ARKANSAS'S BMS AND THE TAMP

OUR DNA

KICK STARTING OUR BMS

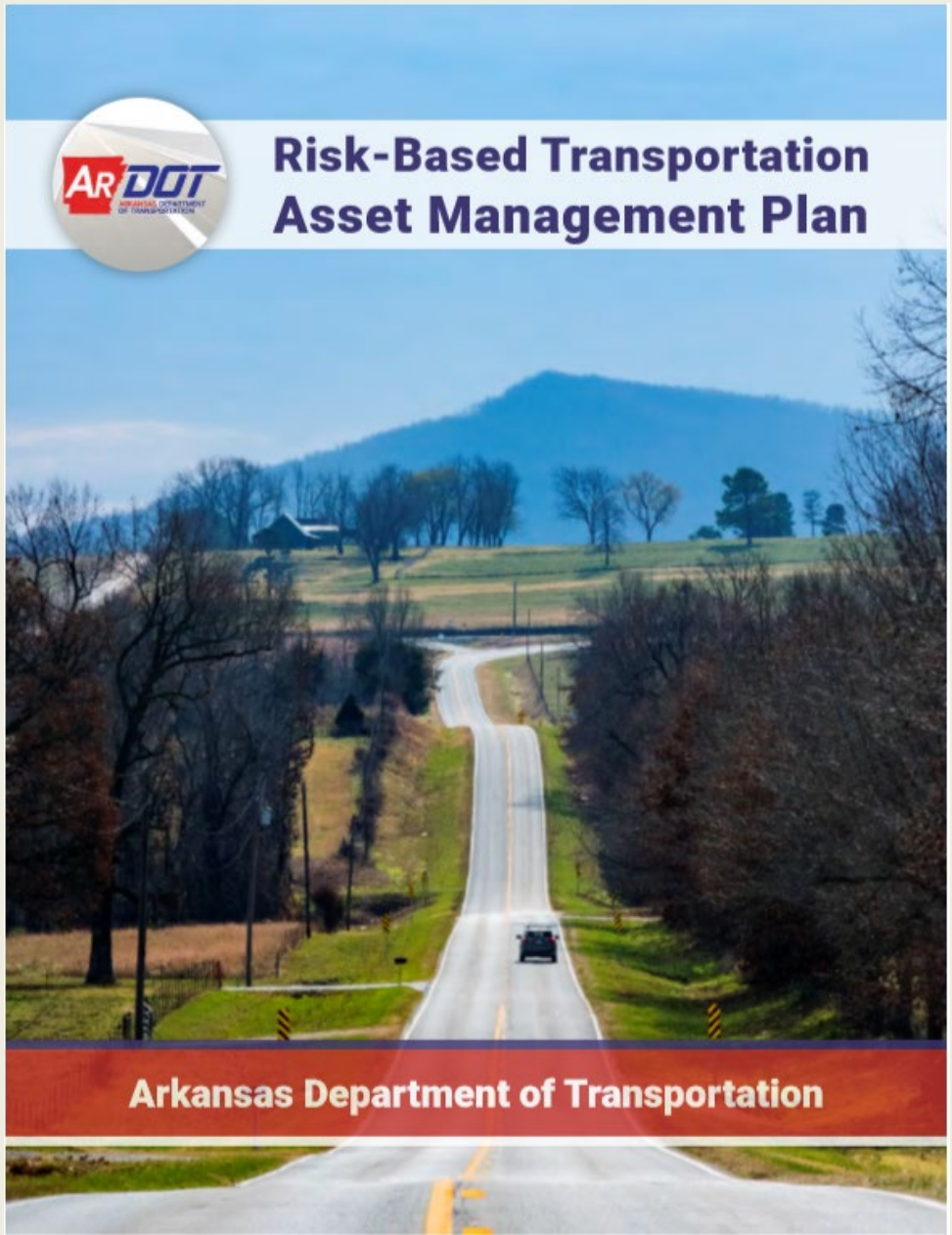
TAMP RESULTS

DOES IT MAKE SENSE

KINKS AND CORRECTIONS

CHANGES THIS YEAR

FUTURE ENDEVORS



OUR DNA - INSPECTION & MAINTENANCE (FIND IT FIX IT)

BRIDGE MANAGEMENT SYSTEM (BMS)
"WHATS THAT?"

