

# Comments to Florida Department of Transportation Pavement Type Selection Process

Sam Joiner, Ajax Paving  
Jim Mack, PE, CEMEX

## Pavement Specification Issues:

Pavement Type Selection is dependent on many items. Most often, designers and engineers look to ensure that equivalent designs and appropriate life cost analysis are used. However, another important issue is the pavement specifications that contractors must use. In order to have a “fair and level” PTS process, the bidding process, specifications, and payment practices must be written so that the material quantity risk between asphalt and concrete projects are treated similarly.

In FHWA’s Nov 13, 2008 Technical Memorandum “*Clarification of FHWA Policy for Bidding Alternate Pavement Type on the National Highway System,*”<sup>1</sup>, there are 3 specific specification items that the FHWA says should be considered when deciding to do alternate bidding. These are:

- Commodity Price Adjustment Factors
- Incentive / Disincentive Provisions for Quality
- Specification of Material Quantities

Note that while these issues were raised with respect to doing Alternate Pavement Bidding, each still has the same impact whether or not Alternate Pavement Bidding or the standard PTS process with initial and life cycle cost analysis is being used. As such, these factors will affect current and historical average bid prices for the different pavement types and the affects should be accounted for.

## Discussion - Commodity Price Adjustment Factors

Commodity Price Adjustment Factors, or Price Indexes are used to limit a contractors’ exposure to raw material price fluctuations and is considered especially beneficial for contracts that extend over several years. However, in the November 2008 Clarification memo, FHWA states:

*The Pavement Type Selection Policy, published in the Federal Register on November 9, 1981, specifies that price adjustment clauses should not be used when using alternate bidding procedures. Price adjustment clauses transfer some material cost escalation risk from the contractor to the owner agency. As it is very difficult, if not impossible, to administer equal treatment with price adjustment factors to alternate materials, using these clauses will result in different levels of materials cost risk being included in the bid for alternate pavement types.*

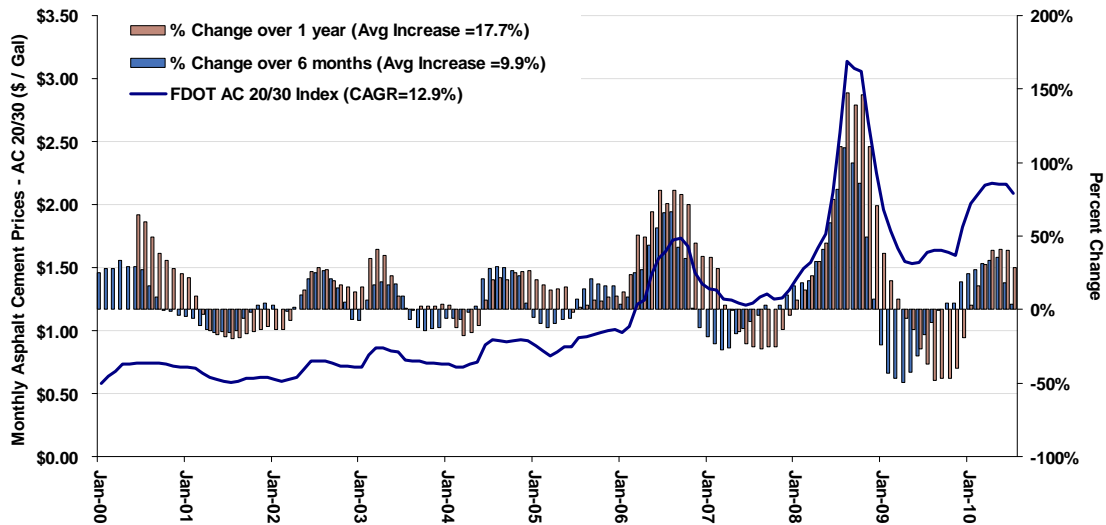
---

<sup>1</sup> Clarification of FHWA Policy for Bidding Alternate Pavement Type on the National Highway System, U.S. Department of Transportation, Federal Highway Administration, Nov 13, 2008 <http://www.fhwa.dot.gov/pavement/081113.cfm>

Typically, indexing has been associated almost exclusively with asphalt pavement projects. When one group is given an index and another is not; the net result is the group that is indexed is given a bidding advantage that is subsidized by the owner and distorts the market. That is, the owner perceives cost savings because of lower bids; but in reality the owner ends up paying more than the bid price.

Figure 1 below shows the historical 10-year trend for the monthly AC20/30 Asphalt Cement Prices (solid dark blue line), the 6 month percent change (light blue column), and yearly percent change (tan column) in Florida<sup>2</sup>. Overall, since 2000 the Asphalt Cement price has increased by 261%. Also note that while FDOT has benefited from both “up” and “down” fluctuations, the majority of the 6 month and yearly changes are in the “up” direction and the percentage change with the “ups” is greater than the percentage change with the “downs.” Overall, the average six month change is a 9.9% increase and the average yearly change is a 17.7% increase.

