Escambia County Bridge Prioritization & Budget Report

2018

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Table of Contents

1.0 Introduction

As of January 2018, Escambia County maintains a bridge inventory of 145 bridges. A large percentage of the bridge inventory is nearing or has passed its useful service life. Without prompt attention, the rate of deterioration will increase rapidly in the coming years leading to decreased safety, increased weight restrictions and additional bridge closures.

To establish a required yearly budget to maintain the bridge inventory and prioritize the distribution of funds, the Engineering Division of the Escambia County Public Works Department developed a bridge prioritization and budget process. This process is used as a tool to determine required actions and necessary funding to prevent deterioration of the bridge inventory and improve the safety and functionality of the county maintained bridges. A description of the process used to rank the bridge inventory based on condition and estimate required rehabilitation and replacement costs is provided in Appendix A. Throughout this report, the term inventory will refer to the Escambia County maintained bridge inventory.

2.0 Inventory Condition Summary

Table 2.1 provides a condition summary of the inventory based on the bridge inspection reports available on April 27, 2018.

Table 2.1 Current Condition Summary

Item	Number	% of Inventory	Comments
Bridges in Inventory	145	100%	Does not include new bridges that have not been inspected
Structurally Deficient	21	14%	Indicates the strength of the bridge
Functionally Obsolete	33	23%	Indicates if the bridge is adequate for current conditions
Does not meet FDOT LOS	105	72%	FDOT minimum desired condition state / level of service (LOS)
Does not meet County LOS	51	35%	Escambia County desired condition state / level of service (LOS)
Sufficiency Rating < 50	31	21%	FHWA minimum for replacement funding
Sufficiency Rating < 80	84	58%	FHWA minimum for rehabilitation funding
Posted < 17 tons	24	17%	Single Unit Truck legal weight limit
Posted for Weight Restrictions	66	46%	Some legal Florida vehicles are not allowed to cross the bridge
0 years remaining life	10	7%	Expected remaining bridge life based on condition and type
< 10 years remaining life	19	13%	Expected remaining bridge life based on condition and type
< 20 years remaining life	73	50%	Expected remaining bridge life based on condition and type
> 50 years old	77	53%	Traditional design service life for older bridges
Timber piles > 30 years old	63	43%	Traditional maximum service life for timber substructure

The average bridge age is 41.7 years. The Level of Service (LOS) represents the condition state of the bridge system. It is a measure of how well the bridges meet the standards which have been set for the system. The Florida Department of Transportation (FDOT) is proactive in its bridge program and sets a high mark for its minimum LOS. The FDOT goal is that 90% of Department maintained bridges meet the Department standards. A bridge that meets the Department standards has the

following characteristics:

1. Shows no evidence of Structural Deterioration
2. Not limited by Weight Restrictions
3. Not needing Preventative Maintenance

Although this is a high standard, the proactive approach has enabled the FDOT to reach this goal and maintain its bridge system in very good condition. Currently, over 95% of all FDOT-maintained bridges meet strict department standards and 100% of the open bridges are safe. Because it takes less money to maintain a bridge in very good condition than it takes to maintain it in a poor condition, the FDOT desired LOS is a good long-term target for the County to pursue. There are 105 bridges, 72% of the inventory, which do not meet the FDOT desired LOS. The county has a less stringent desired LOS which places greater emphasis on minimum bridge strength requirements. (see Appendix A). Although meeting the county desired level of service requires a lower initial capital expenditure, the long-term costs of maintaining a bridge inventory in a poor condition are higher than that required from improving the condition state immediately. There are 51 bridges, 35% of the inventory, which do not meet the county's desired LOS.

The estimated remaining bridge life is an indicator of potential problems. There are 19 bridges (13%) which have estimated remaining service lives less than 10 years. These bridges are likely to have reduced bridge posted load limits and closures over the next 5 years.

Another indicator of potential problems is the age of bridges with timber substructures. A typical average service life for a bridge with non-maintained timber piles is 30 years before significant maintenance is required. There are 68 timber substructure bridges in the inventory and 63 of these bridges (43%) are over 30 years old. A National Bridge Institute (NBI) rating of 4 indicates a poor condition for substructures. There are 14 timber substructure bridges in the inventory with a NBI substructure rating of 4 or less which have significant problems. There are 21 timber substructure bridges with a NBI substructure rating of 5 which have the potential for problems in the next 5 years.

3.0 Required Bridge Funding

The required bridge budget needed to meet both the FDOT and county minimum desired LOS was calculated using minimum current funding and using the minimum long-term funding. A repair cost and repaired remaining service life was estimated for each bridge based on conditions reported in the bridge inspection reports. A bridge replacement size and cost was also estimated for each bridge and compared to the repair cost using a Present Cost (PC) analysis for both options using the formula:

$$PC = \text{Future Cost} * (1+r)^{-n}$$

where, r = rate of return (decimal form) and n = number of years. Refer to Appendix A for additional information concerning how the repair and replacement parameters are determined. The Current Financial Needs for the inventory are shown in Table 3.1.

Table 3.1 Current Financial Needs

Item	Cost	Comments
Recommended Funds required to reach FDOT desired LOS	$ 329,707,658	Using best financial choice for each bridge
Possible FDOT funding	$ 22,528,349	Includes funded and unfunded list
Required County funding to reach FDOT desired LOS	$ 307,179,309	Using best financial choice for each bridge
Minimum Funds required to reach FDOT desired LOS	$ 167,692,141	Using least cost choice for each bridge
Possible FDOT funding	$ 21,504,904	Includes funded and unfunded list
Required County funding to reach FDOT desired LOS	$ 146,187,237	Using least cost choice for each bridge
Recommended Funds required to reach County desired LOS	$ 122,279,848	Using best financial choice for each bridge
Possible FDOT funding	$ 15,609,596	Includes funded and unfunded list
Required County funding to reach County desired LOS	**$ 106,670,252**	Using best financial choice for each bridge
Minimum Funds required to reach County desired LOS	$ 46,610,895	Using least cost choice for each bridge
Possible FDOT funding	$ 13,562,956	Includes funded and unfunded list
Required County funding to reach County desired LOS	$ 33,047,940	Using least cost choice for each bridge
Minimum Required Yearly Bridge Funds (maintenance & repairs)	**$ 9,359,084**	Maintenance and prompt action repairs

Table 3.1 Notes:

1. All funding costs are based on County letting work, which may be significantly lower than FDOT cost estimates.
2. LOS = Level of Service which measures the condition and suitability of the bridge inventory.
3. Recommended funding is based on best long-term investment of funds.
4. Minimum required yearly bridge funding does not include any funding for emergency bridge repairs, bridge replacements, or improvement of the inventory. It represents the approximate required funding to keep the bridge inventory at its current LOS by performing all recommended bridge repairs in the current year. Bridge safety can be maintained by performing fewer repairs, but the bridge inventory LOS will degrade.
5. Totals represent required funding if goal is to be met in current year.
6. Estimated funds are based on available information at the time of the report and an inventory level analysis based on conditions reported in the BIR's. Actual costs will vary.
7. FDOT and county funding distribution does not include required county participation funds in FDOT projects.

The best long-term financial choice for Escambia County bridge funding is to bring the inventory up to FDOT standards as quickly as possible. As shown in Table 3.1, this would require more than $307 million to be utilized in the current year. Note that this amount includes replacement of the Bob Sikes bridges and CR 184 over Escambia River. The minimum funds required to meet the lesser county desired LOS for one year using a combination of repairs and replacements is more than $33 million.

A more accurate method to determine required funding is to develop a work plan based on the disposition of each bridge over several years. A 10-year work program to raise the inventory to minimum county desired LOS was developed for this report. Funding required to perform emergency repairs, minor maintenance, and two small bridge replacements was used to determine the 2018 required budget. Budgets were determined for years 2019 to 2027 to bring each bridge up to the minimum county goals along with estimated emergency repair costs. Year 2018 utilizes reduced pricing for the bridge replacement based on the cost savings shown on the CR99A over Freeman Springs Branch and Nokomis Road over Brushy Creek projects. Years 2 through 10 do not include planned repairs because the repairs will require a future repair or replacement within a 10-year period. Replacement costs do not utilize any savings from county performed work for years 2 through 10. The total required funding for this 10-year program is approximately $63 million. A 10% emergency repair estimate was used for the duration of the work program. No funding for the Bob Sikes bridges or general maintenance was included in this program. A repair cost of $10 million distributed over years 7 and 8 was included in the program for the CR 184 over Escambia River bridge. Tables 3.2 and 3.3 show the required funding for the 10-year work program.

Table 3.2 Budget Distribution Plan Years 2018 to 2022

Year:	2018		2019		2020		2021		2022	
Item	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%
Replacement =	$ 675,000	35.6	$ 5,753,177	90.0	$ 5,903,820	90.0	$ 6,039,088	90.0	$ 6,035,936	90.0
Planned Repair =	$ 641,540	33.8	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0
Emergency Repair =	$ 473,847	25.0	$ 639,242	10.0	$ 655,980	10.0	$ 671,010	10.0	$ 670,660	10.0
New Bridges =	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0
Maintenance =	$ 105,000	5.5	$ 0	0.0	$ 0	0.0	$ (0)	0.0	$ 0	0.0
Total Bridge Budget =	**$ 1,895,387**	100.0	**$ 6,392,419**	100.0	**$ 6,559,800**	100.0	**$ 6,710,098**	100.0	**$ 6,706,596**	100.0
Total 5-year Budget =	**$ 28,264,300**									

Table 3.3 Budget Distribution Plan Years 2023 to 2027

Year:	2023		2024		2025		2026		2027	
Item	Cost	%	Cost	%	Cost	%	Cost	%	Cost	%
Replacement =	$ 6,191,477	90.0	$ 1,668,978	24.0	$ 957,671	13.5	$ 6,336,011	90.0	$ 6,120,878	90.0
Planned Repair =	$ -	0.0	$ 4,588,288	66.0	$ 5,411,712	76.5	$ -	0.0	$ -	0.0
Emergency Repair =	$ 687,942	10.0	$ 695,252	10.0	$ 707,709	10.0	$ 704,001	10.0	$ 680,098	10.0
New Bridges =	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0	$ -	0.0
Maintenance =	$ 0	0.0	$ (0)	0.0	$ (0)	0.0	$ (0)	0.0	$ 0	0.0
Total Bridge Budget =	**$ 6,879,420**	100.0	**$ 6,952,517**	100.0	**$ 7,077,092**	100.0	**$ 7,040,012**	100.0	**$ 6,800,976**	100.0
Total 5-year Budget =	**$ 34,750,017**									

As shown in Tables 3.2 and 3.3, $6.4 to $7.1 million per year will be required to improve the inventory condition to meet the minimum county desired LOS within 10 years. This work program includes the replacement of 45 bridges with timber substructures. It is anticipated that similar spending levels to those shown would be required following the 10-year period until all bridges with timber substructures are replaced. In addition, **this plan does not address the required funding for replacement of the large asset bridges such as Bob Sikes and CR 184 over Escambia River.**

4.0 Proposed Work Plan

Table 4.1 shows the proposed bridge work plan for the next 5 years along with the ranking of the bridge inventory based on the process and approved formula shown in Appendix A. The disposition of each bridge is listed as Maintain, Fix, or Replace for each year. The actual disposition of each bridge will vary considerably beyond a few years and only 5 years of the 10-year work plan are provided. The replacement schedule column identifies who will replace the bridge and “Other” in this column refers to an FDOT replacement with no letting date identified. FDOT replacement costs do not contribute to the required budget funding shown except the county’s contribution for OC Phillips and Dawson Road bridge replacements are included. Costs for the Detroit Blvd and Cove Ave over 8 Mile Creek, currently under construction, are not included in the 2018 budget. In addition, costs for the potential replacement of CR 295A (Old Cory Field Road) bridge replacement in 2018 are not included.

