

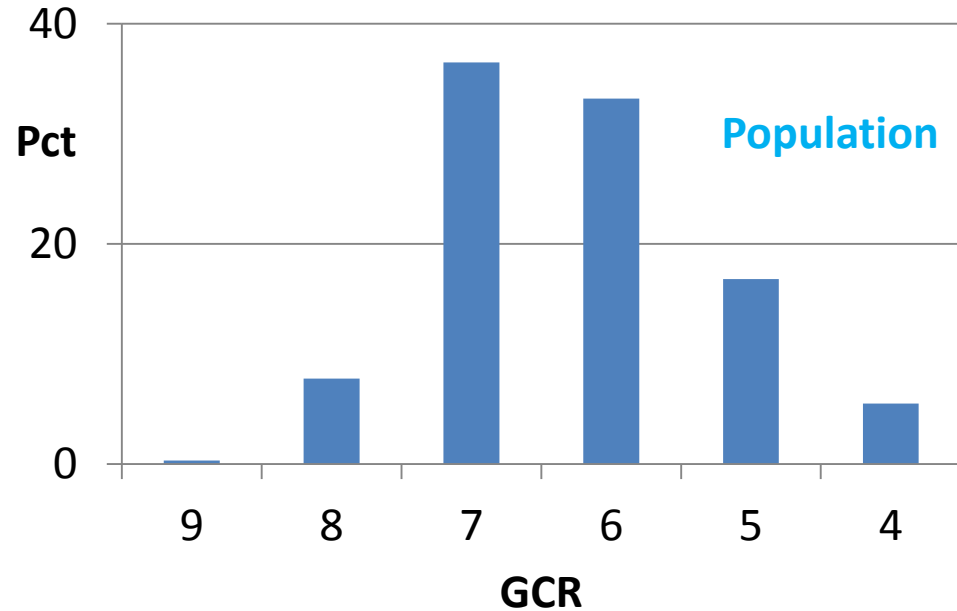
Effect of Bridge Preservation on General Condition Ratings

George Hearn

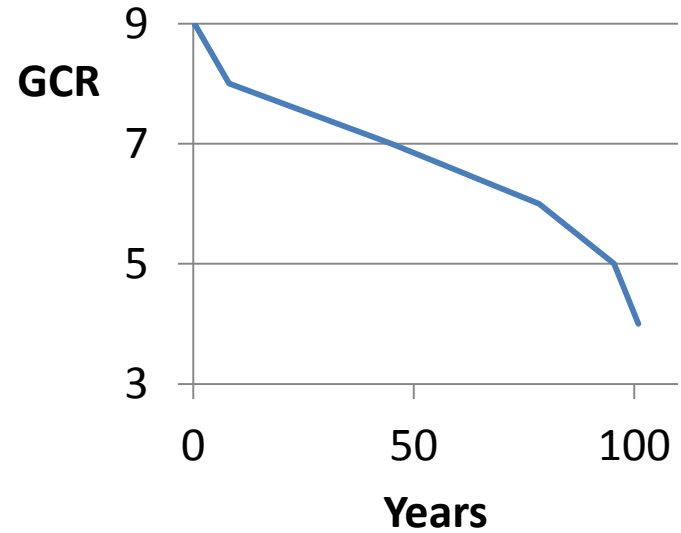
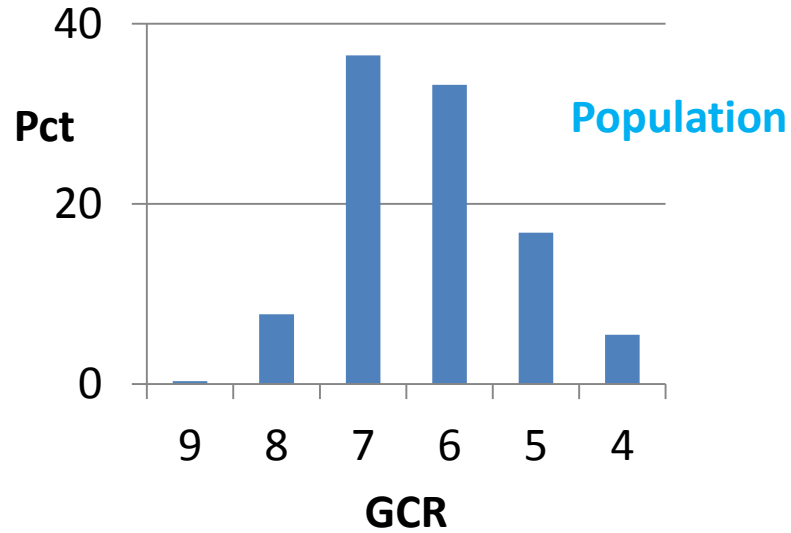
University of Colorado Boulder



