

# Comments to Florida Department of Transportation Pavement Type Selection Process

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## COMMENTS TO THE PRE-DRAFT OF CHAPTER 4

### Section 4.1 General:

As written, projects that will go through the PTS are essentially new construction and reconstruction.

It is recommend to add language that would allow the PTS to be expanded to other types of projects (eg overlays) if the district so desires. This would also let the PTS process be expanded into other applications such as overlays once it has been fully developed. The state of Missouri originally started using Alternate Designs / Alternate Bid on new and reconstruction projects only. However, due to that success, MoDOT has since expanded ADAB into overlays and pavement preservation activities as they have become more familiar with the process. Based on this, FDOT should provide for such a possibility.

### Section 4.2 Economic Analysis (EA):

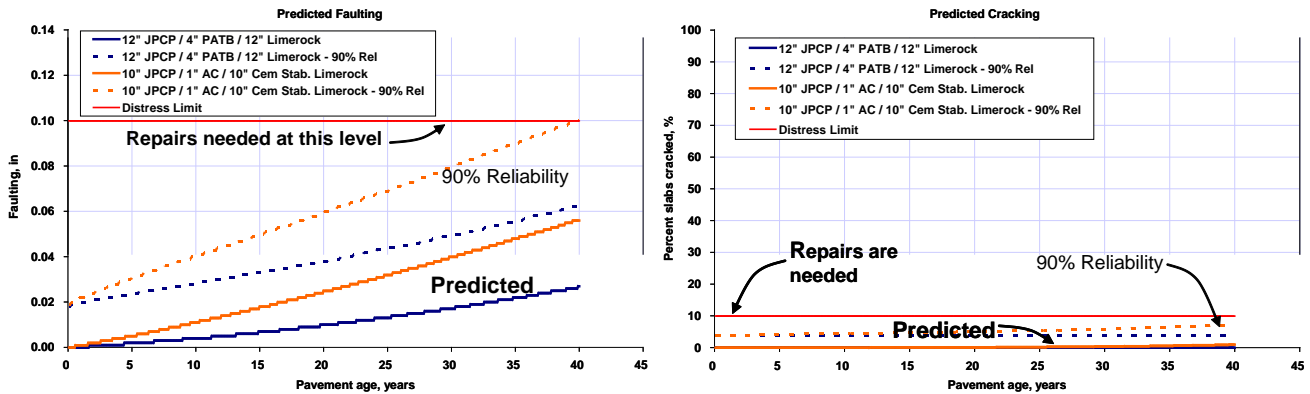
The FHWA RealCost Software is a probabilistic Life Cycle Cost Analysis (LCCA) model and while its adoption is a good step, there are still several issues that need addressed.

1. RealCost does not address equivalency of the initial designs. LCCA is a subset of a Cost/Benefit Analysis where the “Benefits” are assumed to be equal. For this reason, the design objective is to establish pavement sections that have common benefits - in the form of similar performance criteria - so that the comparative analysis can be based upon expected results.

To this end, FDOT still needs to define how similar performance criteria will be established.

Note that this is especially critical when using the AASHTO Mechanistic Empirical Pavement Design Guide (MEPDG). Because the MEPDG provides prediction performance curves for key design analysis parameters (rather than providing thickness), it is possible to have 2 (or more) designs that meet the performance criteria, but which will have drastically different costs. That is, one of the designs may be “optimized” to meet performance criteria and the other is not. For example, Figure 1 below shows an example of 2 concrete pavements (a 12-inch JPCP and a 10-inch JPCP) that both meet the performance criteria for a 40 year design. While both meet the performance criteria, the 10 JPCP will be much lower in costs and as such FDOT needs to describe how the final pavement section will be determined.

**FIGURE 1 MEPDG results for faulting and cracking for a 12” JPCP and 10” JPCP optimized concrete pavements.**



In this case, the performance criteria I used was “*the final design is determined when the 90% reliability curve hits by the pre-defined distress limit for either cracking or faulting.*” Having such a rule will keep designers from stopping at the 12” JPCP design when they could optimize designs further.

2. In RealCost, the agency’s initial pavement and rehabilitation cost are input as total cost for that activity. This means that FDOT will still have to develop costs for each activity for the specific project outside of RealCost using appropriate unit costs from projects of comparable size.

As such, FDOT needs to define how initial and rehabilitation costs will be developed, how appropriate unit costs will be derived, and what pavement and non-pavement items will be included.

- Note: the discussion in “Comments on Design Issues” and “Comments on Specification Issues” play an important role here. Design Policy issues, such as the drainage and diamond grinding requirements, that increase a concrete pavement’s initial costs, but which may not have technical merit for a particular project must be addressed. Similarly, the bidding process and payment practices must be re-written so that the material quantity risk between asphalt and concrete projects are treated similarly and appropriate unit costs can be developed.
3. One of the primary features of RealCost is that it does both “deterministic” and “probabilistic” LCCA analysis. Deterministic LCCA is the standard approach and it uses a single value for the inputs (initial cost, rehabilitation costs, discount rate, etc) and the output is a single Net Present Value (NPV). Probabilistic LCCA takes into account the variability of each input by combining the variability of the individual inputs to generate a probability distribution for the NPV. The results then are not just one value, but a whole distribution on what possible values could be.