Table 4.1 5-Year Work Plan (Replacement Schedule: FDOT; County; Other)

Bridge Rank	Bridge No.	Bridge Name	Yearly Planned Bridge Action					Replace Schedule
			2018	2019	2020	2021	2022	
1	484050	Bratt Road @ Canoe Creek	Maintain	Replace	Maintain	Maintain	Maintain	FDOT
2	484030	CR 99A @ Boggy Creek	Replace	Maintain	Maintain	Maintain	Maintain	FDOT
3	480105	CR 97A @ Boggy Creek	Replace	Maintain	Maintain	Maintain	Maintain	FDOT
4	484048	Crary Road @ Pritchett Mill Creek	Maintain	Replace	Maintain	Maintain	Maintain	FDOT
5	484075	Klondike Road @ Eight Mile Creek	Fix	Maintain	Maintain	Maintain	Maintain	Other
6	484029	Occie Phillips Road @ Brushy Creek	Fix	Maintain	Maintain	Maintain	Replace	FDOT
7	484057	Detroit Blvd @ 8 Mile Creek	Replace	Maintain	Maintain	Maintain	Maintain	County
8	484008	Pineville Road @ Jackson Springs Branch	Fix	Maintain	Maintain	Maintain	Maintain	N
9	484054	Gibson Road @ Alligator Creek	Fix	Maintain	Maintain	Maintain	Maintain	N
10	484023	Guidy Lane @ Unnamed Branch	Maintain	Replace	Maintain	Maintain	Maintain	N
11	484047	Lambert Bridge Road @ Pine Barren Creek	Fix	Maintain	Maintain	Maintain	Maintain	Other
12	484063	Stacy Road @ Branch	Maintain	Maintain	Maintain	Maintain	Replace	N
13	480088	CR 196 @ Jacks Branch	Replace	Maintain	Maintain	Maintain	Maintain	FDOT
14	480030	CR 99A @ Freeman Springs Branch	Replace	Maintain	Maintain	Maintain	Maintain	N
15	484039	Schagg Road @ Jack's Branch	Maintain	Maintain	Maintain	Maintain	Maintain	Other
16	484037	Bet Raines Road @ Jack's Branch	Fix	Maintain	Maintain	Maintain	Maintain	Other
17	484071	Interstate Circle @ Eight Mile Creek	Fix	Maintain	Maintain	Maintain	Maintain	N
18	484015	Rigby Road @ Beaver Dam Creek	Fix	Maintain	Maintain	Maintain	Maintain	N
19	484065	Pinetop Road @ Branch	Maintain	Replace	Maintain	Maintain	Maintain	N
20	480099	CR 168 @ Unnamed Branch	Maintain	Replace	Maintain	Maintain	Maintain	FDOT
21	484058	Cove Ave @ 8 Mile Creek	Replace	Maintain	Maintain	Maintain	Maintain	County
22	484002	Pineville Road @ Long Hollow Creek	Maintain	Replace	Maintain	Maintain	Maintain	N
23	484004	Nokomis Road @ Brushy Creek	Maintain	Replace	Maintain	Maintain	Maintain	N
24	484003	Nokomis Road @ Reedy Branch	Replace	Maintain	Maintain	Maintain	Maintain	N
25	480117	CR 99A @ Little Pine Barren Creek	Maintain	Replace	Maintain	Maintain	Maintain	County
26	480114	CR 182 @ Alligator Creek	Fix	Maintain	Maintain	Maintain	Maintain	N
27	484072	Longleaf Drive @ Bayou Marcus Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
28	484060	Klondike Road @ Unnamed Branch	Maintain	Maintain	Replace	Maintain	Maintain	N
29	484034	Crabtree Church Road @ Alligator Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N

Bridge Rank	Bridge No.	Bridge Name	Yearly Planned Bridge Action					Replace Schedule
			2018	2019	2020	2021	2022	
30	480039	CR 4 @ Canoe Creek	Maintain	Maintain	Maintain	Maintain	Maintain	FDOT
31	484009	Pine Barren Road @ Unnamed Branch	Maintain	Maintain	Replace	Maintain	Maintain	N
32	484069	Patricia Drive @ Bayou Marcus Creek	Replace	Maintain	Maintain	Maintain	Maintain	FDOT
33	480027	CR 168 @ Hobbs Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
34	480026	CR 168 @ Reedy Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
35	480028	CR 186 @ Eleven Mile Creek	Maintain	Maintain	Replace	Maintain	Maintain	N
36	484011	Rockaway Creek Road @ Unnamed Branch	Fix	Maintain	Maintain	Maintain	Maintain	N
37	480108	CR 97 @ Jacks Branch	Maintain	Maintain	Maintain	Replace	Maintain	N
38	484059	Klondike Road @ Branch	Maintain	Maintain	Replace	Maintain	Maintain	N
39	484000	Pineville Road @ Unnamed Branch	Maintain	Maintain	Replace	Maintain	Maintain	N
40	484056	Chestnut Road @ Branch	Maintain	Maintain	Maintain	Replace	Maintain	N
41	484067	Devine Farm Road @ Branch of 11 Mile Creek	Maintain	Maintain	Maintain	Replace	Maintain	N
42	484017	Dortch Road @ Beaverdam Creek	Replace	Maintain	Maintain	Maintain	Maintain	FDOT
43	484006	Lambert Bridge Road @ Little Pine Barren Creek	Fix	Maintain	Maintain	Maintain	Maintain	N
44	484079	Waycross Road @ Branch	Maintain	Replace	Maintain	Maintain	Maintain	N
45	480040	CR 4 @ Reedy Creek	Maintain	Maintain	Maintain	Replace	Maintain	N
46	484083	Woodrun Rd. @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
47	484042	River Annex Road @ Perdido River Relief	Fix	Maintain	Maintain	Maintain	Maintain	N
48	484043	Beulah Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Replace	N
49	480120	CR 99 @ Alligator Creek	Maintain	Maintain	Maintain	Maintain	Replace	N
50	484064	Mckenzie Road @ Branch of Williams Creek	Maintain	Maintain	Maintain	Maintain	Replace	N
51	480045	CR 184 @ Escambia River	Maintain	Maintain	Maintain	Maintain	Maintain	N
52	484049	Wawbeek Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
53	484046	Dawson Road @ Pritchett Mill Branch	Maintain	Maintain	Maintain	Maintain	Replace	FDOT
54	484028	Tungoil Road @ McDavid Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
55	484080	Atlanta Ave. @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
56	480107	CR164 @ Pine Barren Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
57	480103	CR 99A @ Brushy Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
58	480087	CR 196 @ Cowdevil Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N

Bridge Rank	Bridge No.	Bridge Name	Yearly Planned Bridge Action					Replace Schedule
			2018	2019	2020	2021	2022	
59	484012	Greenland Road @ Pine Barren Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
60	484019	Breastworks Road @ Hall Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
61	484221	Marcus Pointe Boulevard @ Bayou Marcus Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
62	484222	Marcus Pointe Boulevard @ Crescent Lake Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
63	484032	Chestnut Road @ Dry Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
64	484081	Augusta Ave. @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
65	480110	CR 184 @ Perdido River	Maintain	Maintain	Maintain	Maintain	Maintain	N
66	480098	CR 99 @ Pine Barren Creek	Fix	Maintain	Maintain	Maintain	Maintain	FDOT
67	484038	Schagg Road @ Branch of Jack's Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
68	484041	Fairground Road @ Wilder Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
69	484018	Breastworks Road @ Breastworks Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
70	480139	CR 399(Bob Sikes) @ Santa Rosa Sound (East Bridge)	Maintain	Maintain	Maintain	Maintain	Maintain	N
71	484020	Hanks Road @ Breastworks Creek	Maintain	Maintain	Maintain	Maintain	Maintain	FDOT
72	484084	Woodrun Rd. @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
73	480123	CR 399(Bob Sikes) @ Santa Rosa Sound (West Bridge)	Maintain	Maintain	Maintain	Maintain	Maintain	N
74	484016	Still Road @ Pine Barren Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
75	480131	CR 196 (Jack's Branch Road) @ Penasula Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
76	484040	Cedartown Road @ Wilder Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
77	480044	CR 184 @ Escambia River Relief	Maintain	Maintain	Maintain	Maintain	Maintain	N
78	480025	CR 168 @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
79	484001	Jakes Road over Reedy Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
80	484061	Bluff Springs Road @ Branch 1	Maintain	Maintain	Maintain	Maintain	Maintain	N
81	484062	Bluff Springs Road @ Branch 2	Maintain	Maintain	Maintain	Maintain	Maintain	N
82	484066	Tate Road @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
83	484014	Rockaway Creek Road @ Rocky Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
84	480038	CR 4 @ Pine Barren Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
85	480097	CR 99 @ Little Pine Barren Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
86	480176	CR 184 @ Ditch	Maintain	Maintain	Maintain	Maintain	Maintain	N
87	484092	CR 295A (Old Corry Field Road) @ Jackson Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N

Bridge Rank	Bridge No.	Bridge Name	Yearly Planned Bridge Action					Replace Schedule
			2018	2019	2020	2021	2022	
88	480093	CR 99 @ McDavid Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
89	484077	CR 341/Marlane Drive @ Bayou Marcus Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
90	484238	Bridge Creek Drive @ Bridge Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
91	484234	Bucyrus @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
92	484227	Tate Road @ Branch of Eleven Mile Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
93	480132	CR 297 @ Unnamed Stream	Maintain	Maintain	Maintain	Maintain	Maintain	N
94	480154	CR 4 @ Beaver Dam Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
95	480129	CR 297A @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
96	484217	Fannie Road @ Big Escambia Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
97	484085	Woodrun Rd. @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
98	484235	Caterpillar Lane @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
99	484094	Foxrun Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
100	484231	Star Lake Road @ Star Lake	Maintain	Maintain	Maintain	Maintain	Maintain	N
101	484271	Northpointe Blvd Over Graveyard Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
102	484292	Jamesville Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
103	484233	Siskin Lane Over Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
104	480119	CR 168 @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
105	484189	CR 297A @ Eleven Mile Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
106	484228	Cantonment Ath @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
107	484229	Tecumseh Trail Over Clear Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
108	484267	CR182 Over Penasula Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
109	480116	CR 182 @ Dry Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
110	484236	Creek Bridge Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
111	484257	Bluff Springs Road over Pritchett Mill Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
112	480130	CR 297A @ Branch of 11 Mile Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
113	484239	Pineville Road @ Brushy Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
114	484253	Bauer Road-CR 293 Over Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
115	484089	Meadow Brook Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
116	484090	Burning Tree Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N

Bridge Rank	Bridge No.	Bridge Name	Yearly Planned Bridge Action					Replace Schedule
			2018	2019	2020	2021	2022	
117	480109	CR 97 @ Cowdevil Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
118	484219	CR 297 (Pine Forest Road) @ Branch of Eleven Mile Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
119	480128	CR 196 (97A) @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
120	484185	CR 292A (Old Gulf Beach Hwy) @ Bayou Grande	Maintain	Maintain	Maintain	Maintain	Maintain	N
121	484216	Barrineau Park Road @ Perdido River	Maintain	Maintain	Maintain	Maintain	Maintain	N
122	484223	Bellview Avenue @ Turner's Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
123	484291	Mills (Smiths) Swamp House over Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
124	484999	Wild Lake Blvd Over Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
125	484242	Stefani Road @ Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
126	484245	CR 292A Sunset Ave over Bayou Grande	Maintain	Maintain	Maintain	Maintain	Maintain	N
127	484212	CR 295A (Old Corry Field Road) @ Jackson Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
128	484252	Johnson Avenue @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
129	484210	Ten Mile Road @ Thompson Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
130	484244	Airway Drive Over Ditch	Maintain	Maintain	Maintain	Maintain	Maintain	N
131	484248	SW Sports Cmplx Rd Over Ditch	Maintain	Maintain	Maintain	Maintain	Maintain	N
132	484249	SW Sports Cmplx Rd Over Ditch	Maintain	Maintain	Maintain	Maintain	Maintain	N
133	484251	Brickyard Road Over Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
134	484276	Ashland Ave Over 8 Mile Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
135	484226	CR 97A @ West Fork of Boggy Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
136	484224	Bauer Road @ Judd Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
137	484240	Beck's Lake Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
138	484273	Stillbrook Road Over Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
139	484241	Brickyard Road @ Unnamed Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
140	484232	Fannie Road @ Dead Lake	Maintain	Maintain	Maintain	Maintain	Maintain	N
141	484243	Rocky Branch Rd Over Rocky Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
142	484246	Sunshine Hill Road @ Branch (2M. S. 97)	Maintain	Maintain	Maintain	Maintain	Maintain	N
143	484250	Brickyard Road Over Big Branch	Maintain	Maintain	Maintain	Maintain	Maintain	N
144	484261	Sandy Hollow Road over Sandy Hollow Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N
145	484264	Ora Drive Over Bridge Creek	Maintain	Maintain	Maintain	Maintain	Maintain	N

Table 4.2 lists the Escambia County Off-System bridges included in the previous and next 5-year work plans. As shown in the table, the number of bridges to be replaced by the FDOT in the next 5 years is less than the number replaced in the previous 5 years.