**Figure 1: FDOT Monthly Asphalt Cement Index (AC 20/30 Index) and Percent Change since Jan 2000**



**Recommendation:**

We recommend that FDOT adjust the asphalt pavement price based on historical trend for indexing adjustments (eg. the 10 year historical trend shown here) prior to comparing initial costs and calculating Life Cycle Costs.

**Discussion - Incentive / Disincentive Provisions for Quality**

Incentives are a way of rewarding quality contractors for their work. Often times, high quality contractors will lower their bids for a project in order to win the project with the idea of obtaining their profit by getting the incentive. Because of this, the November 2008 FHWA Clarification memo states:

<sup>2</sup> FDOT Fuel and Bituminous Price Index , <http://www.dot.state.fl.us/construction/fuel&bit/fuel&bit.shtm>. Data from January 2000 to July 2010.

*If quality based Incentive / Disincentive provisions are included with alternate bidding procedures, the I/D provisions should provide comparable opportunity for each alternate.*

It is our belief that the FDOT Incentive / Disincentive provisions between pavement types, as shown in Table 1 below, are not comparable.

**Table 1: Incentive and Disincentive Provisions in FDOT’s 2010 Standard Specifications**

	<i>Section 334 - Superpave Asphalt Concrete</i>	<i>Section 350 - Cement Concrete Pavement &amp; Section 352 - Grinding Concrete Pavement</i>
Incentive	<b>334-8 Basis of Payment</b> The pay adjustment will be assessed by calculating a Pay Factor for the following individual quality characteristics: pavement density, air voids, asphalt binder content, and the percentage passing the No. 200 and No. 8 sieves.	<b>350-18 Basis of Payment.</b> No bonus options  <b>352-8 Basis of Payment. -</b> Pay (Price) Adjustments for Incentives will be based on the initial measured average Profile Index, prior to any corrective work.
Maximum Incentive Opportunity	5% of the Asphalt ton price	3% of the Diamond Grinding price
Example:	AC price = \$65 / ton Max bonus = \$65 x 0.05 = \$3.25 / ton.	Diamond Grind price = \$3.50 / SY Max bonus = \$3.50 x 0.03 = \$0.11 / SY
Disincentive	Same as Opportunities Incentive  Minimum pay = 80% of Asphalt ton price	<b>350-15 Deficient Thickness</b> The Department will not pay for any pavement which is more than 1/2 inch less than the specified thickness.

As can be seen, the opportunity and values for bonus in concrete pavements is much lower than asphalt pavements ( \$0.11/SY vs \$3.25/ton). The other inequity is in the fact that asphalt tonnage for the full depth of pavement is subject to Incentive/Disincentive, whereas only the value of the Grinding is subject to Incentive in concrete pavements. As grinding of concrete pavements is performed by specialty subcontractors, these subcontractors typically contract to receive the Profile Index Incentive themselves, meaning the contractor/subcontractor who performs the concrete pavement does not receive the Incentive, unlike asphalt pavers.

Compounding the comparative advantage asphalt pavement has over concrete pavement in Incentives is the fact that on some FDOT concrete pavement projects there is no Payment Item No. 352 – 8 under which the Incentive can be paid (diamond grinding is required but subsidiary to Item No. 350 – 1 or Item No. 350 – 2).

The second issue in Table 1 is that the deduct and payment factors for missing the primary quality characteristics (eg density, etc for asphalt and thickness for concrete) are much higher for

concrete. In table 334-10 of Section 334-8: Basis of Payment for asphalt, the minimum Percent Within Limits (PWL) for all incentive / disincentive quality characteristics is 50%. Section 334-8.2.2.2 Pay Factors (PF) then states that Pay Factors will be calculated by using the following equation:

$$\text{Pay Factor} = (55 + 0.5 \times \text{PWL}) / 100$$

Based on the minimum PWL being 50%, the minimum PF for each quality characteristics is 80% ( $\text{PF} = (55 + .5(50))/100 = 80\%$ ) and when combined into the Composite Pay Factor (CPF) using the procedure in Section 334-8.3, the minimum CPF is 80%. Thus the minimum pay is 80% of the bid price. Furthermore, while Section 334-5.1.9.4 states that when the composite pay factor for the LOT is less than 0.75, the contractor is to remove and replace. However, assuming all the above is correct, it is not possible to get a CPF less than 0.80 and as such pavement removal and replacement is not enforceable.

