Justifying Bridge Preservation

Richard I. Kerr, P.E.

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Issues

- Service Life of Florida Bridges
- Will FDOT experience a tidal wave of structural replacements
- How to predict future replacement needs
- Is FDOT's bridge maintenance, preservation and repair program effective

Age of FDOT Maintained Bridges

Decade Built	Number	Decade Built	Number
< 1930s	57	1970s	1281
1930s	105	1980s	900
1940s	221	1990s	904
1950s	595	2000s	989
1960s	1623	2010s	67

Service Life

- FDOT policy requires the programming within 6 years for repair or replacement when a bridge becomes structurally deficient or posted for weight
- The main criteria for a bridge becoming structurally deficient is when the NBI condition is 4 or less

NBI Ratings

NBI Rating	Definition	NBI Rating	Definition
9	Excellent	4	Poor
8	Very Good	3	Serious
7	Good	2	Critical
6	Satisfactory	1	Failing
5	Fair	0	Failed

Tidal Wave???

- Conventional Wisdom says 50 year service life
- If true, FDOT should be currently replacing approximately 160 bridge per year
- LRFD Specification Designed Bridges – 75 year service life

Bridges with Timber Substructure

Timber Substructure

- Timber Substructure
- Built in 1939
- Currently Structurally Deficient (Substructure rated 4)
- Programmed for Replacement

FDOT Timber Substructure Bridges

Year Built	Number	Year Built	Number
1924	2	1948	2
1939	11	1949	2
1940	3	1950	2
1941	2	1953	1
1947	1	Total	26

Condition of Timber Substructures

Substructure Rating	Number
4	5
5	8
6	8
7	5
Total	26

Deterioration Models

- All Inspection events since 1998 in database
- >26,000 inspections
- Condition States decrease, stay the same or improve

Deterioration Models Cont

- Transition Probabilities can be determined between condition states 9 to 4
- Most Transitions are by 1 condition state

