

Table 1 - Benefit-Cost Analysis Results (3% and 7% Discounted)

Base Year 2021
Lifetime 25 years

Year	Construction & Maintenance Costs			Safety Cost Benefit			User Cost Delay from Closure/Detour Benefit		
	Non-Disc.	Discounted 3%	Discounted 7%	Non-Disc.	Discounted 3%	Discounted 7%	Non-Disc.	Discounted 3%	Discounted 7%
2021	\$1,113,728	\$1,081,289	\$1,040,867	\$768,000	\$745,631	\$717,757	\$101,067	\$98,123	\$94,455
2022	\$3,341,184	\$3,149,387	\$2,918,320	\$768,000	\$723,914	\$670,801	\$101,067	\$95,265	\$88,276
2023	\$0	\$0	\$0	\$768,000	\$702,829	\$626,917	\$101,067	\$92,491	\$82,501
2024	\$746	\$662	\$569	\$768,000	\$682,358	\$585,904	\$101,067	\$89,797	\$77,104
2025	\$746	\$643	\$532	\$768,000	\$662,484	\$547,573	\$101,067	\$87,181	\$72,059
2026	\$746	\$624	\$497	\$768,000	\$643,188	\$511,751	\$101,067	\$84,642	\$67,345
2027	\$746	\$606	\$464	\$768,000	\$624,454	\$478,272	\$101,067	\$82,177	\$62,939
2028	\$746	\$589	\$434	\$768,000	\$606,266	\$446,983	\$101,067	\$79,783	\$58,822
2029	\$746	\$571	\$406	\$768,000	\$588,608	\$417,741	\$101,067	\$77,459	\$54,974
2030	\$746	\$555	\$379	\$768,000	\$571,464	\$390,412	\$101,067	\$75,203	\$51,377
2031	\$746	\$539	\$354	\$768,000	\$554,820	\$364,871	\$101,067	\$73,013	\$48,016
2032	\$746	\$523	\$331	\$768,000	\$538,660	\$341,001	\$101,067	\$70,886	\$44,875
2033	\$6,723	\$4,578	\$2,790	\$768,000	\$522,971	\$318,693	\$101,067	\$68,822	\$41,939
2034	\$6,723	\$4,445	\$2,607	\$768,000	\$507,738	\$297,844	\$101,067	\$66,817	\$39,196
2035	\$6,723	\$4,315	\$2,437	\$768,000	\$492,950	\$278,359	\$101,067	\$64,871	\$36,631
2036	\$6,723	\$4,190	\$2,277	\$768,000	\$478,592	\$260,148	\$101,067	\$62,982	\$34,235
2037	\$56,723	\$34,318	\$17,957	\$768,000	\$464,653	\$243,129	\$101,067	\$61,147	\$31,995
2038	\$6,723	\$3,949	\$1,989	\$768,000	\$451,119	\$227,223	\$101,067	\$59,366	\$29,902
2039	\$6,723	\$3,834	\$1,859	\$768,000	\$437,980	\$212,358	\$101,067	\$57,637	\$27,946
2040	\$6,723	\$3,722	\$1,737	\$768,000	\$425,223	\$198,466	\$101,067	\$55,958	\$26,118
2041	\$6,723	\$3,614	\$1,624	\$768,000	\$412,838	\$185,482	\$101,067	\$54,328	\$24,409
2042	\$6,723	\$3,509	\$1,517	\$768,000	\$400,813	\$173,348	\$101,067	\$52,746	\$22,812
2043	\$6,723	\$3,406	\$1,418	\$768,000	\$389,139	\$162,007	\$101,067	\$51,210	\$21,320
2044	\$6,723	\$3,307	\$1,325	\$768,000	\$377,805	\$151,409	\$101,067	\$49,718	\$19,925
2045	\$6,723	\$3,211	\$1,239	\$768,000	\$366,801	\$141,503	\$101,067	\$48,270	\$18,622
TOTALS:		\$ 4,316,387	\$ 4,003,929		\$13,373,297	\$ 8,949,952		\$ 1,759,895	\$ 1,177,793

	3% Discount	7% Discount
Discounted Benefits:	\$15,133,192	\$ 10,127,745
Discounted Costs:	\$ 4,316,387	\$ 4,003,929
Overall B/C:	3.51	2.53