For Concrete pavement on the other hand, section 350-15 Deficient Thickness states that when the pavement is more than 1/2 inch less than the specified thickness, then either the pavement will be removed and replaced based on the engineer's judgment or it may be left in place, at no compensation to the contractor. The end result is that the maximum pay reduction for asphalt is 20% versus vs 100% pay reduction for concrete.

#### **Recommendation:**

Develop a set of incentives for Section 350 Cement Concrete Pavement based on items such as thickness, strength, and smoothness.

Correlate the incentives and disincentives for all pavement systems so that the risk and rewards are similar.

#### **Discussion - Specification of Material Quantities**

The November 2008 FHWA Clarification memo states:

*Using different methods to specify/quantify alternate pavement types may result in different levels of materials quantity risk for the alternate pavement types. Owner-agencies should consider approaches that balance materials quantity risk between the alternate pavement types.*

In our review, we believe that there are several items that place a greater materials risk on concrete paving contractors than asphalt paving contractors. The first of these is the thickness requirements.

Both asphalt and concrete sections have thickness discussions. However, for asphalt, while Section 330-9.1.6 Checking Depth of Layer says "*Check the depth of each layer at frequent intervals, and make adjustments when the thickness exceeds the allowable tolerance*", there is no discussion about a depth check for the entire asphalt layer to make sure it was correct or any discussion on pay being affected by low thickness. Concrete pavements have a depth check

(core or NDT testing) every 2,500 SY and as shown in the previous discussion, the contractor can get a no pay if thickness is low by more than 1/2 inch.

Because of this difference in thickness checks, the second item that places more material quantity risk on a concrete paving contractor is the base and subgrade grade requirements. Item 350-4 in the Cement Concrete Pavement Specifications states "*Accurately trim the subgrade to the required elevation. Trim high areas to proper elevation.*" There is no similar requirement on the subgrade preparation in Sections 330 or 334 for asphalt.

These more stringent requirements can require that an auto grade trimmer be used for the base of concrete pavement and have resulted in the concrete construction being more expensive. While the owner agency benefits from increased concrete thickness (the additional concrete depth placed to avoid penalty adds pavement life), and the increased attention paid to the base and subgrade construction; a thickness deficiency on an asphalt pavement will have a reduction in "load carrying capacity" just as it does for a concrete section without a commiserate penalty to the asphalt contractor.

As an example, Figure 2 below shows the impact of thickness deficiencies for equivalent asphalt and concrete pavements designed to carry 10 M Flexible ESALs and 15 M Rigid ESAL's respectively<sup>3</sup> based on the FDOT design procedure. As can be seen, both pavements have a large and similar reduction in load carrying capacity for the same thickness decreases. For this reason, we believe that both pavements need be held to the same thickness requirements.

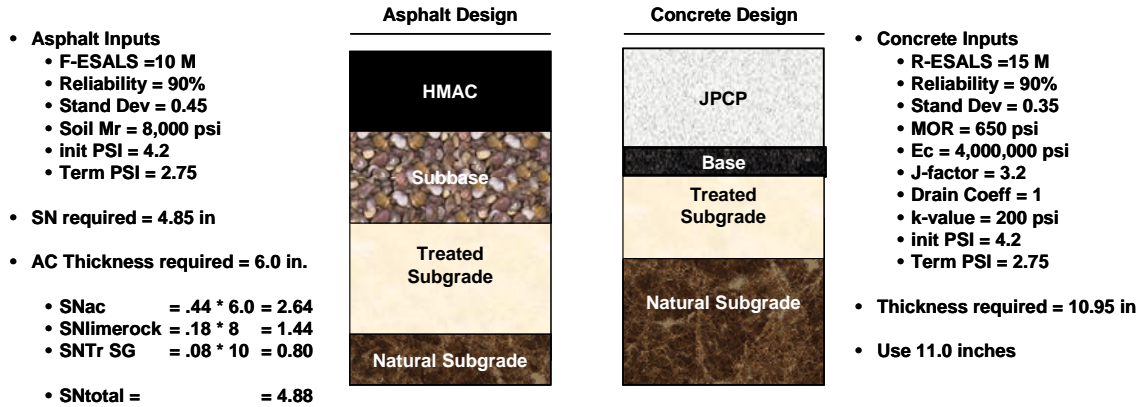
One item to point out is that FDOT typically rounds the specified thickness on concrete projects up to the nearest 1/2-inch to avoid odd thickness requirements (e.g. the 10.95-inch requirement here is rounded to 11.0 inches). This rounding increases the load carrying capacity at approximately the same percentage as the decrease, and given the amount of rounding, the actual load carrying capacity of the pavement could be much higher than the design.

The third item that places a greater material quantity risk on the concrete paving contractors is payment bid items. The issue is that concrete and asphalt pavement payment bid items are not equivalent in how they measure and pay for Item pay quantities. The two issues involved in the disparity are the maximum overage adjustments are not equivalent and the pay adjustments are not based on the same lot sizes.

