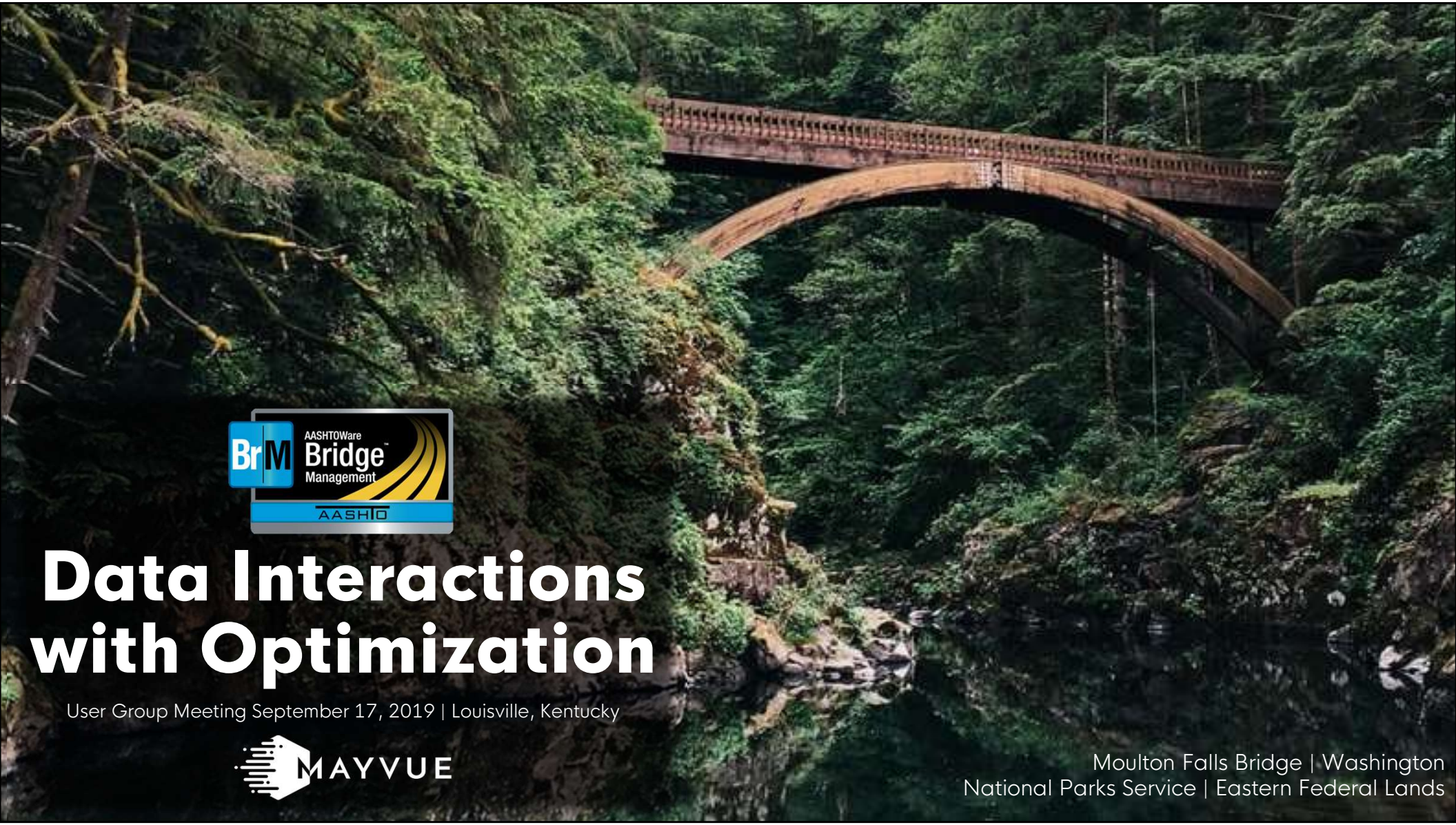

Some interactions we have learned working with several states.

CONTACT

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MAYVUE

Jira Service Desk
https://bridgeware.atlassian.net/servicedesk/customer/portals

Moulton Falls Bridge | Washington
National Parks Service | Eastern Federal Lands

CULVERT DECK AREAS

CULVERT DECK AREAS

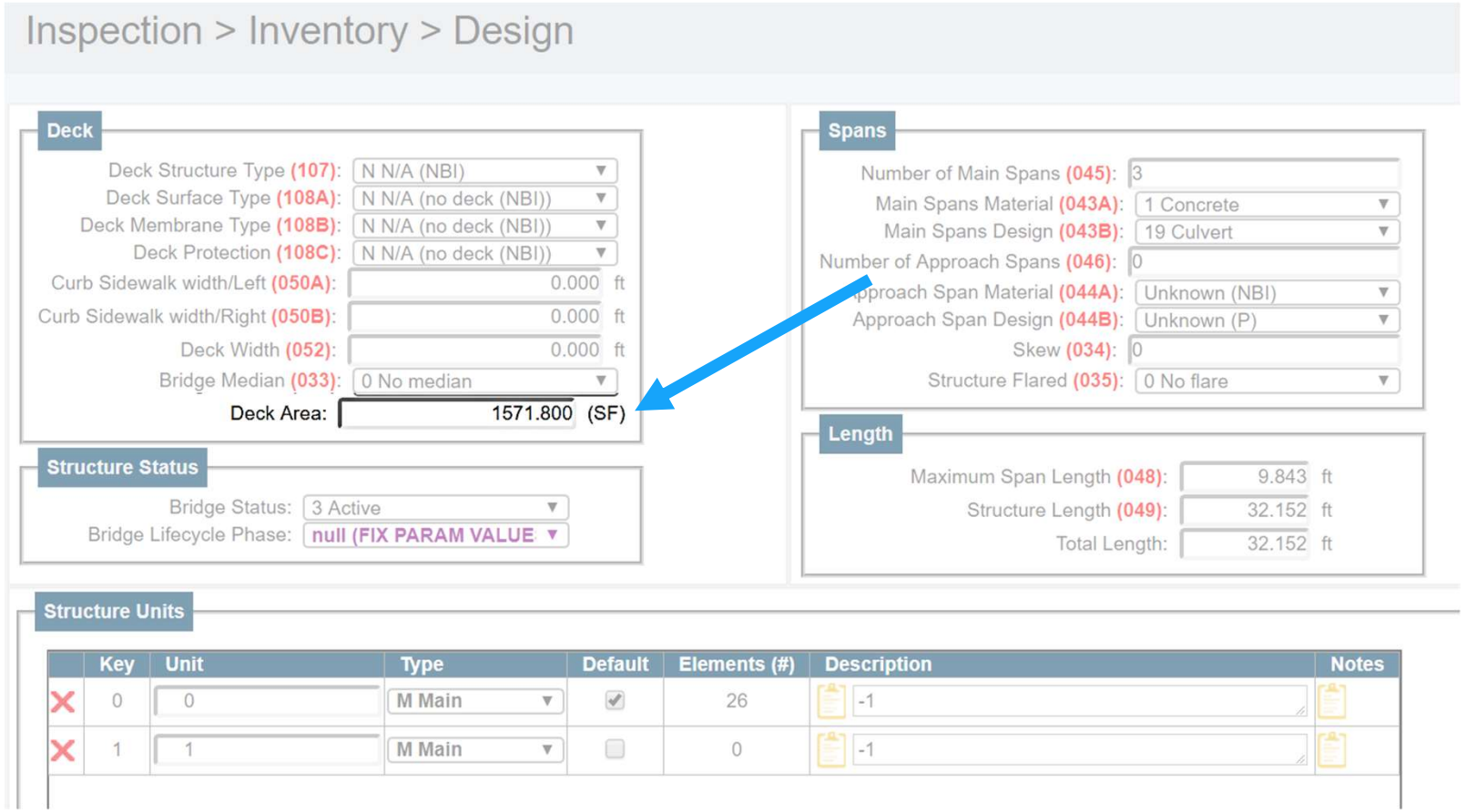
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



First, as a reminder, be aware the optimization uses the bridge.deck_area field because this process pre-dates the FHWA deck area formula. You might not have populated this field for culverts. If you use another program (inspecttech, inspect-x, or a custom inspection solution, make sure this field is being populated.

CULVERT DECK AREAS

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

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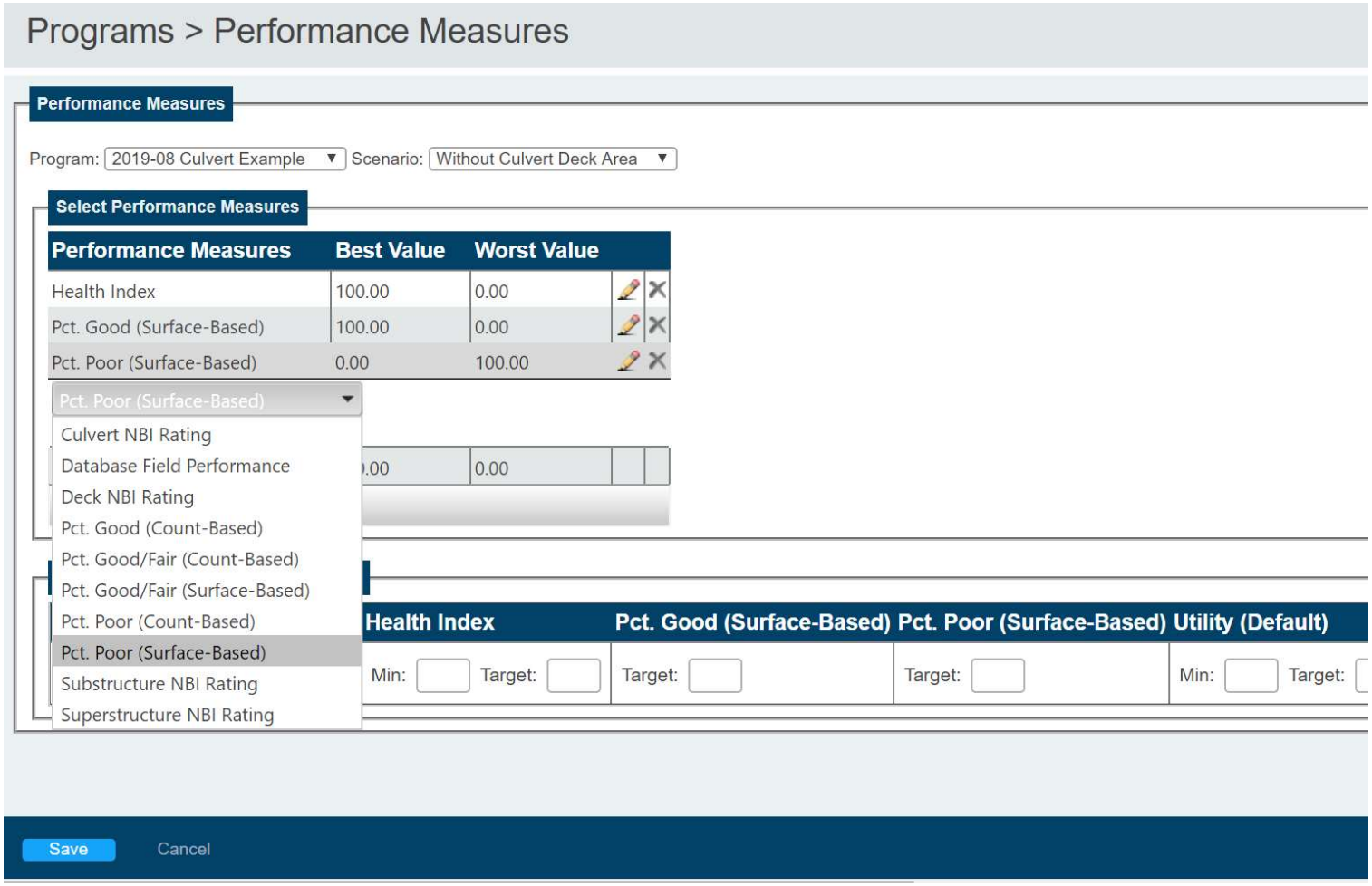

This deck area is used for the performance measures based on surface areas.