Dawnville Road Bridge Replacement

Base Year:	2020
Construction Complete:	2021
Benefit Period (years):	25

Years & Discount Rate		
Year	3% Discount Rate	7% Discount Rate
2021	0.971	0.935
2022	0.943	0.873
2023	0.915	0.816
2024	0.888	0.763
2025	0.863	0.713
2026	0.837	0.666
2027	0.813	0.623
2028	0.789	0.582
2029	0.766	0.544
2030	0.744	0.508
2031	0.722	0.475
2032	0.701	0.444
2033	0.681	0.415
2034	0.661	0.388
2035	0.642	0.362
2036	0.623	0.339
2037	0.605	0.317
2038	0.587	0.296
2039	0.570	0.277
2040	0.554	0.258
2041	0.538	0.242
2042	0.522	0.226
2043	0.507	0.211
2044	0.492	0.197
2045	0.478	0.184

Proj No : TBD
 Proj Name : Dawnville Road Bridge Replacement
 Proj Manager : TBD

Project Location : Dalton, GA
 Project Description : Construct Bridge and Approach
 Bid Advertisement Date : TBD

Dawnville Road Bridge

ITEM No.	ITEM DESCRIPTION	UNIT	DRAFT PRE-DESIGN EST		
			DATE: April-22		
			QUANTITY	UNIT PRICE	AMOUNT
	CLEARING AND GRUBBING	ACRE	3	\$2,500.00	\$7,500.00
	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ.YD.	550	\$6.00	\$3,300.00
	REMOVE GUARD RAIL	L.FT.	264	\$5.00	\$1,320.00
	REMOVE (SIGNS, STRUCTURES, FOUNDATIONS, AND POSTS)	L.SUM	1	\$4,000.00	\$4,000.00
	REMOVE (CONCRETE SLAB)	SQ.FT.	1,920	\$3.00	\$5,760.00
	SAW CUTTING	L.FT.	100	\$3.00	\$300.00
	ROADWAY EXCAVATION	CU.YD.	720	\$12.00	\$8,640.00
	BORROW	CU.YD.	720	\$25.00	\$18,000.00
SUBTOTAL					\$48,820.00
	GR AGGR Base, INCL MATL	TON	650	\$60.00	\$39,000.00
	BITUM TACK COAT	GALLON	200	\$12.00	\$2,400.00
	Recycled ASPH Conc 9.5 MM Superpave, Type I, Gp 1 Or Blend 1, Incl Bitum Matl	TON	150	\$150.00	\$22,500.00
	Recycled ASPH Conc 19 MM Superpave, Type I, Gp 1 Or Blend 1, Incl Bitum Matl	TON	200	\$140.00	\$28,000.00
SUBTOTAL					\$91,900.00
	SIGN POST (PERFORATED) (2 S)	L.FT.	100	\$10.00	\$1,000.00
	FOUNDATION FOR SIGN POST (CONCRETE)	EACH	6	\$200.00	\$1,200.00
	WARNING, MARKER, OR REGULATORY SIGN PANEL	SQ.FT.	64	\$25.00	\$1,600.00
	FLAT SHEET ALUMINUM SIGN PANEL	SQ.FT.	11	\$30.00	\$330.00
	RELOCATE SIGNS	L.SUM	1	\$4,500.00	\$4,500.00
	METAL HANDRAIL	L.FT.	320	\$100.00	\$32,000.00
SUBTOTAL					\$40,630.00
	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, WHITE	L.FT.	600	\$2.00	\$1,200.00
	THERMOPLASTIC SOLID TRAF STRIPE, 5 IN, YELLOW	L.FT.	600	\$2.00	\$1,200.00
SUBTOTAL					\$2,400.00
	PERMANENT GRASSING	ACRE	3	\$2,000.00	\$6,000.00
	STN DUMPED RIP RAP, TP 3, 12 IN	SQ.YD.	250	\$10.00	\$2,500.00
	Temporary Silt Fence, Type C	L.FT.	1,200	\$4.75	\$5,700.00
	EROSION CONTROL MATS, SLOPES	SQ.YD.	250	\$2.00	\$500.00
	PLASTIC FILTER FABRIC	SQ.YD.	100	\$4.50	\$450.00
	Mulch	TON	6	\$820.00	\$4,920.00
	Construction Exit	EACH	2	\$2,100.00	\$4,200.00
	FERTILIZER MIXED GRADE	TON	3	\$2.50	\$7.50
	AGRICULTURAL LIME	TON	3	\$8.00	\$24.00
SUBTOTAL					\$24,301.50
	Grading Complete	L.SUM	1	\$200,000.00	\$200,000.00
	GUARD RAIL, W-BEAM, SINGLE FACE, SHOP CURVED	L.FT.	200	\$75.00	\$15,000.00
	GUARD RAIL TERMINAL (FLARE TYPE)	EACH	4	\$4,000.00	\$16,000.00
	CONC CURB & GUTTER 6 IN X 24 IN TP 2	L.FT.	600	\$20.00	\$12,000.00
	CONCRETE CURB AND GUTTER (TRANSITION)	L.FT.	20	\$20.00	\$400.00
	CONCRETE SIDEWALK RAMP	SQ.FT.	72	\$20.00	\$1,440.00
	EMBANKMENT SPILLWAY	L.FT.	10	\$200.00	\$2,000.00
SUBTOTAL					\$246,840.00

