LCCA Analysis Experiences

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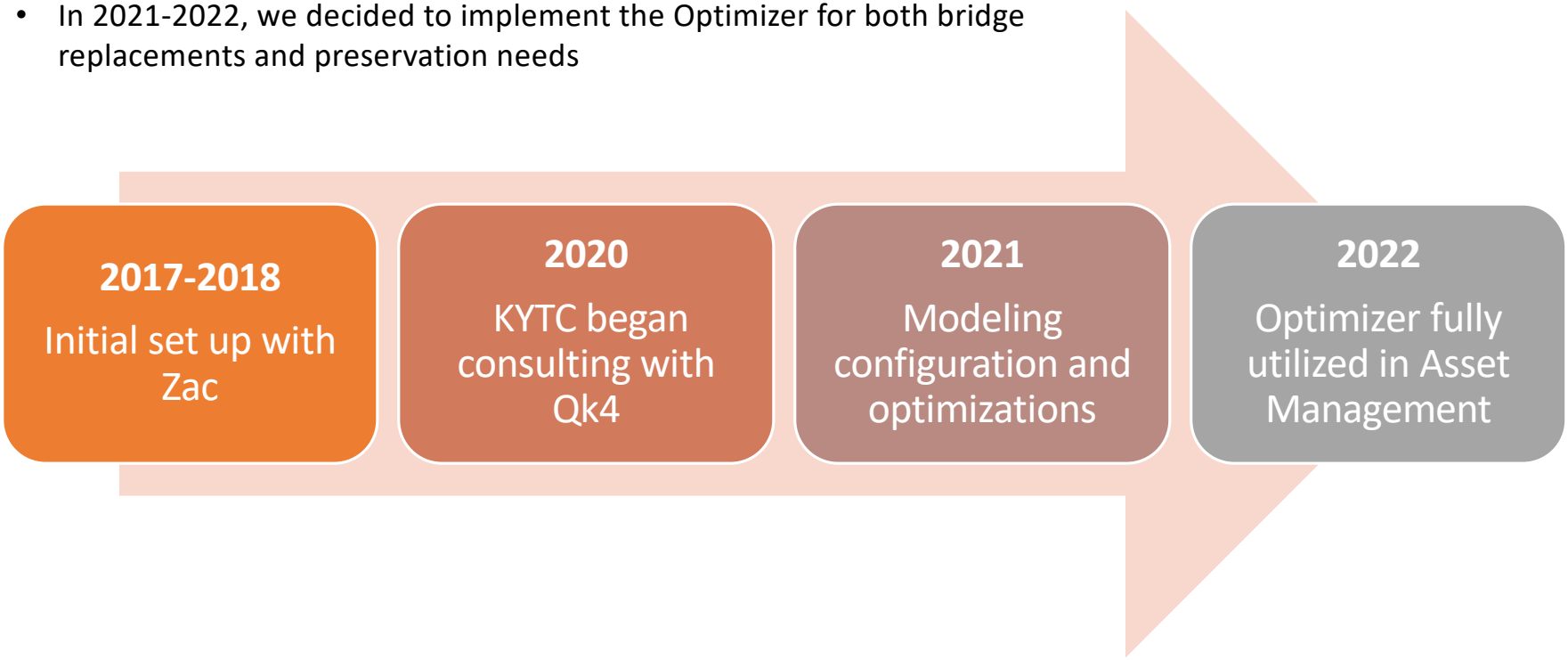
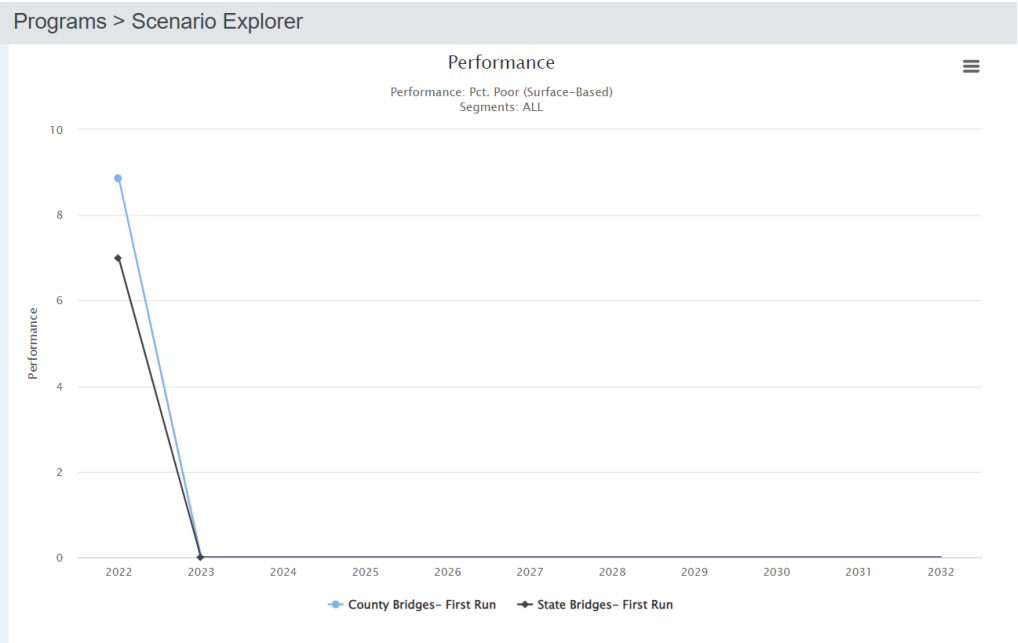
History and Timeline