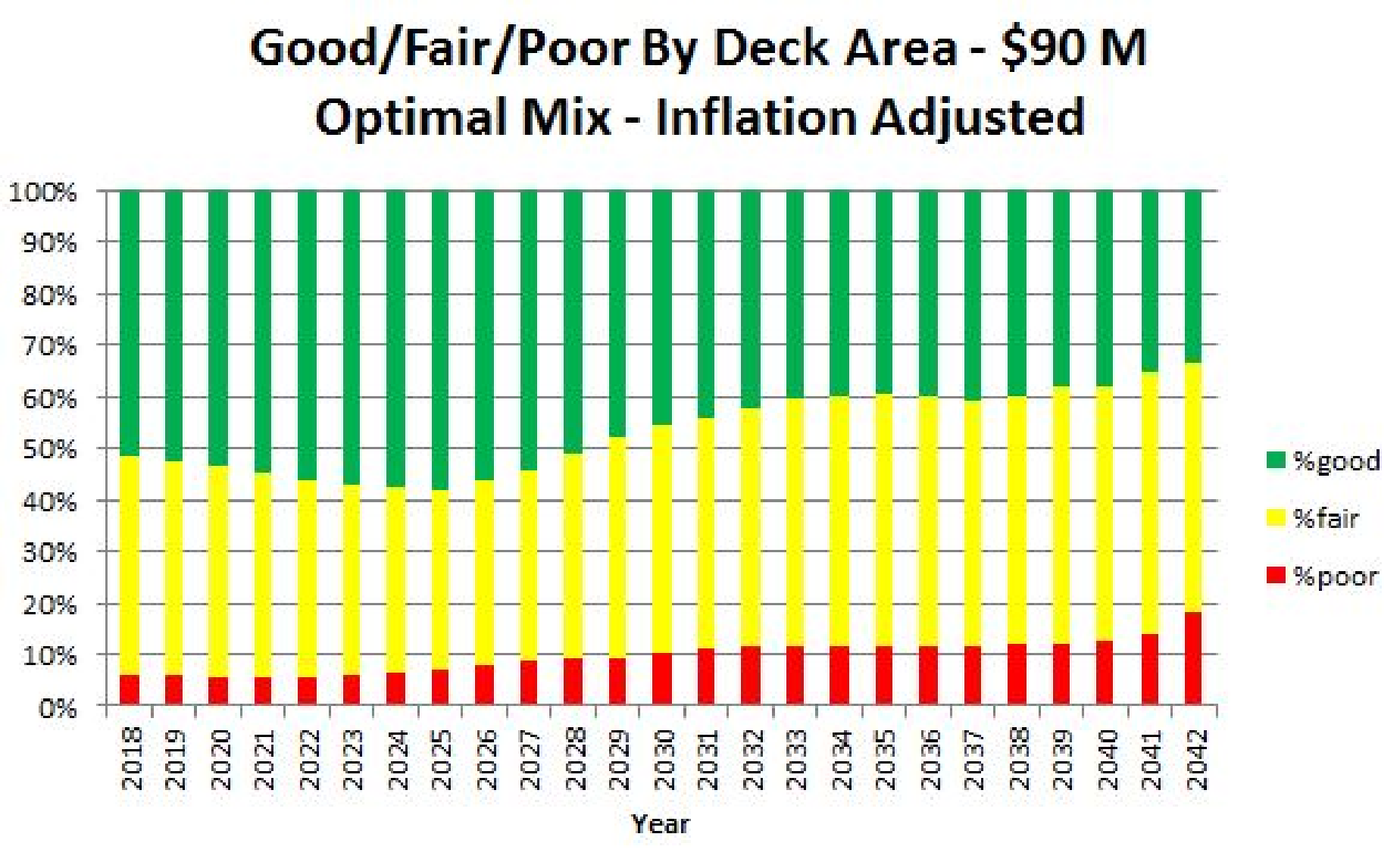
2011 NATIONAL BRIDGE MANAGEMENT, **INSPECTION**, AND PRESERVATON CONFERENCE

KICK-STARTING OUR BMS

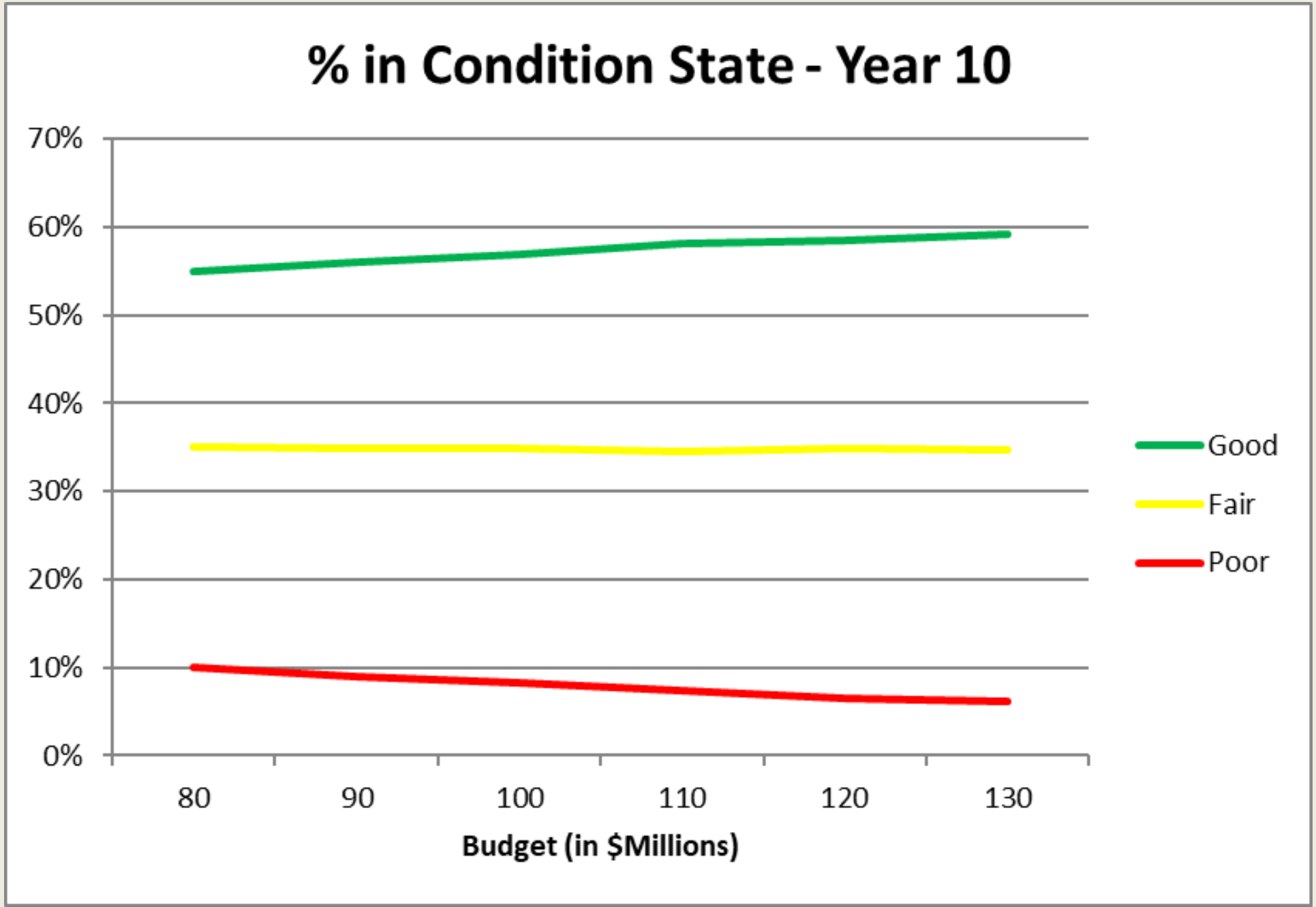
- June 2011 - Transferred Bridge Management Engineer to HBM from Bridge Division (Pontis Manager)
- April 2013 – Requested funding for new bridge inspection platform
- December 2013 – Signed agreement with FHWA to use federal funds for preservation activities (Revised June 2018)
- **MARCH 2014 – 10 YEAR BRIDGE NEEDS – MY JOB CHANGED**
- March 2015 – Went live with InspectTech inspection platform
- August 2015 – 2 new positions, Andy Nanneman as Advanced HBM Engineer and Dave Fuller as Bridge Management Specialist
- October 2015 – Signed agreement to use Deighton's dTIMS software as a bridge management tool
- July 2017 – Received Approval for Bridge Preservation Guidelines
- January 2018 – Started developing bridge models to use in the TAMP

DOES IT MAKE SENSE – IF NOT – WHY NOT

SUMMARY OF TAMP RESULTS



DOES IT MAKE SENSE?