Table 4.2 FDOT Work Plan

BIN	Name	Begin Construction	Contractor	Replacement Number	Status
480039	CR4 W HWY 4 CANOE CREEK BRIDGE	2023			Planned
480041	STEFANI ROAD OVER UNNAMED BRANCH	2015	F&W	484242	Complete
480088	CR 196 OVER JACKS BRANCH	2018	GDB-US		Under Const.
480096	CR 292A SUNSET AVE BAYOU GRANDE	2015	Scott	484245	Complete
480098	CR 99 OVER PINE BARREN CREEK	2017	AC		Under Const.
480099	CR 168 OVER UNNAMED BRANCH	2019			Planned
480105	CR 97A OVER BOGGY CREEK	2017	Murphree		Under Const.
480106	CR 97A OVER W FORK OF BOGGY CK	2013	Murphree	484226	Complete
480115	CR 182 OVER PENASULA CREEK	2017	F&W	484267	Complete
484007	PINEVILLE ROAD BRUSHY CREEK BRIDGE	2014	Murphree	484239	Complete
484017	DORTCH ROAD OVER BEAVER DAM CREEK	2017	Murphree		Under Const.
484020	HANKS ROAD OVER BREASTWORKS CREEK	2019			Planned
484029	O C PHILLIPS ROAD OVER BRUSHY CREEK	2022			Planned
484030	CR 99A OVER BOGGY CREEK BRIDGE	2017	AC		Under Const.
484036	BECK'S LAKE ROAD OVER UNNAMMED BRANCH	2014	Roads Inc	484240	Complete
484045	FANNIE ROAD OVER DEAD LAKE	2014	F&W	484232	Complete
484046	DAWSON ROAD OVER PRITCHETT MILL BR	2022			Planned
484048	CRARY ROAD OVER PRITCHETT MILL CREEK	2019			Planned
484050	BRATT ROAD OVER CANOE CREEK	2018			Planned
484051	SANDY HOLLOW ROAD OVER SANDY HOLLOW CREEK	2017	Murphree	484261	Complete
484052	BLUFF SPRINGS RD OVER PRITCHETT MILL	2017	Murphree	484257	Complete
484053	BRICKYARD ROAD OVER UNNAMED BRANCH	2014	F&W	484241	Complete
484069	PATRICIA DRIVE OVER BAYOU MARCUS CREEK	2017	AC	484256	Under Const.
484073	BELLVIEW AVENUE OVER TURNERS CREEK	2012	AC	484223	Complete
484078	BAUER ROAD OVER UNNAMED BRANCH	2013	Murphree	484224	Complete
484039	Schagg Road @ Jack's Branch	No Letting Date, FM 422899, not in work plan			
484075	Klondike Road @ Eight Mile Creek	No Letting Date, FM 422896, not in work plan			
484037	Bet Raines Road @ Jack's Branch	No Letting Date, No FM number, candidate only			
484047	Lambert Bridge Road @ Pine Barren Creek	No Letting Date, FM 426239, not in work plan			

Escambia County has ongoing rehabilitation and bridge replacement projects under construction or design as part of the bridge maintenance program for the inventory. Prompt responses to deficient bridge conditions identified by the state are provided in the form of re-posting, bridge closures, rehabilitation projects and bridge replacements. Table 4.3 identifies the planned activities for 21 bridges which are currently either closed, require immediate attention, or will be under construction by the county in 2018. These activities are represented in the proposed $1.9 million 2018 work plan.

(Open = no restrictions, MP = Maintain Posting, PCA = Prompt Corrective Action, DEF = Deficiency, O/C = Open or Closed during construction)

Table 4.3 2018 Action Plan

Rank	BIN	Bridge Name	Status	Posted	Budget	Notes
14	480030	CR 99A @ Freeman Springs Branch	Open	NA	$ 386,000	County replaced, Pile foundation and setting bridge by Davis Marine
66	480098	CR 99 @ Pine Barren Creek	Open	31	$ 28,742	Pile rehab under traffic, DKE Marine
26	480114	CR 182 @ Alligator Creek	MP	6	$ 22,770	7 beam shims, 2 helper beams
24	484003	Nokomis Road @ Reedy Branch	Open	NA	$ 289,000	County performed full replacement
43	484006	Lambert Bridge Road @ Little Pine Barren Creek	PCA	16	$ 46,332	2 piles, wingwalls, backwall, approach
8	484008	Pineville Road @ Jackson Springs Branch	PCA	5	$ 42,390	Stub 3 piles, treat 5 piles
36	484011	Rockaway Creek Road @ Unnamed Branch	PCA	12	$ 49,650	Stub 3 piles, abutment strut
18	484015	Rigby Road @ Beaver Dam Creek	PCA	14	$ 71,370	Stub 5 piles, guardrail posts
6	484029	Occie Phillips Road @ Brushy Creek	Closed	0	$ 55,226	Stub 4 piles, abutment helper beam and struts, Gulf Marine
16	484037	Bet Raines Road @ Jack's Branch	PCA	23	$ 25,000	County stubbed 4 piles, work performed prior to reduced posted load
47	484042	River Annex Road @ Perdido River Relief	PCA	23	$ 24,210	Stub 2 piles, abutment cap strut, reduced posting not currently issued
11	484047	Lambert Bridge Road @ Pine Barren Creek	PCA	8	$ 107,850	Stub 4 piles, 2 helper beams, 4 wingwalls, cap, 15 spans misc. rehab
1	484050	Bratt Road @ Canoe Creek	Closed	0	$ -	Monitored until state closed, $94K rehab, wait for 2019 replacement
9	484054	Gibson Road @ Alligator Creek	PCA	6	$ 52,800	12 helper beams
7	484057	Detroit Blvd @ 8 Mile Creek	O / C	14	$ -	2018 construction, open until closed for construction, Chavers
21	484058	Cove Ave @ 8 Mile Creek	O / C	14	$ -	2018 construction, open until closed for construction, Chavers
17	484071	Interstate Circle @ Eight Mile Creek	PCA	7	$ 42,990	Pile strut, helper beam
5	484075	Klondike Road @ Eight Mile Creek	DEF	7	$ 72,210	Stub 3 piles, 4 helper beams, backwall
87	484092	CR 295A (Old Corry Field Road) @ Jackson Creek	Open	NA	$ -	2017 rehab corrected PCA, possible bridge replacement 2018
		Miscellaneous maintenance 484014, 484016, 484018, 480103, 480114	Open		$ 105,000	Non-structural maintenance
		Additional anticipated emergency rehab	PCA		$ 473,847	

5.0 Conclusion

A significant portion of the inventory is beyond its useful service life and the number of severe load postings and bridge closures will continue to increase without a substantial investment to fund bridge replacements. Based on current condition assessments, an annual bridge budget of more than $6 to $7 million is required to bring the inventory up to the desired county standards within a 10-year period. Out of the $1.9 million proposed 2018 work plan, only $675,000 will improve the bridge inventory while $1.22 million will allow bridges to remain open until they can be replaced.

Appendix A

A1.0 Bridge Prioritization and Estimating Process

Appendix A contains a description of the process used to rank the Escambia County Bridge Inventory to determine the best distribution of bridge funding. The Escambia County Board of Commissioners approved this process in 2010.

A2.0 Background Information

A2.1 NBI Rating

The information used to rank the bridges is taken from the Bridge Inspection Reports (BIR) obtained from the Florida Department of Transportation, FDOT, for bridges that are longer than 20' and from local consultants for shorter bridges. The national guidelines for performing bridge inspections and rating their condition on a consistent scale are the National Bridge Inspection Standards (NBIS). These Federal bridge inspection program regulations were developed as a result of the Federal-Aid Highway Act of 1968 following the collapse of the Silver Bridge in Point Pleasant, West Virginia. The United States Secretary of Transportation established the NBIS to inventory and evaluate existing bridge conditions to ensure the safety of the traveling public. Bridges longer than 20' are required to be listed in the National Bridge Inventory, NBI. Single culverts or closely spaced culverts with an overall span length greater than 20' are also considered to be NBI bridges.

NBIS general condition ratings are used to describe the current condition of a bridge or culvert. The general condition ratings are an overall assessment of the physical condition of the deck (riding surface), the superstructure (load carrying members such as beams or trusses that support the driving surface), substructures (abutments, piers, piles) or culvert. General condition ratings range from 0 (failed condition) to 9 (new condition). The General NBI Condition Ratings Table A2.1.1 is an example of how the ratings relate to the condition of the bridge components.

Table A2.1.1 General NBI Condition Ratings Table

Code	State	Description
N	NOT APPLICABLE	
9	EXCELLENT CONDITION	
8	VERY GOOD CONDITION	No problems noted.
7	GOOD CONDITION	Some minor problems.
6	SATISFACTORY CONDITION	Structural elements show some **minor deterioration**.
5	FAIR CONDITION	All primary structural elements are sound but may have minor section loss, cracking, spalling or scour
4	POOR CONDITION	**Advanced section loss**, deterioration, spalling or scour
3	SERIOUS CONDITION	Loss of section, deterioration, spalling or scour have seriously affected primary structural components. **Local failures** are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	CRITICAL CONDITION	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may have removed substructure support. Unless closely monitored it may be necessary to close the bridge until corrective action is taken.
1	"IMMINENT" FAILURE CONDITION	Major deterioration or section loss present in critical structural components or obvious vertical or horizontal movement affecting structure stability. Bridge is closed to traffic but corrective action may put back in light service.
0	FAILED CONDITION	Out of service - beyond corrective action.

A2.2 Sufficiency Rating

The sufficiency rating (SR) provides is a method of rating a bridge sufficiency compared to current standards. It uses a formula in which 55% of the total rating is based on structural adequacy and safety, 30% on serviceability and functional obsolescence, and 15% on essentiality for public use, as shown in Figure A2.2.1. The result of this calculation is a percentage in which 100% would represent an entirely sufficient bridge and 0% would represent an entirely deficient bridge. Condition ratings of the superstructure, substructure (or culvert, if applicable) and the inventory rating (load carrying capacity of the structure), have the most impact in the sufficiency rating calculation. Serviceability, functional obsolescence, and essentiality for public use are also considered in the sufficiency rating calculation. Examples of these factors include: 1) Loss of accessibility to desired locations due to a posted or closed bridge, constitutes a hardship to the public, and results in a reduction or loss of essential services such as, fire protection, police, and medical services; 2) Financial costs due to a lengthy detour can be significant. All these factors combine to produce the sufficiency rating. Calculation of the SR for a bridge is essential to the Federal Highway Administration (FHWA) funding process as well the ranking and funding process for most states.

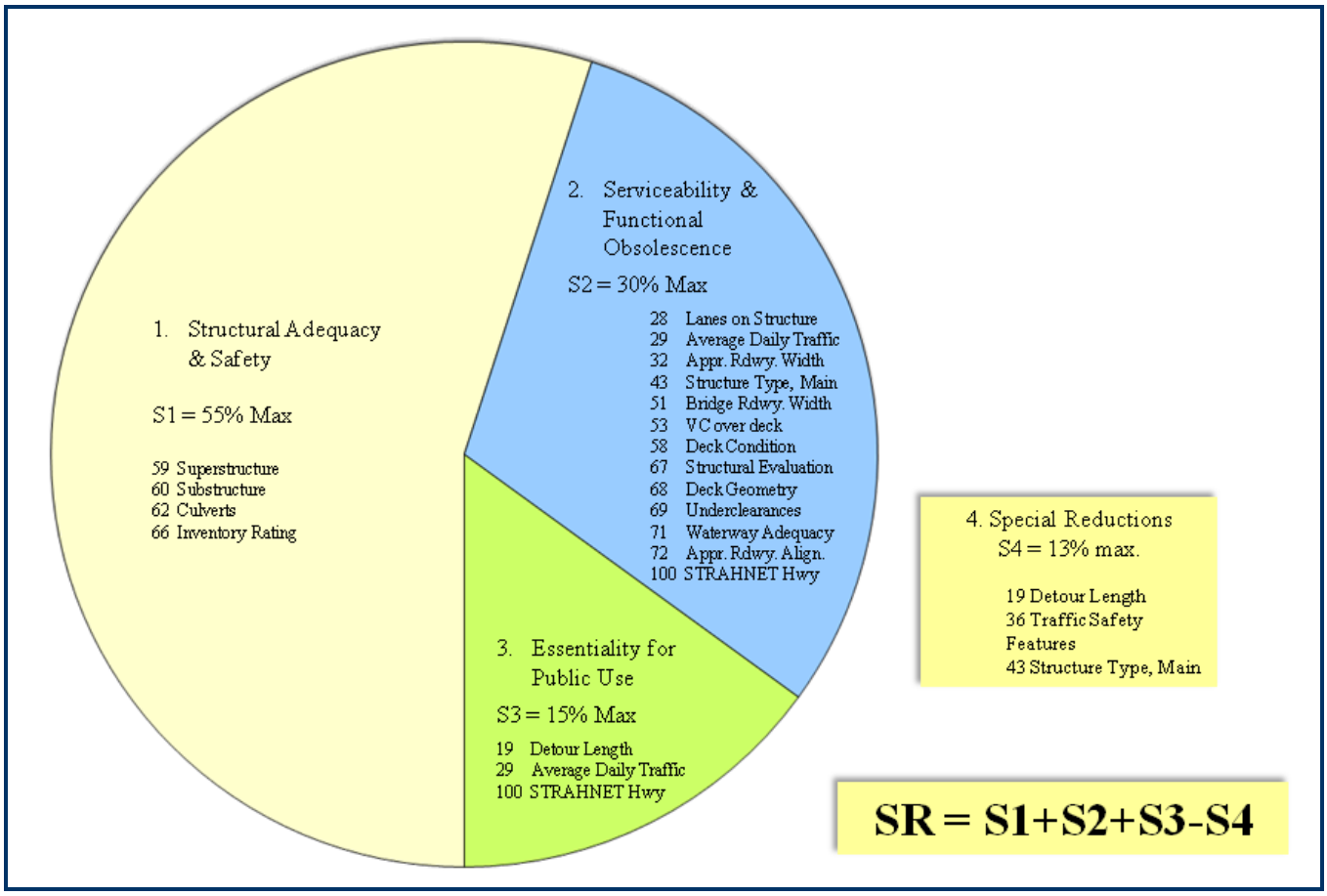


Figure A2.2.1 Sufficiency Rating

2.3 Structurally Deficient, Functionally Obsolete

To be eligible for FHWA Highway Bridge Program (HBP) funds, a bridge must meet all of the following four (4) criteria: (*NBI item numbers shown are found in the bridge inspection report)

1. Bridge must be on the NBI database. Bridges that meet the following criteria are on the NBI database:
    a. longer than 20 feet (item 49) AND
    b. highway bridge that carries a public road

2. To be eligible for rehabilitation, bridge must have a SR of 80 or less; To be eligible for replacement, bridge must have a SR of less than 50.