CULVERT DECK AREAS

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

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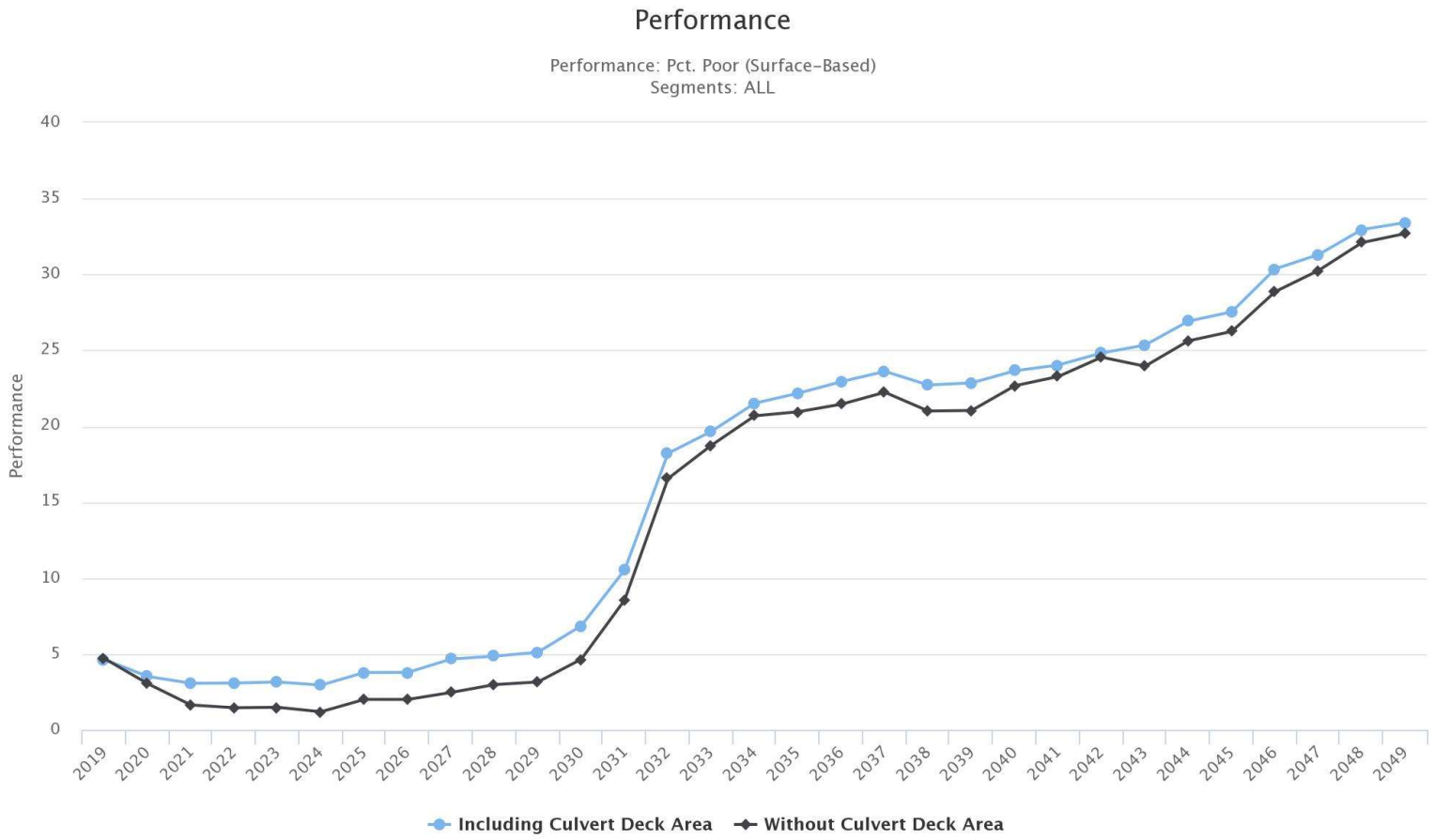
NETWORK POLICIES



Note here, in a state with 4% poor by deck area outside of BrM, that not including the culverts leads to a 2% better (or inaccurate) performance measure.

CULVERT DECK AREAS

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

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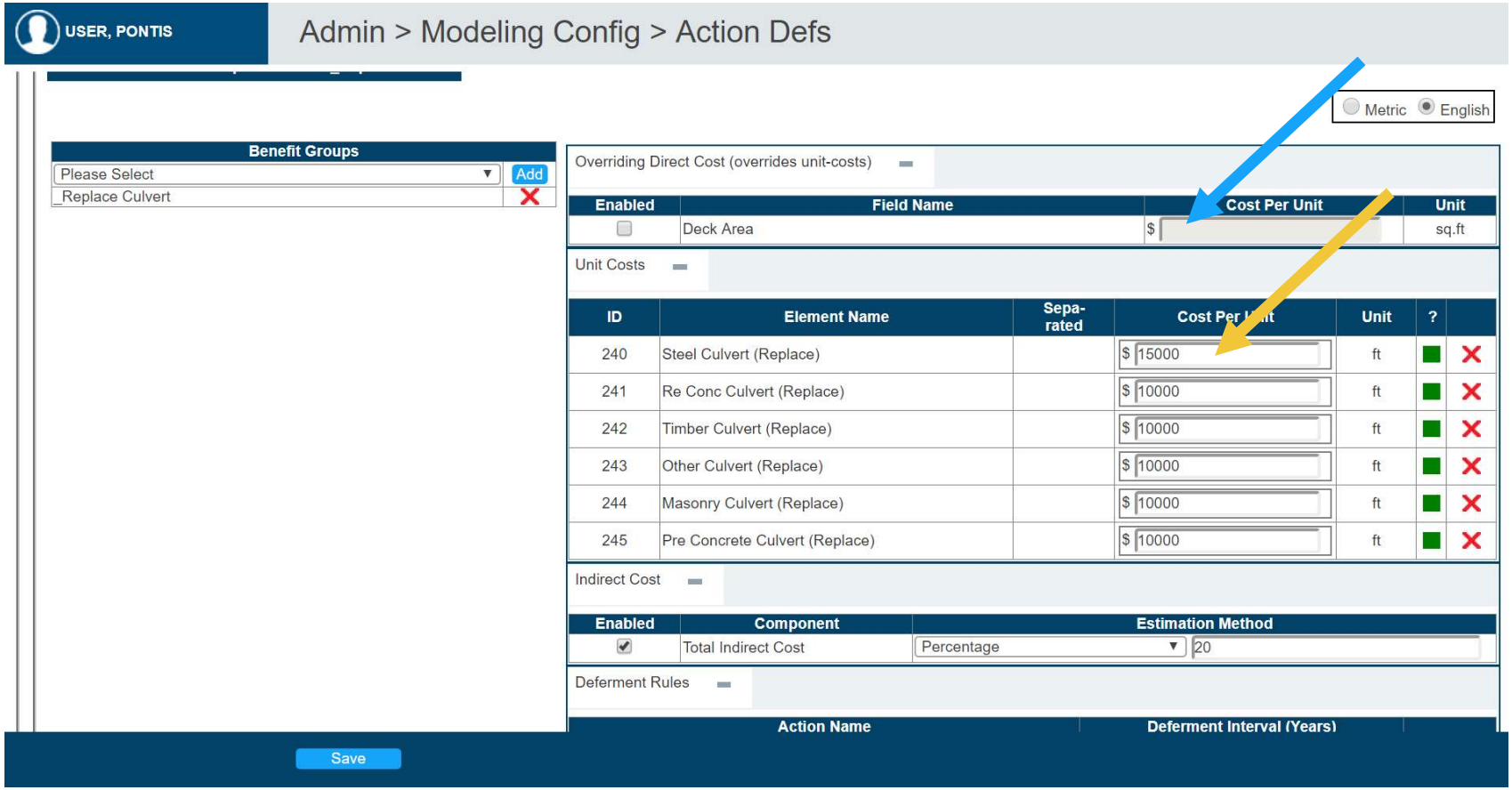
NETWORK POLICIES



That missing deck area can also affect the costs-per-deck-area.

CULVERT DECK AREAS

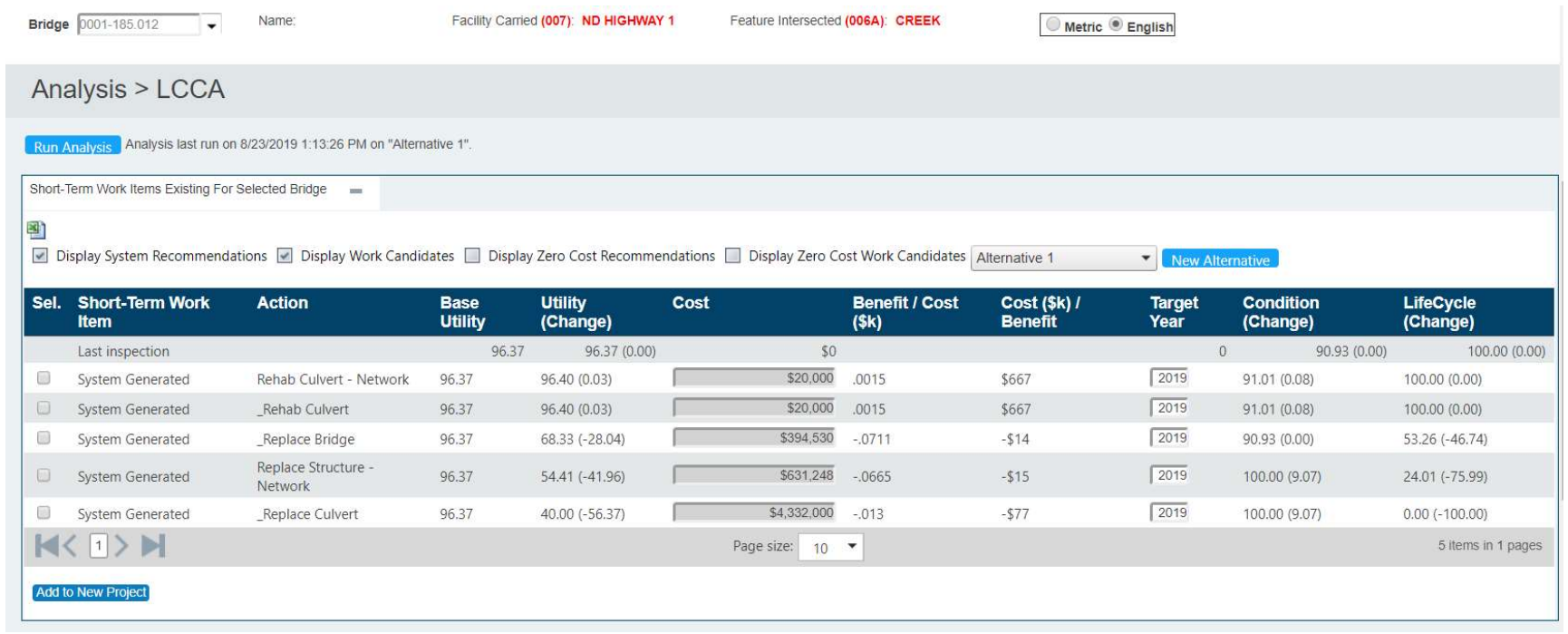
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



Sel.	Short-Term Work Item	Action	Base Utility	Utility (Change)	Cost	Benefit / Cost ($k)	Cost ($k) / Benefit	Target Year	Condition (Change)	LifeCycle (Change)
	Last inspection		96.37	96.37 (0.00)	$0			0	90.93 (0.00)	100.00 (0.00)
☐	System Generated	Rehab Culvert - Network	96.37	96.40 (0.03)	$20,000	.0015	$667	2019	91.01 (0.08)	100.00 (0.00)
☐	System Generated	_Rehab Culvert	96.37	96.40 (0.03)	$20,000	.0015	$667	2019	91.01 (0.08)	100.00 (0.00)
☐	System Generated	_Replace Bridge	96.37	68.33 (-28.04)	$394,530	-.0711	-$14	2019	90.93 (0.00)	53.26 (-46.74)
☐	System Generated	Replace Structure - Network	96.37	54.41 (-41.96)	$631,248	-.0665	-$15	2019	100.00 (9.07)	24.01 (-75.99)
☐	System Generated	_Replace Culvert	96.37	40.00 (-56.37)	$4,332,000	-.013	-$77	2019	100.00 (9.07)	0.00 (-100.00)

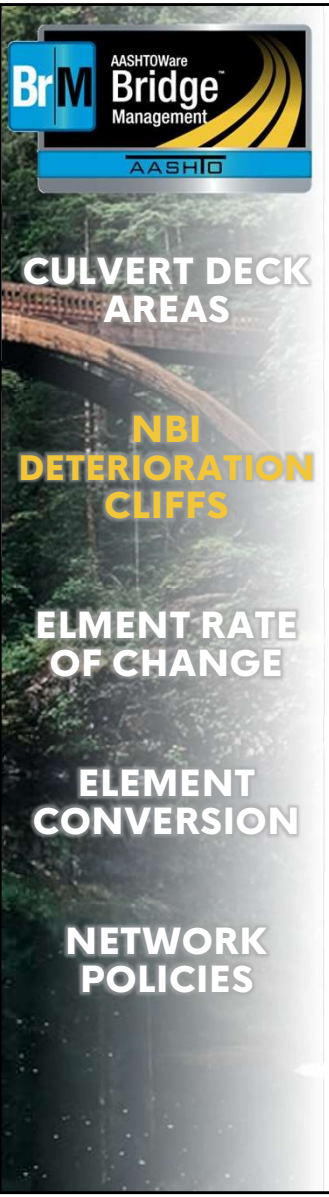
Page size: 10 — 5 items in 1 pages

It will also affect the cost-benefits of work when you look at the LCCA page for the single structure.

CULVERT DECK AREAS


```
UPDATE bridge
SET deck_area= CASE WHEN length <=0 THEN NULL
                    WHEN deckwidth > 0 THEN length * deckwidth
                    WHEN (SELECT  x.roadway_gd FROM roadway x WHERE
                      x.bridge_gd= bridge.bridge_gd and x.on_under='1') IS
                      NULL THEN NULL
                    WHEN (SELECT  x.aroadwidth FROM roadway x WHERE
                      x.bridge_gd= bridge.bridge_gd and x.on_under='1') <= 0
                      THEN NULL
                    ELSE (length * (SELECT x.aroadwidth FROM roadway x WHERE
                      x.bridge_gd = bridge.bridge_gd and x.on_under='1'))
                    END
UPDATE bridge SET deck_area = (ROUND(deck_area, 1));
```

Here is a quick SQL script to populate your deck areas with the FHWA formula if needed.