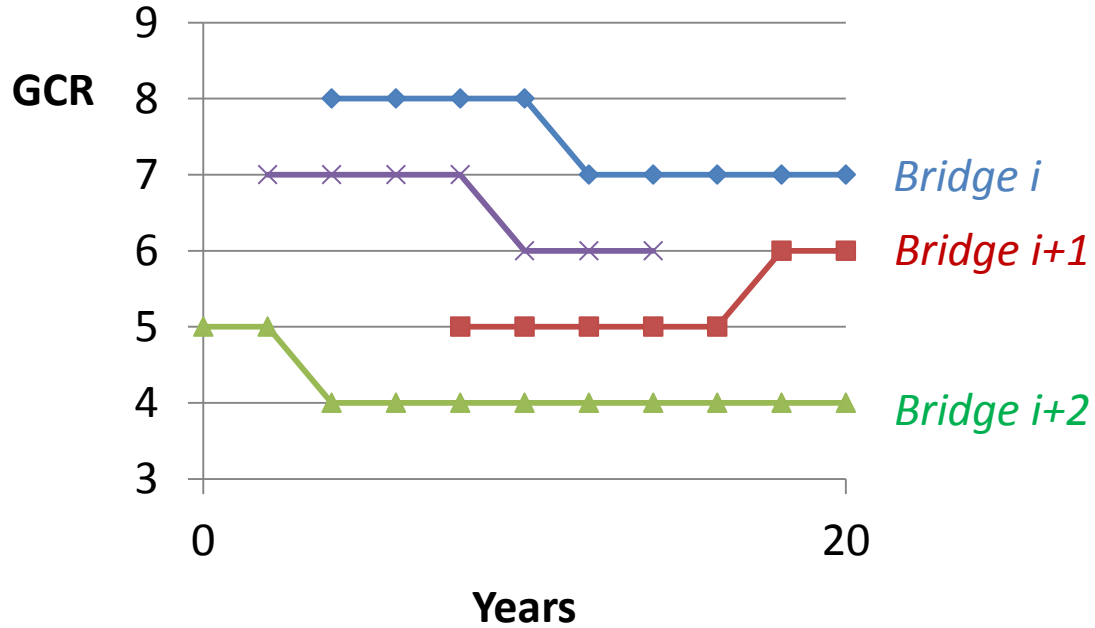
General Condition – WBPP Bridges



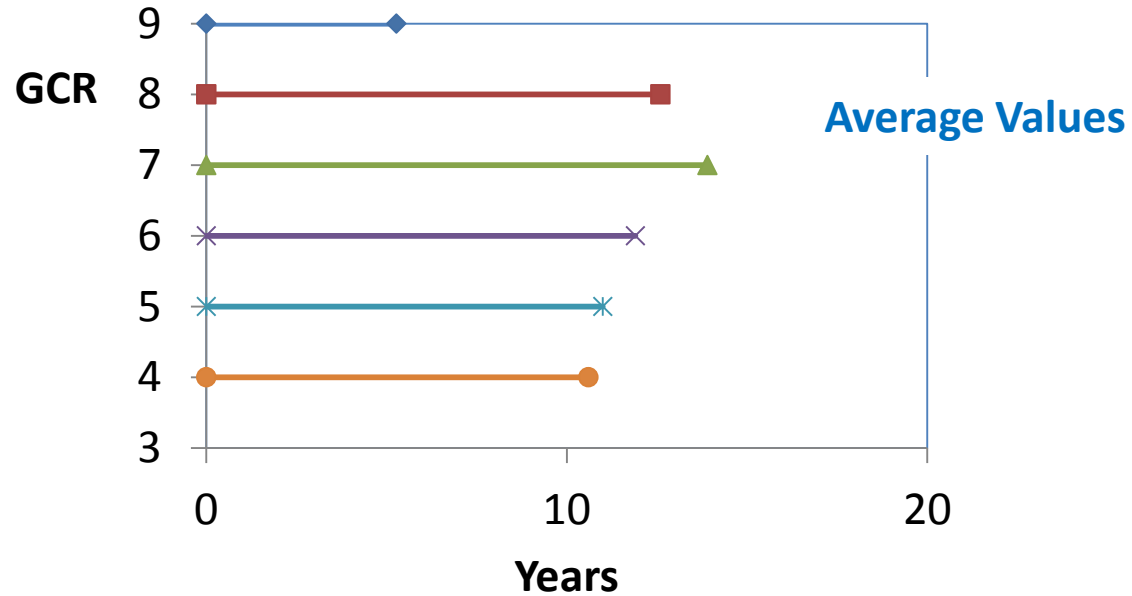
General Condition – Progression



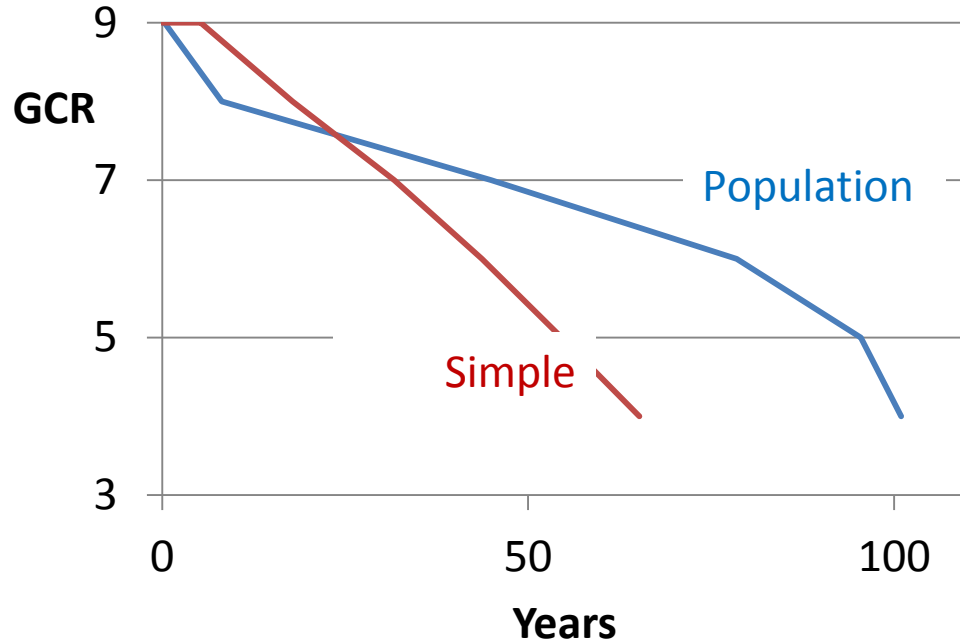
Condition History



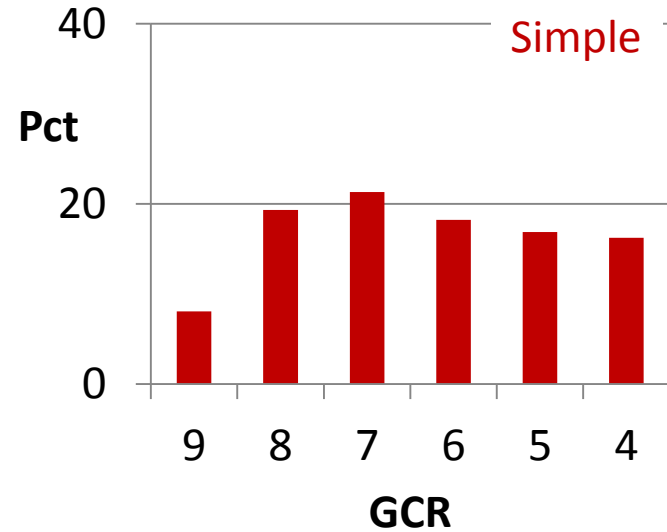
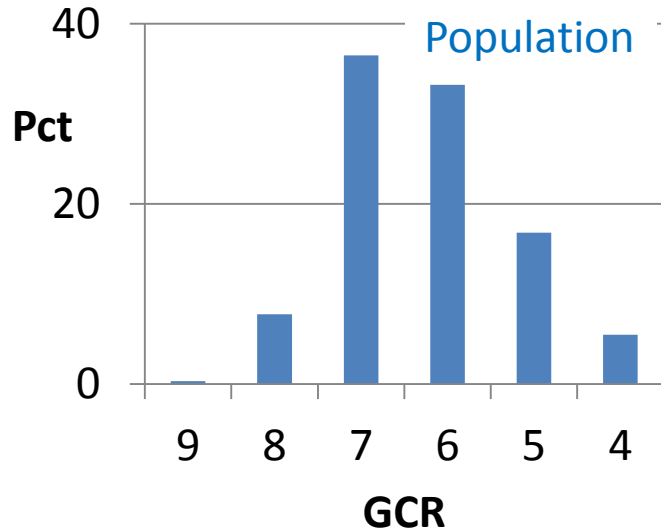
Simple Deterioration



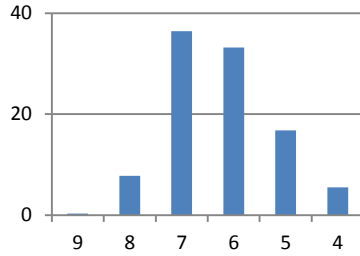