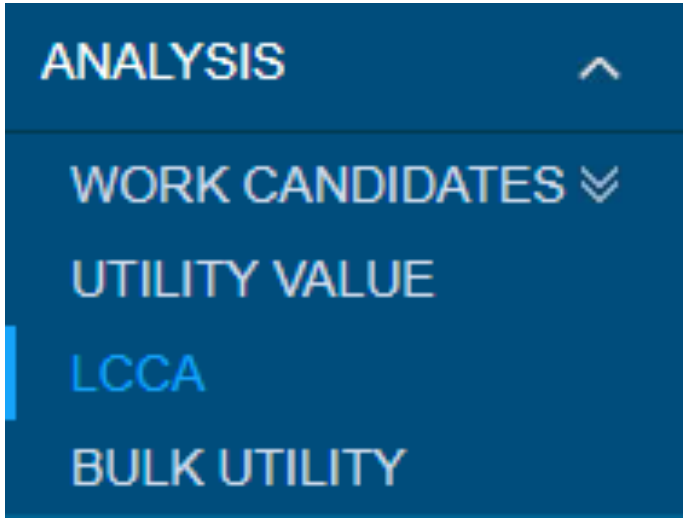
- KYTC initial vision in 2017 was a complete preservation approach
- Our vision shifted towards recommending bridge replacements in 2020
- In 2021-2022, we decided to implement the Optimizer for both bridge replacements and preservation needs



Today (2023)

- BrM optimization tools are being used for project scoping, funding management and analysis, and “fun runs”
- Working on SNBI implementation and how that will affect optimizer tools