NBI DETERIORATION CLIFFS

NBI DETERIORATION CLIFFS

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

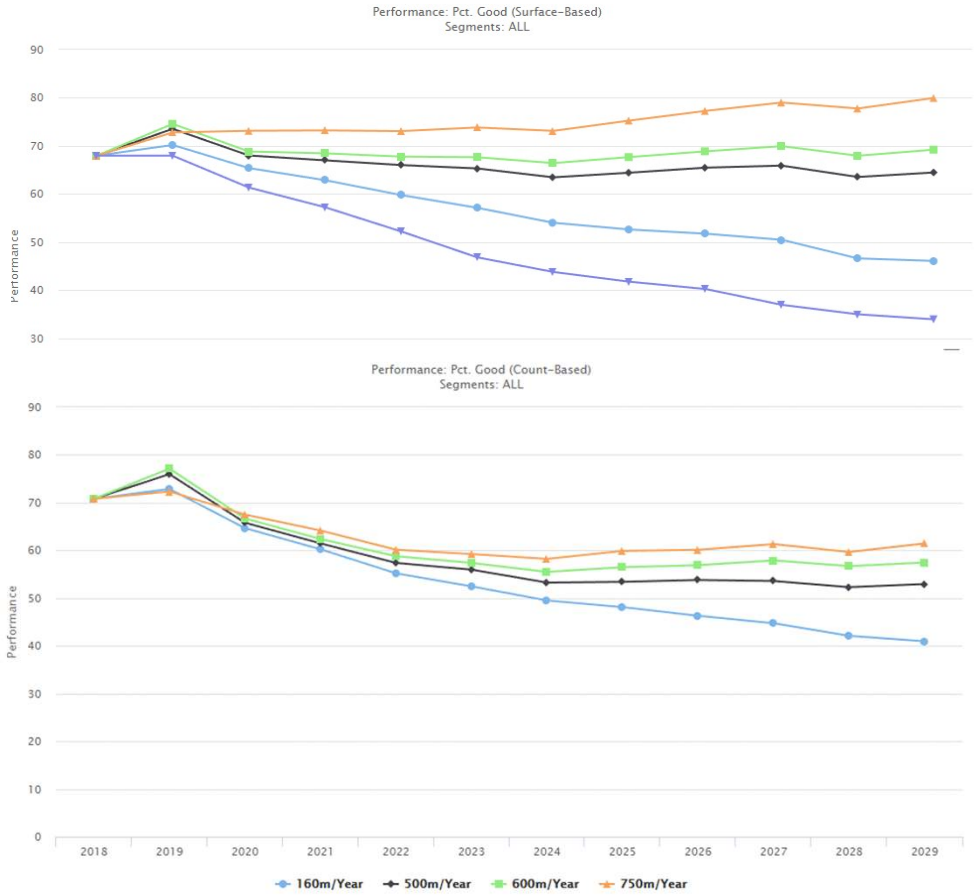
ELEMENT CONVERSION

NETWORK POLICIES

Consider this example early draft run from a DOT:

At no funding, low funding or current funding, the % Good area drops quickly (10% in 3 years)

The Count Good drops very quickly no matter the funding.



NBI DETERIORATION CLIFFS

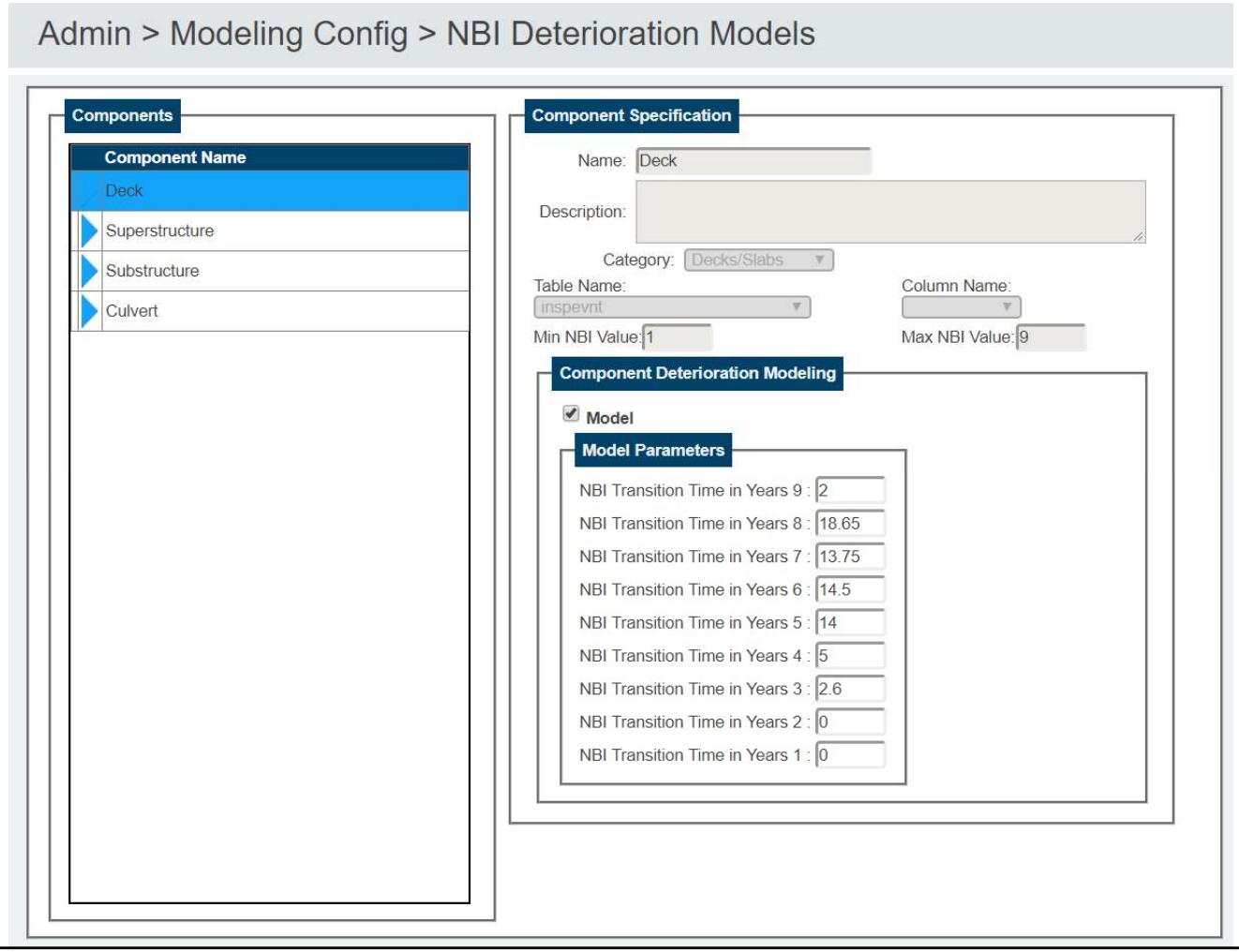
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



NBI deterioration is a monatonically decreasing number. Meaning it's a fixed number of years as a 5 before dropping to a 4.

NBI DETERIORATION CLIFFS

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

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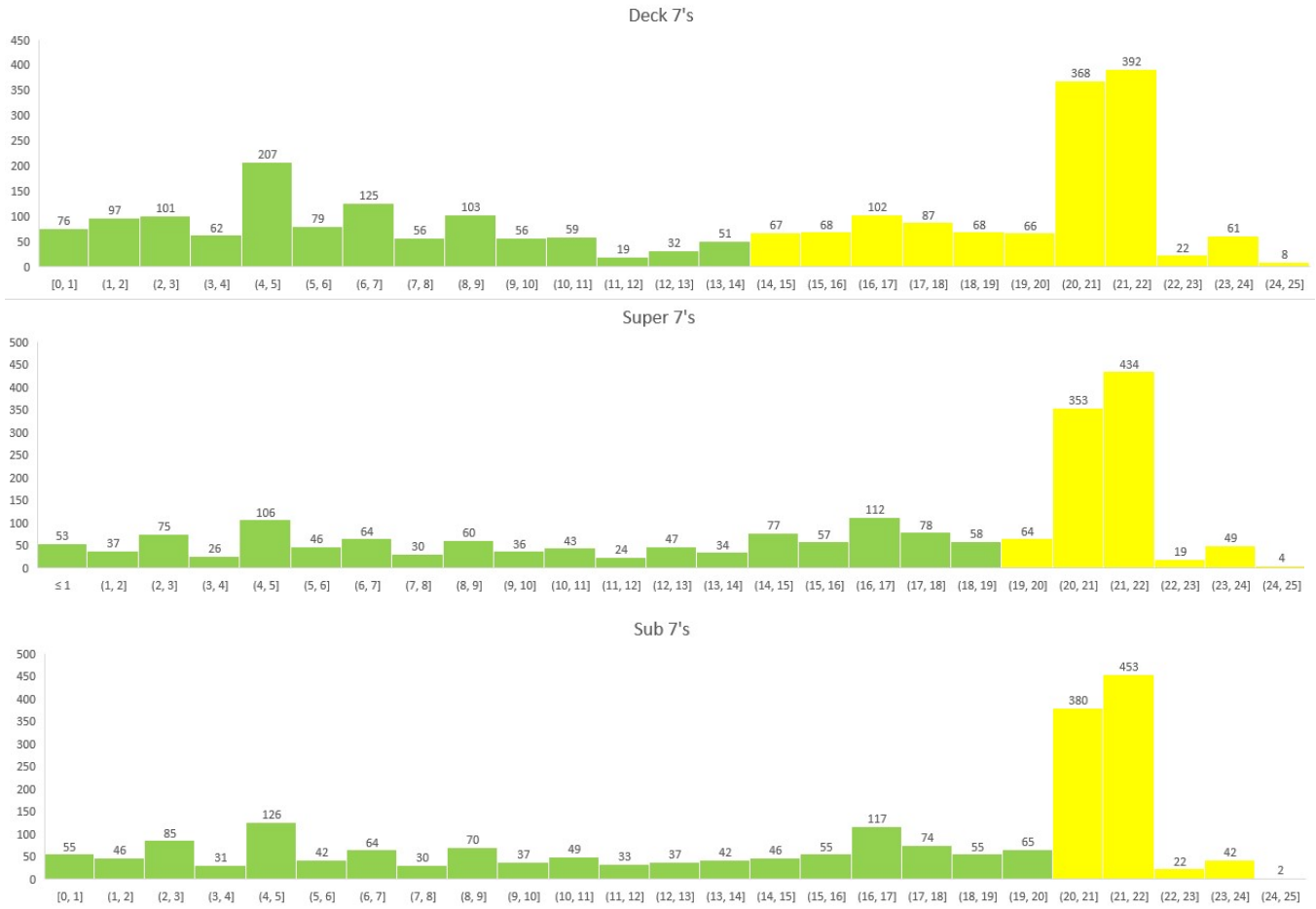
NETWORK POLICIES



We went and looked into how long a structure has been in a certain condition. In this case, a large number of them have always been 7's as far back as the state has data.

