



# Life Cycle Cost Analysis in BrM

Bryon Patterson – GDOT State Bridge Asset manager

**BrMUG 2024 | Long Beach, CA | September 17-18**





## LCCA Examples

- Bridge No. 237-0012-0 – Widening and Rehab vs Bridge Replacement
- Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement
- Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widening and Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widening and Rehab vs Bridge Replacement

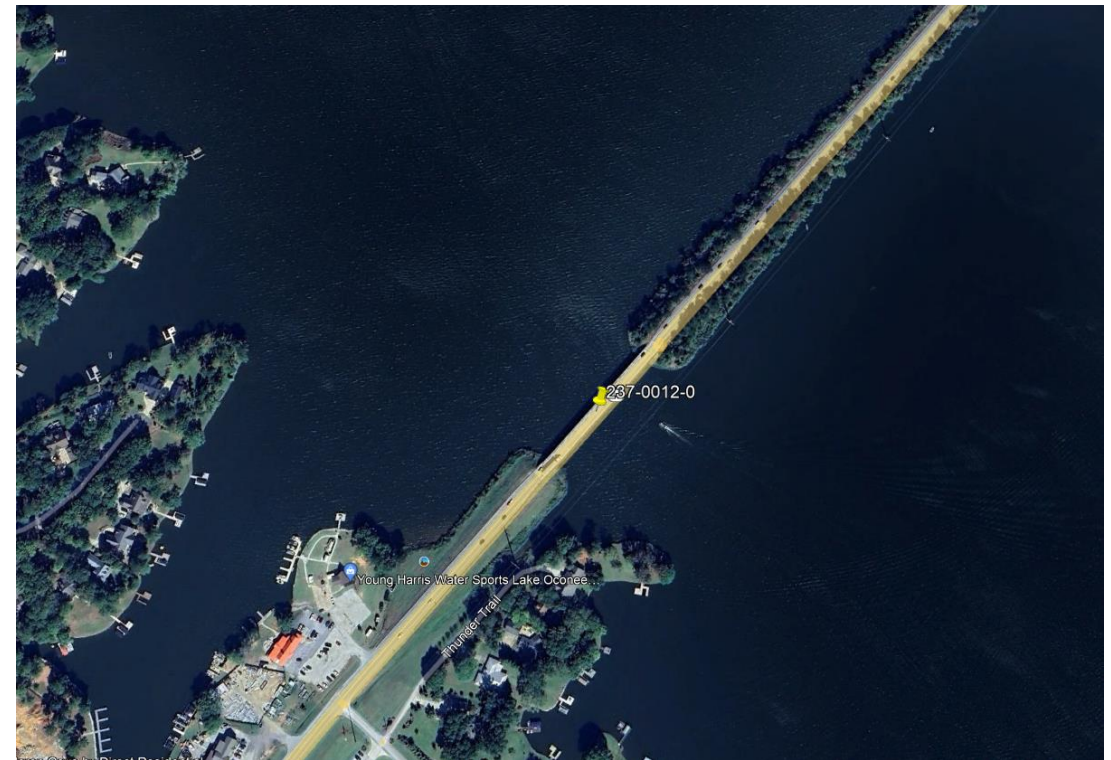
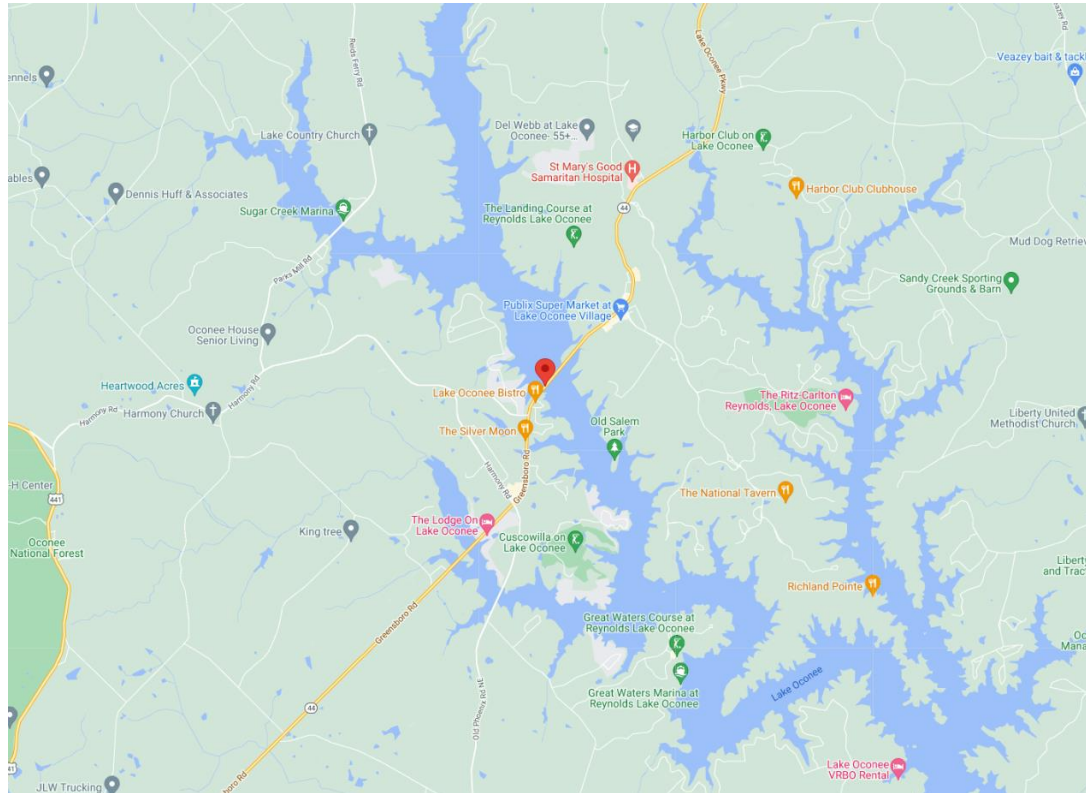


# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widening and Rehab vs Bridge Replacement





## Bridge No. 237-0012-0 – Widening and Rehab vs Bridge Replacement

### Current Bridge Condition

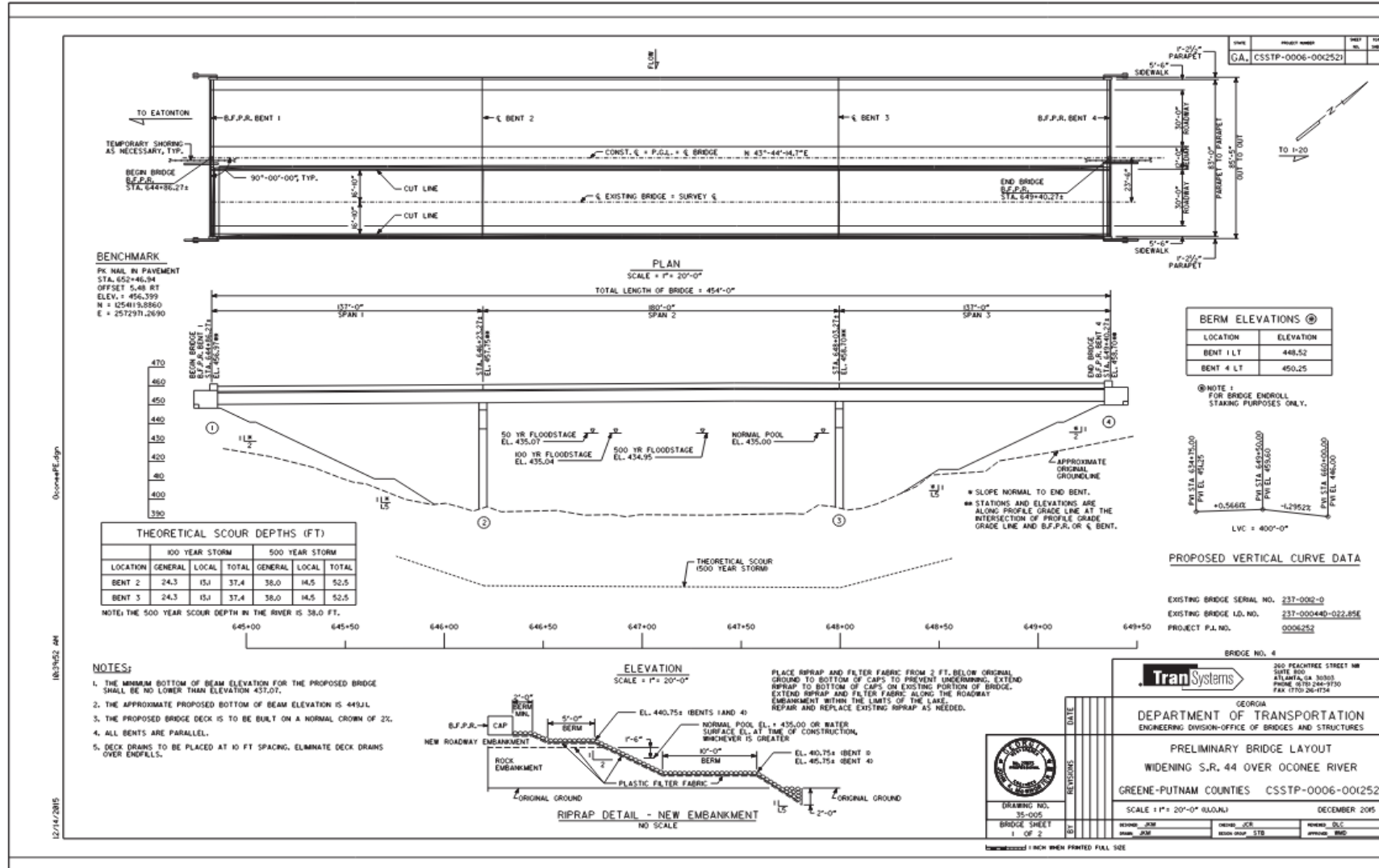
- Deck Rating = 7
- Superstructure Rating = 7
- Substructure Rating = 7