Analysis > LCCA

My reaction…

The Task and First Attempt

- Future maintenance and lifecycle costs of bridges along an Interstate corridor

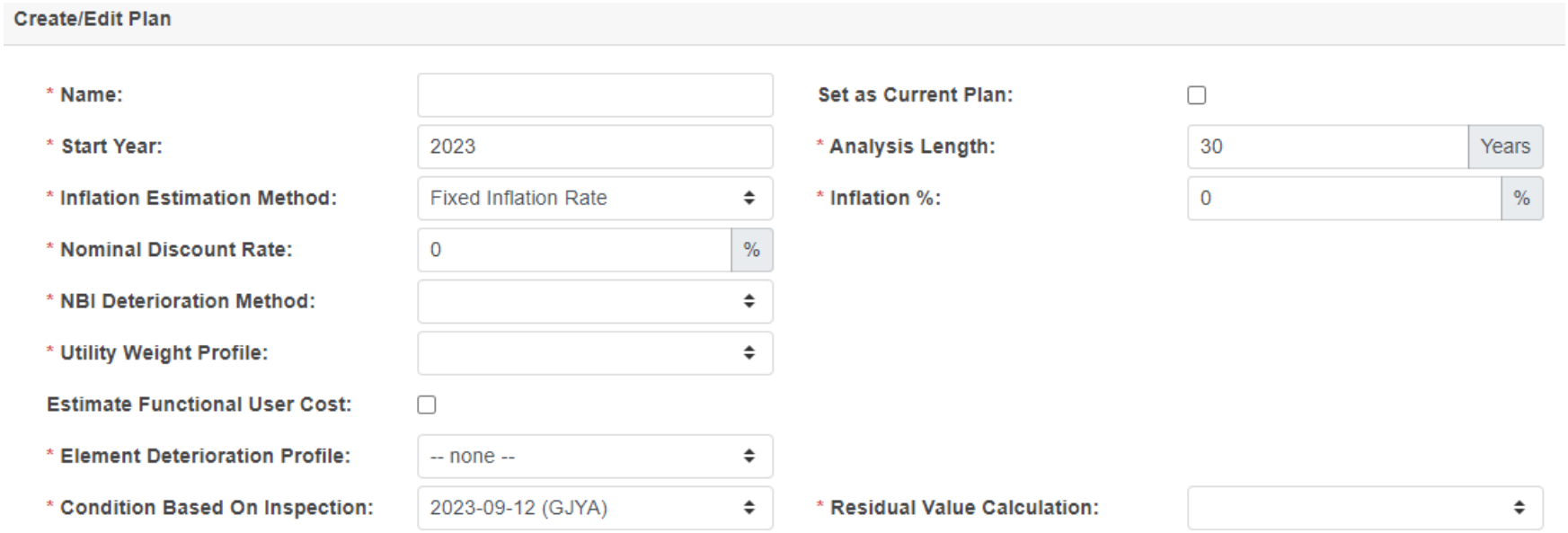
	A	B	C	D	E	F	G
1				Routine Maintenance		No Maintenance	
2				Remaining Life (Years)	Total LCC	Remaining Life (Years)	Replacement Cost
3		3 Steel		0	$ 37,639,876.97	77	$ 16,598,538.34
4		3 Steel		59	$ 31,940,821.98	30	$ 19,801,976.60
5		4 Steel Continuous		42	$ 21,560,648.51	21	$ 22,468,189.20
6		4 Steel Continuous		55	$ 49,122,720.18	36	$ 83,402,889.82
7		6 P/S Conc Continuous		40	$ 34,809,106.00	32	$ 32,864,087.15
8		4 Steel Continuous		58	$ 6,474,963.38	32	$ 10,939,590.70
9		3 Steel		37	$ 18,315,161.30	14	$ 14,869,053.70
10		4 Steel Continuous		39	$ 14,458,974.91	25	$ 11,004,056.03
11		4 Steel Continuous		56	$ 7,691,147.74	34	$ 11,542,527.96
12		4 Steel Continuous		41	$ 15,295,423.06	19	$ 11,410,920.91
13		3 Steel		32	$ 31,457,265.66	19	$ 20,209,128.09
14		3 Steel		51	$ 1,094,233.91	35	$ 1,013,774.10
15		3 Steel		68	$ 3,697,129.23	33	$ 3,002,924.70
16		3 Steel		37	$ 3,646,279.40	22	$ 3,009,905.16
17		4 Steel Continuous		55	$ 8,091,199.87	33	$ 12,242,216.35
18		2 Concrete Continuous		16	$ 12,923,433.71	25	$ 11,475,495.13
19		2 Concrete Continuous		33	$ 8,486,849.95	25	$ 7,972,905.51
20		4 Steel Continuous		62	$ 7,259,555.17	35	$ 8,809,442.07