Progression – Simple Deterioration



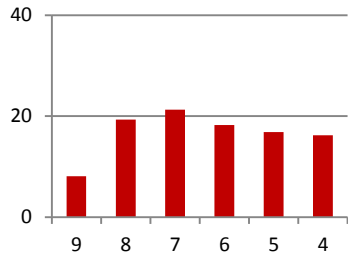
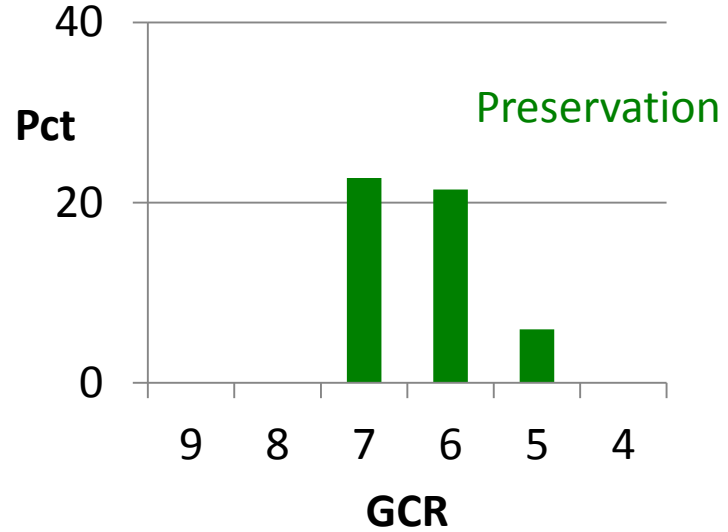
GCR as Outcome



Preservation is Difference

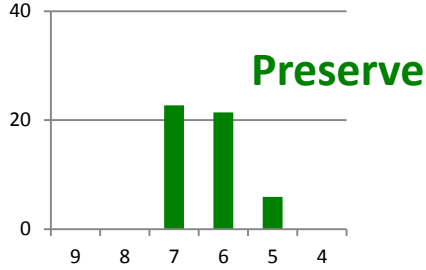


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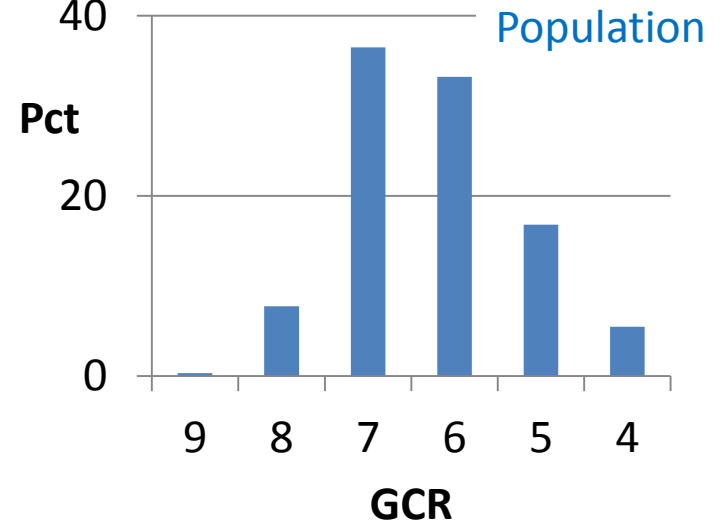
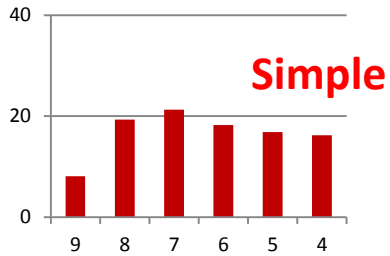