NBI DETERIORATION CLIFFS

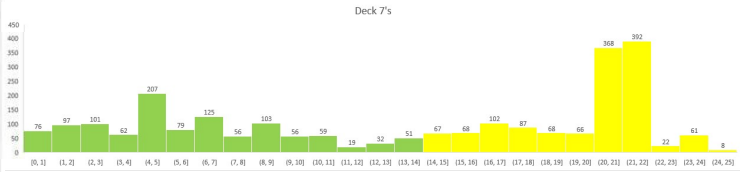
CULVERT DECK AREAS

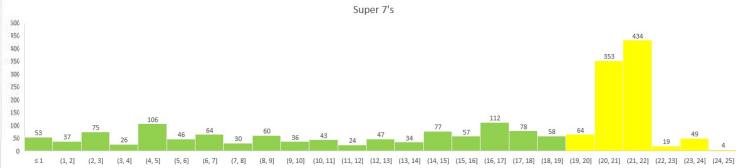
NBI DETERIORATION CLIFFS

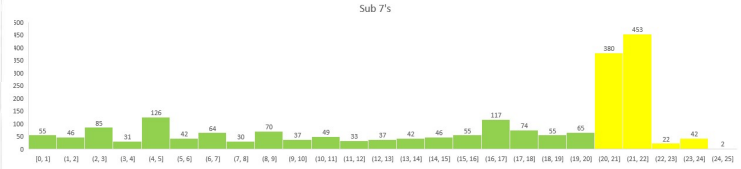
ELMENT RATE OF CHANGE

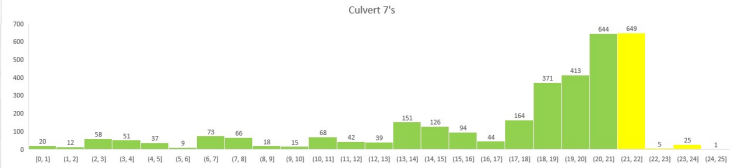
ELEMENT CONVERSION

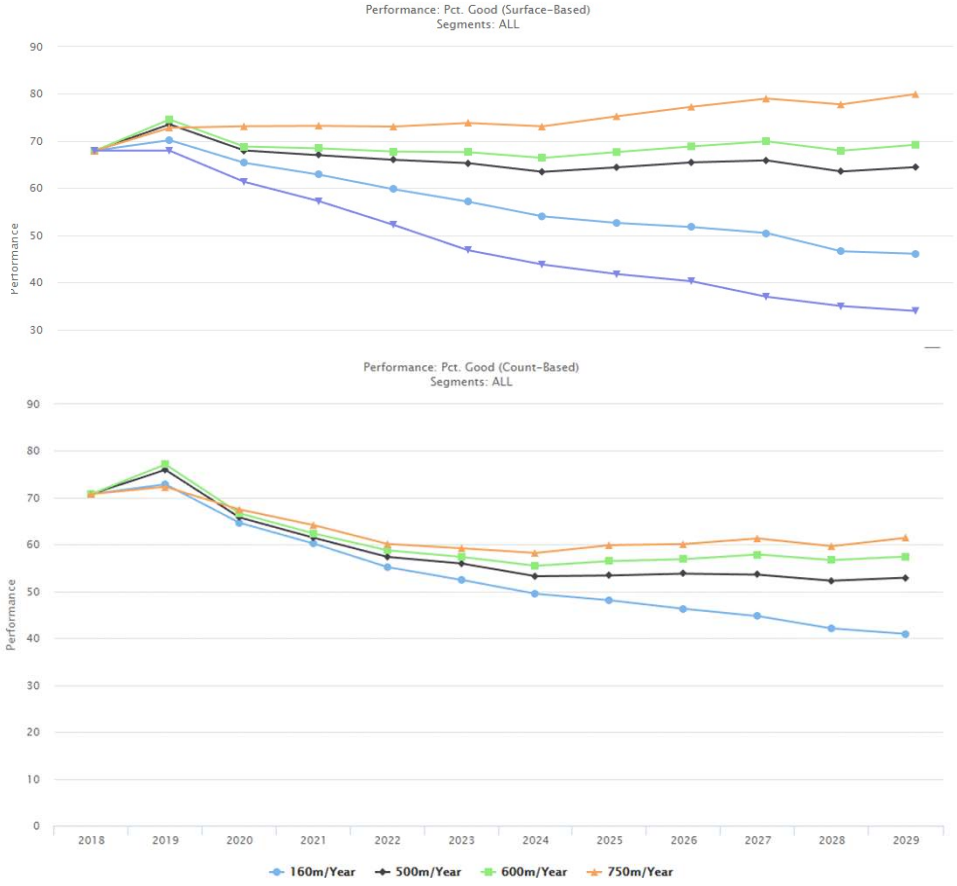
NETWORK POLICIES











These large flocks of structures deteriorating to fair at the same time causes this steep dropoff in deterioration.

NBI DETERIORATION CLIFFS

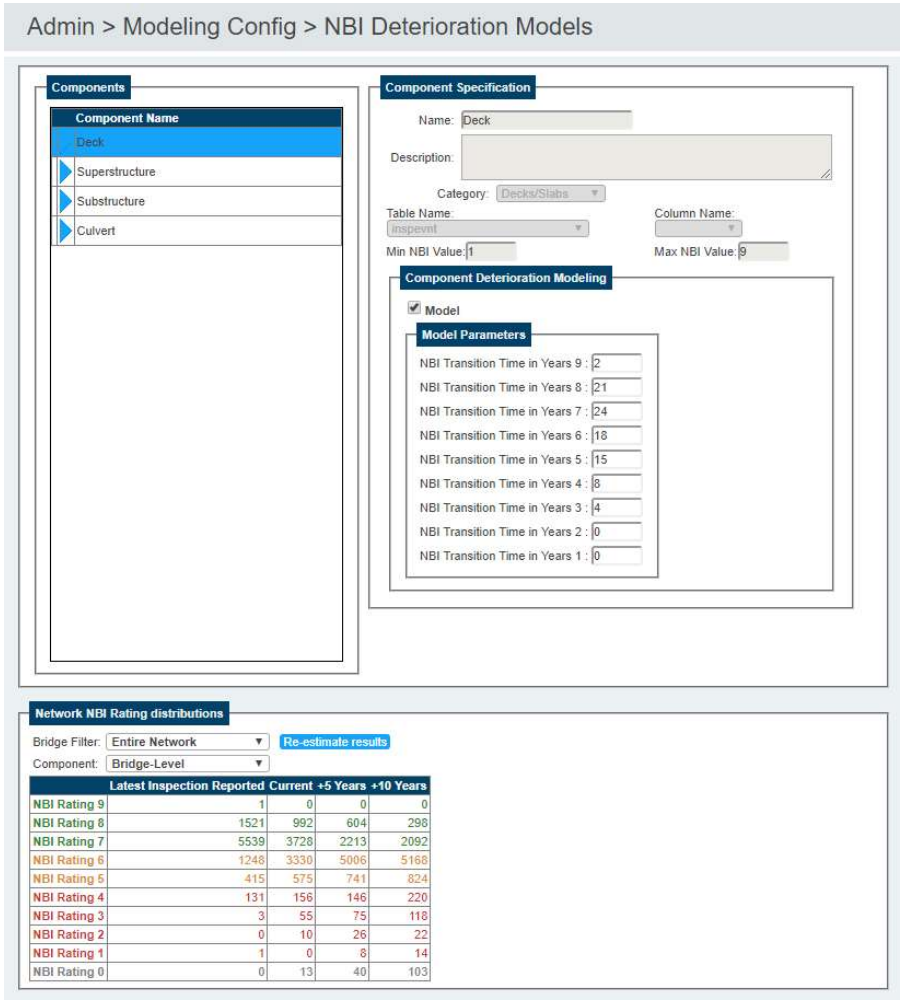
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

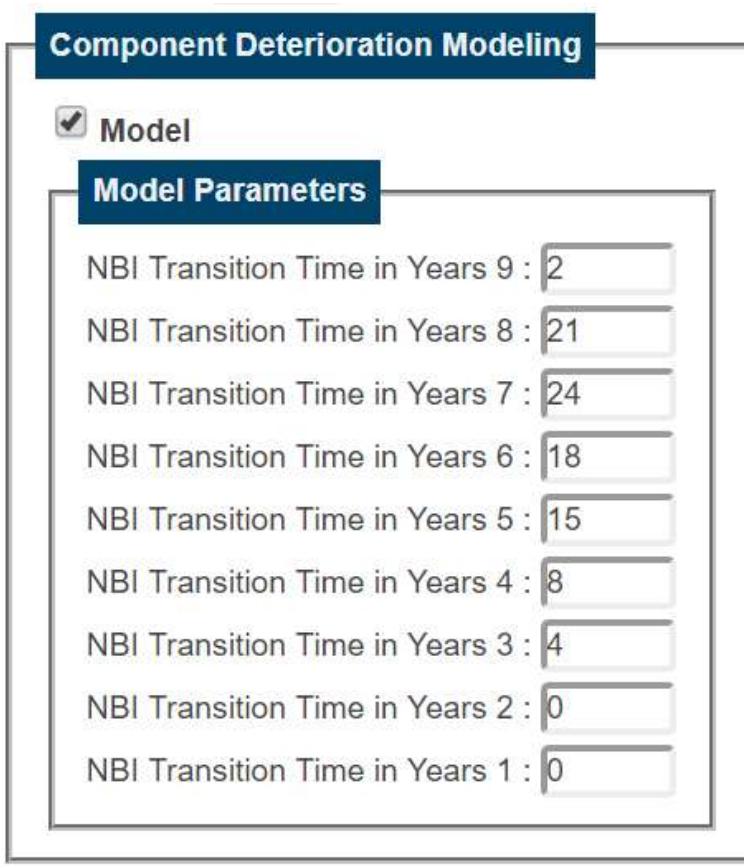
ELMENT RATE OF CHANGE

ELEMENT CONVERSION

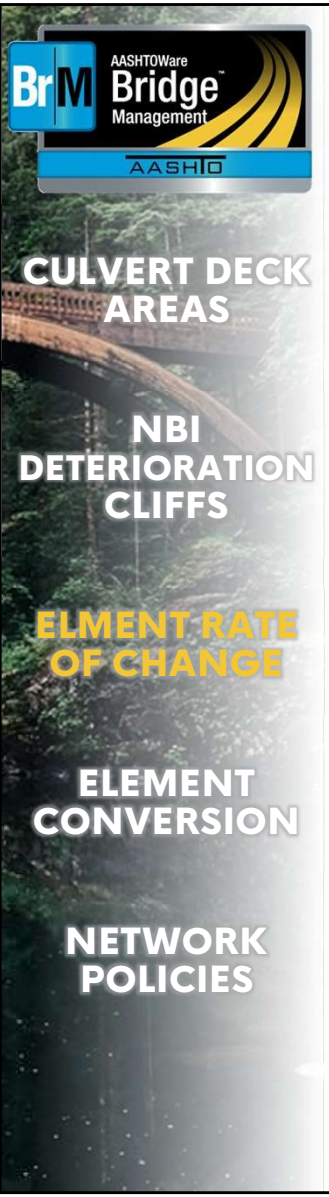
NETWORK POLICIES



	Latest Inspection Reported	Current	+5 Years	+10 Years
NBI Rating 9	1	0	0	0
NBI Rating 8	1521	992	604	298
NBI Rating 7	5539	3728	2213	2092
NBI Rating 6	1248	3330	5006	5168
NBI Rating 5	415	575	741	824
NBI Rating 4	131	156	146	220
NBI Rating 3	3	55	75	118
NBI Rating 2	0	10	26	22
NBI Rating 1	1	0	8	14
NBI Rating 0	0	13	40	103



So if you chose to use NBI (or GCR) deterioration, be aware of the quirks in your data which may cause steep deterioration rates.



ELEMENT RATE OF CHANGE

ELEMENT RATE OF CHANGE

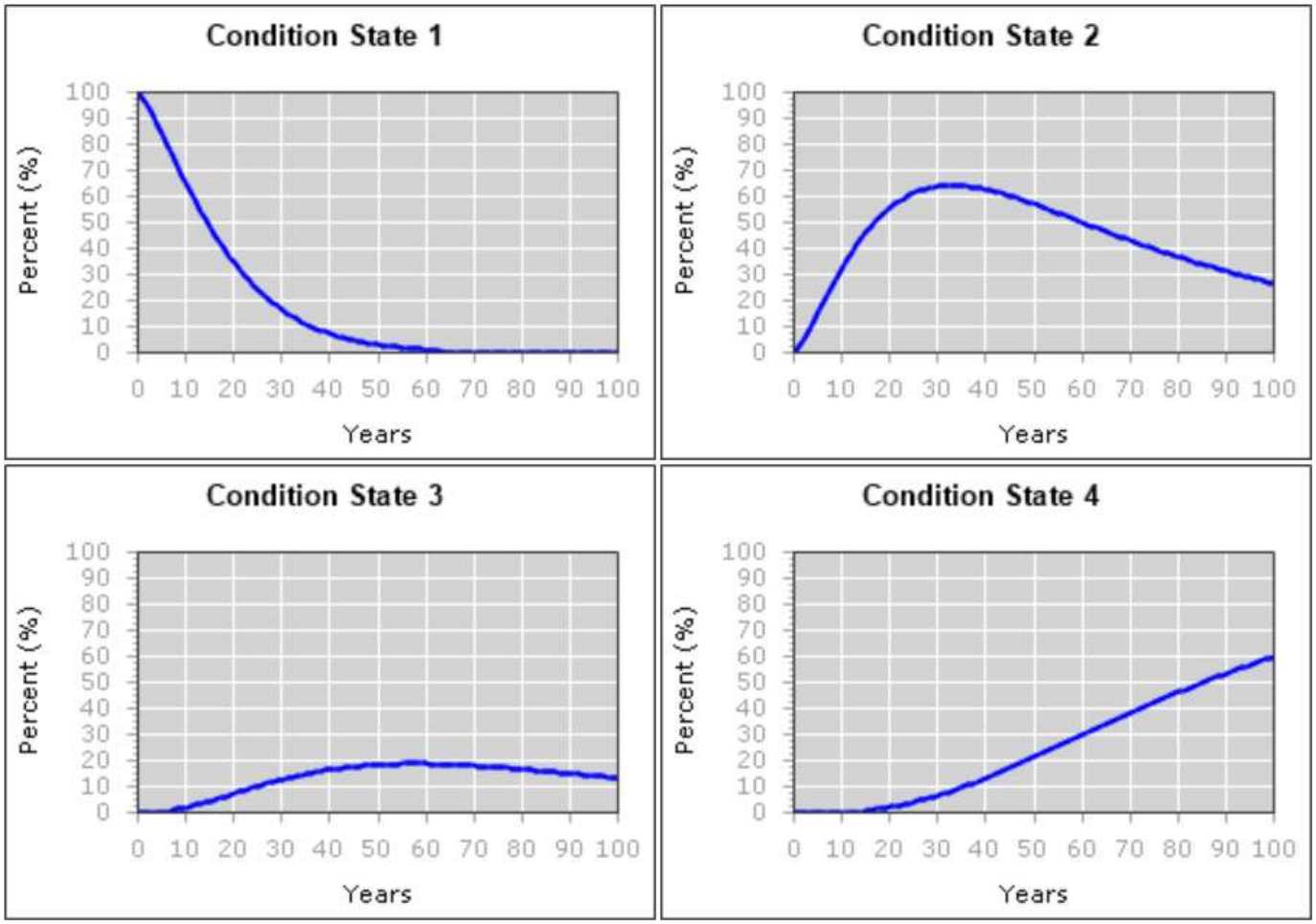
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



This is the markovian deterioration – the ideal of what we expect from elements.