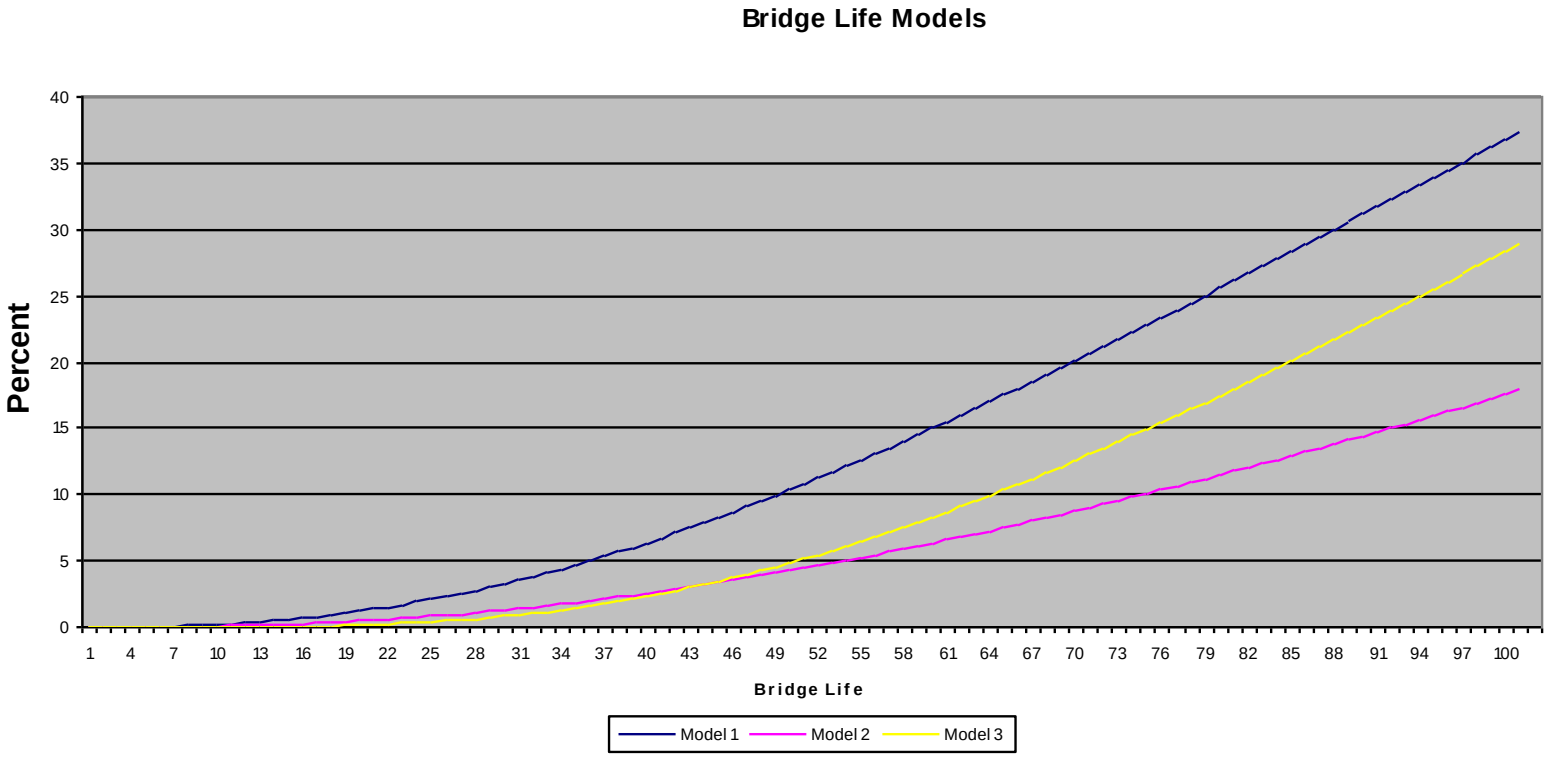
Deterioration Models Cont

- 3 models created
- Model 1 ignores Condition State increases
- Model 2 includes Condition State increases
- Model 3 Created Transition Probabilities that match current inventory

Comparison of Models

Rating	Inventory	Model 1	Model 2	Model 3
9 or 8	1331	1168	1448	1331
7 or 6	4588	4365	4395	4588
5	285	676	363	285
4 or below	55	316	120	55