3. Bridge must be classified as either structurally deficient or functionally obsolete base on the NBI rating numbers.

a. To be classified as **Structurally Deficient**, a bridge must have:
   i. Rating of 4 or less for:
      1. deck (item 58) OR
      2. superstructure (item 59) OR
      3. substructure (item 60) OR
      4. culvert (item 62) OR
   ii. Rating of 2 or less for:
      1. structural evaluation (item 67) OR
      2. waterway adequacy (item 71)

b. To be classified as **Functionally Obsolete**, a bridge must have:
   i. Rating of 3 or less for:
      1. deck geometry (item 68) OR
      2. underclearance (item 69) OR
      3. approach roadway alignment (item 72) OR
   ii. Rating of 3 for:
      1. structural evaluation (item 67) OR
      2. waterway adequacy (item 71)

4. Bridge cannot have been rehabbed/reconstructed (item 106) or new/replaced (item 27) within the past 10 years, regardless of the source of funding. In addition to checking items 27 and 106, FHWA also checks its fiscal records to determine if any federal -aid funds were used to rehab/replace a bridge during the past 10 years.

A3.0 Prioritization Process

A3.1 Prioritization Examples

Numerous methods are being used by State and local governments to prioritize bridges for receiving budgetary funding for maintenance, rehabilitation, or replacement (MR&R) as well as for increasing capacity. The main goals of the prioritization process usually contain three important factors:

- ✓ **Maintain Public Safety**
- ✓ **Improve Highway Capacity**
- ✓ **Invest Bridge Funding Wisely**

The importance given to each of these factors depends on the state of the bridges in the system and the amount of money available for funding bridge activities. Managing bridge systems in good condition with high funding levels allows the use of best investment strategies in the MR&R decisions and allows more importance to be placed on improving highway capacity through building new bridges. Managing bridge systems in poor condition with inadequate funding levels requires that all emphasis be placed on maintaining public safety

without regard to best long-term investment strategies. Because increased funds are required each year just to maintain the same level of service, these bridge systems eventually descend to conditions that possibly require bridge closures. Maintaining a bridge in good condition is much more cost effective than performing repairs on a deteriorated structure.

A3.1.1 Florida Department of Transportation (FDOT)

The FDOT takes a proactive approach towards bridge maintenance by performing preventative maintenance and repairs at early stages of the deterioration process. As a result, the state of the 6,222 FDOT maintained bridges is very good. Currently, over 95% of all FDOT-maintained bridges meet strict department standards and 100% of the open bridges are safe. Because the FDOT has the necessary funding to meet its stated goals, it does not follow a prioritization process for distributing funds for MR&R, but rather performs all necessary maintenance and repairs in a timely manner as they are identified. Bridge inspections identify problems and categorize the needs for each bridge into one of three categories:

- Routine maintenance
- Periodic maintenance and repair
- Replacements

The recommendations of the inspection reports are used to create work orders with priorities from 1 to 4.

1 – Emergency, requiring work to be completed within 60 days
2 – Urgent, requiring 180-day completion
3 – Routine work to be completed within 1 year
4 – No immediate deadline

The FDOT identifies bridges to be replaced based on their deficiency status. The replacement criteria is:

- Posted Bridge
- Structurally Deficient <= 4
- Sufficiency Rating <= 50

Strength replacement bridges are programmed for construction within (6) years of deficiency identification. These bridges are either structurally deficient, or posted for weight restrictions. Economy replacement bridges require structural repair, but are more cost effective to replace. These bridges are programmed within (9) years of deficiency identification.

The FDOT allocates funding for bridge repairs to each District based on the deck area of bridges with an overall structural appraisal rating of "fair" or "poor". This performance rating is based on the lowest rating values for the deck, superstructure or substructure. (5 = fair, 4 or below = poor) The FDOT ranking of the deficient bridges is based on the lowest sufficiency rating but other dynamic factors are also considered in selecting the order of bridge replacements.

A3.1.2 California Department of Transportation (Caltrans)

Caltrans developed the Bridge Health Index (HI), which is a single number assessment of a bridge's condition base on the bridge's economic worth, determined from an element-level inspection. The HI reports the structural condition of a bridge without regard to the bridges functional adequacy. This indicator is expressed as a percentage value. This value may vary from 0%, which corresponds to the worst possible condition, to 100% in the best condition. Health index is calculated as a function of the fractional distribution of the bridge elements' quantities across the range of their applicable condition states. Health index of an individual element is calculated according to the formula shown in Figure A3.1.1.

$$HI = \left(\sum CEV / \sum TEV\right) * 100$$

$$TEV = TEQ * FC$$

$$CEV = \sum (QCS_i * WF_i) * FC$$

$$WF = [1 - (\text{Condition State \#} - 1)\ (1/\text{State Count} - 1)]$$

Figure A3.1.1 Health Index (Source: Caltrans)

where,

HI = Health Index
CEV = current element value
TEV = total element value
TEQ = total element quantity
FC = failure cost of element
QCS = quantity in a condition state
WF = weighting factor for the condition state

Caltrans uses the HI along with other weight factors in a utility formula to determine bridge priority. Some other states are using the HI in some form within their prioritization process, but FDOT District 3 does not currently consider the HI useful due to the unreliability of estimating element costs at different stages of deterioration.

A3.1.3 Connecticut Department of Transportation (ConnDOT)

ConnDOT assigns each bridge a Priority Rating, (PR), using the utility functions explained below. In general, the structures in the worst condition will have the lowest Priority Ratings, with the lowest rating being the highest priority for funding, with exceptions possible in emergency situations. The Priority Rating represents the physical condition of the structure, based upon the sufficiency rating with additional "weight" given to the ratings of the main structural components and the structure's load carrying capacity. The following formulas are used, depending upon whether the structure is a bridge or a culvert.

1. For Structures with Abutments and Piers:

PR = SR - 2 [1-(DC+SUB+SUP)/27] - 4 [1-(IR)/36]

SR = Sufficiency Rating
DC = Deck Condition Rating (0-9)
SUB = Condition Rating of Substructure (0-9)
SUP = Condition Rating of Superstructure (0-9)
IR = HS-20 Gross Inventory Rating in Tons (Tractor semi-trailer combinations inventory rating - Max. 36)

Note: The factor of 27 is the maximum ratings for deck, substructure and superstructure conditions (9 x 3) and 36 is the acceptable load limit for a structure (36 tons).

2. For Culverts and Arches:

PR = SR - 2 [1-(CUL)/9] - 4 [1-(IR)/36]

CUL = Culvert Condition Rating (0-9)

Other states and public entities have similar formulas utilizing the SR or HI with various additional weighting factors to place priority on the aspects that they deem of higher importance.

Due to this flexibility, reliability, and ease of implementation, it was determined that a utility function based on the SR would be the best method for prioritizing Escambia County maintained bridges. This approach uses information contained in the bridge inspection reports and allows additional importance to be placed on the strength and condition of the bridges in the ranking process.

A3.2 Prioritization Factors

A multitude of factors must be considered to determine which bridges should receive prioritization for funding as is shown in the Figure A3.2.1. It is helpful to differentiate these factors between those that are based solely on the structure and those that depend on other factors that are more dynamic and often difficult to quantify. The "Condition" factors, shown in yellow, provide the necessary information to evaluate the state of the structure. The "Dynamic" factors, shown in green, provide additional information used to determine the proper disposition of the deficient structures.

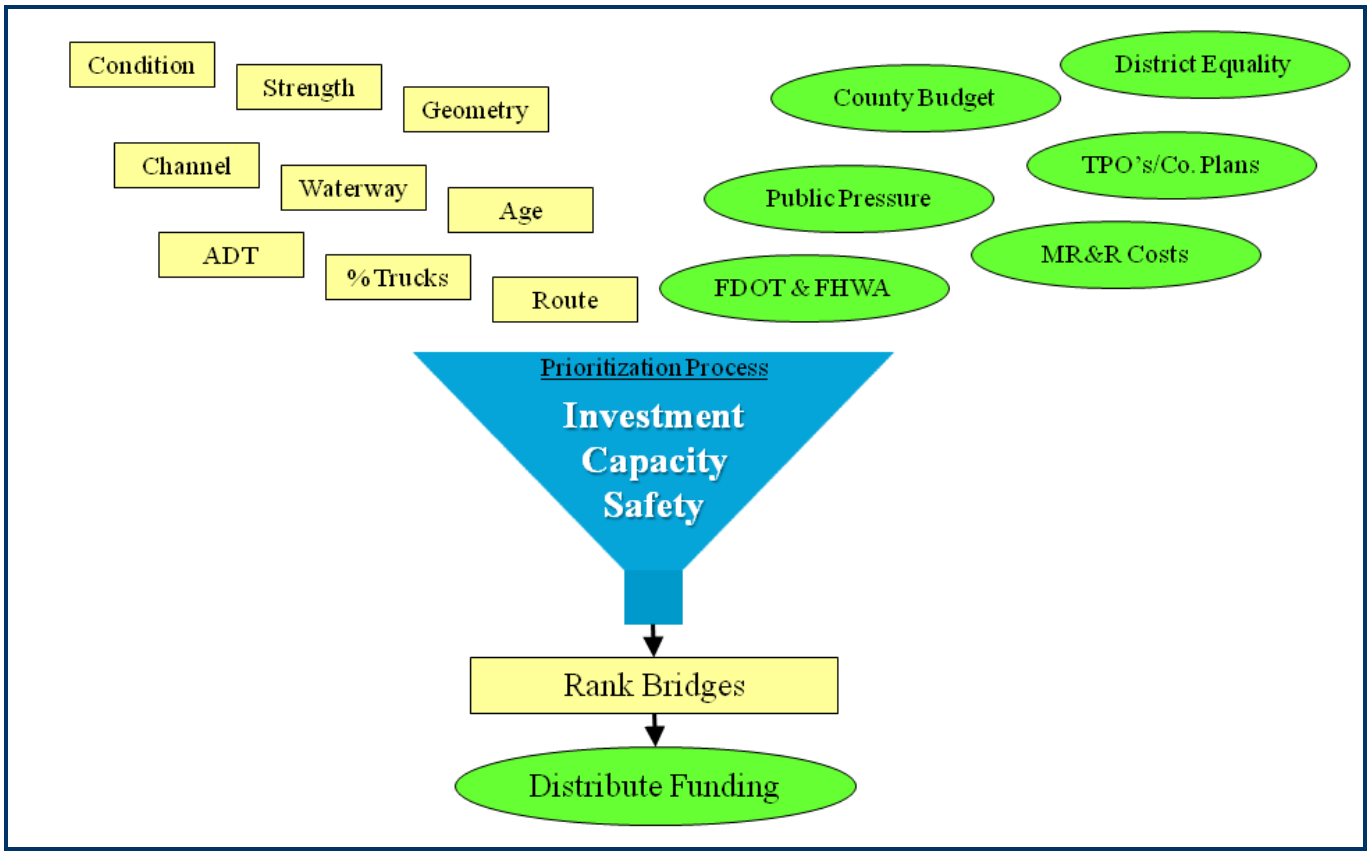


Figure A3.2.1 Prioritization Process

To provide consistency and to isolate dynamic factors which must be re-evaluated annually, the prioritization process for Escambia County is divided into two phases as is shown in the Figure A3.2.2. Phase 1, the assessment phase, utilizes the condition factors to rank the bridges in order of need. Phase 2, the funding phase, considers all the dynamic factors to make MR&R decisions and distribute funding.