Second Attempt

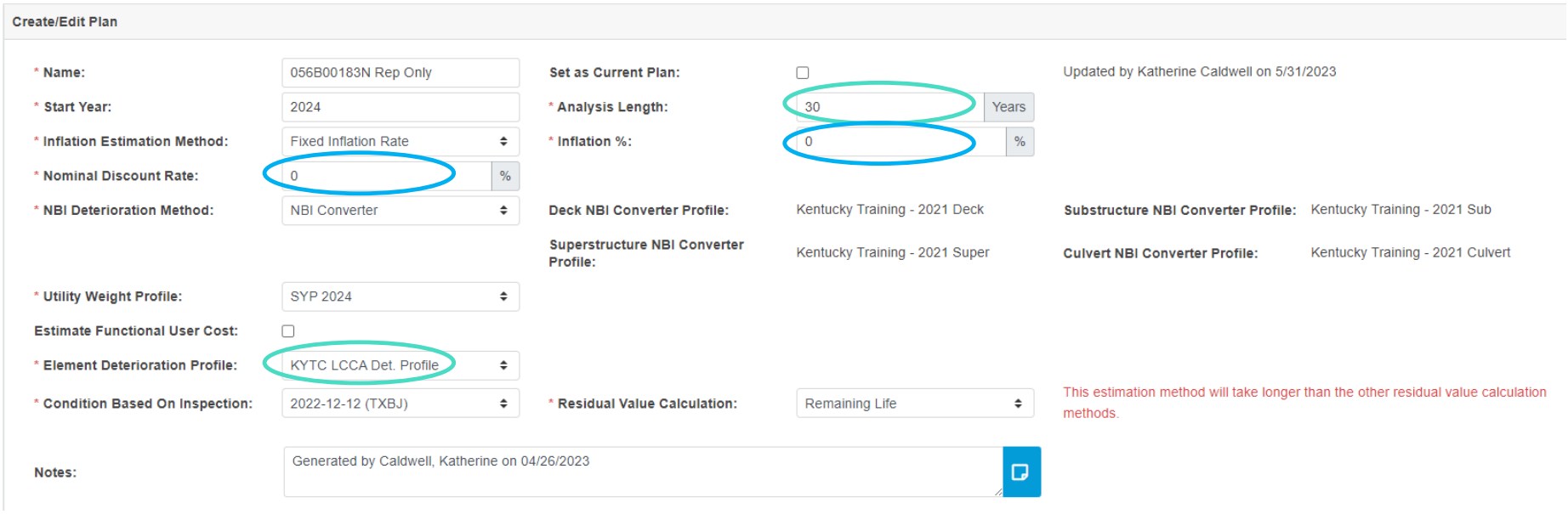
….all of my optimization work thus far has been to advocate for routine maintence. This time, I needed to find a way to advocate for replacement…

- Build and No-Build scenarios
  - Build: replace bridge now
  - No-Build: continue maintaining, future replacement plan
- Project Scopes: Full replacement, superstructure replacement, deck replacement