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widening and Rehab vs Bridge Replacement

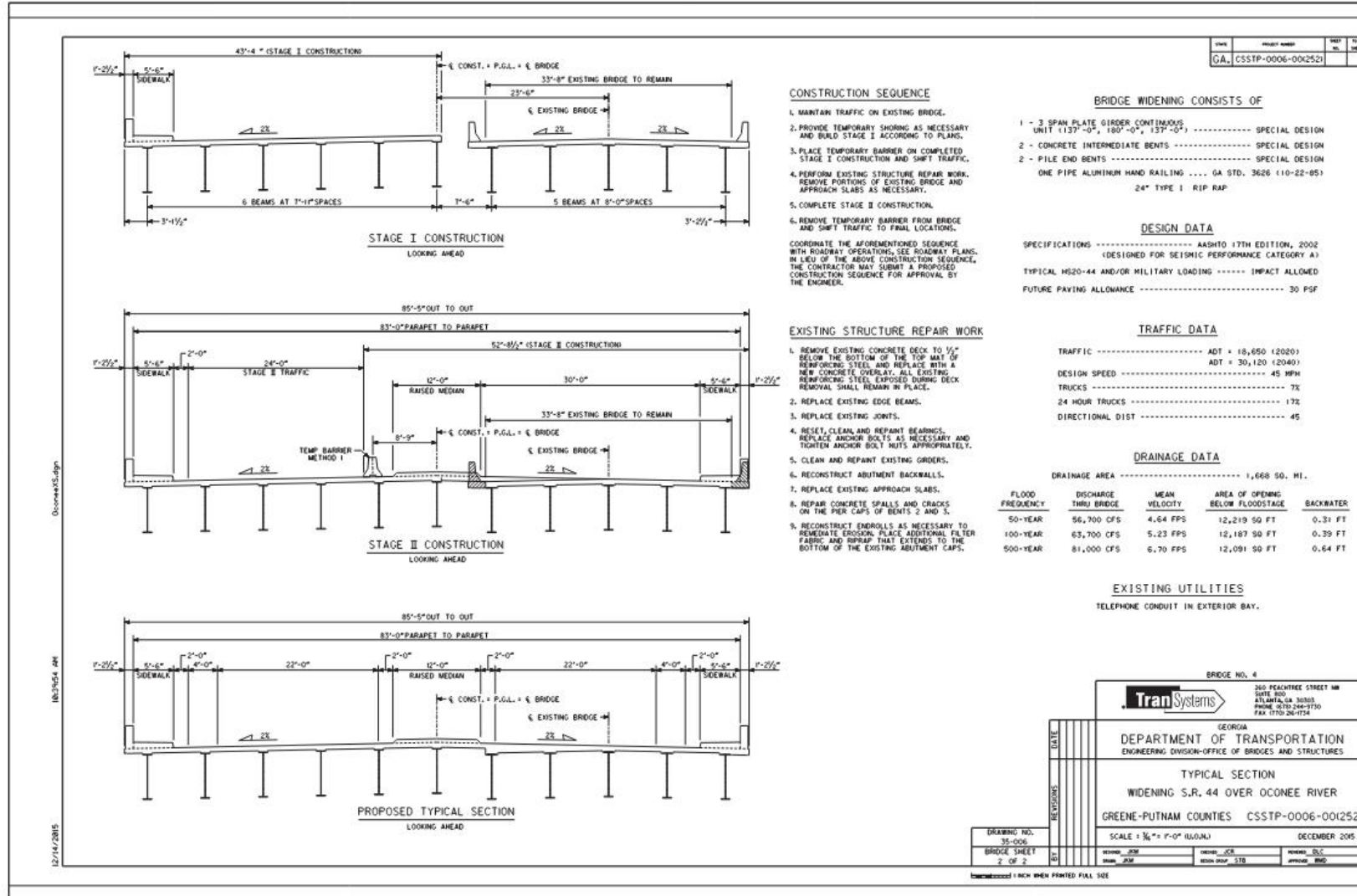


# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widen and Rehab vs Bridge Replacement





# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widen and Rehab vs Bridge Replacement

### Alternative 1

237-0012-0 - Widen in 2026 Actions			
Year #	Year	Action(s)	2024 \$
4	2026	Paint Structure Widen Bridge	\$4,876,670.00
22	2044	Paint Structure	\$927,800.00
40	2062	Bridge Replacement	\$16,981,770.00
Subtotal:			\$22,786,240.00
Residual Value ((Remaining Life=93)/(Service Life=103))			(\$15,333,054.47)
Total Life Cycle Cost:			\$7,453,185.53

### Alternative 2

237-0012-0 - Widen and Rehab in 2026 Actions			
Year #	Year	Action(s)	2024 \$
4	2026	Widen Bridge Paint Structure Bearing Replacement Joint Replacement Substructure Rehabilitation	\$5,018,080.58
22	2044	Paint Structure	\$926,200.00
Subtotal:			\$5,944,280.58
Residual Value ((Remaining Life=25)/(Service Life=78))			(\$5,442,875)
Total Life Cycle Cost:			\$501,405.58

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widen and Rehab vs Bridge Replacement

### Alternative 3

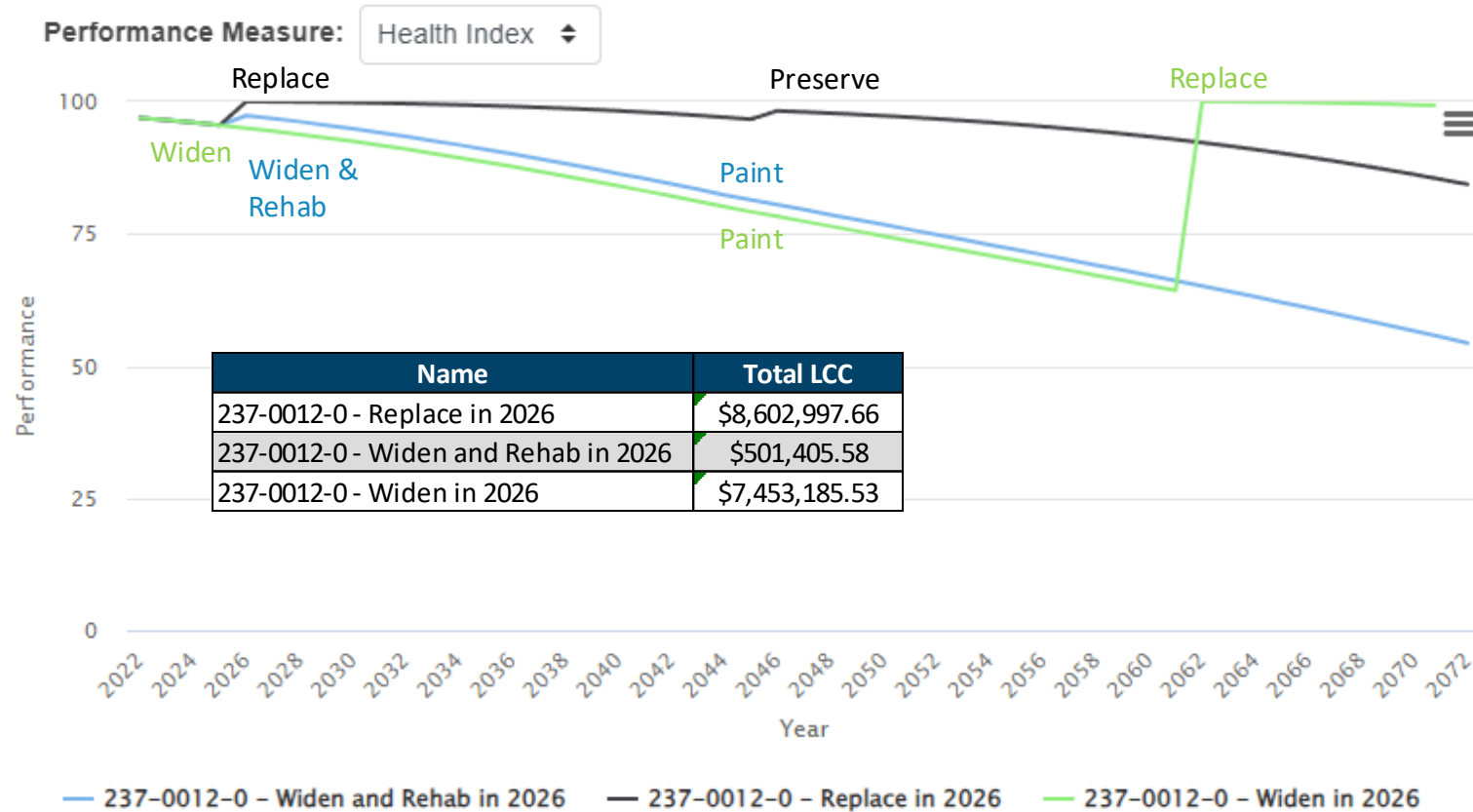
237-0012-0 - Replace in 2026 Actions			
Year #	Year	Action(s)	2024 \$
4	2026	Bridge Replacement	\$16,981,770.00
24	2046	Bridge Preservation	\$1,018,906.20
Subtotal:			\$18,000,676.20
Residual Value ((Remaining Life=57)/(Service Life=103))			(\$9,397,678.54)
Total Life Cycle Cost:			\$8,602,997.66