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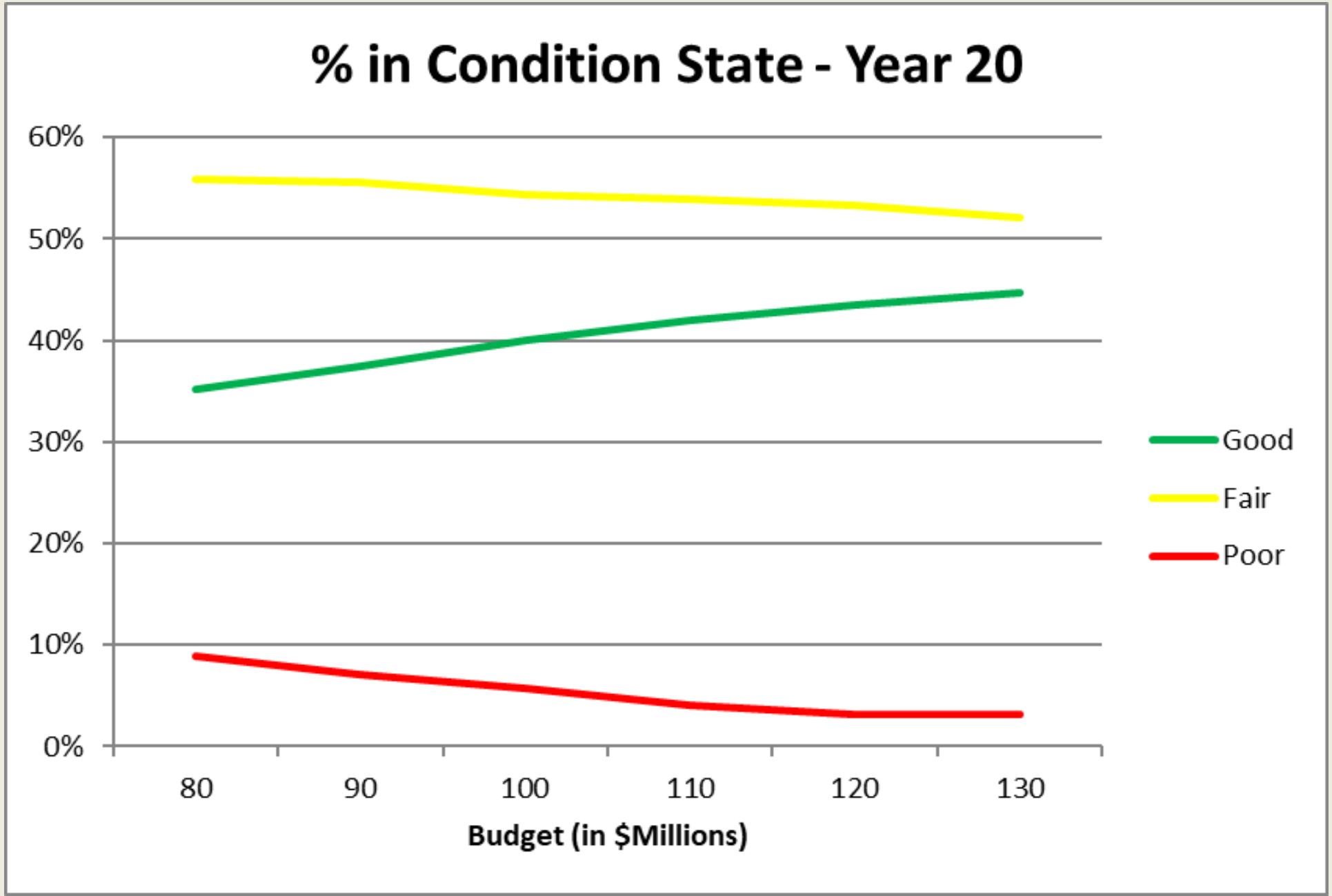
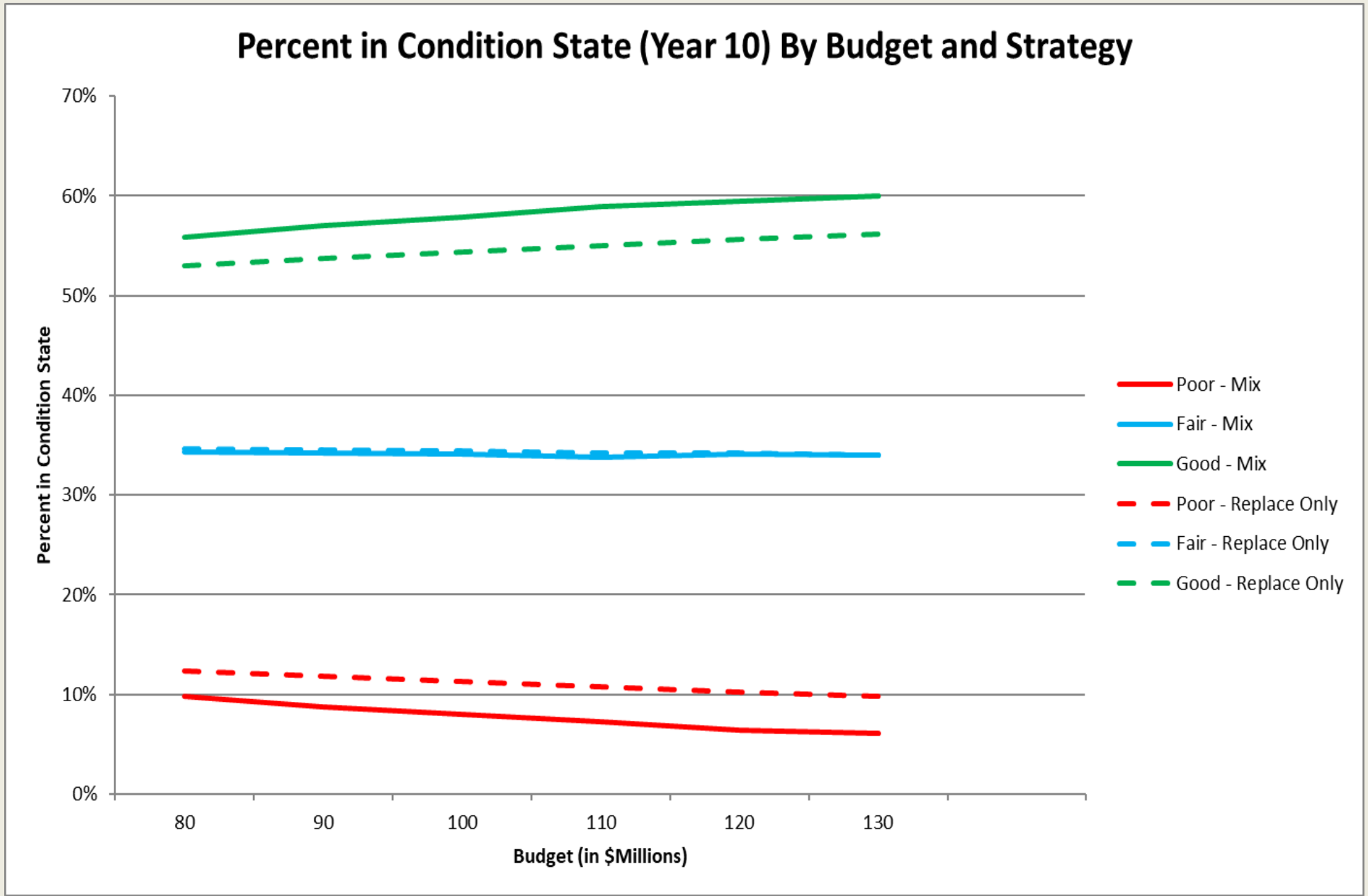