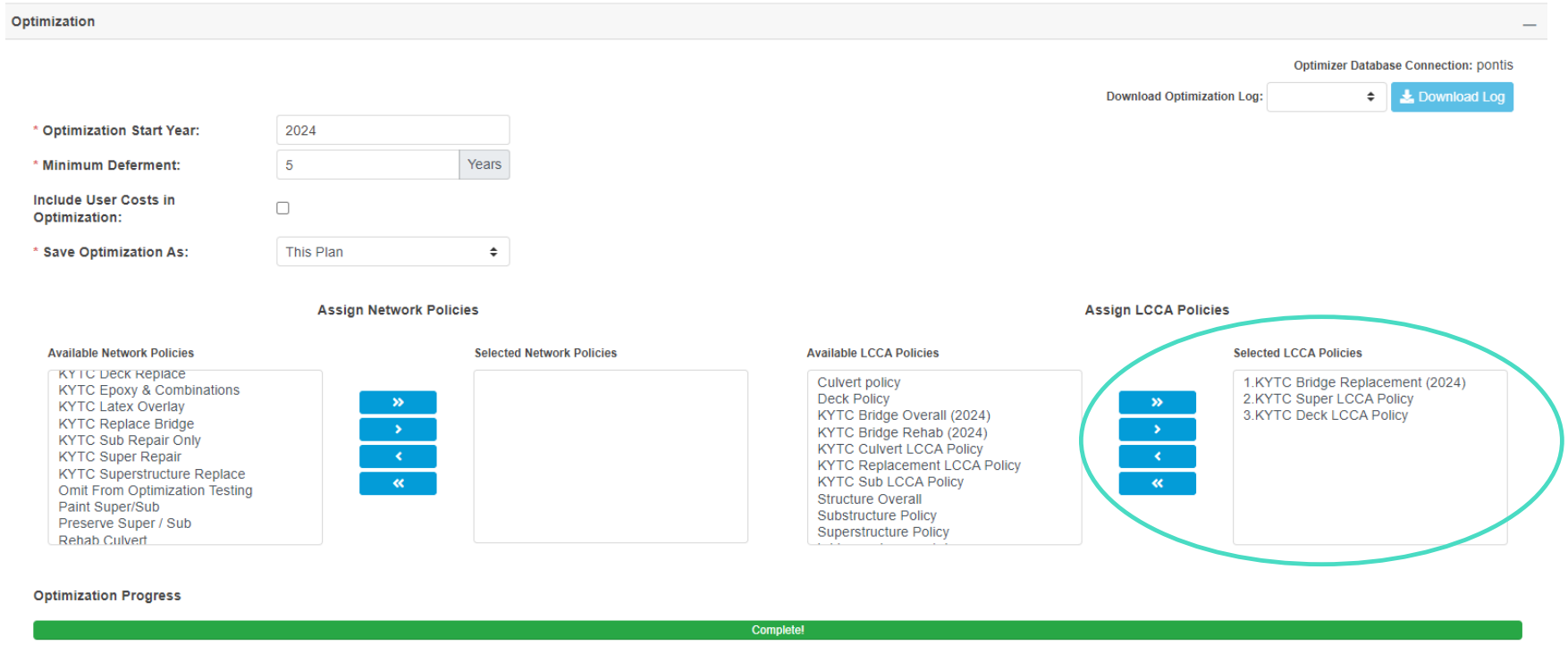
Creation of Lifecycle Plans part 1: **Create/Edit Plan**