Preservation Fraction α

α



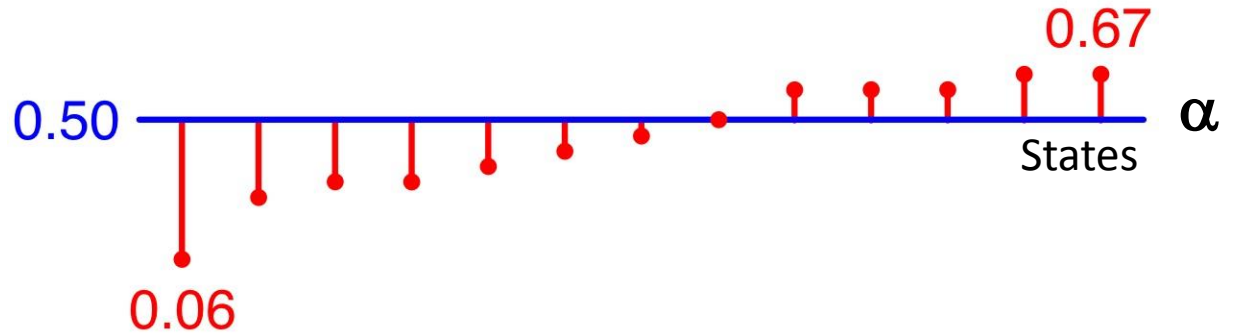
$(1-\alpha)$



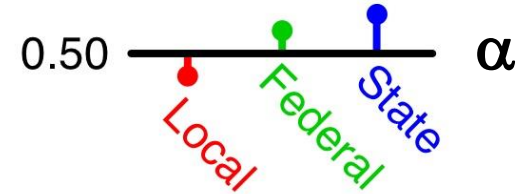
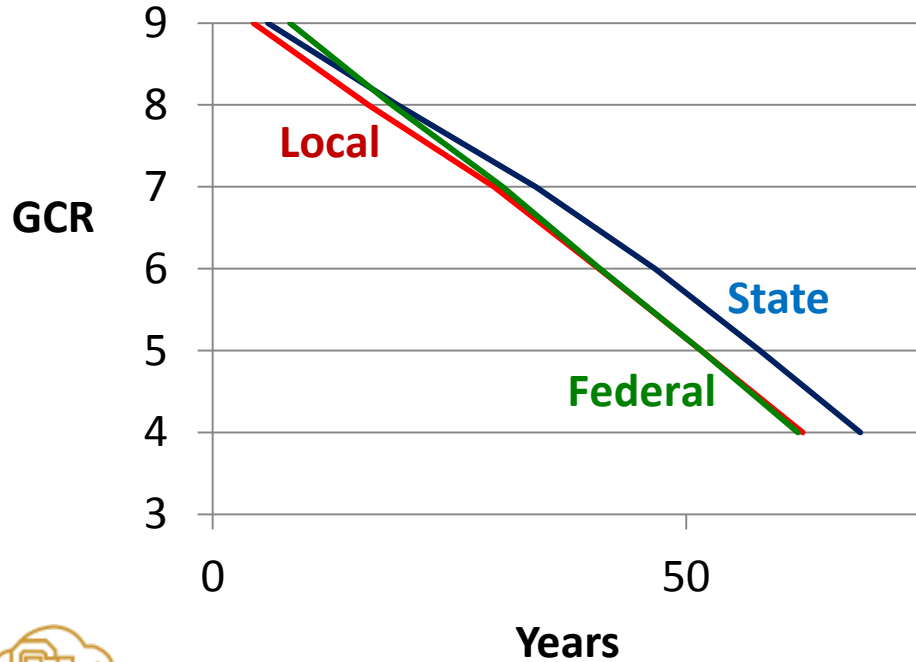
Preservation Fraction α



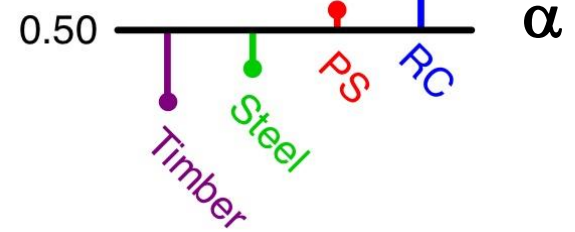
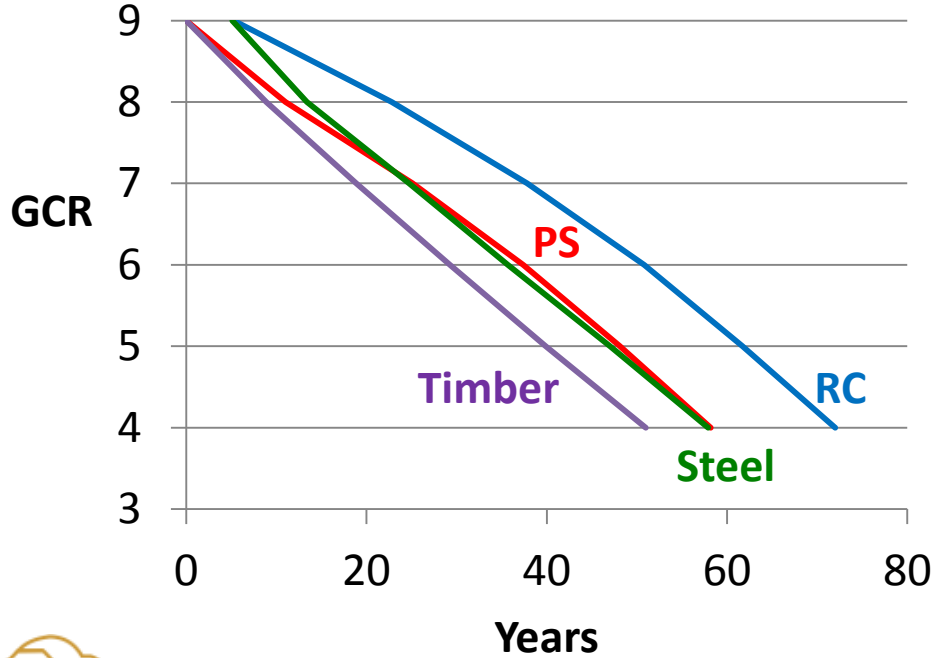
WBPP $\alpha = 0.50$