MODEL SHOWS THAT PRESERVATIONS HELPS



BRIDGE MODEL - START WITH SIMPLE

- DEVELOP DETERIORATION MODELS FOR CULVERT, DECK, SUPERSTRUCTURE, & SUBSTRUCTURE
- WORK TYPES – POLYMER OVERLAYS, HYDRODEMOLITION, & REPLACEMENTS
- SET TRIGGERS FOR ACTIONS
- INPUT COSTS FOR WORK TYPES
- CALCULATE BENEFITS FOR WORK TYPES
- SET BUDGET AND ALLOCATIONS
- OPTIMIZE ON BEST BENEFIT/COST RATIOS
- DOES IT MAKE SENSE

PERFORMANCE CURVES DEVELOPED FOR EACH FAMILY OF: CULVERTS, DECKS, SUPERSTRUCTURE, & SUBSTRUCTURES (18 FAMILES X 3 TRANSIT CURVES = 54 POSSIBLE CURVES)

	Main Structure Type													
Material Main (43A)	1-Slab	2-Stringer / Multi Beam/ Girder	3-Girder and Floorbeam	4-Tee Beam	5-Box Beam	7-Frame	9-Truss Deck	10-Truss Thru	11-Arch Deck	12-Arch Thru	13-Suspension	22-Channel Beam	Grand Total	Families
1-Concrete	1173	12	3	465					24	2		565	2244	5 families
2-Concrete Continuous	95	5		14					1				115	1 family
3-Steel		1412	8		4		3	25	1	3	1		1457	2 families
4-Steel Continuous		1098	19		16	10		4		1			1148	2 families
5-Prestressed Concrete	2	37			1							3	43	1 family
6-Prestressed Concrete Continuous		52											52	1 family
7-Woor or Timber		88											88	1 family
8-Masonry									3				3	
9-Aluminum / Iron		6											6	
0- Other													0	
Grand Total	1270	2710	30	479	21	10	3	29	29	6	1	568	5156	

OUR SUPERSTRUCTURE FAMILIES

For each family, a series of deterministic performance curves are used to predict condition, using a concept called curve clustering. This develops multiple curves for families based upon three different types of deterioration patterns.