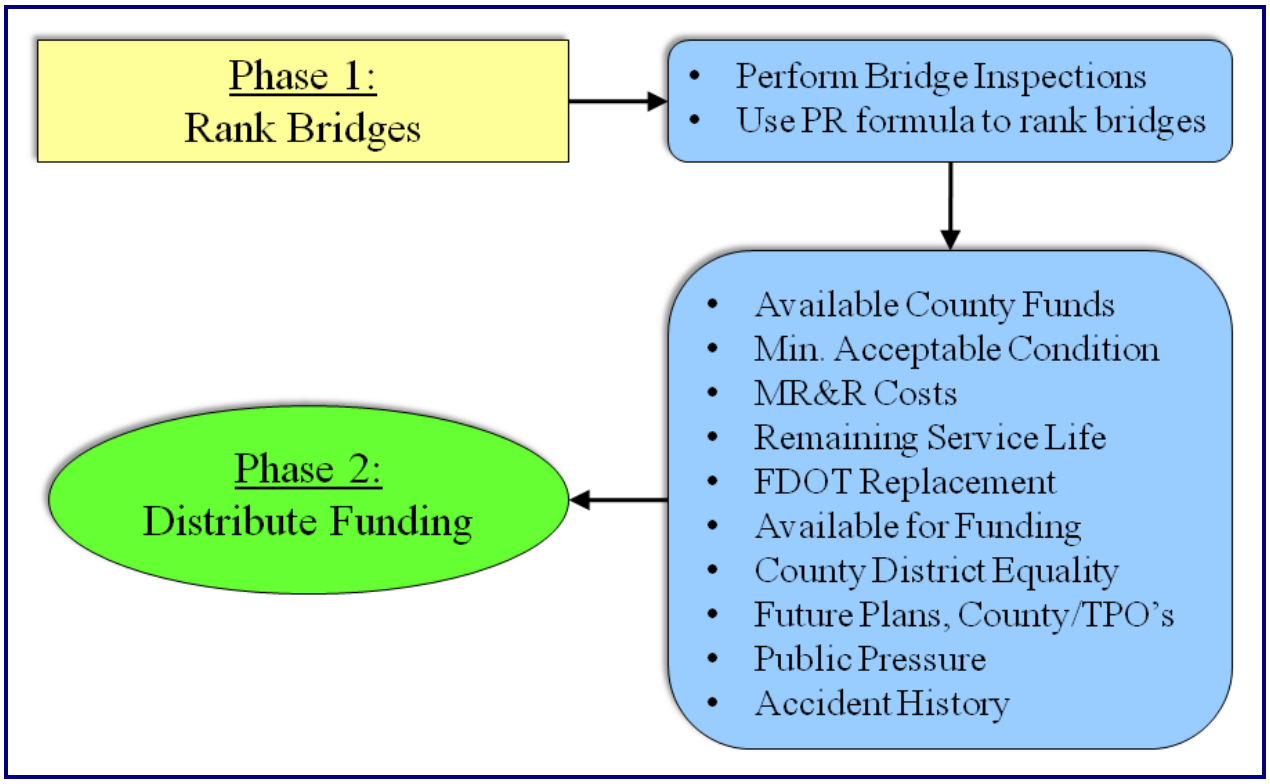


Figure A3.2.2 Prioritization Phases

A3.3 Prioritization Process Phase 1

The assessment phase examines the state of the bridges and ranks each according to its structural condition and ability to function adequately. This process utilizes the information contained in the bridge inspection reports to rank the bridges according to need, considering public safety and function.

- ***Safety*** – the top concern for the County is to maintain public safety
- ***Function*** – the bridge should be adequate to carry the crossing traffic

To rank the bridges, the County utilizes a Priority Rating, (PR), formula to rank the bridges from worst to best according to structural and functional condition. The PR formula, shown in Figure A3.3.1, utilizes the sufficiency rating (SR) and applies additional weighting factors to the structural condition and load carrying capacity of the bridges.

At some minimum level, the bridge structural condition and ability to carry traffic loads safely should control over any other factors in the ranking process. The SR rating provides a good overall assessment of a bridges ability to serve its intended purpose. As illustrated above, more than 55% of the SR rating is composed of the structural adequacy and safety considerations. The remaining 45% considers essentiality for public use (15%) and,

serviceability and functional obsolescence (30%). To apply additional importance to the strength and condition of the bridges, weighting factors F1 through F5 are included in the PR formula. Factor F1 increases the importance of the overall condition of the bridge. F2 raises the importance of the condition even higher when the state of the bridge is deteriorated to the point where it has become deficient. Factor F3 increases the importance of the overall strength of the bridge. F4 raises the importance of the strength even higher when the bridge is posted for a load below a minimum threshold value of 17 tons. This limit was set based on a bridge being able to safely carry the minimum SU2 Florida legal load on a daily basis. The SU2 vehicle is a two-axle truck that could represent a school bus, ambulance, delivery truck, or other common trucks that routinely travel over all of the County bridges. F5 raises the importance of the bridge strength even higher if the bridge carries a high percentage of truck traffic.

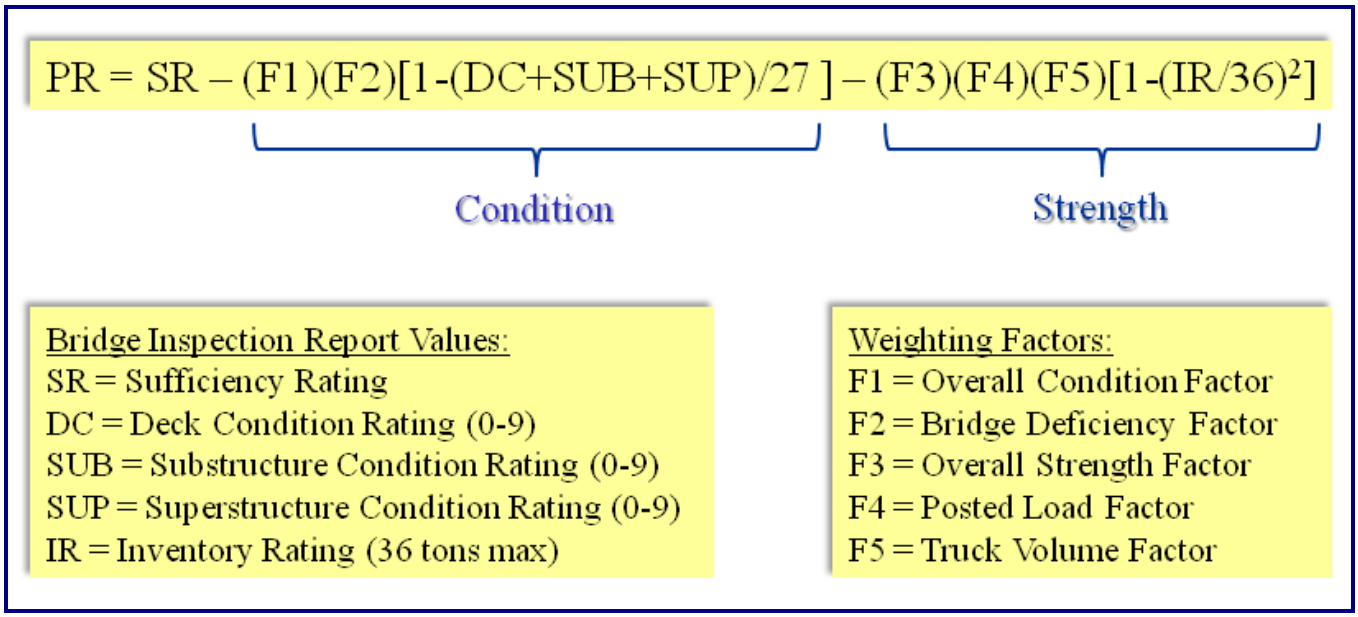


Figure A3.3.1 Basic Priority Rating Formula

The weighting factor values, F1 through F5, were determined based on reducing the SR rating an additional 45 points at a minimum acceptable condition level. This 45-point reduction is evenly divided between the condition of the bridge and the strength of the bridge.

Using DC = SUB = SUP = 4 and F2 = 2 => **F1 = 45/2/2/[1-(4+4+4)/27] = 20.2**

Using F5 = (1+%truck/10)[1 + ADT/ADT max] and considering 10% truck, 500 ADT => **F5 = 1.13**

Using F4 = 2 and a posted load of 17 tons => **F3 = 45/2/2/1.13/[1-(17/36)2] = 12.8**

With these weighting factors, the PR formula is revised to that shown in Figure A3.3.2.

for Bridges:

$$PR = SR - 20*F2*[1-(DC+SUB+SUP)/27] - 13*F4*F5*[1-(IR/36)^2]$$

for Culverts:

$$PR = SR - 20*F2*[1-(CUL)/9] - 13*F4*F5*[1-(IR/36)^2]$$

Weight Factors:
F2 = 2 for deficient bridges, 1 for others
F4 = 2 for bridges posted below 17 tons, 1 for others
F5 = (1+%Truck/10)(1+ADT/ADT max)

Figure A3.3.2 Final Priority Rating Formula

A3.4 Prioritization Process Phase 2

The funding phase of the prioritization process consists of evaluating each bridge to determine if the deficiencies should be addressed through repair, rehabilitation, replacement, or non-action. The items considered during this process include:

- Minimum and Desired Level of Service for the bridge system
- Available County funds, the Bridge Budget
- Cost of maintenance, rehabilitation, or replacement (MR&R)
- Remaining structure life with and without repair
- Is the bridge on FDOT replacement list and when is construction scheduled
- Other factors due to future transportation plans or political issues.

A3.4.1 Bridge Funding

Prior to completing the disposition of a structure in Phase 2, the overall amount of bridge funding for the system must be established. In establishing this County Bridge Budget, it is important to consider both the minimum required budget and the desired budget. The steps to determine these amounts are as follows:

Minimum Required Bridge Budget:

1. Set the minimum acceptable level of service (LOS) for the bridge system.
2. Calculate the required costs to reach this minimum LOS.

Desired Bridge Budget:

1. Set the desired LOS for the bridge system.
2. Calculate the optimum return costs to reach this desired LOS.
3. Consider higher costs for a better return on the investment (benefit-cost analysis).
4. Consider structure age and total cost of repairs versus replacement.
5. Distribute funds to all bridges as required to reach the minimum LOS.
6. Distribute funds to bridges in order of rank to reach the desired LOS.
7. Include additional factors such as future transportation plans and public pressure to set funding for new bridges (increased capacity).

3.4.2 Level of Service (LOS)

The LOS represents the condition state of the bridge system. It is a measure of how well the bridges meet the standards which have been set for the system. To determine a minimum bridge budget, the minimum LOS must be established. Consider the bridge LOS goals that have been set by other entities:

FDOT Desired LOS:

As stated above, the FDOT is proactive in its bridge program and has set a high mark for its minimum LOS. The FDOT goal is that ***90% of Department maintained bridges meet the Department standards.*** A bridge that meets the Department standards has the following characteristics:

4. Shows no evidence of Structural Deterioration
5. Not limited by Weight Restrictions
6. Not needing Preventative Maintenance

Although this is a high standard, the proactive approach has enabled the FDOT to reach this goal and maintain its bridge system in very good condition. Currently, over 95% of all FDOT-maintained bridges meet strict department standards and 100% of the open bridges are safe. Because it takes less money to maintain a bridge in very good condition than it takes to maintain it in a poor condition, the FDOT desired LOS is a good target for the County to pursue.

Other State DOT LOS Targets:

Table A3.4.2.1 shows examples of State DOT performance targets that were reported in NCHRP 2005. Clearly there is a wide range of goals among bridge management systems and that some States are dealing with overall poor bridge conditions.

Table A3.4.2.1 State DOT Performance Targets (Source: NCHRP 2005)

Measure	Description	State	Target
Bridge Value Index	Ratio of current value to replacement value	Oregon	87-90%
GASB 34 Bridge Rating	0-10 scale assigned to each component-rating category	Alabama	≥ 5
Health Index	0-100 scale based on condition of several elements	Kansas	Overall ≥ 80
NBI Appraisal Ratings	0-9 scale based on deck, substructure, and superstructure condition	Ohio Delaware Washington	≥ 85% of deck area ≥ 5 75% ≥ 6 <10% ≤ 4 95% Good or fair
Number of Closed Bridges		Pennsylvania	Reduce by 50% by 2010
Number of Posted Bridges	Bridges with weight restrictions	Oregon Pennsylvania	0 Reduce by 30% by 2010
Structural Condition Rating	Good, fair or Poor based on 3 0-9 NBI condition codes plus 2 NBI appraisal ratings	Minnesota	Principle – 92% Fair to Good Other – 80% Fair to Good
Structurally deficient (SD)/ Functionally Obsolete (FO)	SD – FHWA-defined rating that the bridge is in structurally poor condition FO – FHWA-defined rating based on deck geometry, load carrying capacity, clearance, and approach roadway alignment	Colorado Federal Georgia	≤ 25% SD <20% of NHS either SD or FO <5% (based on deck area)
Structures Inventory System	1-100 scale based on condition of major elements	Utah	50% ≥ 80; ≤ 15% ≤ 49
Sufficiency Rating	0-100 scale based on 4 factors reflecting ability to remain in service	Indiana Maine Wyoming	Interstate – 87% NHS – 85% Others-83% Overall- 60% NHS – 83% Others – 80%

Escambia County Bridge LOS:

Although using the FDOT goals is a desirable long-term LOS to pursue, the existing condition of the County maintained bridges makes this target unreasonable in the short-term. For the immediate goal, it is appropriate that the County adopt a minimum LOS that not only maintains the public safety, but steadily improves the condition state of the bridge system. Because the PR number calculated represents the ranked state of a bridge with the condition and strength importance modifications that are important to the County, it is the most useful value upon which to base the minimum LOS. In discussions with County personnel, it was agreed that maintaining a minimum posting limit of 17 tons was very important. Based on the existing bridges and the final PR formula, the minimum PR value that did not have a corresponding posted load limit less than 17 tons was 45. Therefore, the minimum short-term LOS adopted was PR = 45.