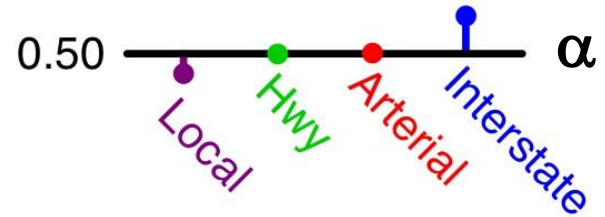
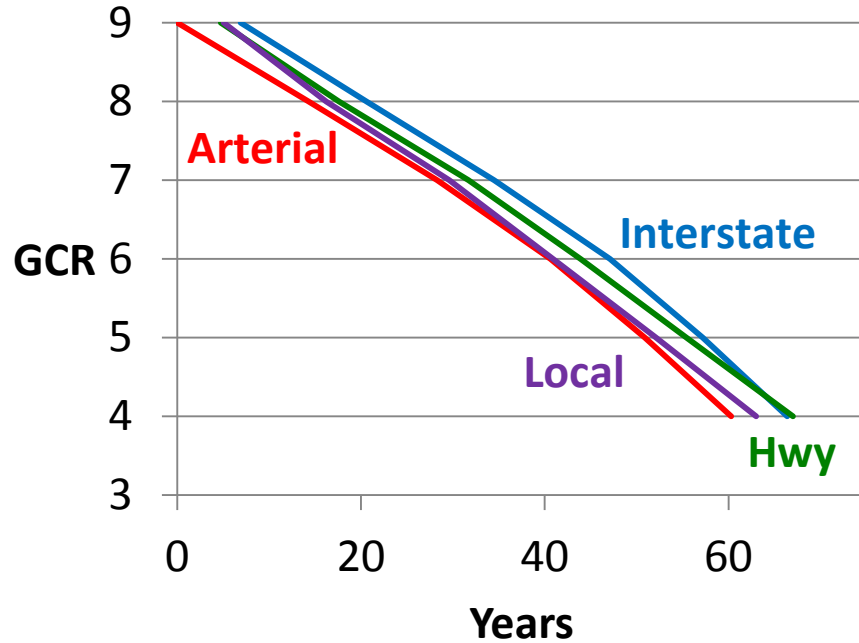
α , Bridge Owner



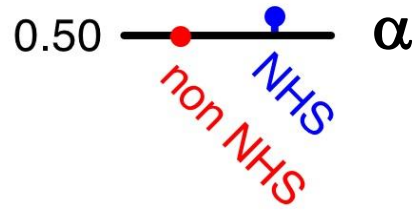
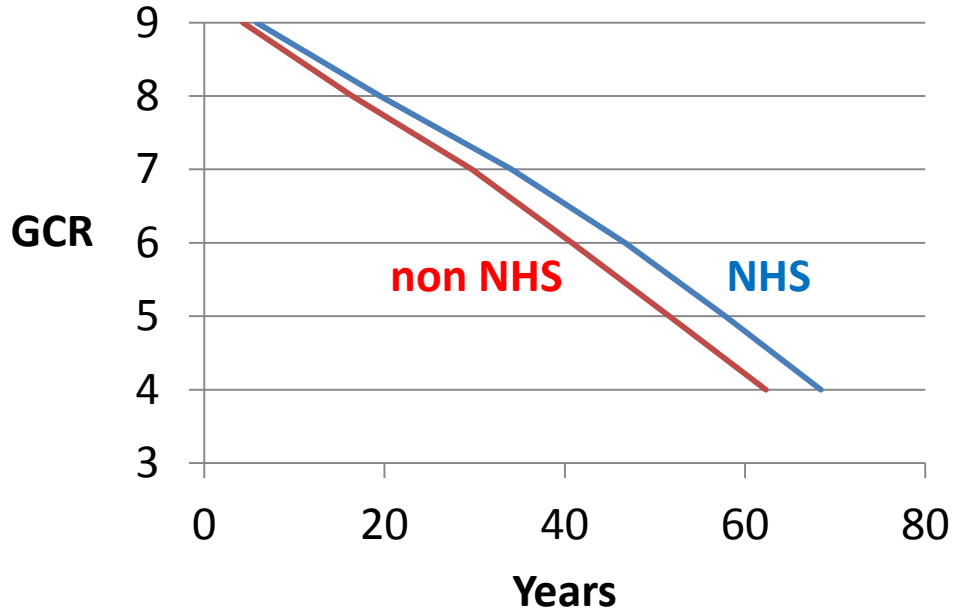
α , Bridge Material