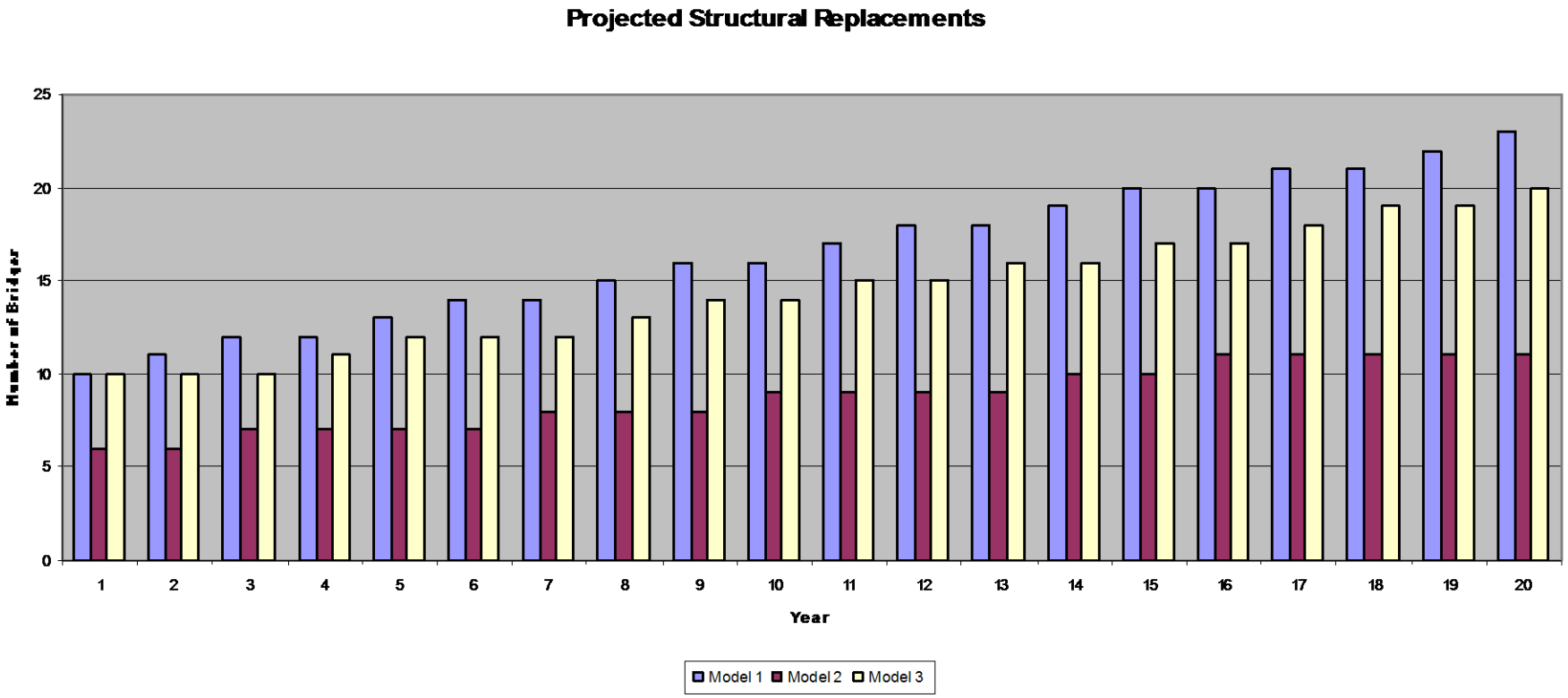
Deterioration Models



Service Life

- No clear definition
- Assume Service Life ends 6 years after 10 % of bridges reach condition state 4
- Model 1 55 years
- Model 2 80 years
- Model 3 70 years

Deterioration Models



Comparison of Models vs. History

Year	Model 1	Model 2	Model 3	Actual
2001	9	6	9	2
2002	10	6	10	4
2003	11	6	10	8
2004	12	6	11	7
2005	12	7	11	13
2006	13	7	11	4
2007	14	7	12	7
2008	15	7	12	12
2009	16	8	12	7
2010	16	8	13	3
2011	17	8	14	9
Total	145	76	125	75

Best Model

- Model 2 reflects recent history most accurately
- Model 1 reflects conditions if FDOT had no bridge repair, maintenance or preservation program

Evaluation of Bridge Program

- Average age of Bridge inventory 34 years
- At 34 years Model 1 predicts 19 bridge replacements per year
- At 34 years Model 2 predicts 8 bridges per year
- Average deck area 25,000 sq ft

Evaluation Continued

- Per FHWA coding guide a new bridge deck area is 2.2 times larger than original bridge
- 2009 FHWA cost for Florida is $137/SF
- FHWA excludes design, right of way, approach work, etc.
- Assume 2011 costs $160/SF