It is the goal of the County to bring all bridge PR numbers to above 45.

The minimum PR number should be raised over time to continually improve the inventory condition state and it is recommended that the minimum PR number be evaluated prior to each budget and bridge ranking process.

A4.0 Cost Estimation

A4.1 Cost Input Information

An accurate cost estimate for the repair or replacement of a bridge requires detailed plans, quantity calculations, current construction costs, and other information that is not available at the planning stage. For budgeting and planning purposes, however, only a reasonably accurate estimate of the overall costs associated with the repair and replacement activities for the overall bridge system is required. For this reason, all costs are calculated using approximate square foot bridge costs that are available from the current FDOT BDR Estimating Guidelines. For the type of bridges maintained by the County, the bridge length is the biggest factor affecting the construction costs. In general, longer (bigger) bridges can be constructed for less per square foot than short (small) bridges. Therefore, cost data for both short length bridges (flat slab simple span) and medium length bridges (pre-stressed girder simple span) is utilized in the estimating process. The maximum length for the short bridge costs and the minimum length for long bridge costs are entered. Costs for bridges between these two lengths are interpolated.

In addition to the basic square foot construction costs, values for the costs of the following are required:

- Approach Costs (App)
- Contingency (Con)
- Mobilization (Mob)
- Detour Bridge (Det)
- Demolition (Dem)
- Engineering, Project Management, Construction Engineering and Inspection (Eng)
- Right of Way Purchase (R/W)

Wetland impacts and other environmental costs are not specifically included due to their varied nature, but the costs for R/W can be increased to accommodate these costs if necessary. The total project costs are estimated using the following formula:

Total Cost = SF*Cost/SF + Det + Dem + Mob + App + Con + Eng + R/W

Costs for bridge repairs are adjusted for remaining service life as described later, and do not include approach, detour, demolition, or R/W. The basic input cost data for 2018 is shown in Table A4.1.1.

Please note that Mott MacDonald does not guarantee that proposals, bids, or actual costs will not vary from its opinions of cost. MM does not control the cost of labor, materials, equipment or services furnished by others, methods of determining prices, or competitive bidding or market conditions. Therefore, any opinions rendered as to costs, including but not limited to opinions as to the costs of construction and materials, shall be made on the basis of MM's experience and represent MM's judgment as an experienced and qualified professional, familiar with the industry.

Table A4.1.1 Input Cost Data for 2018

Item	Cost/ Factor	Unit	Description
Budget Year =	2018	Year	
Approach and Roadway Costs =	50	%	*Approach embankment, roadway, slabs, guardrail, slope protection, ect. (20% large projects, 50% small)*
Contingency =	20	%	*Contingency costs (15% to 30%)*
Mobilization =	8	%	*Approximately 8% typical. (5% to 10%)*
Minimum Replacement Mobilization =	$ 15,000		*Use minimum for small bridges.*
Minimum Repair Mobilization =	$ 8,000		*Use minimum for small bridge repair projects.*
Reinforced Concrete Flat Slab Simple Span Minimum Cost =	$ 115	per SF	*Update using current minimum FDOT BDR Cost Estimating guidelines.*
Concrete Deck/Pre-stressed Girder Simple Span Minimum Cost =	$ 105	per SF	*Update using current minimum FDOT BDR Cost Estimating guidelines.*
Max Bridge Length for High Cost =	180.00	ft	*Smaller bridges usually cost more per SF. The higher cost per SF will be used for all bridges less than this length.*
Min Bridge Length for Low Cost =	400.00	ft	*Larger bridges usually cost less per SF. The lower cost per SF will be used for all bridges greater than this length.*
m =	-0.0455		*Used to interpolate between short and long bridges.*
b =	123.1818		*Used to interpolate between short and long bridges.*
Detour Bridge Cost =	$ 110	per SF	*Update using current FDOT BDR Cost Estimating guidelines. $55 bridge + $55 Approach (could be low)*
Max Detour Length =	15	miles	*Maximum length allowed for detour before requiring that a temporary bridge be utilized for a bridge replacement.*
Demolition Cost =	$ 48	per SF	*Update using current average FDOT BDR Cost Estimating guidelines.*
Engineering & CEI Cost =	20	%	*Total preliminary and design engineering, construction administration, construction engineering and inspection which is up to 36% for FDOT projects.*
Minimum Engineering Cost =	$ 5,000		*Used for small projects.*
Right of Way Cost =	5	%	*Wider bridge replacements often require the purchase of right of way. (wetland impact costs for a particular site are not included)*
% Bridge Budget for Increased Capacity & Emergency Repairs =	20	%	*% of budget dedicated to new bridges. This amount should be increased to also serve as a contingency for required emergency repairs/replacements.*

A4.2 Estimating Repair Costs

Estimating repair costs for a bridge system at the planning level requires an estimate of the cost required to raise the bridge condition from its current state to a higher state. It is also useful to predict the remaining service life of the bridge before and after repair. Several research projects have been completed using Markov Probability Matrices developed from historical data from different bridge sets to predict future bridge conditions based on past NBI ratings. It was concluded, however, that the best prediction of the decay rates for the Escambia County maintained bridges would be obtained through developing curves based on the actual condition of these bridges. As expected, the deterioration rates for the timber structures were found to be significantly different than those for concrete or steel. For this reason, the structures were separated into two groups: Timber and Other. The decay rate formulas developed for deck, superstructure, substructure, and culverts are shown below:

A4.2.1 Escambia County Maintained Bridges Service Life

Chart A4.2.1 Non-Timber Substructure Service Life

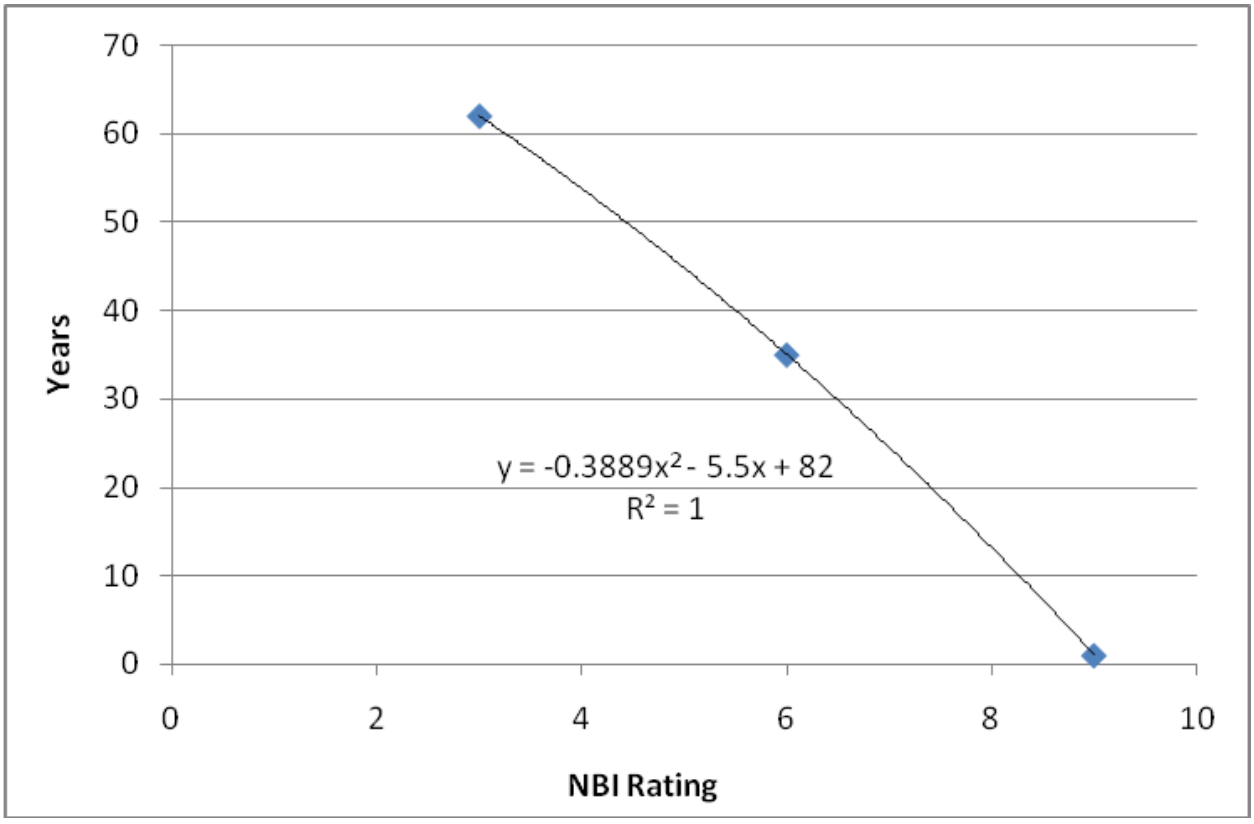


Chart A4.2.2 Timber Substructure Service Life

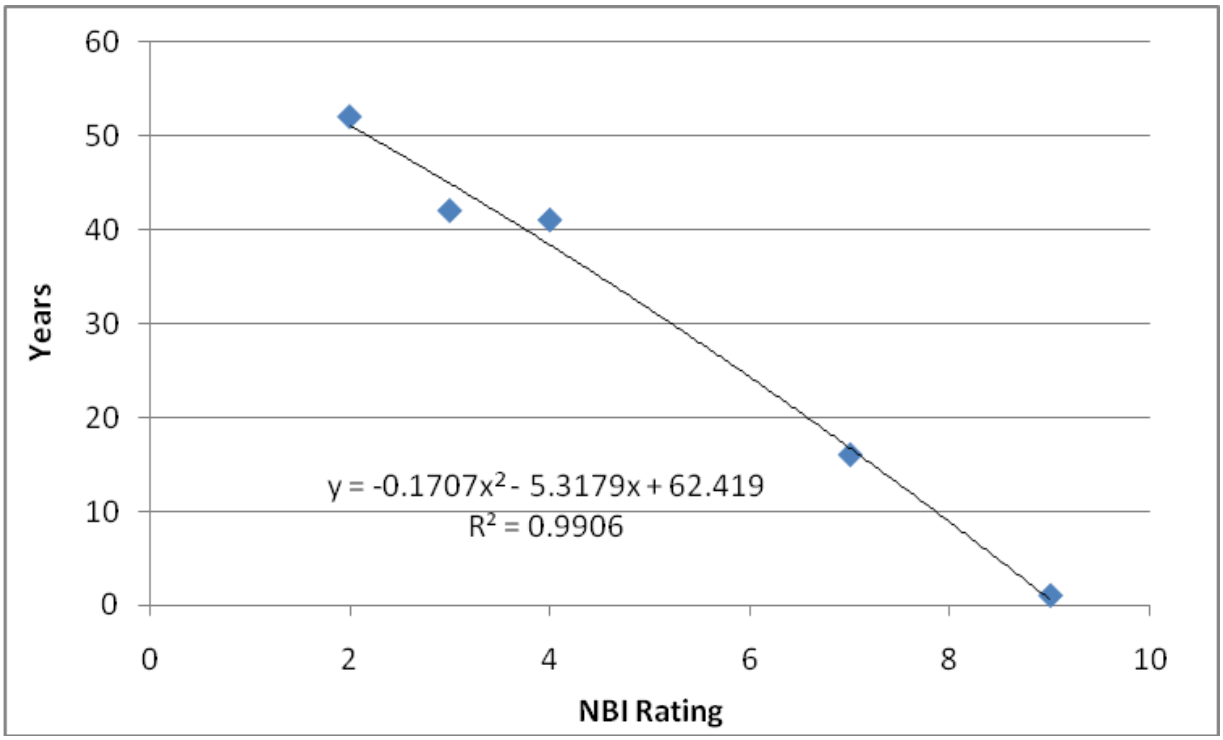


Chart A4.2.3 Non-Timber Superstructure Service Life

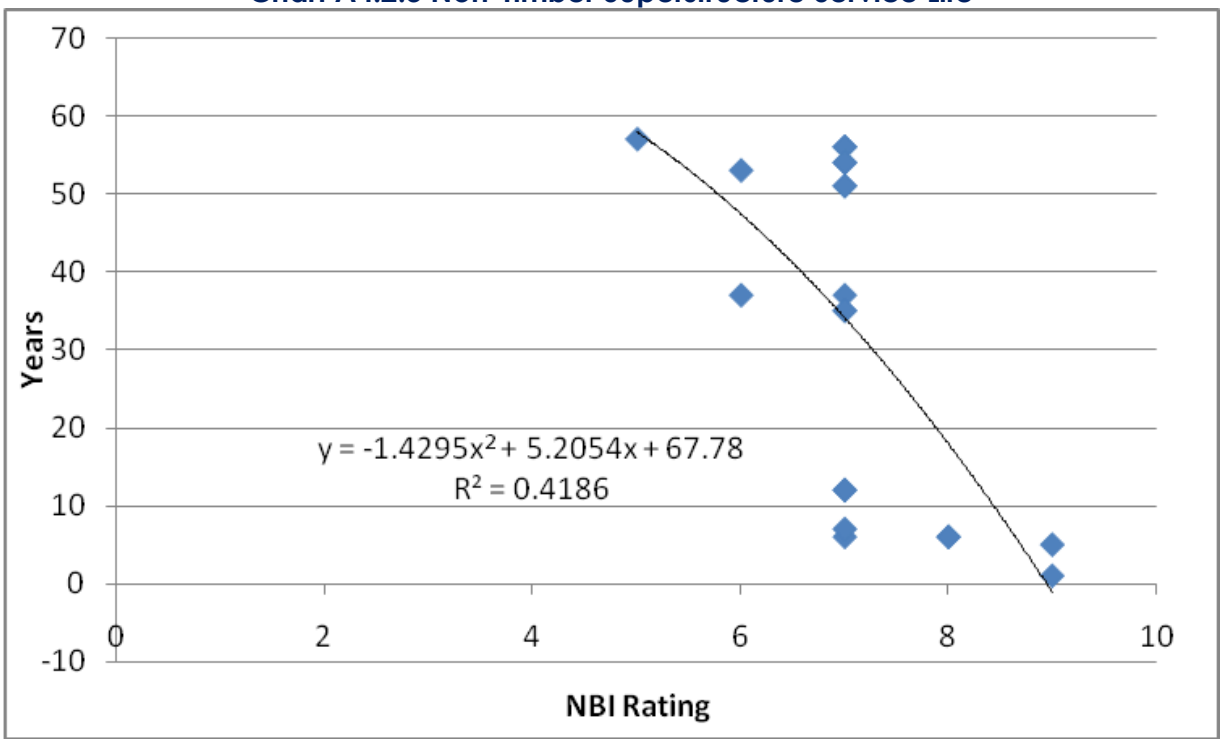


Chart A4.2.4 Timber Superstructure Service Life

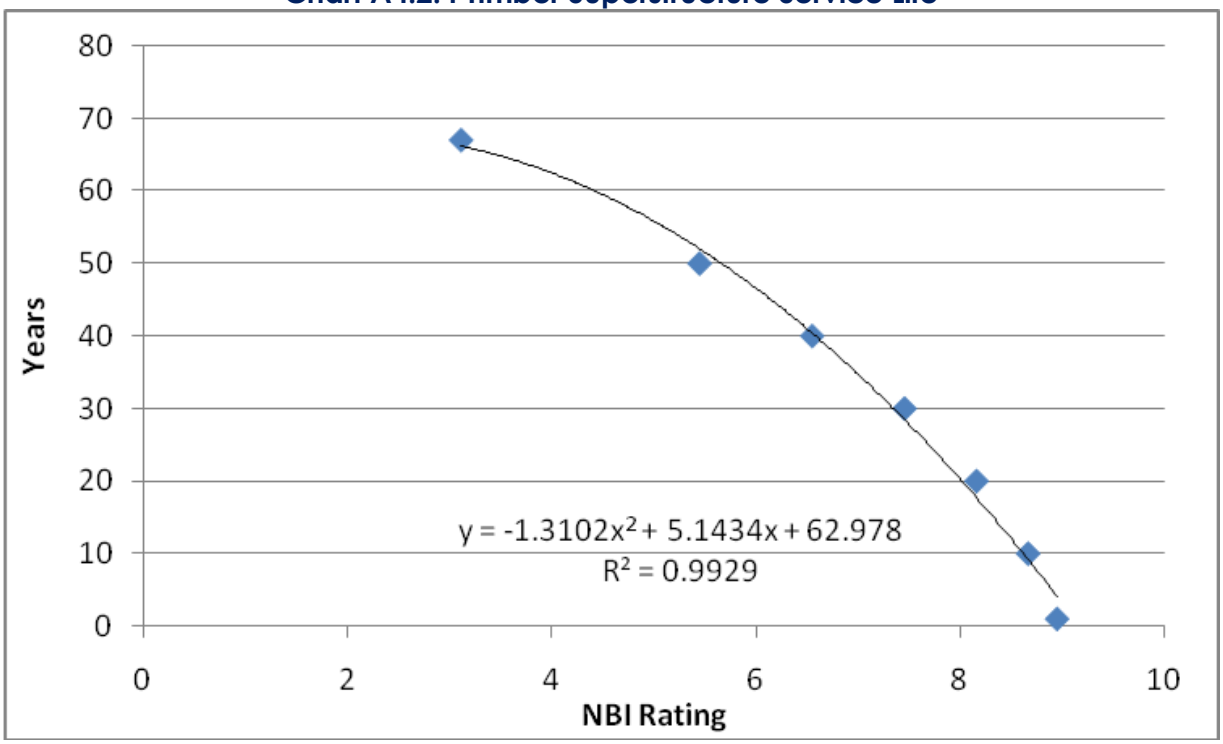


Chart A4.2.5 Deck Service Life

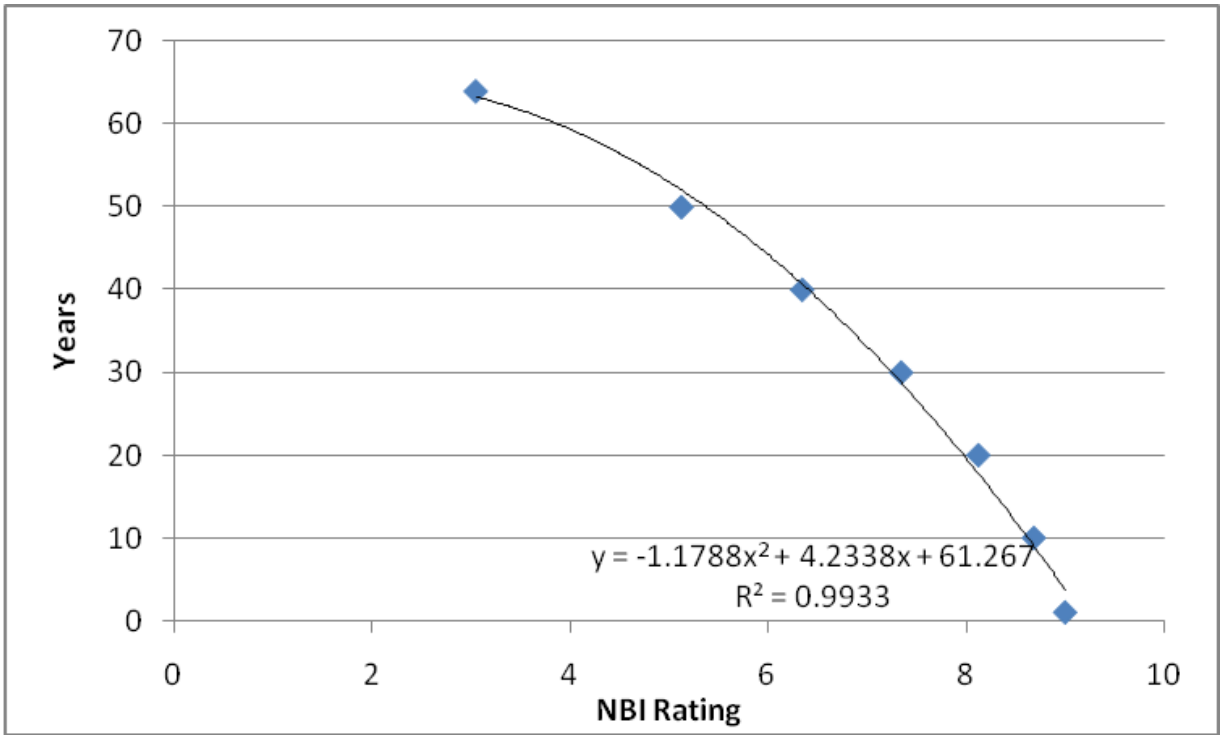
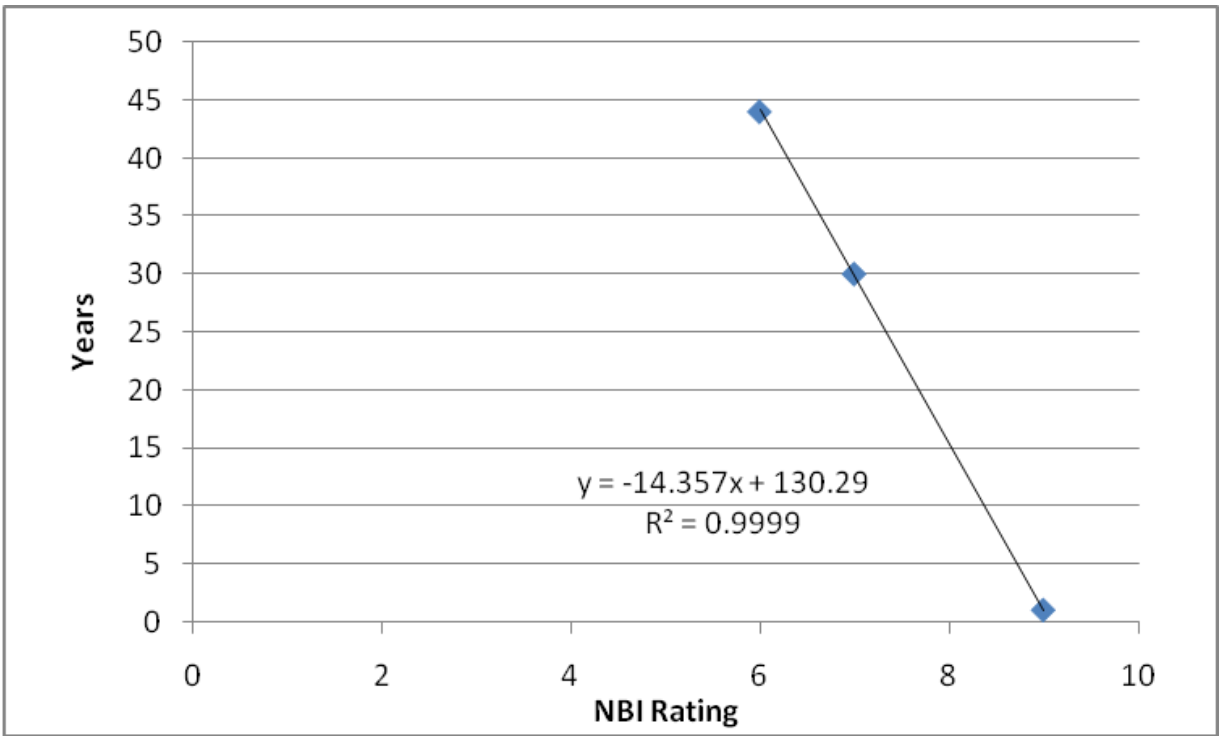


Chart A4.2.6 Culvert Service Life



The formulas in Charts A4.2.1 to A4.2.6 above are used to calculate the remaining service life of a bridge based on its current NBI rating. (X = NBI Rating, Y = Years) To calculate the remaining life, an NBI rating of 3 is used to represent the end of the service life. When the NBI rating reaches 3, a bridge replacement or major repair is recommended. To determine the remaining life, calculate Y with X = 3, then subtract the Y value calculated with X = the current NBI rating.

A4.2.2 Repair/Maintenance Recommendations

Based on the descriptions of the NBI condition ratings as shown in Table A2.1.1, the FHWA developed a Maintenance Rating Scale shown in Table A4.2.1. This table provides a guideline to the urgency of repair and maintenance activities based on the NBI condition. The general repair/maintenance recommendations corresponding to the NBI condition ratings are:

- 6 – Maintenance (general)
- 5 – Some Repair Needed
- 4 – Repair
- <= 3 – Replace or perform Major Repair

Table A4.2.1 Maintenance Rating Scale (Source: FHWA-NHI-03-003)

Maintenance Urgency Index	Maintenance Immediacy of Action	Inspection Course of Action
9	No repairs needed.	
8	No repairs needed. List specific items for special inspection during next regular inspection.	
7	No immediate plans for repair. Examine possibility of increased level of inspection.	Note in inspection report only.
6	Repair by end of next season – add to scheduled work.	
5	Place in current schedule – current season, first reasonable opportunity.	
4	Priority – current season, review work plan for relative priority, adjust schedule if possible.	Special notification to superior is warranted.
3	High priority – current season, as soon as can be scheduled.	
2	Highest priority – discontinue other work if required, emergency basis or emergency sub-sidiary actions if needed (post, one-lane traffic, no trucks, reduced speed, etc.).	Verbally notify superiors immediately and confirm in writing.
1	Emergency actions required – reroute traffic and close.	
0	Facility is closed for repairs.	

A4.2.3 Repair Cost Calculations

According to research performed by the LADOT on bridges similar to those in the County, the costs to repair a structure can be represented as a fraction of the total replacement cost of the structure. The appropriate fraction of replacement cost can be correlated with the current NBI rating.