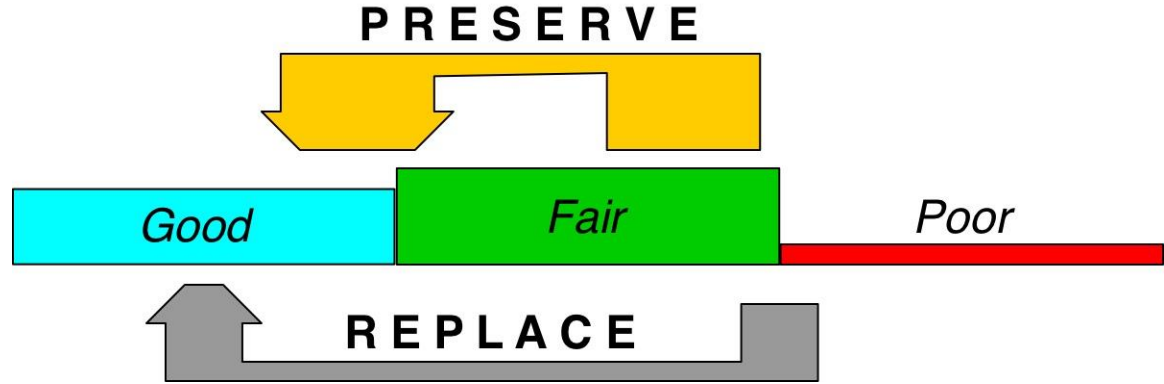
α , Functional Class



α , NHS



Projects



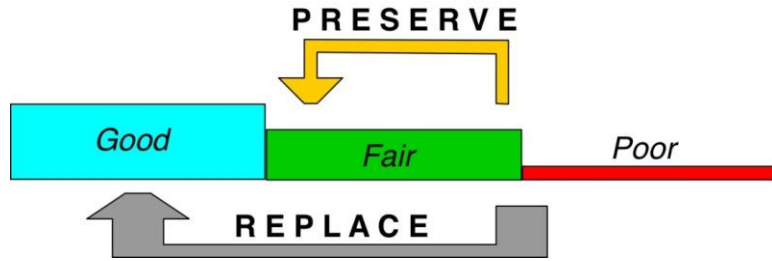
General Condition	Inventory		Disposition, Annual			Addition, Annual	
	Deck Area	Annual I/O	No Action	Replace	Preserve	New Bridge	Preserved Bridge
<i>Good</i>	267	16	16	-	-	6	10
<i>Fair</i>	300	17	3	3	11	0	1
<i>Poor</i>	33	3	-	3	-	-	-