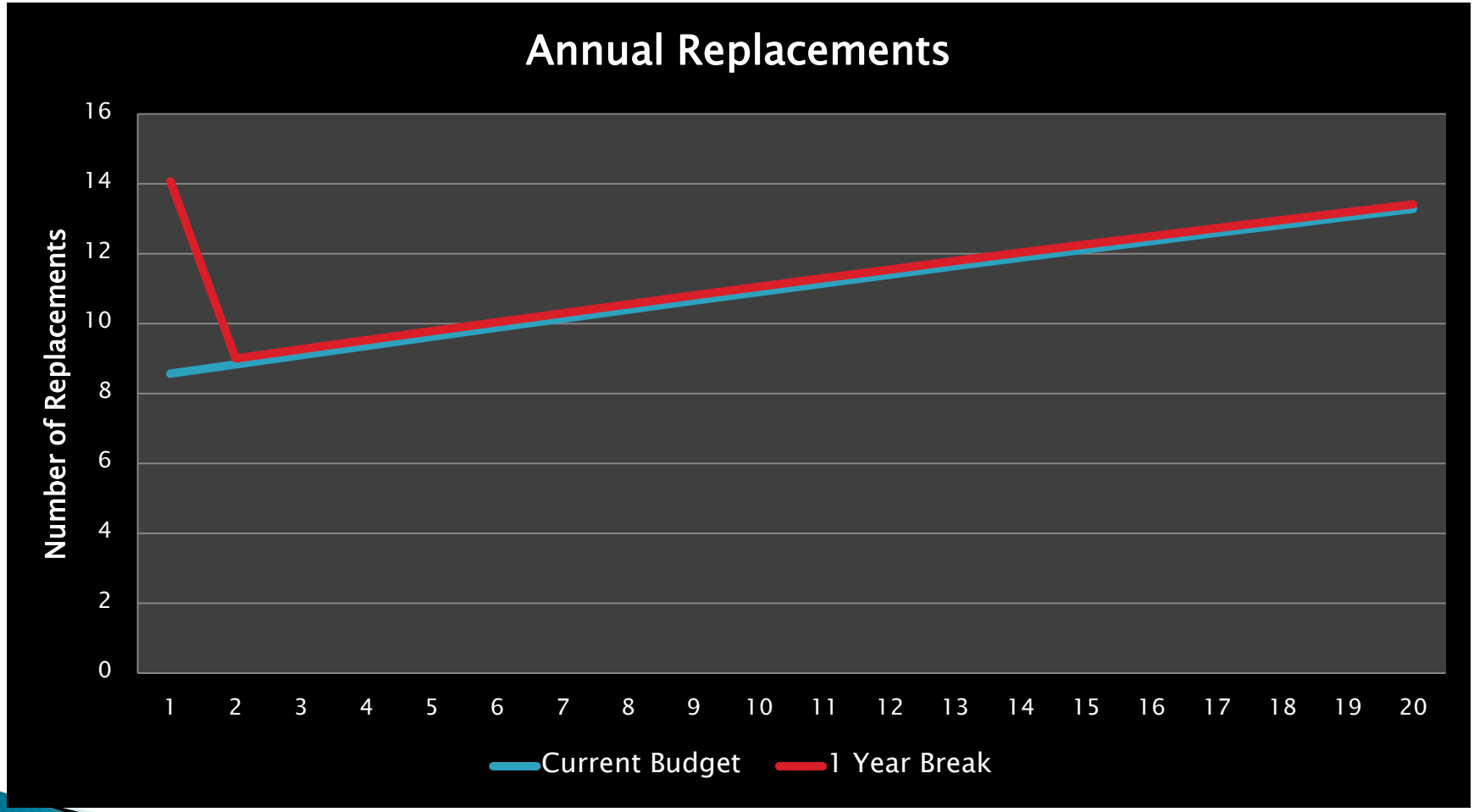
Evaluation Continued

- $8,800,000 per replacement
- $96,800,000 total agency cost savings
- Current Bridge Program about $60,000,000
- Approximately $36,800,000 per year savings

Cost of Deferred Work

- Assume Bridge Repair, Maintenance and Preservation not funded for 1 year
- Funding restored to previous levels in following years

Effect of 1 Year Deferral



In other words

- Approximately 6 additional bridges first year
- Then approximately every 4 to 5 years an additional bridge

Excluded benefits

- User costs not included
- Detour and time delay costs
- Increased safety of public

Conclusions

- The number of structural replacements will slowly increase over the next 20 years, but the increase will be manageable
- A good estimate of service life for Florida Bridges in 80 years
- FDOT's Bridge preservation, maintenance and repair programs are a good investment with solid returns

Questions?

- Richard I. Kerr
- 850-410-5808
- Richard.kerr@dot.state.fl.us