ROADWAY TOTAL: \$454,891.50

	STRUCTURAL EXCAVATION	CU.YD.	225	\$25.00	\$5,625.00
	FOUNDATION BACKFILL MATERIAL SIZE 57 STONE	CU.YD.	205	\$50.00	\$10,250.00
	STRUCTURAL CONCRETE (CLASS S) (F'C = 3,500)	CU.YD.	65	\$550.00	\$35,750.00
	STRUCTURAL CONCRETE (CLASS S) (F'C = 4,500)	CU.YD.	505	\$650.00	\$328,250.00
	COMBINATION PEDESTRIAN-TRAFFIC BRIDGE RAILING	L.FT.	450	\$325.00	\$146,250.00
	DECK JOINT ASSEMBLY (4X4 COMPRESSION SEAL)	L.FT.	65	\$200.00	\$13,000.00
	DECK JOINT ASSEMBLY (STRIP SEAL JOINT)	L.FT.	125	\$175.00	\$21,875.00
	APPROACH SLAB	SQ.FT.	1,000	\$35.00	\$35,000.00
	PRECAST, P/S MEMBER (AASHTO TYPE Super VI Mod.)	L.FT.	1,500	\$350.00	\$525,000.00
	REINFORCING STEEL	LB.	200,000	\$1.35	\$270,000.00
	MISCELLANEOUS	L.SUM	1	\$1,000,000.00	\$1,000,000.00
BRIDGE OVER COAHULLA CREEK TOTAL:					\$2,391,000.00
	LUMP SUM STRUCTURE (TOTAL OF PRECEDING STRUCTURE ITEMS)	L.SUM	1		\$2,391,000.00

ROADWAY & BRIDGE TOTAL: \$2,845,891.50

CONSTRUCTION COST SUBTOTAL		\$2,845,891.50
SUBTOTAL		\$2,845,891.50
ROADWAY / STRUCTURES SUBTOTAL		\$2,845,891.50
Estimated Construction Engineering @	15%	\$426,883.73
Estimated Construction Contingencies @	5%	\$142,294.58
Estimated Consultant Post Design @	1.4%	\$39,842.48
Land Acquistion (Right-of-Way)		\$45,000.00
Utility Relocations		\$250,000.00
Final Plans & Specifications		\$750,000.00
TOTAL COST		\$4,499,912.00

Table 4 - Construction Costs for Dawnville Road Bridge

Roadway:	\$454,892
Bridge:	\$2,391,000
Other:	\$1,609,021 (Utility Relo, CE,Contingency, CPD)
Total:	\$4,454,912

Estimate of Future Annual Maintenance Costs of Roadway per Lane-Mile

Annual Maintenance Cost Per Lane Mile	
Category	Other Locations
1. Paved Surfaces & Shoulders	\$420
2. Roadside	\$230
3. Drainage & Environmental	\$100
6. Landscaping	\$85
7. Winter Storms	\$155
8. Emergency Response	\$30
9. Miscellaneous Maintenance	\$300
10. Support and Other Operating Expenses	\$1,165
11. Other Specialty Items	\$0
MCL = Maintenance Cost per Lane Mile	\$2,485
Annual Maintenance Cost of Project	
PW = Pavement Width	24
NL = Number of 12-ft Lanes	2.000
LP = Length of Project in Miles	0.15
PMC = Current Project Maintenance Cost	\$746