ELEMENT RATE OF CHANGE

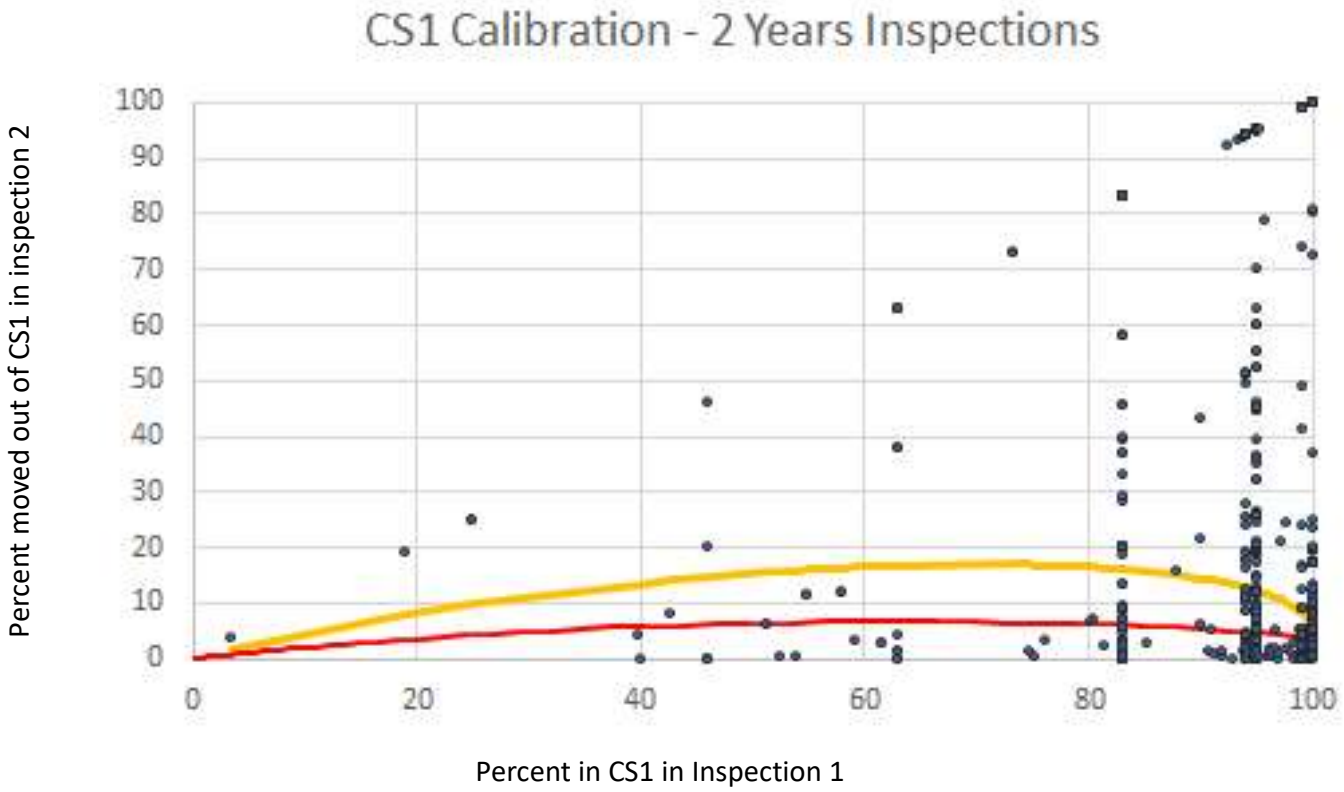
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



Comparing the rate of deterioration from two inspections in a state produces this interesting graph.

ELEMENT RATE OF CHANGE

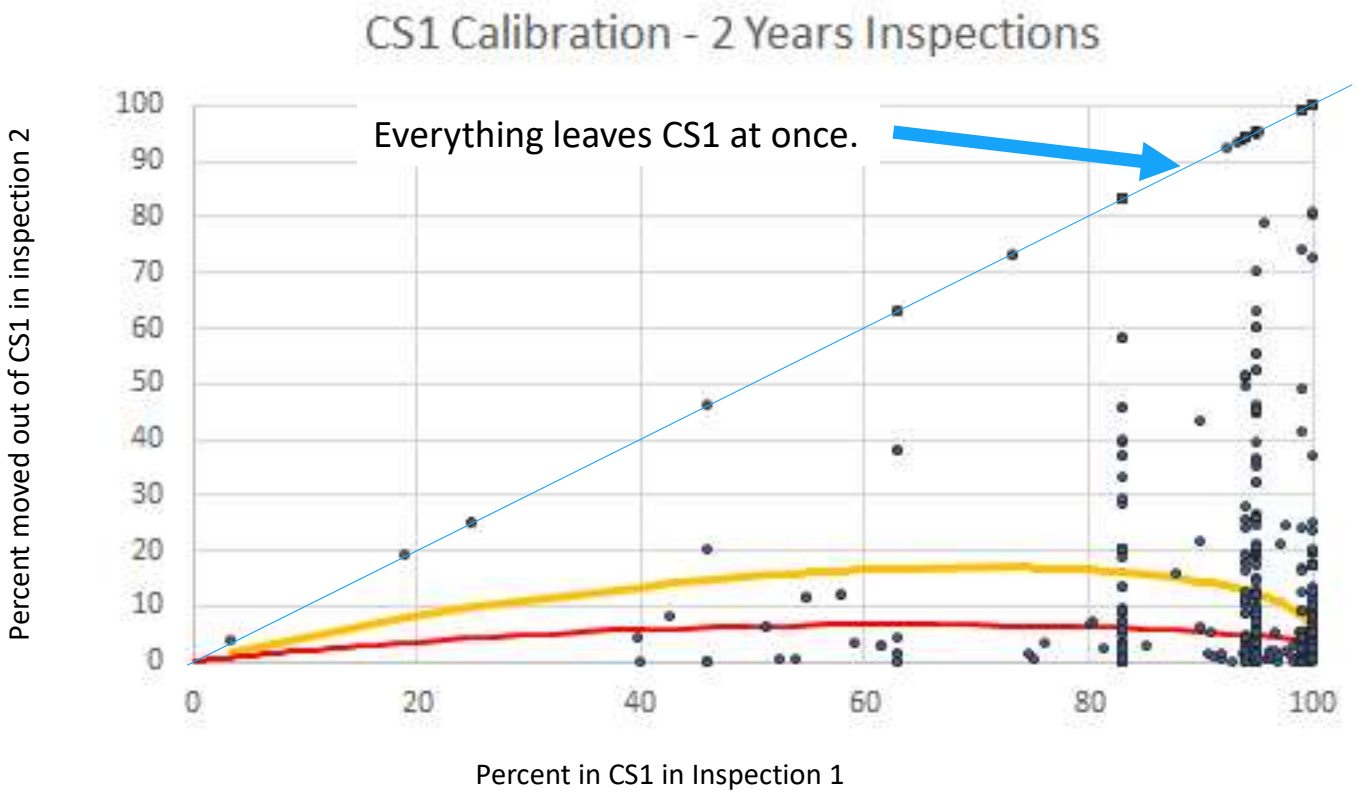
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



It was more frequent than expected that all of CS1 would leave in an inspection.

ELEMENT RATE OF CHANGE

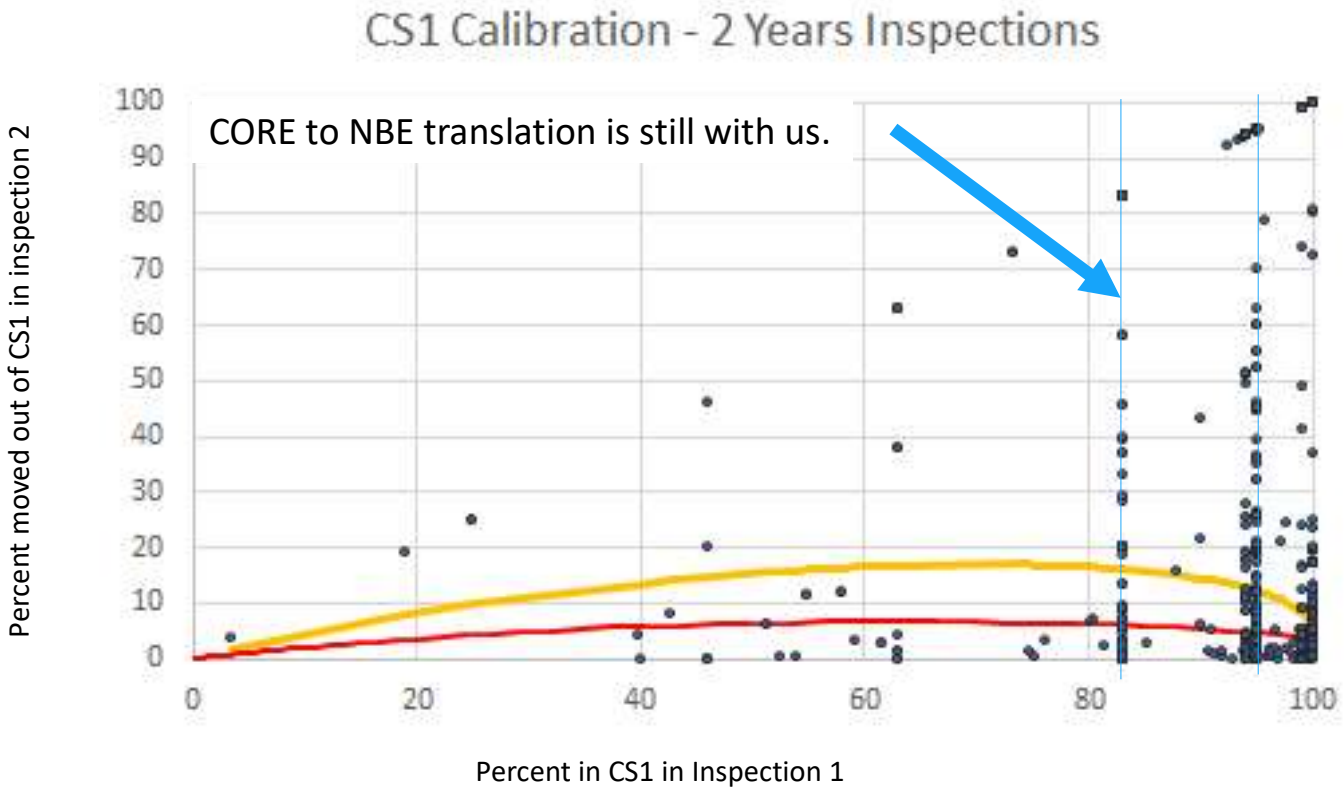
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



And notice that high percentages of CS1 in the CORE translation zones are still with us.

ELEMENT RATE OF CHANGE

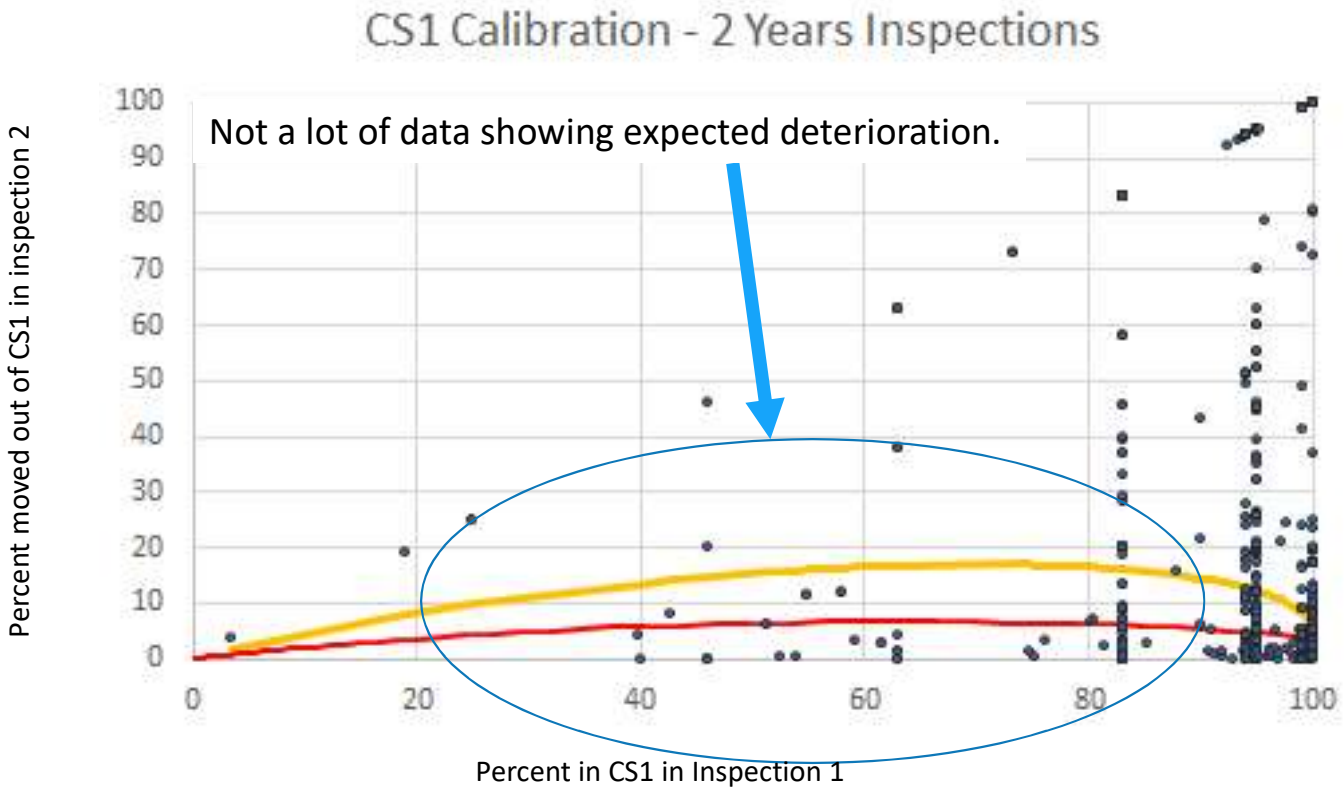
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



This is where we would expect the deterioration signal, and there wasn't a lot there.