Creation of Lifecycle Plans part 1: **Create/Edit Plan**



Creation of Lifecycle Plans part 2: **Optimization**

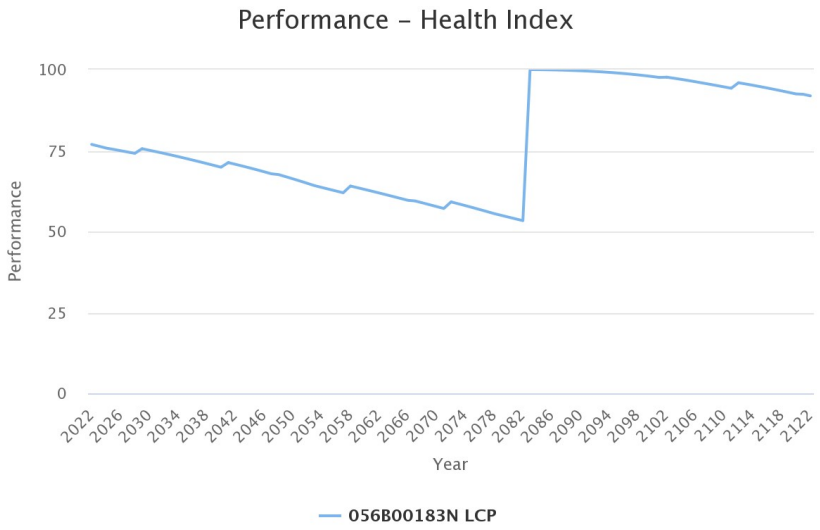


Raw Results

056B00183N - 056B00183N LCP Actions																
					Agency Cost			Functional + Action User Cost			Total Cost			Utility	
Locked	Year #	Year	Action(s)	Action(s) Added As	2023 $	Inflated $	PV $	2023 $	Inflated $	PV $	2023 $	Inflated $	PV $	Start	End
	1	2024	Paint-Structural	LCCA Policy	$1,705,620.00	$1,756,788.60	$1,722,341.76	$0.00	$0.00	$0.00	$1,705,620.00	$1,756,788.60	$1,722,341.76	54.67	54.67
	6	2029	Joints-Replace	LCCA Policy	$1,361,500.00	$1,625,702.20	$1,443,577.03	$0.00	$0.00	$0.00	$1,361,500.00	$1,625,702.20	$1,443,577.03	50.28	51.96
	18	2041	Deck Repair	LCCA Policy	$1,401,923.37	$2,386,680.69	$1,671,056.86	$0.00	$0.00	$0.00	$1,401,923.37	$2,386,680.69	$1,671,056.86	50.20	57.79
	25	2048	Joints-Replace	LCCA Policy	$1,361,500.00	$2,850,678.65	$1,737,576.64	$0.00	$0.00	$0.00	$1,361,500.00	$2,850,678.65	$1,737,576.64	46.18	47.03
	30	2053	Paint-Structural	LCCA Policy	$1,705,620.00	$4,139,987.42	$2,285,566.53	$0.00	$0.00	$0.00	$1,705,620.00	$4,139,987.42	$2,285,566.53	42.41	42.41
	35	2058	Deck Repair	LCCA Policy	$1,834,479.54	$5,161,973.09	$2,581,129.09	$0.00	$0.00	$0.00	$1,834,479.54	$5,161,973.09	$2,581,129.09	37.83	49.40
	44	2067	Joints-Replace	LCCA Policy	$1,361,500.00	$4,998,682.27	$2,091,452.35	$0.00	$0.00	$0.00	$1,361,500.00	$4,998,682.27	$2,091,452.35	41.63	42.48
	49	2072	Deck Repair	LCCA Policy	$1,837,068.44	$7,818,966.42	$2,963,063.31	$0.00	$0.00	$0.00	$1,837,068.44	$7,818,966.42	$2,963,063.31	37.75	49.32
	55	2078	Paint-Structural	LCCA Policy	$1,705,620.00	$8,668,214.28	$2,916,890.94	$0.00	$0.00	$0.00	$1,705,620.00	$8,668,214.28	$2,916,890.94	41.69	41.69
	60	2083	Bridge-Replacement	LCCA Policy	$17,206,507.00	$101,373,910.05	$30,896,970.07	$0.00	$0.00	$0.00	$17,206,507.00	$101,373,910.05	$30,896,970.07	41.18	92.08
	79	2102	Joints-Replace	LCCA Policy	$1,361,500.00	$14,065,604.36	$2,942,692.13	$0.00	$0.00	$0.00	$1,361,500.00	$14,065,604.36	$2,942,692.13	71.15	72.38
	84	2107	Paint-Structural	LCCA Policy	$1,538,240.00	$18,422,602.25	$3,490,893.08	$0.00	$0.00	$0.00	$1,538,240.00	$18,422,602.25	$3,490,893.08	62.82	62.82
	89	2112	Deck Repair	LCCA Policy	$1,489,904.10	$20,685,751.96	$3,550,226.21	$0.00	$0.00	$0.00	$1,489,904.10	$20,685,751.96	$3,550,226.21	61.80	69.54
	98	2121	Joints-Replace	LCCA Policy	$1,361,500.00	$24,664,122.39	$3,542,002.26	$0.00	$0.00	$0.00	$1,361,500.00	$24,664,122.39	$3,542,002.26	61.15	62.12
			Subtotal			$63,835,438.28			$0.00			$63,835,438.28			
	65 years until next replacement			Residual Value ((Remaining Life=65)/(Service Life=103))		($28,525,751.12)									
	Life Cycle Costs				Agency Life Cycle Cost $35,309,687.16			User Life Cycle Cost $0.00			Total Life Cycle Cost $35,309,687.16				