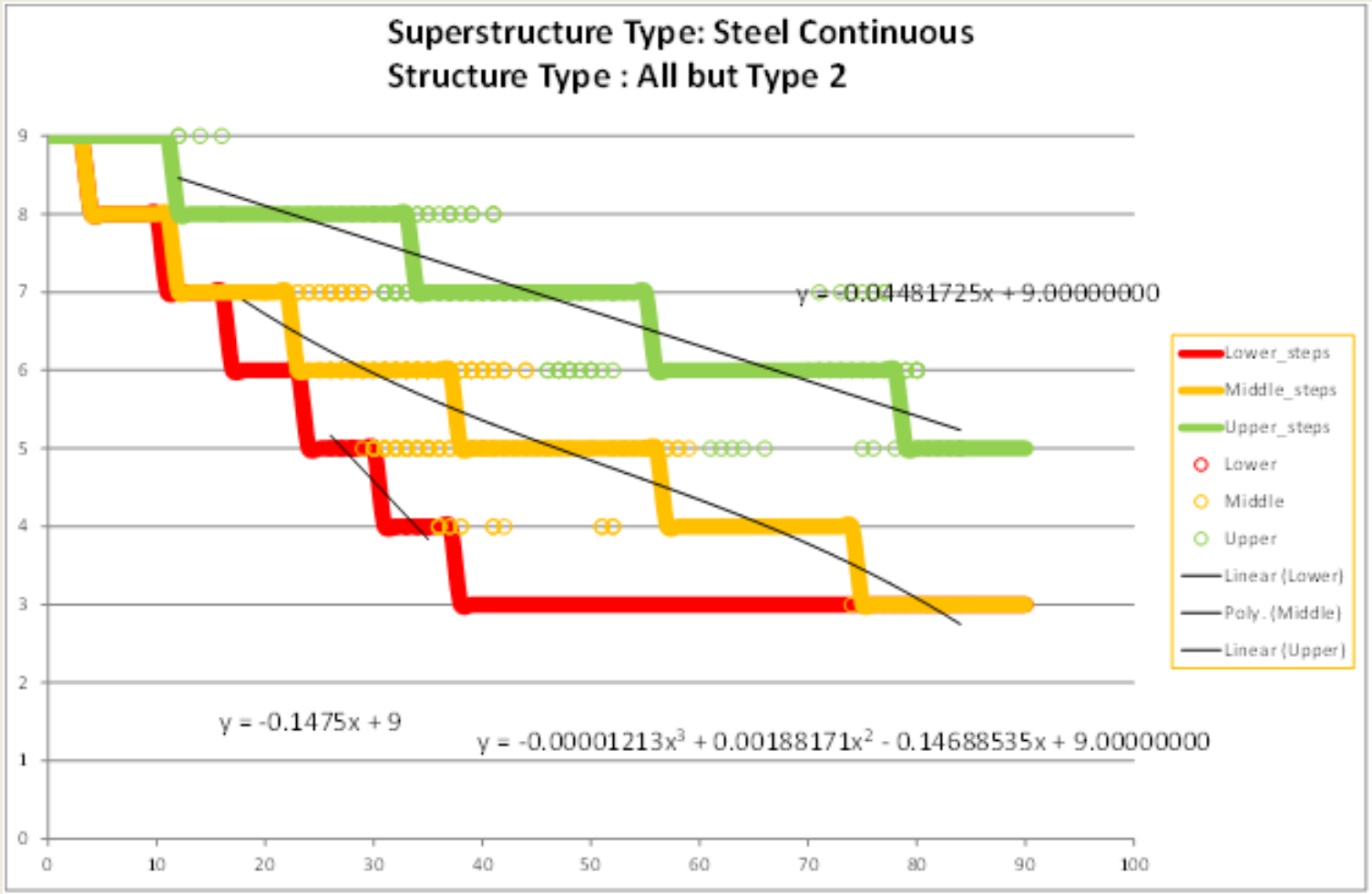


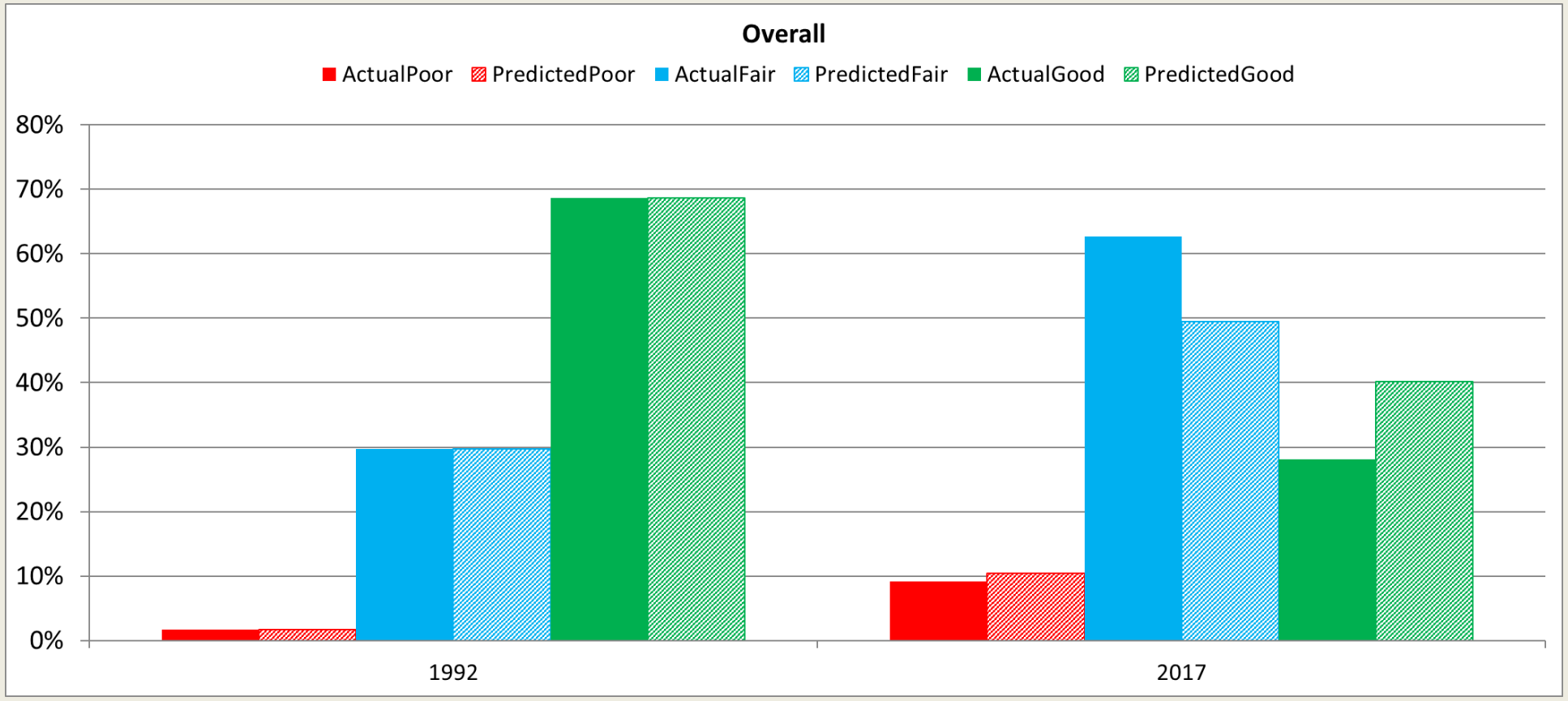
Figure 17: Superstructure Family 10 Curve

dTIMS used the age of the structure in combination with the condition rating to determine which curve to use.