ELEMENT RATE OF CHANGE

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

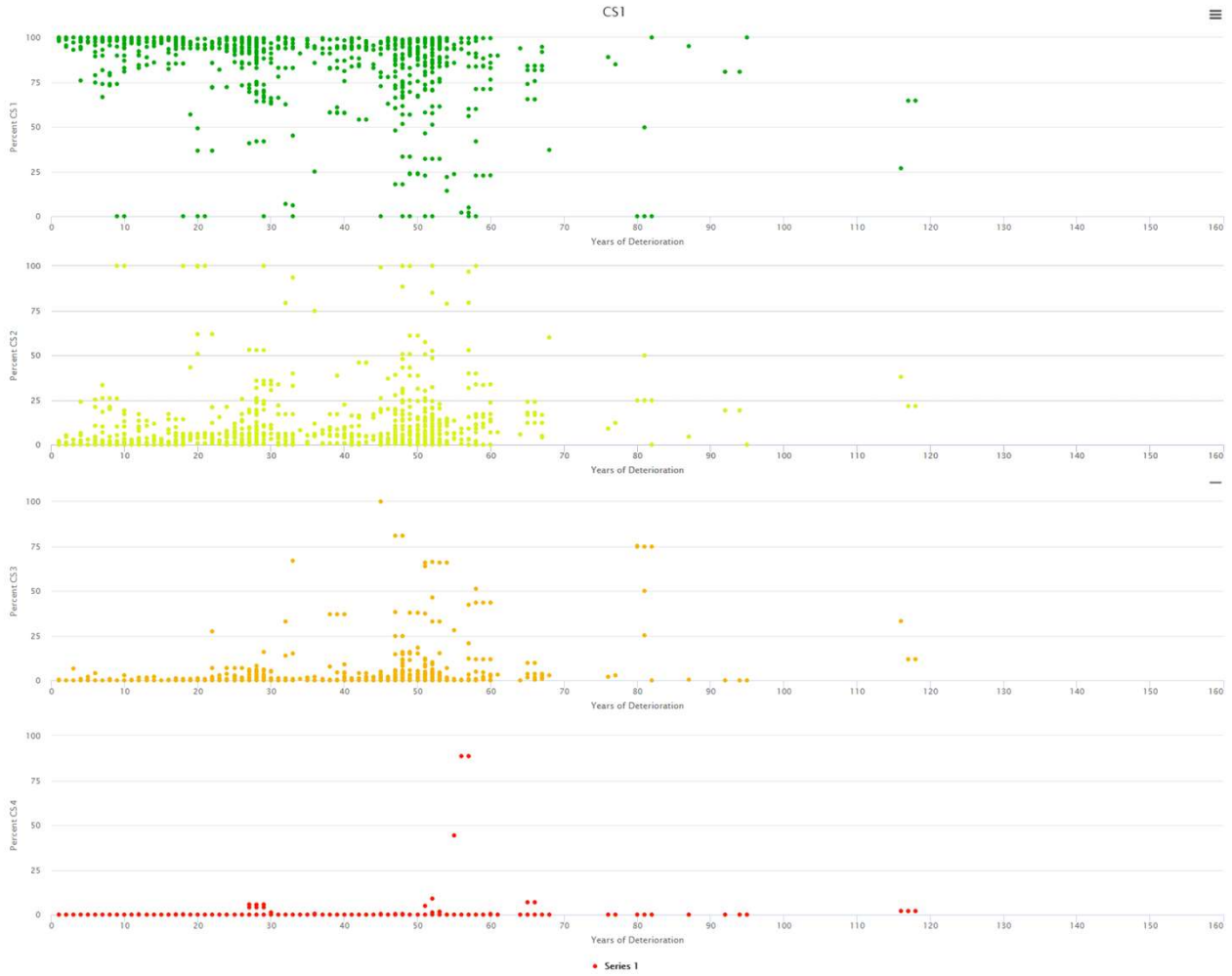
ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES

RIDOT Element 12 Data
Filtered to:

- Inspections since 2015
- Deck areas greater than 1k sqft.
- Year built is not before inspection
- Newest of year built or year reconstruct



Graphing instead age vs. amount in each condition state, with some basic filters.

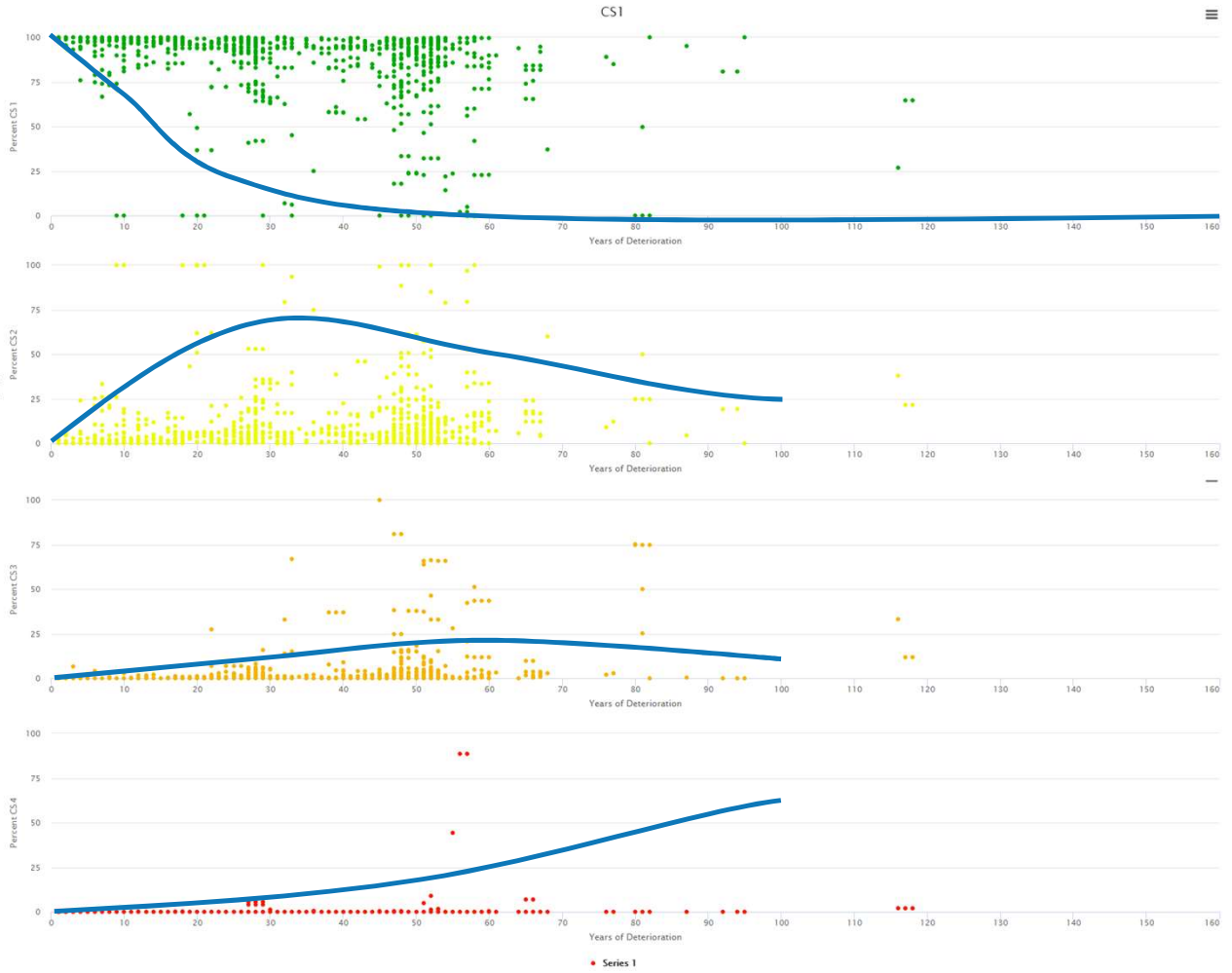
ELEMENT RATE OF CHANGE

AASHTOWare Bridge Management

- CULVERT DECK AREAS
- NBI DETERIORATION CLIFFS
- ELMENT RATE OF CHANGE
- ELEMENT CONVERSION
- NETWORK POLICIES

2015+ RIDOT Element 12

- Not zero deck area
- Year built is not before i
- Newest of year built or



We would expect curves something like this.

ELEMENT RATE OF CHANGE

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES

RIDOT NBE Element 215

- Year built is not before inspection
- Newest of year built or year reconstruct
- 1k+ deck area

Taking out some of the filters, just shows the match is pretty hard. Computer methods cannot find the pattern in here. Even talking to staticians, the best we can do for now is apply human's best expectations of deterioration.

AASHTOWare Bridge Management

AASHTO

ELEMENT CONVERSION

ELEMENT CONVERSION

- CULVERT DECK AREAS
- NBI DETERIORATION CLIFFS
- ELMENT RATE OF CHANGE
- ELEMENT CONVERSION
- NETWORK POLICIES

Generic | Deck | Superstructure | Substructure | Culvert

Generic Upper Limits

☑ Group enabled

Method of CS averag: Element weighting

NBI	Enabled	CS1 %	CS2 %	CS3 %	CS4 %
9	☑	100	1	1	1
8	☑		5	5	1
7	☑		20	5	2
6	☑			10	3
5	☑			20	5
4	☑				15
3	☑				100
2	☐				
1	☐				

ELEMENT CONVERSION

CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES

Category	Deck																																					
NBI	9	8	7	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	0	
CS	1									2									3									4												
0	2	19	142	252	254	88	17	3	5	129	365	413	181	91	41	9	4	4	149	523	868	665	375	93	19	8	6	154	538	924	768	466	150	20	8	3	3	
2	1	0	1	0	1	1	0	0	0	13	61	88	28	3	0	0	0	0	2	12	45	54	21	2	1	0	0	0	1	11	23	12	5	1	1	0	0	
4	0	0	0	0	1	0	0	0	0	1	11	31	22	5	1	1	0	0	1	1	8	27	14	1	0	0	0	0	0	1	2	4	1	0	0	0	0	
6	0	0	0	1	0	1	0	0	0	2	41	136	138	68	15	0	0	0	2	0	4	3	9	1	0	0	0	0	0	1	1	1	1	1	0	0	0	
8	0	1	1	1	1	0	0	0	0	3	7	15	27	6	1	0	0	0	0	1	1	7	5	2	0	0	0	0	0	0	1	1	1	0	0	0	0	
10	0	0	0	0	1	1	0	0	0	0	5	13	20	4	2	0	0	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	1	1	0	0	0	
12	0	0	1	1	1	2	1	0	0	1	2	14	13	3	1	0	0	0	0	0	2	3	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	0	1	1	1	0	0	0	0	0	2	7	10	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	1	7	14	4	0	0	0	0	0	0	1	2	3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	
18	0	0	1	0	0	0	0	0	0	1	5	7	29	33	20	2	1	1	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	1	0	0	0	0	0	1	7	5	4	1	0	0	0	0	0	0	3	2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	
80	0	1	6	10	2	2	0	0	0	0	0	1	3	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
82	0	1	7	7	5	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
84	1	5	7	32	28	16	1	1	1	0	0	0	0	0	2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
86	0	1	6	11	4	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
88	0	2	7	9	2	0	0	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
90	1	2	14	12	5	1	0	0	0	0	0	0	2	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
92	1	7	14	23	6	1	0	0	0	0	0	0	2	3	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
94	2	7	15	30	6	1	0	0	0	0	1	0	1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
96	3	40	141	136	69	12	1	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
98	1	11	33	26	3	0	0	0	0	0	0	1	8	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100	141	423	484	174	40	1	1	2	0	3	18	137	223	191	36	5	1	1	0	1	2	12	36	32	1	1	0	0	0	0	0	4	1	5	1	3	7	

More states than expected have these unusual inspections, where element and NBI ratings do not match up.