---

<sup>3</sup> Rigid and Flexible ESALS are not the same. For equivalent designs, Flexible ESALS ~ 2/3 Rigid ESALS. Designed using the current FDOT Rigid and Flexible Pavement Design Procedures, which are based on the AASHTO 93 procedures.

**Figure 2: Effect of Thickness on Load Carrying Capacity for FDOT Example Pavement Designs**



Thickness Reduction	Asphalt		Concrete	
	Allowable ESALS	% reduction	Allowable ESALS	% reduction
0.25	8,884,414	11.2%	13,318,969	11.2%
0.5	7,579,362	24.2%	11,471,730	23.5%
1.0	5,482,506	45.2%	8,440,355	43.7%
1.5	3,930,412	60.7%	6,140,947	59.1%

With respect to the issue on maximum overage adjustments, for asphalt, Section 334-7 Method of Measurement states:

*“For the work specified under this Section (including the pertinent provisions of Sections 320 and 330), the quantity to be paid for will be the weight of the mixture, in tons. The pay quantity will be based on the project average spread rate, excluding overbuild, limited to a maximum of 105% of the spread rate ...”*

For concrete, Section 350-17 Method of Measurement states:

*The quantities to be paid for will be the plan quantity, in square yards, of Plain Cement Concrete Pavement and of Reinforced Cement Concrete Pavement, omitting any areas not allowed for payment under the provisions of 350-15.3 and adjusted for average thickness as provided herein. ...subject to the limitation that the maximum average of over-thickness permitted in the adjustment of the quantity of pavement to be paid for will be 1/4 inch*

Table 2 shows the maximum percentage overage that is paid on various thicknesses of concrete pavements assuming the full ¼ inch adjustment. As can be seen, the maximum percentage (%) overage payment for concrete is anywhere from 1.88% to 3.21% below the maximum overage payment for asphalt depending on the concrete thickness (from 8 inches to 14 inches

**Table 2: Maximum Percentage Overage for Various Thickness of Concrete**

<i>Planned Thickness (in)</i>	<i>Planned Quantity (CY) for 1 SY of Pavement</i>	<i>As-built Thickness (in)</i>	<i>As-built Quantity (CY) for 1 SY of Pavement</i>	<i>Percent (%) Difference</i>
14.00	0.39	14.25	0.40	<b>1.79%</b>
13.00	0.36	13.25	0.37	<b>1.92%</b>
12.00	0.33	12.25	0.34	<b>2.08%</b>
11.00	0.31	11.25	0.31	<b>2.27%</b>
10.00	0.28	10.25	0.28	<b>2.50%</b>
9.00	0.25	9.25	0.26	<b>2.78%</b>
8.00	0.22	8.25	0.23	<b>3.13%</b>

respectively). While it is not the desire for the concrete paving contractors to overcharge FDOT for materials, we do believe that the 2 pavement systems need to be treated consistently and paid equivalently.

With respect to the unequal payment lot adjustment issue, Section 334-8 Basis of Payment for Asphalt pavements states:

*For materials accepted in accordance with 334-5.1, based upon the quality of the material, a pay adjustment will be applied to the bid price of the material as determined on a LOT by LOT basis.*

For concrete, Section 350-14.2 Method of Calculating Average Thickness, subsection (c) states:

*The Department will calculate the average thickness for the entire job as a unit.*

And section 350-17 Method of Measurement states:

*The area of pavement represented by the difference between the calculated average thickness and the specified thickness will be converted into equivalent square yards of specified thickness pavement, and the quantity thereby obtained will be added to, or deducted from, the quantity of pavement to be paid for...*

The net result is that because asphalt contractors are paid on a lot per lot basis, problems, when they occur, are more isolated and asphalt contractor does not have to worry about them interacting with the payment on previous or subsequent work. Similarly, the asphalt contractor has more opportunities to achieve bonus. Concrete paving contractors on the other hand, because the entire job is considered one unit, do not have this benefit that may allow them to bid concrete pavement at a more aggressive and less-risky unit price. One bad day's paving can interfere with the payment schedule for the whole project.

**Recommendations:**

Balance specifications by having the same the thickness standards for both pavement types.

Have consistent requirements for grade/elevation/profile between the two pavement systems. (Because concrete pavements and subgrade are constructed with much tighter control and methods, concrete pavements adhere much better to cross slope requirements.)

Have the same Pay Items for both materials: use Square Yards, as specified by IL and MO or use Cubic Yards and Tons as specified by CA and OK.

Pay for, and calculate Incentive/Disincentives, on comparable or equivalent Lot sizes for each pavement type.