Estimate of Future Maintenance Cost of Bridge

Maintenance Cost of Bridge	
Category	
Bridge Deck Replacement after 30 years	\$1,500,000
Bridge Joint Replacement after 15 years	\$50,000
Annual Maintenance after year 10	0.25%
Annual Maintenance Costs (0.25% x Construction Cost)	\$5,978

Costs - Construction & Maintenance

Year	Initial Constr.	Roadway Annual Maint.	Bridge Annual Maint.	Bridge Deck/Joint	Total Costs	3% Discount Rate	7% Discount Rate
2021	\$1,113,728	\$0	\$0	\$0	\$1,113,728	\$ 1,081,289	\$ 1,040,867
2022	\$3,341,184	\$0	\$0	\$0	\$3,341,184	\$ 3,149,387	\$ 2,918,320
2023	\$0	\$0	\$0	\$0	\$0	\$ -	\$ -
2024	\$0	\$746	\$0	\$0	\$746	\$ 662	\$ 569
2025	\$0	\$746	\$0	\$0	\$746	\$ 643	\$ 532
2026	\$0	\$746	\$0	\$0	\$746	\$ 624	\$ 497
2027	\$0	\$746	\$0	\$0	\$746	\$ 606	\$ 464
2028	\$0	\$746	\$0	\$0	\$746	\$ 589	\$ 434
2029	\$0	\$746	\$0	\$0	\$746	\$ 571	\$ 406
2030	\$0	\$746	\$0	\$0	\$746	\$ 555	\$ 379
2031	\$0	\$746	\$0	\$0	\$746	\$ 539	\$ 354
2032	\$0	\$746	\$0	\$0	\$746	\$ 523	\$ 331
2033	\$0	\$746	\$5,978	\$0	\$6,723	\$ 4,578	\$ 2,790
2034	\$0	\$746	\$5,978	\$0	\$6,723	\$ 4,445	\$ 2,607
2035	\$0	\$746	\$5,978	\$0	\$6,723	\$ 4,315	\$ 2,437
2036	\$0	\$746	\$5,978	\$0	\$6,723	\$ 4,190	\$ 2,277
2037	\$0	\$746	\$5,978	\$50,000	\$56,723	\$ 34,318	\$ 17,957
2038	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,949	\$ 1,989
2039	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,834	\$ 1,859
2040	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,722	\$ 1,737
2041	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,614	\$ 1,624
2042	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,509	\$ 1,517
2043	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,406	\$ 1,418
2044	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,307	\$ 1,325
2045	\$0	\$746	\$5,978	\$0	\$6,723	\$ 3,211	\$ 1,239
						\$ 4,316,387	\$ 4,003,929

Table 5 - Project Benefits

Accidents - Dawnville Road related deaths¹

1 - GDOT Fatality Data

0.08	average/year over previous 25 yrs
\$9,600,000	2016 Economic Value of Statistical Life (VSL) per fatality
\$768,000	Average Annual VSL

User Cost Delays from Road Closure/Detour²

2- Long Term User Information

Daily User Cost:	\$101,067
Average Days Closed per Event:	1
Average # Closure Events per Year:	1
Average Yearly Total:	\$101,067

Benefit - Eliminate Accidental Fatalities

Year	Average VSL	3% Discount Rate	7% Discount Rate
2021	\$768,000	\$745,631	\$717,757
2022	\$768,000	\$723,914	\$670,801
2023	\$768,000	\$702,829	\$626,917
2024	\$768,000	\$682,358	\$585,904
2025	\$768,000	\$662,484	\$547,573
2026	\$768,000	\$643,188	\$511,751
2027	\$768,000	\$624,454	\$478,272
2028	\$768,000	\$606,266	\$446,983
2029	\$768,000	\$588,608	\$417,741
2030	\$768,000	\$571,464	\$390,412
2031	\$768,000	\$554,820	\$364,871
2032	\$768,000	\$538,660	\$341,001
2033	\$768,000	\$522,971	\$318,693
2034	\$768,000	\$507,738	\$297,844
2035	\$768,000	\$492,950	\$278,359
2036	\$768,000	\$478,592	\$260,148
2037	\$768,000	\$464,653	\$243,129
2038	\$768,000	\$451,119	\$227,223
2039	\$768,000	\$437,980	\$212,358
2040	\$768,000	\$425,223	\$198,466
2041	\$768,000	\$412,838	\$185,482
2042	\$768,000	\$400,813	\$173,348
2043	\$768,000	\$389,139	\$162,007
2044	\$768,000	\$377,805	\$151,409
2045	\$768,000	\$366,801	\$141,503
SUM (ALL YEARS)		\$13,373,297	\$8,949,952