Adjusting the values used by LADOT to change from a 4-point condition scale to the NBI scale gives the following values:

- NBI = 5, 10% of Replacement Cost for Repair
- NBI = 3, 60% of Replacement Cost for Repair

The following equation was developed to represent this general relationship and extend it to NBI ratings from 2 through 5 to calculate the basic repair cost:

$$RF = 1.371 * e^{-.064*CR^{2.3}}$$

where,

RF = Repair Fraction of Replacement Cost, calculated for substructure, superstructure, deck, and culvert
e = 2.71828
CR = NBI Condition Rating for component under consideration

The replacement cost to which the RF factor is multiplied is the cost of the component under consideration, which is calculated by taking a representative percentage of the total basic cost of the structure. Typically, the total basic structure cost is divided evenly between the superstructure and substructure with the deck cost taken out of the superstructure portion. Because the repairs are performed on an existing structure, the costs are adjusted based on the location of the component being repaired. In general, the increase in repair costs for location is inversely proportional to the order in which the component was placed for the County bridges. (substructure repairs usually cost more than deck repairs) The component percentages and increases for location used in 2018 are shown in Table A4.2.2.

Table A4.2.2 Repair Cost Modification Factors

Item	*Factor*	*Unit*	*Description*
Substructure Repair Costs =	50	%	*% of Total Cost of Bridge used in calculating approximate repair costs.*
Superstructure Repair Costs =	40	%	*% of Total Cost of Bridge used in calculating approximate repair costs.*
Deck Repair Costs =	10	%	*% of Total Cost of Bridge used in calculating approximate repair costs.*
Substructure Location =	2	Ea	*Factor applied to account for difficulty of repair and required additional repair costs to access members in this location.*
Superstructure =	1.5	Ea	*Factor applied to account for difficulty of repair and required additional repair costs to access members in this location.*
Deck =	1	Ea	*Factor applied to account for difficulty of repair and required additional repair costs to access members in this location.*
Culvert =	1	Ea	*Factor applied to account for difficulty of repair and required additional repair costs to access members in this location.*

Total repair costs are calculated as follows:

BC = Existing Bridge SF * Cost/SF
RC sub = RF sub * BC * Sub% * SubLoc
RC sup = RF sup * BC * Sup% * SupLoc
RC dk = RF dk * BC * Deck% * DeckLoc
BRC = RC sub + RC sup + RC dk, for a bridge
= RF cul * BC * CulLoc, for a culvert
CON = BRC * Contingency%
MOB = (BRC + CON) * Mobilization% >= minimum repair mobilization cost
ENG = (BRC + CON + MOB) * Engineering% >= minimum engineering cost

Total Repair Cost = BRC + CON + MOB + ENG

where,

BC = basic total bridge cost (bridge structure only)
SF = bridge deck area in square feet
Cost/SF = average bridge cost per SF adjusted for existing bridge length
RC sub = basic repair cost for the substructure
RF sub = repair fraction for substructure
Sub% = (% of total cost of bridge applied to substructure)/100
SubLoc = location increase factor for the substructure
RC sup = basic repair cost for the superstructure
RF sup = repair fraction for superstructure
Sup% = (% of total cost of bridge applied to superstructure)/100
SupLoc = location increase factor for the superstructue
RC dk = basic repair cost for the deck
RF dk = repair fraction for deck
Deck% = (% of total cost of bridge applied to deck)/100
DeckLoc = location increase factor for the deck
BRC = total basic repair cost for the structure
RF cul = repair fraction for culvert
CulLoc = location increase factor for a culvert
CON = contingency cost
MOB = mobilization cost
ENG = engineering, project management and CEI costs

A4.2.4 Maintenance Costs

General maintenance includes activities performed to prevent or delay bridge deterioration but are not structurally required. Maintenance does not improve the state of the structure. To calculate the required funds for maintenance procedures, a maintenance cost factor is multiplied by the deck area of all bridges that are not being repaired or replaced. In 2018,

the maintenance factor used was 0.40. The maintenance cost calculated for each bridge should not be interpreted as the cost of maintenance needs for that bridge. Some bridges will require maintenance and some will not. The total sum of the maintenance costs will be distributed as required. Maintenance cost may be removed from work plans to increase available funding for required replacements.

A4.2.5 Improvement from Repair or Maintenance

Repairs typically cannot restore a bridge to new condition, and the procedures shown in Table A4.2.2 represent the change in NBI rating resulting from repair or maintenance activities.

Table A4.2.2 Repaired NBI Ratings

NBI Rating	Action	Repaired NBI Rating
2	Replace	-
3	Repair (or replace)	5
4	Repair	5
5	Repair	6
6	Maintenance	6
7	Maintenance (or nothing)	7
8	Do Nothing	8

A4.3 Estimating Replacement Costs

Calculating a replacement bridge cost includes consideration of the following:

- New Bridge Length
- New Bridge Width
- Utilize Average SF Bridge Costs based on the new size
- Includes consideration of costs for detours, demolition, R/W, and approaches

A4.3.1 Replacement Bridge Length

Due to various reasons such as raised roadway elevations or the need to span over wetlands, new replacement bridges are usually longer than the existing bridge. The FHWA developed a formula to calculate new bridge lengths as part of the TIGER Grant process. This formula is based on historical data from a nationwide set of bridges. This formula, along with a replacement bridge length formula used by the Indiana DOT, was reviewed for application into this prioritization process. The formula used here results in slightly shorter bridge lengths for existing bridges with lengths less than 43' or between 74' and 96'.

Replacement Bridge Length = $-0.0005*L^2 + 1.21*L + 14$ for L up to 200'
= L + 36 for L > 200'

where, L = length of the existing bridge, ft.

A4.3.2 Replacement Bridge Width

The new bridge width is calculated based on the minimum width required to obtain a NBI rating of 8 for Deck Geometry. An estimate of the Future Average Daily Traffic (ADT) and the number of lanes is required to perform this calculation. The future ADT, typically at 20 years in the future, is calculated based on applying a traffic growth rate to the existing ADT according to the following formula:

$$\textbf{ADT future} = \textbf{ADT existing} * (1 + \textbf{ADT growth rate})^{20}$$

For 2018, an ADT growth rate of 0.48% was used (0.0048 in the formula). The number of future traffic lanes must also be estimated by dividing the ADT by the maximum ADT per lane. For 2018, the maximum ADT per lane used was 7000. Both the ADT growth rate and maximum ADT per lane are values that can be adjusted annually to reflect the status of the county traffic. The formula to obtain a NBI rating of 8 for the Deck Geometry varies depending on the number of lanes on the bridge. This formula, adjusted to add width for barriers, is as follows:

For # lanes > 2,	**W = (# lanes * 3.7 + 5.5)/0.3048 + 5.0833**
For # lanes = 2,	**ADT <= 100, W = 32 + 3.0833**
	ADT <= 400, W = 36 + 3.0833
	ADT <= 1000, W = 40 + 3.0833
	ADT > 1000, W = 44 + 3.0833

where,

W = Replacement Bridge Width, ft.
ADT = future ADT

A4.3.3 Replacement Bridge Cost

The total bridge replacement cost is calculated as follows:

BC = Replacement Bridge SF * Cost/SF
DET = DetourCost * Existing Bridge Deck Area, (only apply when detour length > max)
DEM = DemCost/SF * Existing Bridge Deck Area
APP = BC * Approach%
CON = (BC+DET+DEM+APP) * Contingency%
MOB = (BC+DET+DEM+APP+CON) * Mobilization% >= min repair mobilization cost
ENG = (BC+DET+DEM+APP+CON+MOB) * Engineering% >= minimum engineering cost
RW = (BC+DET+DEM+APP+CON+MOB) * RightOfWay%

Total Bridge Replacement Cost = BC+DET+DEM+APP+CON+MOB+ENG+RW

where,

BC = basic total bridge cost (bridge structure only)
SF = replacement bridge deck area in square feet
Cost/SF = average bridge cost per SF adjusted for replacement bridge length
DET = detour bridge cost applied when the length of the detour exceeds max
DetourCost = detour bridge cost per SF
DEM = existing bridge demolition costs
DemCost = demolition cost per SF
APP = approach costs
Approach% = (approach cost percentage)/100
CON = contingency cost
Contingency% = (contingency cost percentage)/100
MOB = mobilization cost
Mobilization% = (mobilization cost percentage)/100
ENG = engineering, project management and CEI costs
Engineering% = (engineering cost percentage)/100
RW = R/W cost
RightOfWay% = (R/W cost percentage)/100

A5.0 Financial Comparison

One method utilized in deciding between bridge repair or bridge replacement is to compare the Present Cost (PC) of both options using the formula,

$$PC = \text{Future Cost} * (1+r)^{-n}$$

where, r = rate of return (decimal form) and n = number of years

To accurately utilize this method, the length of the time period for both options needs to be the same. To do this, the two options compared were modified as follows:

Option-1: Repair the bridge now, then replace the bridge at the end of the repaired bridge remaining service life (EOL).

Option-2: Replace the bridge now, then repair the bridge at the end of the new bridge life, which is taken to be 75 years.

Although an entity rarely invests money as part of a plan to construct a future project, the comparison is valid because the funds that could have been invested are utilized in other

current projects. It is also important to consider both the rate of return (r), and the inflation rate (i) in the calculations. Funds invested today are worth more in the future, but construction costs also rise with inflation. The inflation rate can be taken from the yearly FDOT Transportation Costs. For 2018, i = 3.3% was used. The growth rate can be taken from the minimum 30-year Treasury Yield Rate. For 2018, r = 2.90% was used. Accounting for both inflation and growth, the formulas for a monetary only comparison of both options are as follows:

Option-1: PC = Repair Cost + Replacement Cost *$[(1+i)/(1+r)]^{EOL}$

Option-2: PC = Replacement Cost + Repair Cost *$[(1+i)/(1+r)]^{75}$

There are additional benefits of replacing a bridge now that are not considered in the monetary only comparison of the two options. These benefits may include increased highway capacity, reduced accident rates and other items that are directly related to the size of the structure. These added benefits may or may not be a valid reason to choose Option-2, but another PC calculation for this option was included to provide a value comparison. This PC calculation discounts Option-2 costs based on the ratio of the old deck SF to the new deck SF over the life of the repaired bridge (EOL). The value PC formula used is as follows:

Option-2 (value):
PC = [Replacement Cost + Repair Cost *$[(1+i)/(1+r)]^{75}$] * [(Exist SF/New SF) * EOL+75] / [75+EOL]

A6.0 Bridge Ranking Process and Budget

Based on the process described the county maintained bridges are ranked and a bridge workplan is formed. The process includes the following functions:

- Input bridge inspection data, county comments, and cost data
- Rank the bridges according to the PR formula
- Calculate repair, maintenance and replacement costs
- Calculate financial comparisons
- Calculate the repaired service life, SR, and PR
- Analyze repair bridge deficiency
- Check for compliance with FDOT goals
- Provides decision data and means to determine disposition of structures
- Determine disposition of each structure
- Summarizes budget and workplan

The disposition process is required to determine what actions are to be performed on bridges to establish the replacement, repair, and maintenance portion of the Bridge Budget. Bridge data is to be used to determine whether a bridge should be Replaced, Repaired (Fix), or if general maintenance should be performed. The bridges are placed in the order of their Priority Rating (PR).

Bridges that have a PR less than the proposed minimum level to reach the desired LOS and have not already been identified for replacement or repair are highlighted in orange on the workplan. It is the goal to enter "Replace" or "Fix" in all orange cells within the workplan.

Tips:
Multiple parameters should be considered when determining whether a bridge should be Replaced or Fixed:

1. Consider the condition of the bridge after the repair. If the repaired bridge is Functionally Deficient, it would be better to maintain the bridge until it can be replaced. If the Repaired Priority Rating is less than the minimum PR set for the desired level of service, it would be better to maintain the bridge until it can be replaced.

2. Because repair will most likely not eliminate Posting, the "Fix" option should normally be used for small bridges with low ADT or large busy bridges that are relatively new and not posted.

3. A financial comparison between the Fix and Replace options is provided. This comparison is based on the size of bridge and costs only. No attempt is made to assign a numeric value to benefits such as reduced accidents or improved traffic flow resulting from a new bridge. (see note below concerning costs)

Repair Bridge PW = Present Worth/Cost to fix bridge now then replace it with a new bridge at the end of the Repaired Bridge Life. (total life = repaired life + 75 years)

New Bridge Value PW = Present Worth/Cost to replace bridge now then fix it after 75 years. This cost is reduced to compare equivalent bridge sizes.

New Bridge PW = Present Worth/Cost to replace bridge now then fix it after 75 years. Options are compared considering costs only.

4. Other dynamic issues should be considered when making the bridge disposition choice. These issues may include past accident history, future TPO plans, County District, emergency routes, or public interest. Repair may also be the required action due to insufficient funds.

Bridge Costs shown for repair or replacement should be considered as an approximate estimate to be used for preliminary budget purposes only. More accurate estimates must be developed during the design phase for each bridge.