ELEMENT CONVERSION

- CULVERT DECK AREAS
- NBI DETERIORATION CLIFFS
- ELMENT RATE OF CHANGE
- ELEMENT CONVERSION
- NETWORK POLICIES

Category	Deck																																					
NBI	9	8	7	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	9	8	7	6	5	4	3	2	1	0	
CS	1									2									3									4												
0	2	19	142	252	254	88	17	3	5	129	365	413	181	91	41	9	4	4	149	523	868	665	375	93	19	8	6	154	538	924	768	466	150	20	8	3	3	
2	1	0	1	0	1	1	0	0	0	13	61	88	28	3	0	0	0	0	2	12	45	54	21	2	1	0	0	0	1	11	23	12	5	1	1	0	0	
4	0	0	0	0	1	0	0	0	0	1	11	31	22	5	1	1	0	0	1	1	8	27	14	1	0	0	0	0	0	1	2	4	1	0	0	0	0	
6	0	0	0	1	0	1	0	0	0	2	41	136	138	68	15	0	0	0	2	0	4	3	9	1	0	0	0	0	0	1	1	1	1	1	0	0	0	
8	0	1	1	1	1	0	0	0	0	3	7	15	27	6	1	0	0	0	0	1	1	7	5	2	0	0	0	0	0	0	1	1	1	0	0	0	0	
10	0	0	0	0	1	1	0	0	0	0	5	13	20	4	2	0	0	0	0	1	1	4	5	0	0	0	0	0	0	0	0	1	1	1	0	0	0	
12															1	0	0	0	0	0	2	3	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
14															0	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16															0	0	0	0	0	0	1	2	3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
18															20	2	1	1	0	0	0	0	0	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0	
20															1	0	0	0	0	0	0	3	2	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
80															1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
82															1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
84															2	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
86															1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
88															0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
90															3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
92															1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
94															2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
96															1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
98															2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
100															36	5	1	1	0	1	2	12	36	32	1	1	0	0	0	0	0	4	1	5	1	3	7		

Generic | Deck | Superstructure | Substructure | Culvert

Generic Upper Limits

Group enabled

Method of CS averag: Element weighting

NBI	Enabled	CS1 %	CS2 %	CS3 %	CS4 %
9	☑	100	1	1	1
8	☑		5	5	1
7	☑		20	5	2
6	☑			10	3
5	☑			20	5
4	☑				15
3	☑				100
2	☐				
1	☐				

These will not get converted how you would expect when applying FHWA's NBI conversion method. This conversion will probably be greatly improved by adding more controls to the QC process.

ELEMENT CONVERSION

CULVERT DECK AREAS

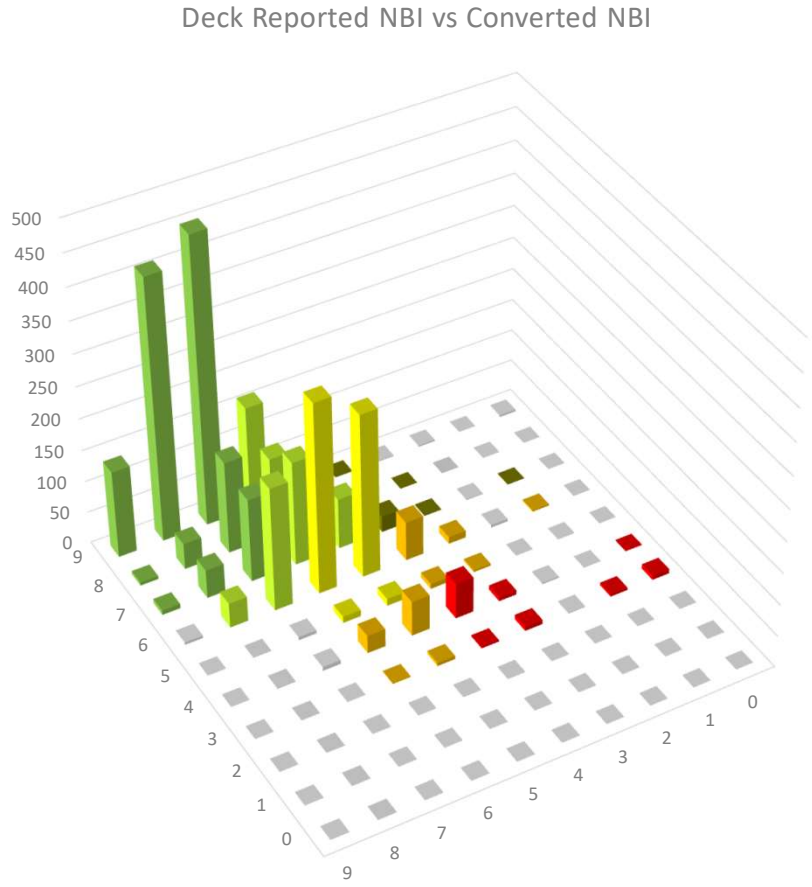
NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

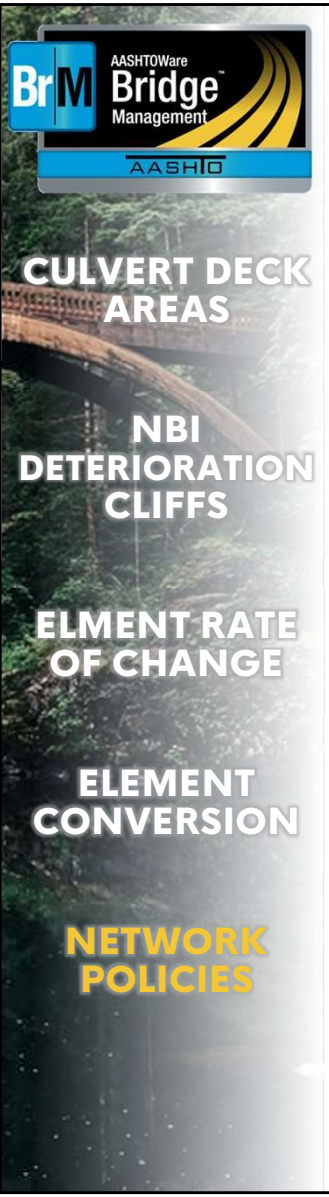
ELEMENT CONVERSION

NETWORK POLICIES

Reported \ Converted	9	8	7	6	5	4	3	2	1	0
9	138	5	7	4	0	0	0	0	0	0
8	413	41	45	39	0	1	0	0	0	0
7	452	146	132	196	5	6	0	0	0	0
6	164	126	165	302	10	28	1	0	0	0
5	38	42	80	259	11	55	5	0	0	0
4	1	7	25	62	8	56	2	0	0	0
3	1	0	1	11	3	7	7	0	0	0
2	2	0	1	4	0	2	1	0	0	0
1	0	0	1	2	0	0	4	0	0	0
0	3	0	0	0	0	0	7	0	0	0



For now, be aware that some bridges will be converted to better conditions and some to worse when using element conversion rates.



NETWORK POLICIES

NETWORK POLICIES

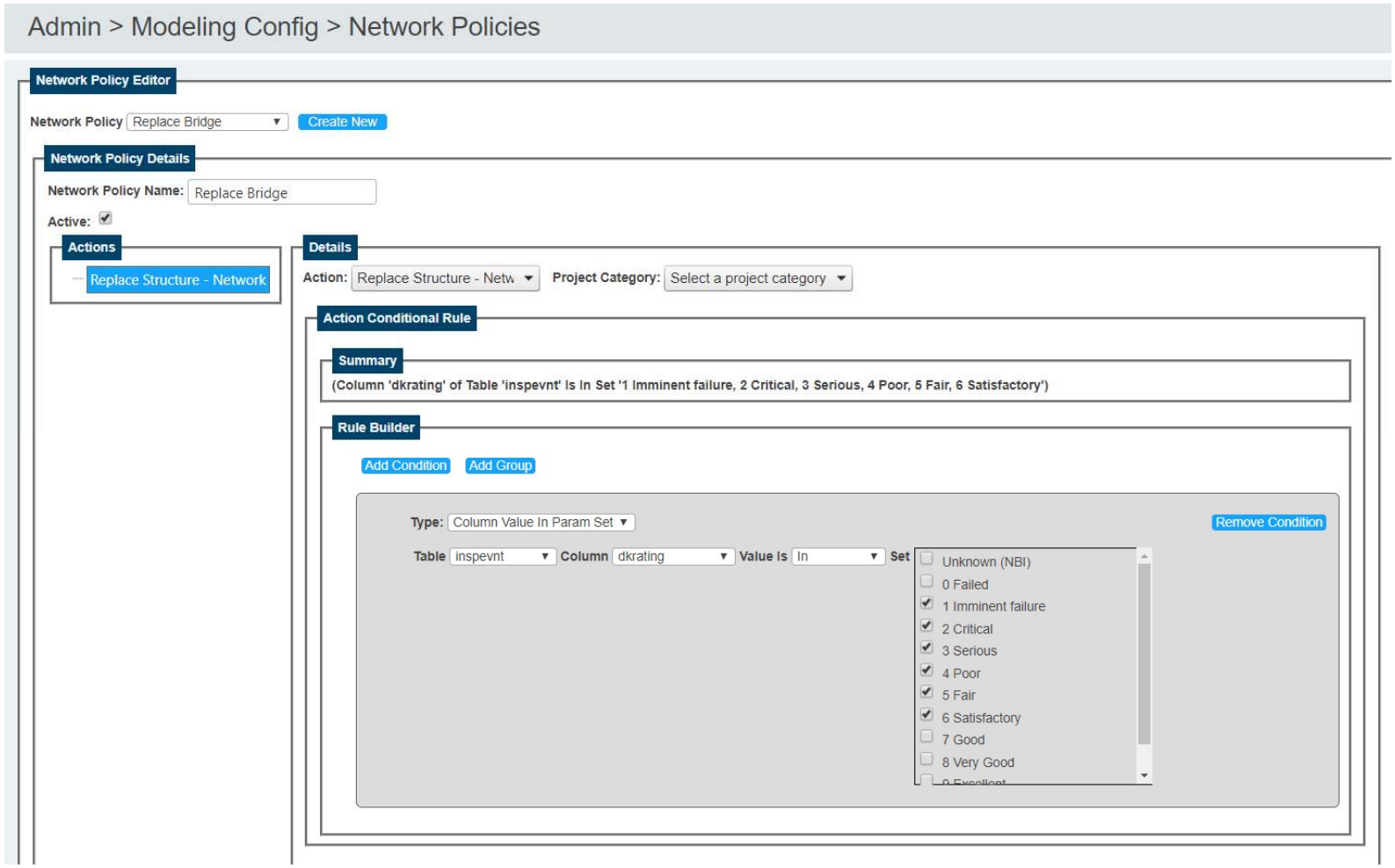
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



Network policies include limitations about which bridges are eligible for this work.

NETWORK POLICIES

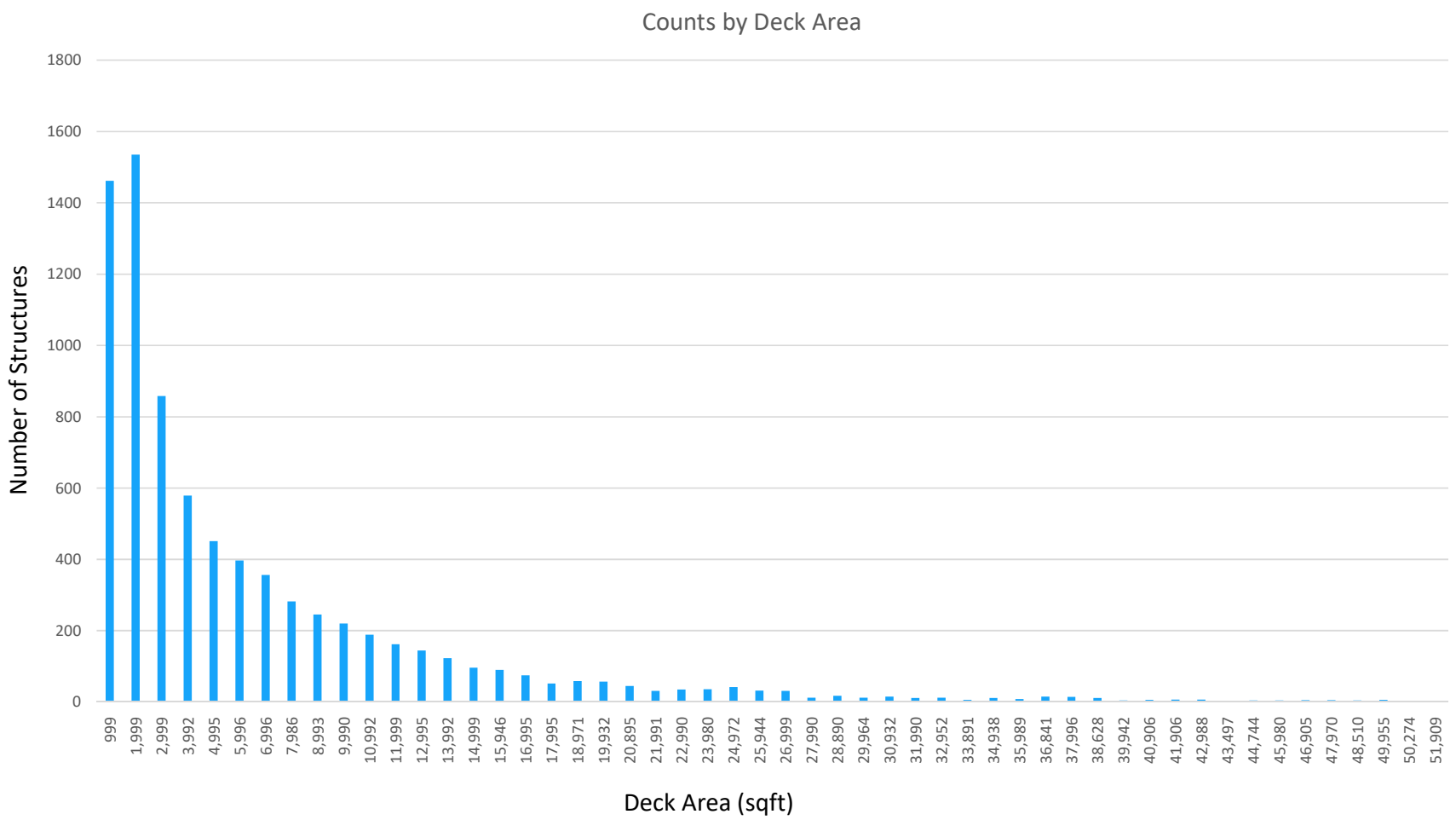
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



One state with this inventory expected more replacements.

