\$ 320,368.54	\$ 1,165,920.16	\$ 1,940,547.98	\$ 608,331.32	\$ -	\$ 4,035,168
Construction Related Costs	\$ -	\$ -	\$ -	\$ 590,050.88	\$ 708,061.06	\$ 2,168,071.69	\$ 1,398,861.80	\$ 47,652.24	\$ 4,912,698
<b>Total</b>	<b>\$ -</b>	<b>\$ 71,583</b>	<b>\$ 3,491,401</b>	<b>\$ 2,550,460</b>	<b>\$ 7,013,608</b>	<b>\$ 9,987,812</b>	<b>\$ 5,961,189</b>	<b>\$ 47,652</b>	<b>\$ 29,123,705</b>