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widen and Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



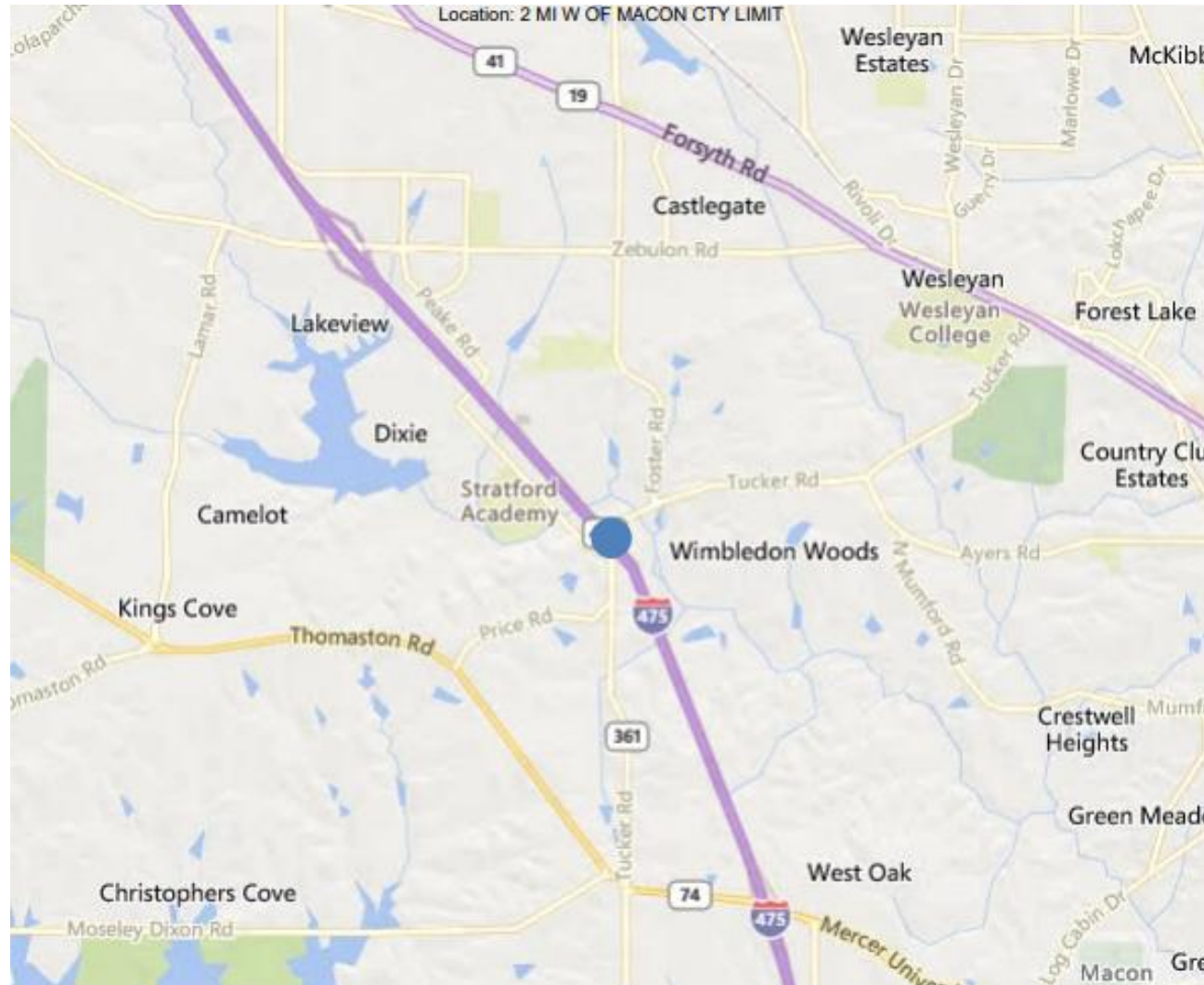
Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement





# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 237-0012-0 – Widen and Rehab vs Bridge Replacement

### Current Bridge Condition

- Deck Rating = 6
- Superstructure Rating = 7
- Substructure Rating = 7

Elements & Defects							
ELEMENTS	DESCRIPTION	UNITS	TOTAL	CS1	CS2	CS3	CS4
12	Reinforced Concrete Deck	SF	9968	0	4984	4984	0
1080	Delamination/Spall/Patched Area	SF	30	0	0	30	0
1130	Cracking (RC and Other)	SF	9938	0	4984	4954	0
107	Steel Open Girder/Beam	LF	1424	1424	0	0	0
515	Steel Protective Coating	SF	17802	17802	0	0	0
205	Reinforced Concrete Column	EA	6	6	0	0	0
215	Reinforced Concrete Abutment	LF	60	60	0	0	0
234	Reinforced Concrete Pier Cap	LF	84	84	0	0	0

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement

### Alternative 1

021-0066-0 - Deck Rehab & Paint Actions				
Year #	Year	Action(s)	Action(s) Added As	Cost
2	2025	Bearing Replacement, Deck Rehab w LMC Overlay	Action	\$864,240.19
19	2042	Paint Structure	LCCA Policy	\$742,080.00
22	2045	Deck Preserve & Joint Replace	LCCA Policy	\$157,876.62
37	2060	Paint Structure	LCCA Policy	\$742,080.00
39	2062	Substructure Rehabilitation	LCCA Policy	\$213,781.22
70	2093	Bridge Replacement	LCCA Policy	\$11,956,230.00
72 years until next replacement				\$14,676,288.03
Residual Value ((Remaining Life=72)/(Service Life=105))				(\$8,198,557.71)
Total Life Cycle Cost				\$6,477,730.32

### Alternative 2

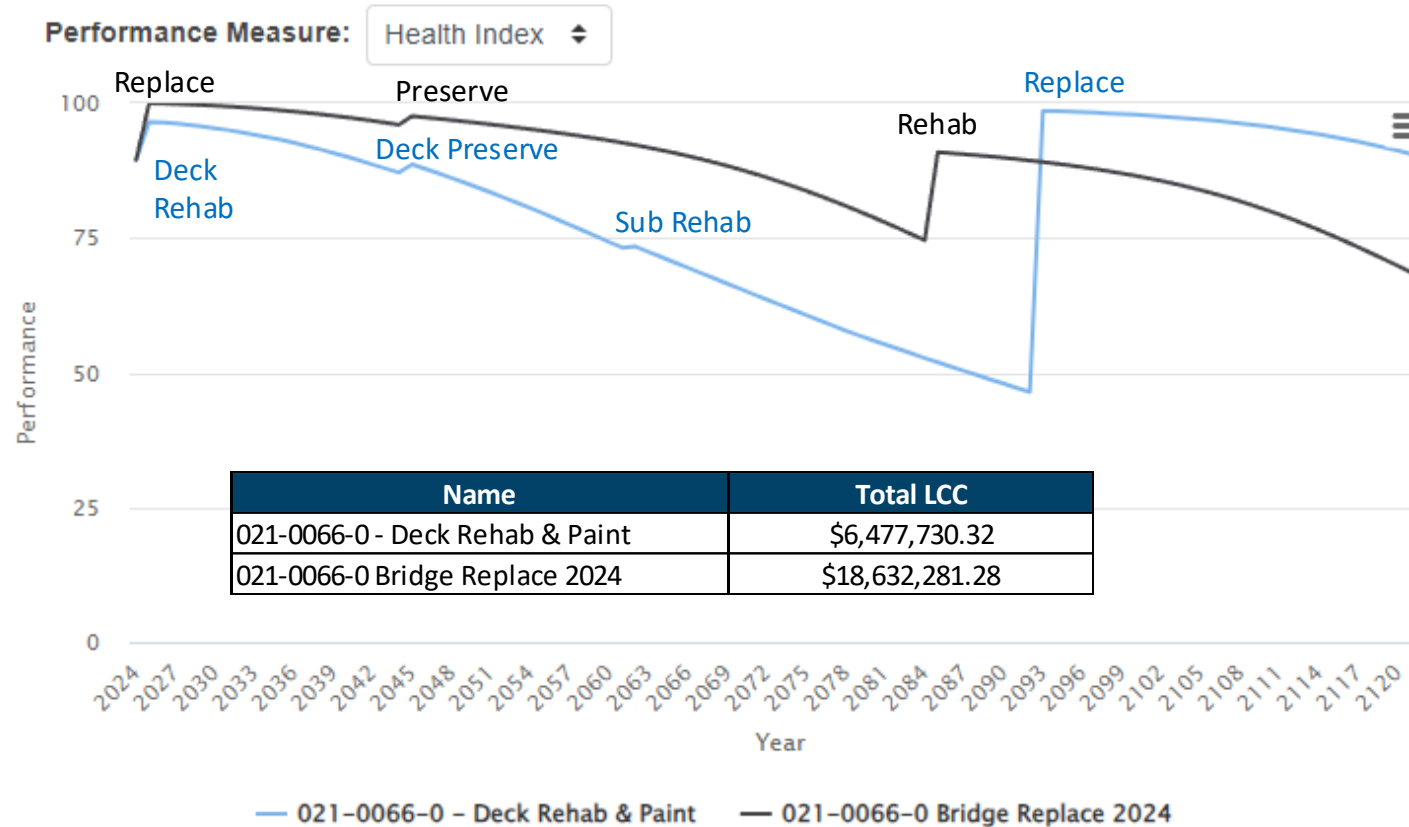
021-0066-0 Bridge Replace 2024 Actions				
Year #	Year	Action(s)	Action(s) Added As	Cost
2	2025	Bridge Replacement	Action	\$11,956,230.00
22	2045	Bridge Preservation	LCCA Policy	\$717,373.80
62	2085	Bridge Rehabilitation	LCCA Policy	\$6,869,628.34
8 years until next replacement				\$19,543,232.14
Residual Value ((Remaining Life=8)/(Service Life=105))				(\$910,950.86)
Total Life Cycle Cost				\$18,632,281.28