PERFORMANCE CURVES

DOES IT MAKE SENSE

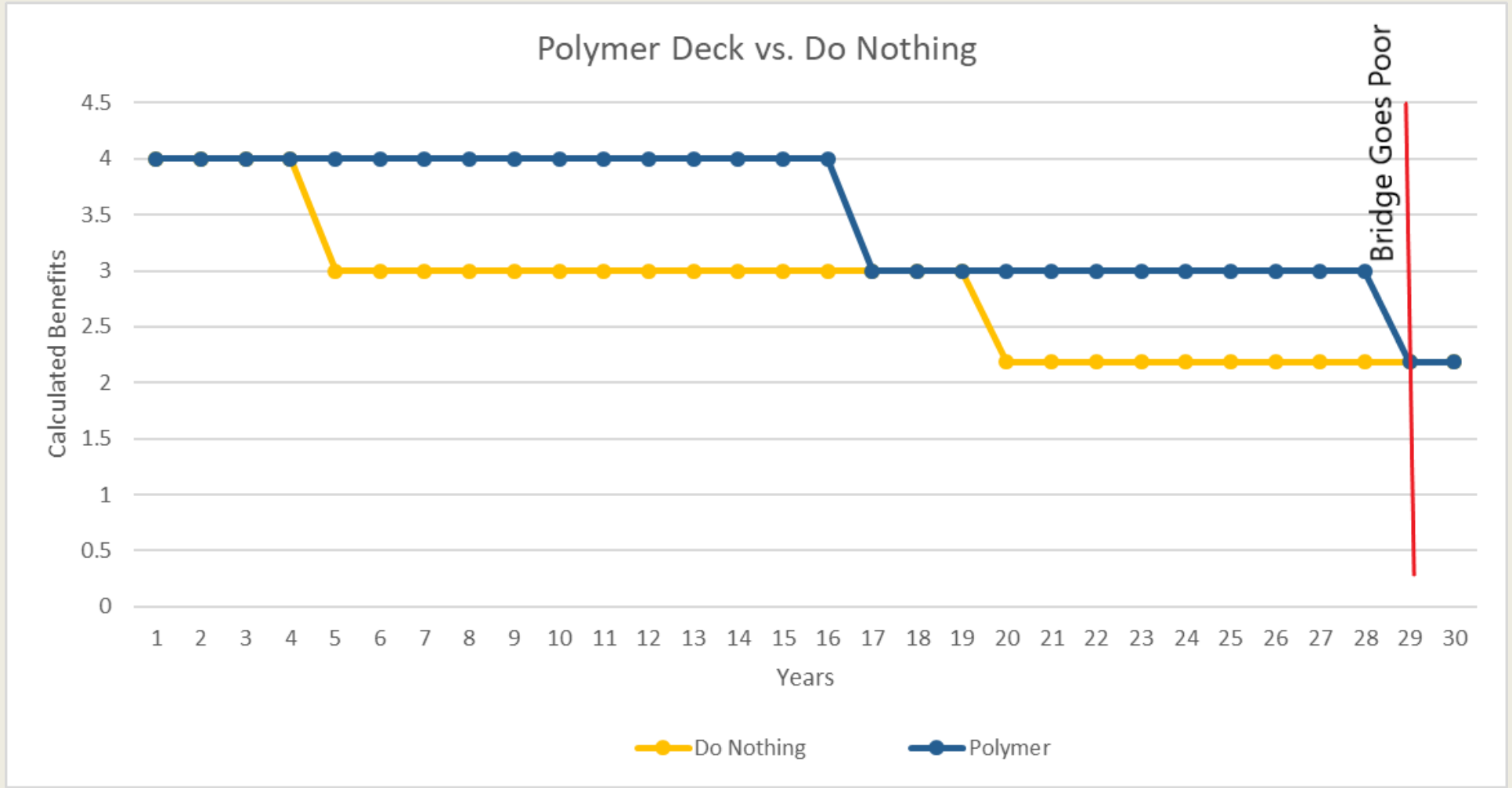
YES - RAN 1992 DATA THROUGH MODEL AND
COMPARED PREDICTED TO ACTUAL AFTER 25 YEARS