The advantage of a probabilistic approach is that it is a much greater, in depth Risk Analysis that exposes areas of the uncertainty typically hidden in the traditional deterministic approach to LCCA . For more information on see the FHWA Publication *Life-Cycle Cost Analysis in Pavement Design*, Pavement Division Interim Technical Bulletin, FHWA Publication No. FHWA-SA-98-079, September 1998.

Therefore, if a probabilistic analysis is to be implemented, there are 2 issues that need addressed:

- How will the 10% rule be implemented when the output is a range of values?
  - How will ranges and distribution values for the inputs be developed?
4. The other primary feature of RealCost is that it calculates User's Costs. However, the calculation of User's costs in RealCost has as more to do with traffic control; number of lane closed; duration and time work lane closures are estimated to occur; and congestion development rather than pavement type. That is, a 3 lane roadway with a 2 lane closure for repairs that last 15 days may have 100 times or more User's Costs than the single lane closure for 45 days due solely to the amount of congestion that may develop. Similarly, late rehabilitation activities can cause very high User's Cost because the traffic in later years is often near congestion even before rehabilitation and any activity will increase user costs substantially.

As such, it is recommended to keep User's Costs and Agency Costs separate so that User's Costs do not overwhelm the agency costs. It is also recommended that when extremely high User's Costs are encountered, a detailed analysis be made to determine what the cause of the high User's Costs is in order to see if the results are actually due to difference in pavement type and the required rehabilitation activities, or due to some issue like those described here.

### **Section 4.3.1 Time Periods:**

#### Analysis Period:

Currently, FDOT uses a 20 year design period for all designs. Many State DOTs use 30 or 40 year design periods for high impact projects, such as the I-595 Express Lanes in Fort Lauderdale and then the 20 year design periods for lower impact projects. In such cases, it means that the Analysis period must change in order to ensure that at least one or more rehabilitation activities are incorporated.

In a recent draft report to the North Carolina Turnpike Authority, The Transtec Group states that many agencies use an Analysis Period that is 2 times the design period in order to ensure that at least one major rehabilitation activity is incorporated<sup>1</sup>. Adoption of such a rule would give FDOT Flexibility to adjust the analysis period to address specific cases such as the ones described above.

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<sup>1</sup> Alternate Pavement Type Selection: Literature Search and Data Collection, Reported for the North Carolina Turnpike Authority by The Transtec Group, March 4, 2010

*Discount Rate:*

For discussion on Discount rate, see previously submitted comments:

**Section 4.3.2 Rehabilitation Strategies:**

Ideally, the frequency of pavement rehabilitation activities should be matched to each individual pavement’s design, and then compared to historical performance data of similar roadways (e.g. interstates compared to interstates), using empirical databases, such as FDOT PMS data, the LTPP database, and performance prediction data, such as the MEPDG. The goal is to objectively match the rehabilitation schedules with the expected performance. For example, on a given roadway with a given traffic volume, an 8-inch concrete pavement will not have the same rehabilitation schedule as a 12-inch concrete pavement.

With respect to selection of rehabilitation activities, we recommend that Concrete Pavement Preservation (CPP) activities be used for at least the first and second activities. CPP activities, such as full depth repair, diamond grinding, joint and crack resealing, etc. are used to repair isolated areas of deterioration in a concrete pavement and slow the rate of deterioration. They have historically provided 10 years or more of service at ¼ to ½ the cost of an asphalt overlay and have been done up to 3 times on the same pavement. After that, an asphalt or concrete overlay can be placed.<sup>2,3</sup>

Based on this, it is recommended to replace the concrete portion on Table 4.1 with the following. The reasoning for replacing Year 20 and 30 with “1st rehab activity” and “2<sup>nd</sup> rehab activity” is so that range of anticipated activity years can be given and the designer can make adjustments based on historical performance or MEPDG prediction curves<sup>4</sup>. The 3<sup>rd</sup> set of rehab activities have been added in anticipation of longer analysis periods as discussed in Section 4.3.1

Concrete			
Rehab Cycle	Urban Arterial	Rural Arterial	Limited Access
1 <sup>st</sup> Rehab (Year 20 -25)	CPR (3% Slab Replacement)	CPR (3% Slab Replacement)	CPR (3% Slab Replacement)
2 <sup>nd</sup> Rehab (Year 30 -35)	CPR (5% Slab Replacement)	CPR (5% Slab Replacement)	CPR (5% Slab Replacement)
3 <sup>rd</sup> Rehab (Year 40 -45)	CPR (8% Slab Replacement) Or Resf. 1 inch Str. AC and DGFC  (Choice should be made on cost analysis)	CPR (8% Slab Replacement) Or Resf. 3 inch Str. AC and FC  (Choice should be made on cost analysis)	CPR (8% Slab Replacement) Or Resf. 4 inch Str. AC and FC  (Choice should be made on cost analysis)

<sup>2</sup>“The Concrete Pavement Restoration Guide” TB020P, American Concrete Pavement Association, Skokie IL, 1998

<sup>3</sup> “The Longevity and Performance of Diamond Ground Pavements,” S Rao, T. Yu and M. Darter, Research and Development Bulletin RD118, Portland Cement Association, Skokie IL, 1999

<sup>4</sup> The Ohio DOT uses ranges for their rehabilitation activities and in the year that they are done in order to give latitude for designers .