NETWORK POLICIES

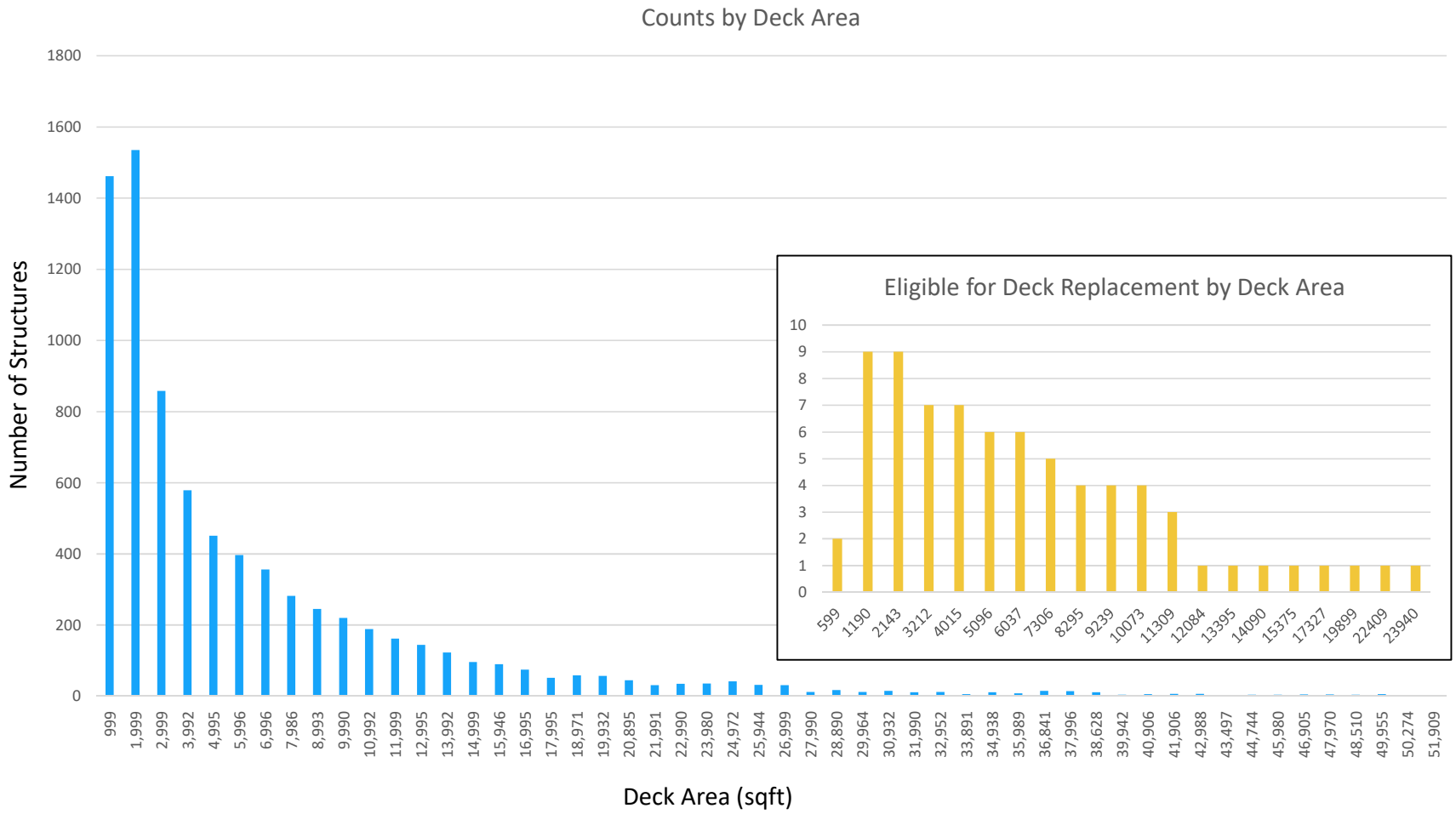
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

NETWORK POLICIES



What we found was that very few structures are really eligible for replacement based on those rules. We can't even graph them together in a visible way.

NETWORK POLICIES

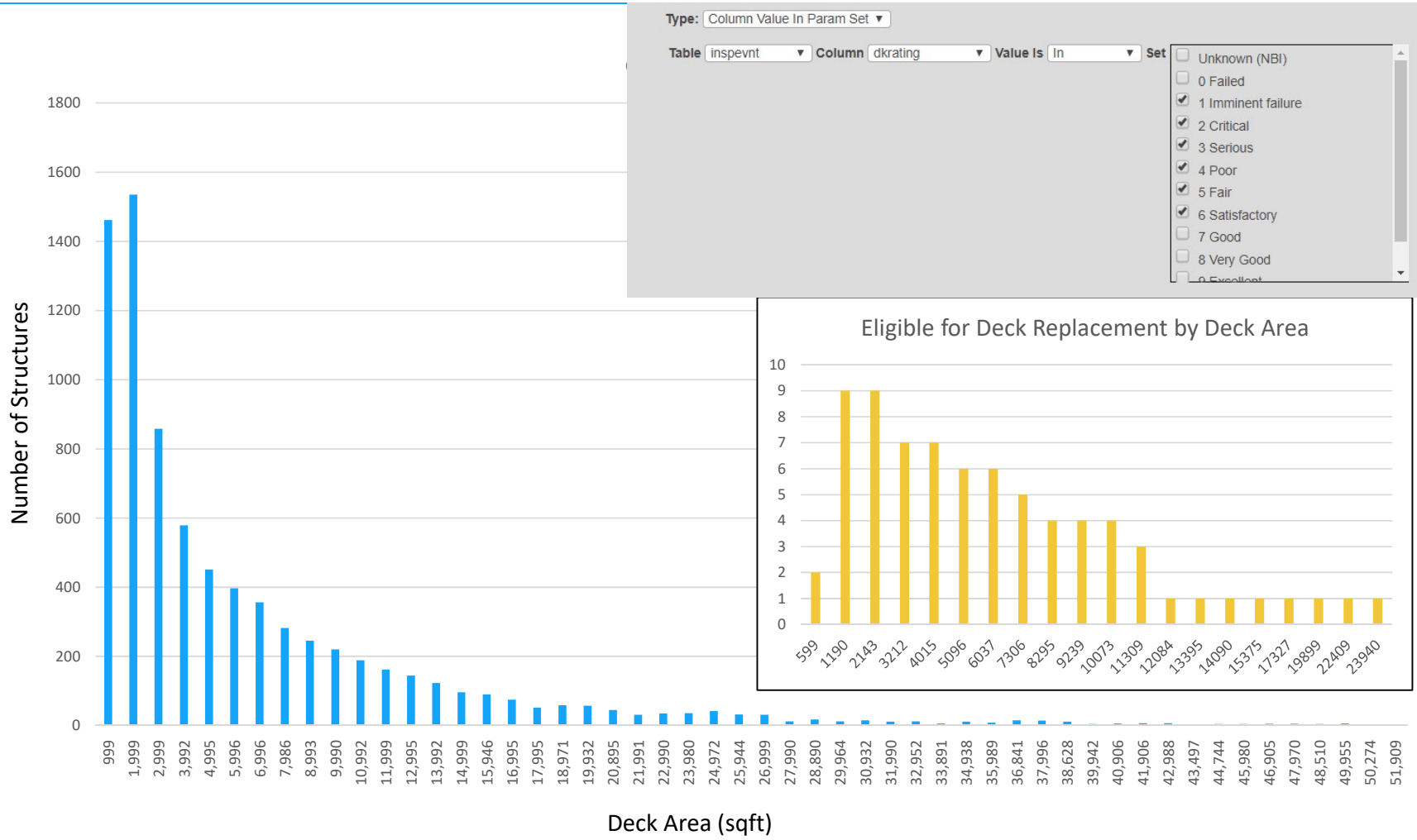
CULVERT DECK AREAS

NBI DETERIORATION CLIFFS

ELMENT RATE OF CHANGE

ELEMENT CONVERSION

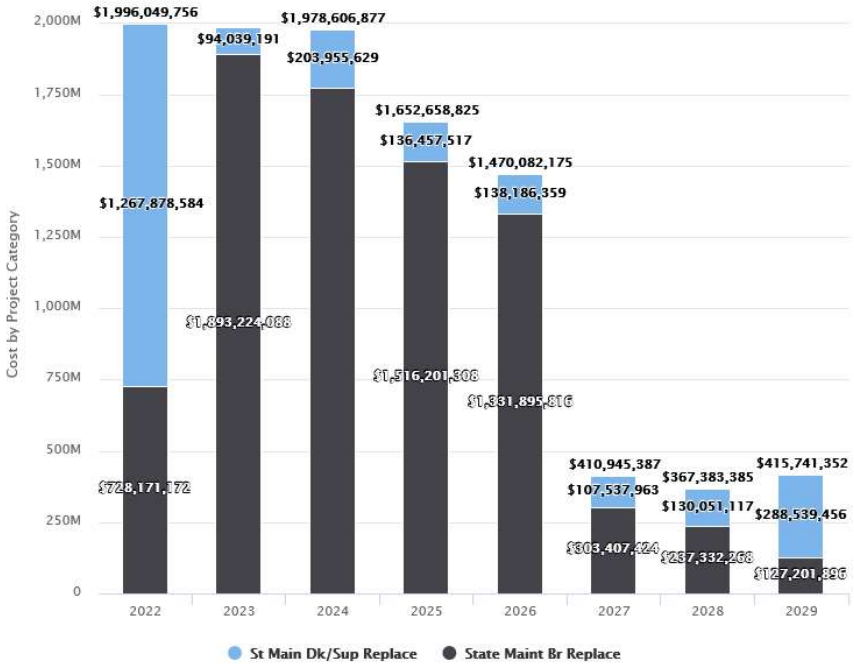
NETWORK POLICIES

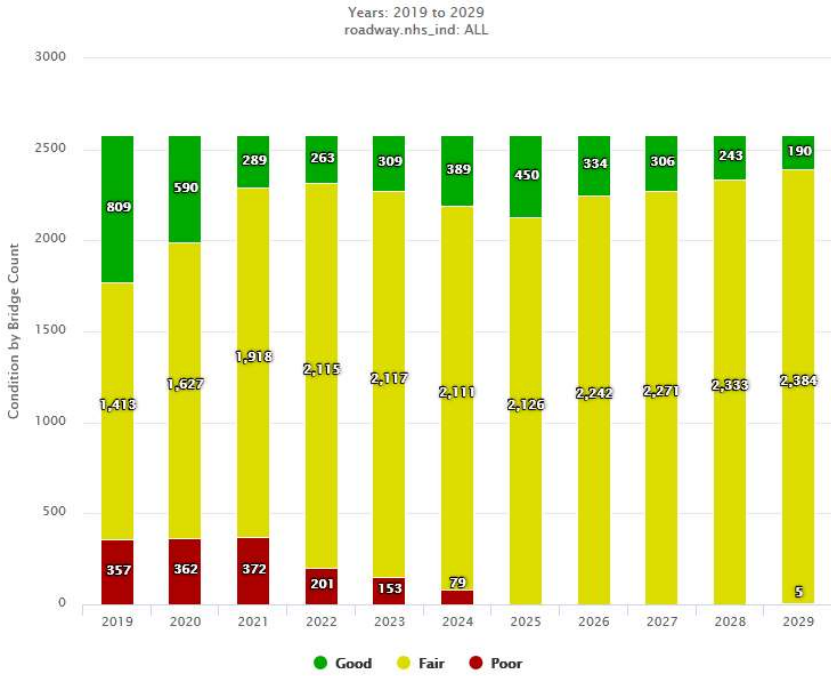


So please keep in mind that based on network policies, not all of your bridges are eligible for work. If that is your intent, you may need to expand the limits of your network policies or remove the conditions all together.

NETWORK POLICIES

- CULVERT DECK AREAS
- NBI DETERIORATION CLIFFS
- ELMENT RATE OF CHANGE
- ELEMENT CONVERSION
- NETWORK POLICIES





In this particular case, the optimizer stopped spending money after a few years. It can only replace things in poor condition, so you see it leaving money on the table after a few years because of this limitation.

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