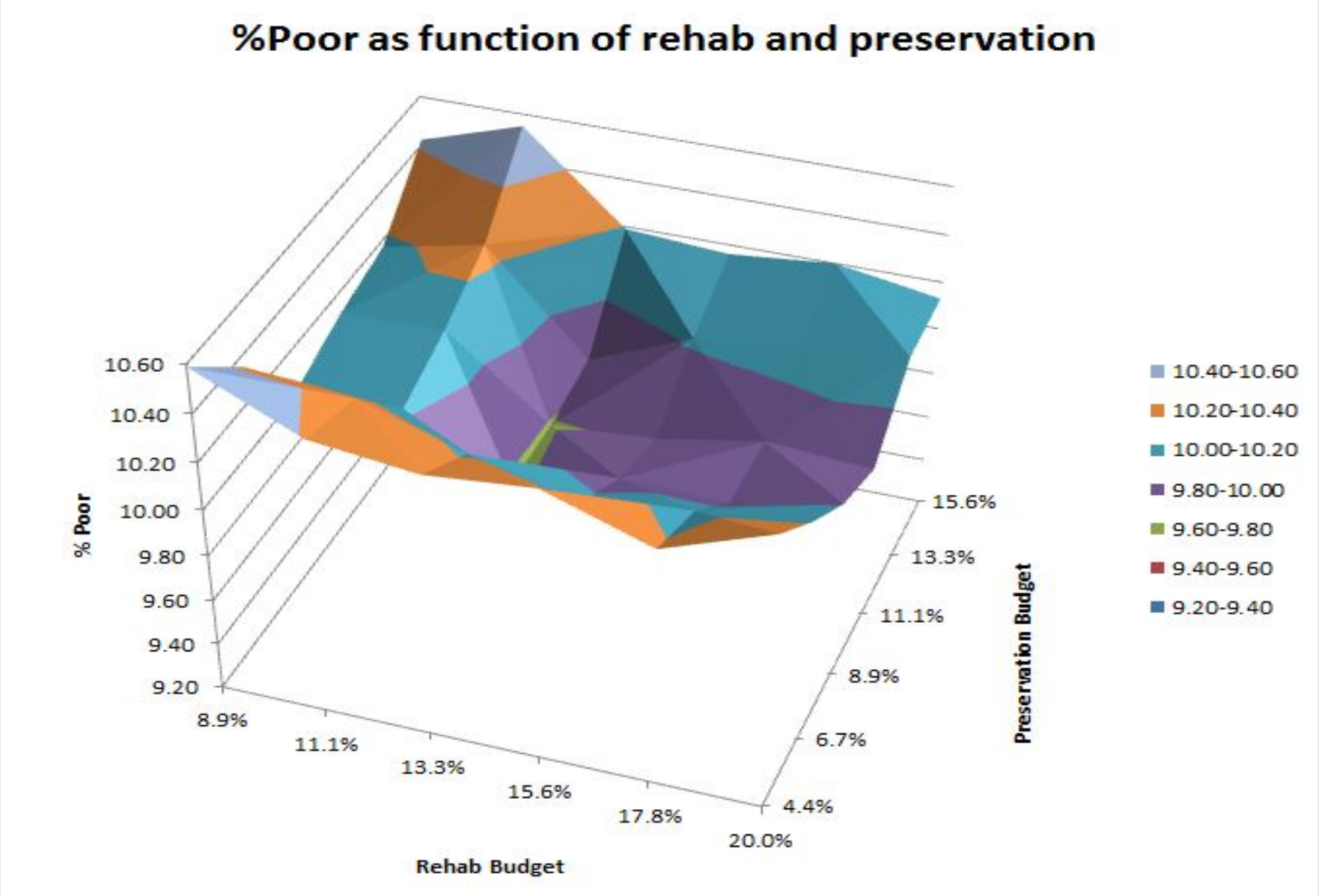
SIMPLE BENEFIT

$$\text{Benefit}_{\text{yearly}} = \frac{\text{Deck Rtg} * \text{Super Rtg}}{9 + [\text{Deck Rtg} - \text{Super Rtg}]}$$

Full Benefit = Area bounded by graphs until bridge goes poor



YOU SHOULD DETERMINE BUDGET ALLOCATIONS



Running 36 models with different amounts allocated to preservation/rehab/replacement showed fewest number of poor bridges spending $90 M/year for 25 years at a 8/12/70 split.

KINKS AND CORRECTIONS

DOES IT MAKE SENSE

- START WITH SIMPLE BENEFIT
- REPLACE BRIDGES WITH NEW “TYPE” OF BRIDGES
- RUN YOUR MODEL PAST WHAT YOU ARE LOOKING AT TO CAPTURE MORE BENEFITS
- STOP ACCUMULATING BENEFIT WHEN BRIDGE GOES POOR
- DON’T LET MODEL PICK YOUR BUDGET ALLOCATIONS

CHANGES THIS YEAR

- ADDED ADDITIONAL AREA FOR REPLACED BRIDGES
- CHANGED HOW LOCATED ON DETERIORATION CURVE FROM AGE TO HOW LONG IN CURRENT STATE
- MOVED TO NEWEST DTIMS VERSION (BA)

FUTURE ENDEVORS

- BETTER COST MODEL USING MACHINE LEARNING
- PROBOLISTIC DETERORATION MODELS FOR JOINT AND PAINT WORK
- CLUSTERING TO PUT TOGETHER MULTIPLE BRIDGES INTO A PROJECT

QUESTIONS?