Deck Area, Million Sq Feet

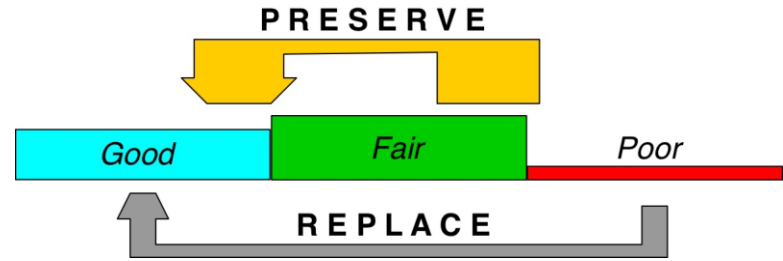


WBPP States

$\alpha = 0.06$

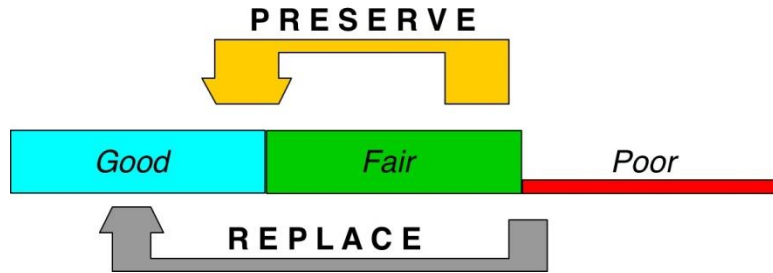


$\alpha = 0.67$

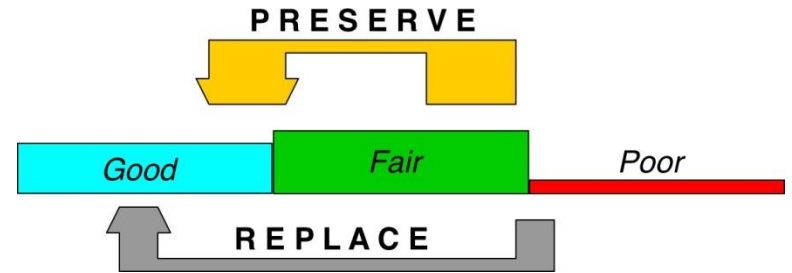


Owner

Local $\alpha = 0.44$

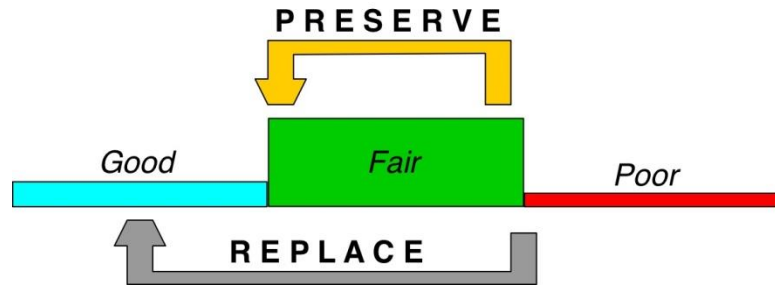


State $\alpha = 0.67$

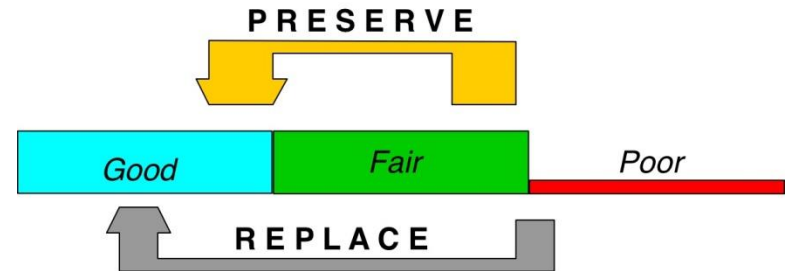


Material

Timber $\alpha = 0.20$

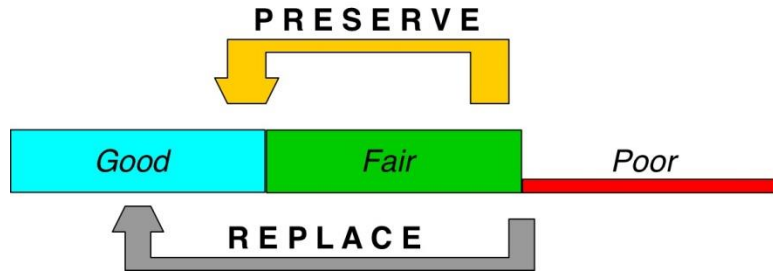


RC $\alpha = 0.51$

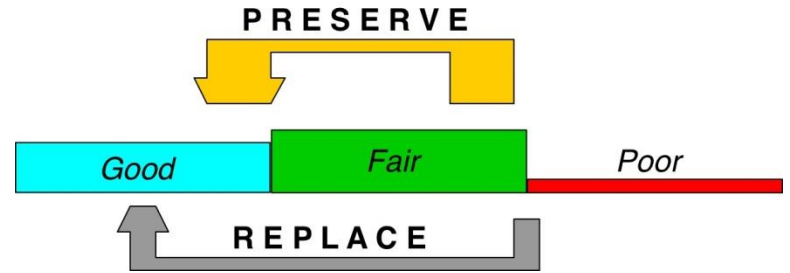


Functional Class

Local $\alpha = 0.47$



Interstate $\alpha = 0.58$

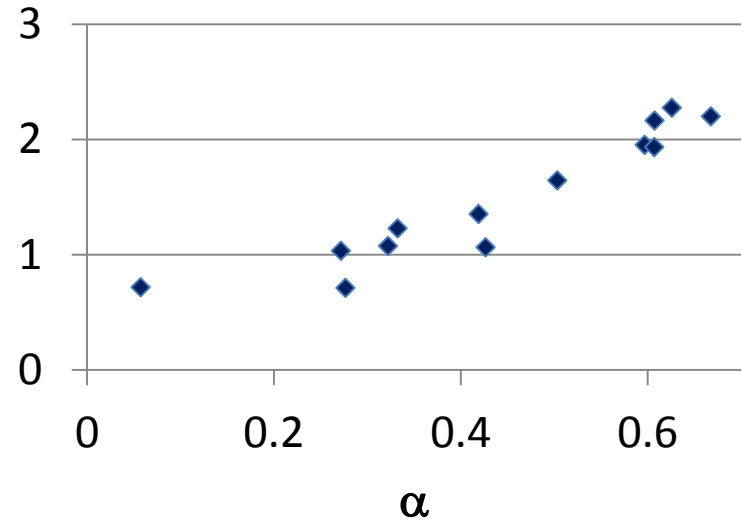


α , Δ Service Life

$$\text{Simple Life} = \sum_{gcr} E[t_{gcr}]$$

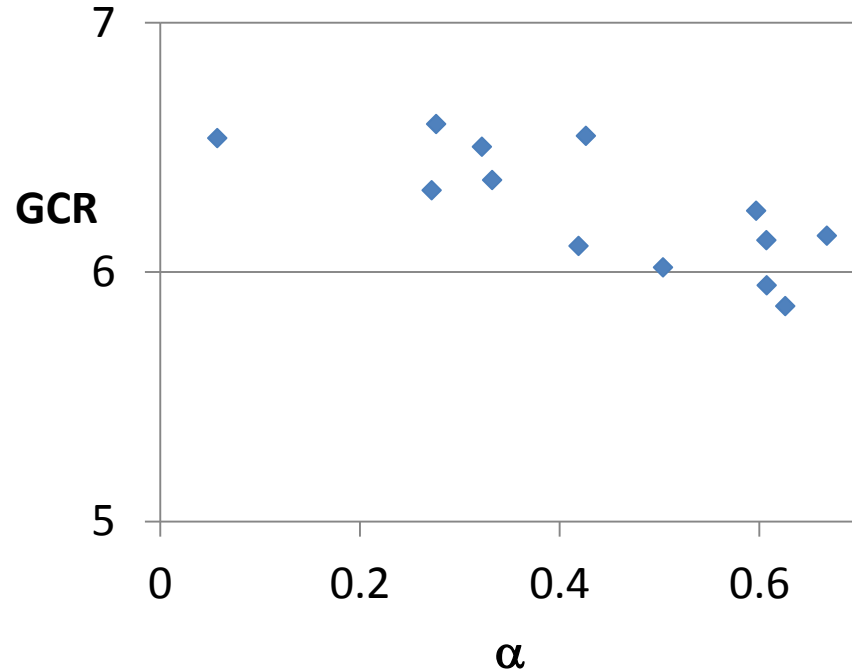
$$\text{Population Life} = \frac{\text{Population}}{\text{Annual Replacement}}$$