Raw Results cont.

Year #	Year	Action(s)	Action(s) Added As	2023 $
1	2024	Paint-Structural	LCCA Policy	$1,705,620.00
6	2029	Joints-Replace	LCCA Policy	$1,361,500.00
18	2041	Deck Repair	LCCA Policy	$1,401,923.37
25	2048	Joints-Replace	LCCA Policy	$1,361,500.00
30	2053	Paint-Structural	LCCA Policy	$1,705,620.00
35	2058	Deck Repair	LCCA Policy	$1,834,479.54
44	2067	Joints-Replace	LCCA Policy	$1,361,500.00
49	2072	Deck Repair	LCCA Policy	$1,837,068.44
55	2078	Paint-Structural	LCCA Policy	$1,705,620.00
60	2083	Bridge-Replacement	LCCA Policy	$17,206,507.00
79	2102	Joints-Replace	LCCA Policy	$1,361,500.00
84	2107	Paint-Structural	LCCA Policy	$1,538,240.00
89	2112	Deck Repair	LCCA Policy	$1,489,904.10
98	2121	Joints-Replace	LCCA Policy	$1,361,500.00



What I didn't like

- This is a poor bridge, on an interstate. It should be replaced ASAP.
- Even with maintenance, it wouldn't make it 60 years
- This just begins to scrape the surface of actions to maintain a bridge

Burning question: why is this bridge not being replaced until year 60?

Year #	Year	Action(s)	Action(s) Added As	2023 $
1	2024	Replacement	LCCA Policy	$1,705,620.00
6	2029	Joints-Replace	LCCA Policy	$1,361,500.00
18	2041	Deck Repair	LCCA Policy	$1,401,923.37
25	2048	Joints-Replace	LCCA Policy	$1,361,500.00
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Joint Reseal
Deck Overlay
Paint Sub

“Finalized Results”– Build Scenario

Scope Kentucky/Brooke					
056B00183N Full Replacement					
	Deck Area=	49,791 sf			
		Build Scenario #1			
	Year	Description	Unit Cost	Cost	
	1	Full Replacement		$ 22,754,487.00	
	10	Epoxy Overlay, Joint Reseal, Paint Substructure under Joints	Epoxy: $30/sf, Joint Reasel: $700ea, Paint Sub: $21/sf		
	20	Epoxy Overlay, Joint Reseal, Paint Substructure under Joints	Epoxy: $30/sf, Joint Reasel: $700ea, Paint Sub: $21/sf		
	25	Paint Steel Beams	$21/sf		
	30	Bridge Preservation: Latex/Epoxy Overlay, Joint Replacement, Paint Substructure under Joints	Epoxy: $30/sf, Latex: $45/sf, Joint Replace: $700ea, Paint Sub: $21/sf		

Conclusions and Recommendations

- LCCA Analysis is a great tool to use when analyzing specific bridges.
  - Important assets, key bridges
- The tool itself easy to use, as it mostly mimics the Network Optimizer
- 20 bridges in one sitting was a lot. If I could go back, I would have used LCCA Analysis for select ones and spent more time in the settings.
- Establish a good, concise naming system for your LCCA Plans

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