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 021-0066-0 – Deck Rehabilitation vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



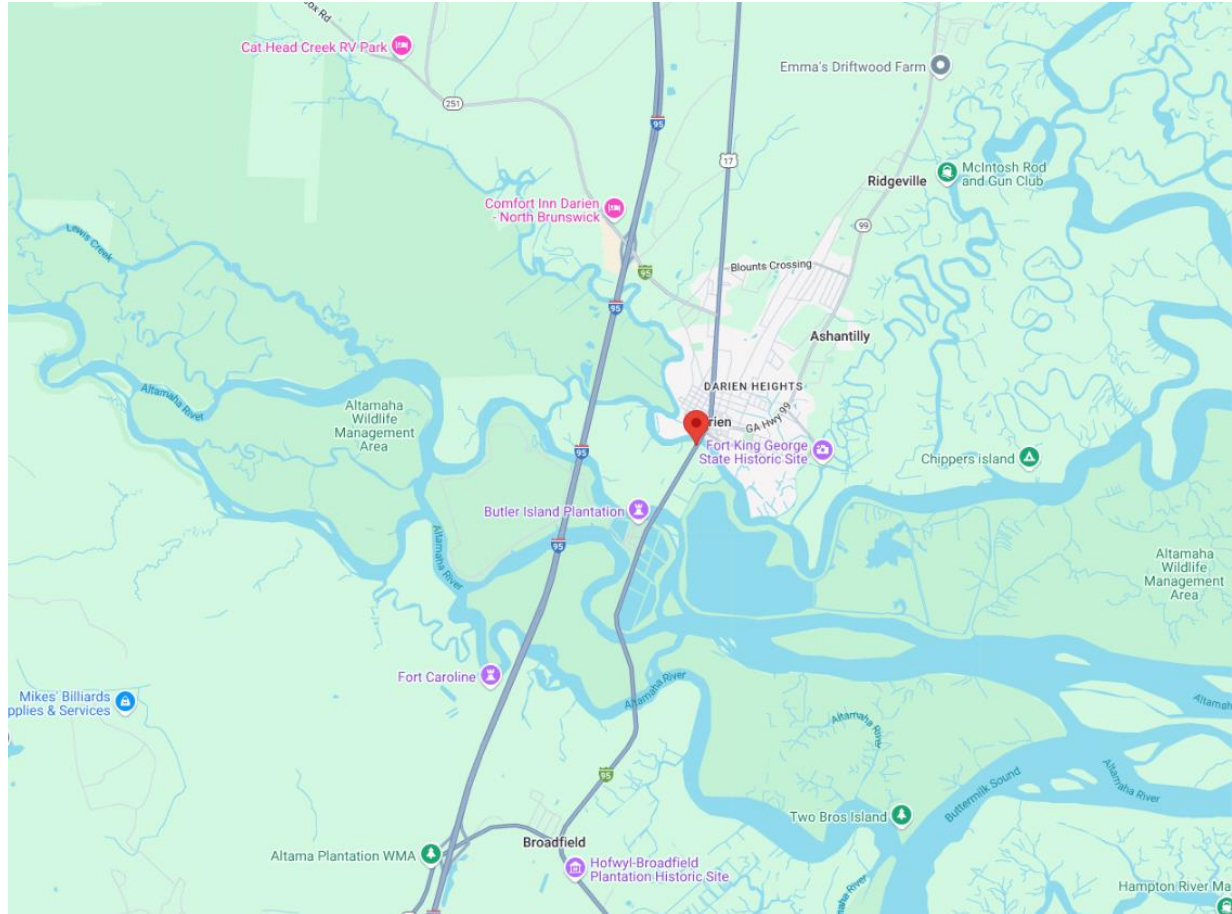
Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement





# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement



# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement

### Current Bridge Condition

- Deck Rating = 6
- Superstructure Rating = 4
- Substructure Rating = 4

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement

### Alternative 1

191-0007-0 Bridge Rehab in 2026 Actions											
Year #	Year	Action(s)	Agency Cost			Road User Cost			Total Cost		
			2024 \$	Inflated \$	PV \$	2024 \$	Inflated \$	PV \$	2024 \$	Inflated \$	PV \$
3	2026	Deck Rehab w LMC Overlay Substructure Rehabilitation Bearing Replacement	\$8,269,185.32	\$8,603,260.40	\$8,603,260.40	\$1,500,771.00	\$1,561,402.15	\$1,561,402.15	\$9,769,956.32	\$10,164,662.55	\$10,164,662.55
9	2032	Paint Structure	\$531,840.00	\$623,135.33	\$623,135.33	\$0.00	\$0.00	\$0.00	\$531,840.00	\$623,135.33	\$623,135.33
26	2049	Bridge Replacement	\$143,185,112.00	\$234,910,353.07	\$234,910,353.07	\$7,980,047.00	\$13,092,112.94	\$13,092,112.94	\$151,165,159.00	\$248,002,466.01	\$248,002,466.01
46	2069	Bridge Preservation	\$4,821,511.50	\$11,754,142.09	\$11,754,142.09	\$0.00	\$0.00	\$0.00	\$4,821,511.50	\$11,754,142.09	\$11,754,142.09
86	2109	Bridge Rehabilitation	\$58,623,856.72	\$315,565,114.29	\$315,565,114.29	\$0.00	\$0.00	\$0.00	\$58,623,856.72	\$315,565,114.29	\$315,565,114.29
Subtotal:			\$571,456,005.18			\$14,653,515.09			\$586,109,520.27		
30 years until next replacement						Residual Value ((Remaining Life=30)/(Service Life=103))			(\$290,401,413.71)		
						<b>Total Life Cycle Cost:</b>			<b>\$295,708,106.55</b>		

### Alternative 2

191-0007-0 Bridge Replace in 2030 Actions											
Year #	Year	Action(s)	Agency Cost			Road User Cost			Total Cost		
			2024 \$	Inflated \$	PV \$	2024 \$	Inflated \$	PV \$	2024 \$	Inflated \$	PV \$
7	2030	Bridge Replacement	\$143,185,112.00	\$161,249,692.13	\$161,249,692.13	\$7,980,047.00	\$8,986,829.04	\$8,986,829.04	\$151,165,159.00	\$170,236,521.17	\$170,236,521.17
27	2050	Bridge Preservation	\$4,821,511.50	\$8,068,404.68	\$8,068,404.68	\$0.00	\$0.00	\$0.00	\$4,821,511.50	\$8,068,404.68	\$8,068,404.68
67	2090	Bridge Rehabilitation	\$60,092,852.79	\$222,041,502.84	\$222,041,502.84	\$0.00	\$0.00	\$0.00	\$60,092,852.79	\$222,041,502.84	\$222,041,502.84
Subtotal:			\$391,359,599.66			\$8,986,829.04			\$400,346,428.69		
11 years until next replacement						Residual Value ((Remaining Life=11)/(Service Life=103))			(\$106,480,518.36)		
						<b>Total Life Cycle Cost:</b>			<b>\$293,865,910.33</b>		

# 2024 BrMUG Annual Meeting

Long Beach, CA | September 17-18



## Bridge No. 191-0007-0 – Bridge Rehab vs Bridge Replacement