Benefit - Elimination of User Cost Delays from Road Closure/11 mile Detour

Year	User Cost \$	3% Discount Rate	7% Discount Rate
2021	\$101,067	\$98,123	\$94,455
2022	\$101,067	\$95,265	\$88,276
2023	\$101,067	\$92,491	\$82,501
2024	\$101,067	\$89,797	\$77,104
2025	\$101,067	\$87,181	\$72,059
2026	\$101,067	\$84,642	\$67,345
2027	\$101,067	\$82,177	\$62,939
2028	\$101,067	\$79,783	\$58,822
2029	\$101,067	\$77,459	\$54,974
2030	\$101,067	\$75,203	\$51,377
2031	\$101,067	\$73,013	\$48,016
2032	\$101,067	\$70,886	\$44,875
2033	\$101,067	\$68,822	\$41,939
2034	\$101,067	\$66,817	\$39,196
2035	\$101,067	\$64,871	\$36,631
2036	\$101,067	\$62,982	\$34,235
2037	\$101,067	\$61,147	\$31,995
2038	\$101,067	\$59,366	\$29,902
2039	\$101,067	\$57,637	\$27,946
2040	\$101,067	\$55,958	\$26,118
2041	\$101,067	\$54,328	\$24,409
2042	\$101,067	\$52,746	\$22,812
2043	\$101,067	\$51,210	\$21,320
2044	\$101,067	\$49,718	\$19,925
2045	\$101,067	\$48,270	\$18,622
SUM (ALL YEARS)	\$1,759,895	\$1,759,895	\$1,177,793

Equation #1

$$E = \frac{(s/12) * 1.467}{1.572} - 0.00047 \text{ lb/VMT}$$

where: s (%) Non-gravel roads = 11.00

$$E = 0.855 \text{ lb/VMT}$$

Average Daily Traffic (ADT) = 12000

Length of unpaved roadway (L) = 0.2 miles (combined length of dirt roads removed due to project)

$$PM_{10} = (ADT) * (L) * (365 \text{ days/yr}) * 0.85 \text{ lb.VMT}$$

$$PM_{10} = 561,735 \text{ lb/year}$$

$$280.87 \text{ tons/year} \quad (\text{short tons} = 2,000 \text{ lb})$$

Multi-Pollutant Emissions Benefits of Transportation Strategies - FHWA

7. Road Dust Reduction Strategies

34. Road Paving

Road paving reduces air pollution caused by dust particulates released into the air. According to EPA estimates, the difference between paved and unpaved emission rates is close to 572.32 g/VMT, which represents a significant reduction in PM-10 emissions due with implementation of this strategy. Typical projects include paving shoulders, curbs and gutters, roads, and access points.

Project Length = 0.2 miles

ADT = 12000 vehicles/day

PM-10 emission factor = 573.91 grams/vehicle-mile (unpaved)

PM-10 emission factor = 1.59 grams/vehicle-mile (paved)

VMT Affected = (ADT) x (Project Length)

= 1800 vehicle miles/day

Calculated emissions reduced = (VMT Affected) x [(emission factor unpaved) - (emission factor paved)]

PM₁₀ = 1,030,176 grams/day

1 short ton = 907,184 grams

PM₁₀ = 1.1355756 short tons/day

= 414.00 short tons/year

Table 6: Benefit - Cost - Ratio and Net Present Value (\$2021)

	Present Value @ 3%	Present Value @ 7%
Costs:		
25-yr Analysis Period		
Dawnville Road	\$ 4,316,387	\$ 4,003,929
Benefits:		
Emergency Response Exp.		
Annual Maint. Exp.	\$15,133,192	\$ 10,127,745
Deaths avoided (VSL)		
User Cost Delays		
Benefit/Cost Ratio:	3.51	2.53