Life Actual / Simple

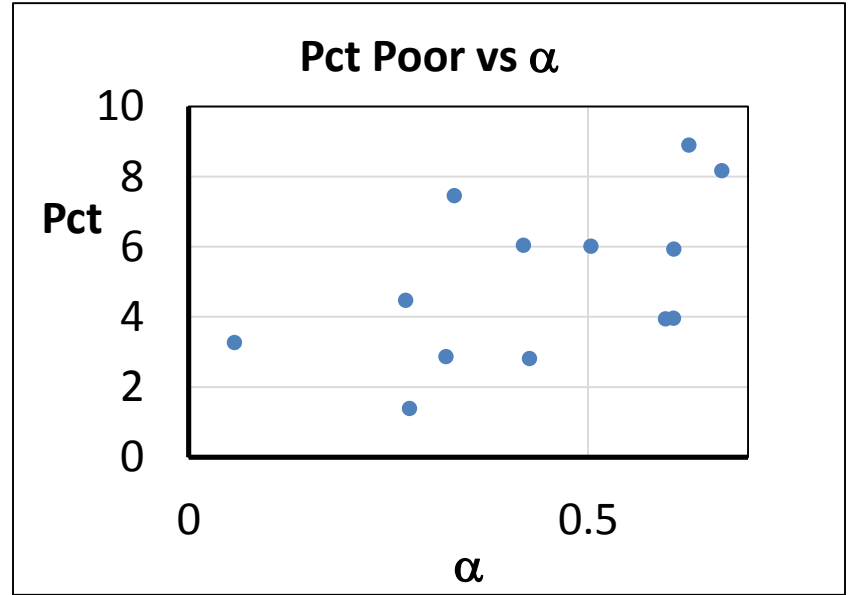
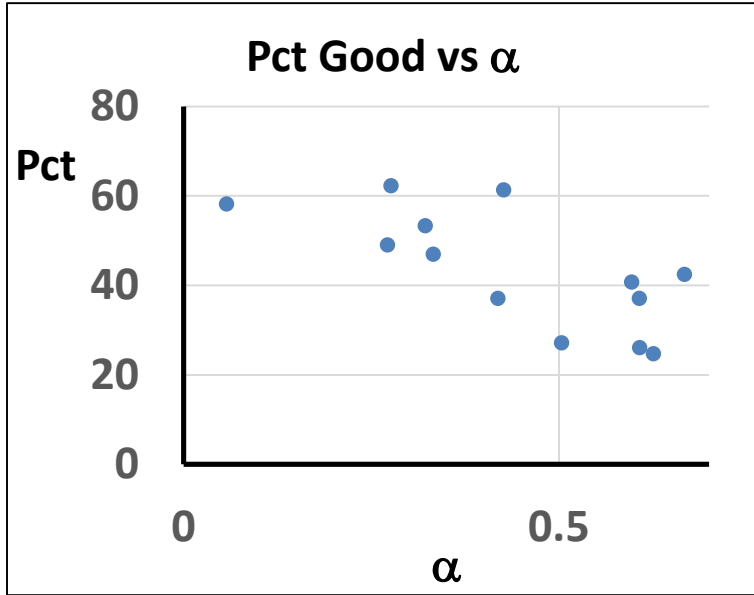


α , General Condition

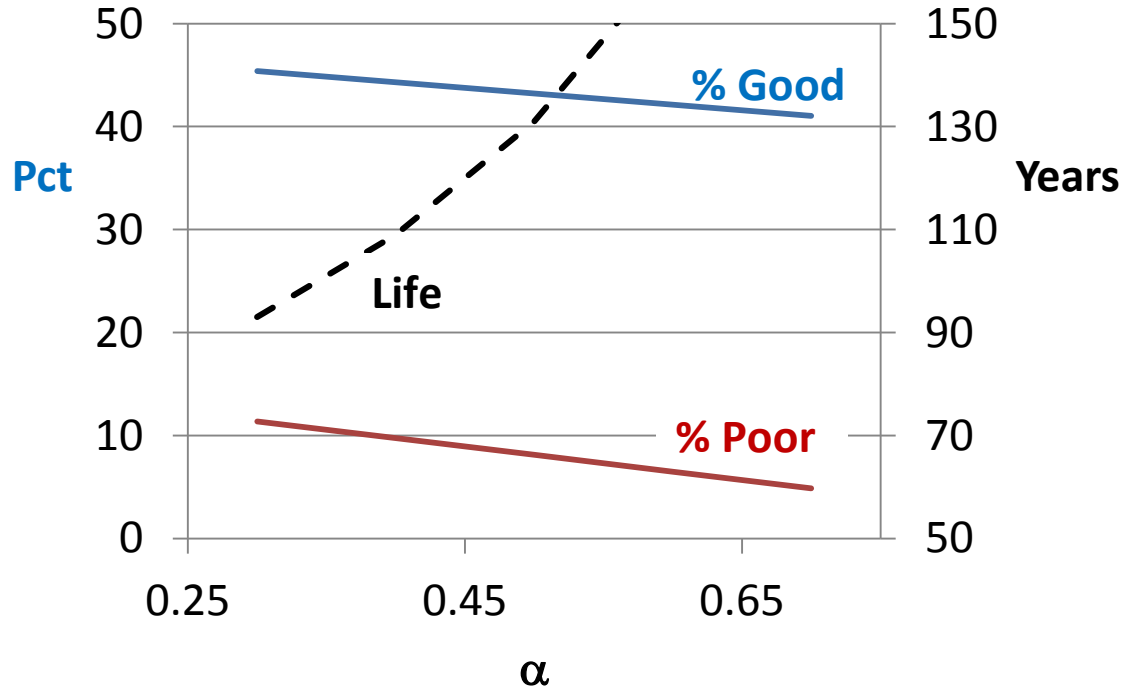
$$\overline{GCR} = \frac{\sum GCR_i \times Deck Area_i}{\sum Deck Area_i}$$



α , CFR 490.4xx



CFR 490.4xx WBPP



α Targets, WBPP

Criteria:

Life \geq 100 years

Poor Area \leq 10%

α	Life, years	% Poor Area	% Good Area
0.13	100	10	58
0.30	126	10	54
0.31	163	10	37
0.32	100	9	63
0.34	154	10	51
0.36	111	10	58
0.40	120	10	45
0.46	136	10	40
0.48	100	8	47
0.49	100	8	55
0.50	115	10	53
0.50	125	10	46
0.56	151	10	51



Cost?

General Condition	Inventory		Disposition, Annual			Addition, Annual	
	Deck Area	Annual I/O	No Action	Replace	Preserve	New Bridge	Preserved Bridge
<i>Good</i>	267	16	16	-	-	6	10
<i>Fair</i>	300	17	3	3	11	0	1
<i>Poor</i>	33	3	-	3	-	-	-

Rehabilitation \$?

Replace \$



Summary

- Condition is result of deterioration + preservation
- ‘Simple’ deterioration
 - Two segments of inventory
 - α preservation measure
 - Flow of projects
- Preservation effect on
 - Service life
 - General condition
 - Performance measures



Effect of Bridge Preservation on General Condition Ratings

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