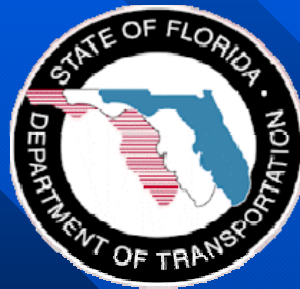


CROSS SLOPE

Revised Specifications Highlights



David Wang
State Construction Office
Feb.23, 2010

Background

- A prevalence of cross slope issues was found during the project reviews of the ACAF Pavement Awards Evaluation in 2002.
- The first cross slope control specification was developed and implemented in 2003.
- Since that specification was used, there has been a great improvement in mainline on the tangent section, but lack of control on the superelevation sections.

Cross Slope Specifications Work Group

- A Specifications Work Group was organized to revise the current Specifications in 2009.
- Members:
 - FDOT (Paul Steinman, Greg Sholar, Stacy Scott, Alex Mraz, Robert Lopes, Frank Kreis, Richard Hewitt, Jim Martin, Jimmy Pitman, Sandra Chitwood, Frank Crawford, Paul Barnes, Emmanuel Uwaibi, David Wang)
 - Industry (Matt Siegel, Richard Dodd, Wayne Sweet, Ken Murphy, Parks Allman, Jim Warren)



Goals of the Work Group

- Develop QC and VT processes for Tangent Section and Superelevated Section for cross slope control operations.
- Develop the requirements for accuracy, calibration and comparison check of the cross slope measuring device.
- Finalize the criteria of cross slope acceptance and removal and replacement of the defect area on the pavement.

Measuring Device

- Electronic level with a length of 4 feet and an accuracy of 0.1 degree.
- Calibration: minimum of once per day before any paving operation in accordance with the manufacturer's instructions.



330-12.3.1 Quality Control Requirements

- Comparison Check: QC level vs. VT level
 - If reading difference between QC and VT is $\leq 0.2\%$, the QC level is acceptable for QC measurement.
 - If reading difference between QC and VT is $> 0.2\%$, perform second comparison check using third calibrated level (FDOT or Contractor) for resolution.
 - If the resolution level compares favorably with the QC level, the QC level is acceptable.
 - If the resolution level does not compare favorably with the QC level, reject the QC level.

Cross Slope Measurement

Place the level at the center of a lane and perpendicular to the roadway centerline. Record the measurement to the nearest 0.1 %.



Cross Slope QC Processes

- Tangent Sections
 - Minimum Frequency: One measurement every 100 feet.
 - Calculate the deviation cross slope at each measurement ($\text{Deviation} = \text{Measured cross slope} - \text{Design cross slope}$) and take the absolute deviation value (Always use the positive value of deviation).
 - Average the absolute deviation of ten consecutive cross slope measurements.

Cross Slope QC Processes

- Tangent Sections (cont'd)
 - When the average absolute deviation cross slope is consistently within the acceptable tolerance as shown in Table 330-2 and upon the approval of the Engineer, the frequency of the cross slope measurements can be reduced to one measurement every 200 feet during paving operations.



Cross Slope QC Processes

- **Superelevated Sections**
 - Measure the cross slope every 100 feet per lane within the full superelevation and calculate the absolute deviation of measurements.
 - Average the absolute deviation of ten consecutive cross slope measurements.
 - For every transition section, measure the cross slope at control points identified in the Plans, or if not shown in the Plans, at a control point of 0.0 % cross slope.



Cross Slope QC Processes

- Superelevated Sections (cont'd)
 - For length of full superelevation section less than 250 feet, measure three sections (beginning point, midpoint and ending point). Calculate the absolute deviation of each measurement. Average the absolute deviation of the three cross slopes.
 - For length of full superelevation section greater than 250 feet and the number of measurements is less than 10, average the absolute deviations of all the measurements.



Table 330-2
Cross Slope Acceptance Tolerance

Roadway Feature	Individual Absolute Deviation	Average Absolute Deviation
Tangent section (including turn lanes)	0.4%	0.2%
Superelevated curve	0.4%	0.2%
Shoulder	0.5%	0.5%

Adjust Cross Slopes on Variable Areas

- For intersections, tapers, crossovers, transitions at the beginning and end of the project, bridge approaches and similar areas, adjust the cross slope to match the actual site conditions, or as directed by the Engineer.



Corrective Actions

- Average absolute deviation falls outside the acceptable tolerance – Stop paving and make adjustments of the construction operations.
- Individual deviation falls outside the acceptable tolerance – Make corrections per 330-12.5 to cover the deficient area on structural course.
- For multiple layer, the deficient areas may be left in place, upon the approval of the Engineer. Corrections must be completed before placement of final surface layer.

Corrective Actions (cont'd)

- Friction Course: Correct deficiencies per 330-12.5.
- In the event that the distance between two edges of deficient areas is less than 100 feet, the correction work shall include the area between the deficient sections.



Waive Corrective Actions at No Reduction

Submit a request to the Engineer for approval, if the deficiencies are sufficiently separated so as not to affect the overall traffic safety, surface drainage and ride quality characteristics of the pavement and the corrective action would unnecessarily mar the appearance of the finished pavement.



330-12.3.2 Verification

Randomly measure a minimum of ten cross slopes per lane per mile in tangent sections, control points in transition sections, and a minimum of three cross slope measurements on fully superelevated sections over a day's production.

- If the average absolute deviation or an individual cross slope deviation falls outside of the acceptance tolerance as shown in Table 330-2, immediately make a comparison check at the QC test locations to verify the QC measurements in the questionable section.

330-12.3.2 Verification (cont'd)

- If the comparisons are beyond the acceptable comparison tolerance ($\pm 0.2\%$), stop the paving operations until the problem is resolved to the satisfaction of the Engineer.
- Correct any cross slope not meeting the individual deviation acceptance tolerance in accordance with 330-12.5 at no cost to the Department.
- The Engineer reserves the right to check the pavement cross slope at any locations, any time.

327-3.2 QC Requirements (Milling)

Same requirements as Section 330-12.3 :

- Type and Accuracy of the Measuring Device
- Calibration and Comparison Check
- QC and VT Processes
- Corrective Actions
- Waive Corrective Actions at No Reduction
- Adjust Cross Slopes on Variable Areas



Table 327-1

Cross Slope Milling Acceptance Tolerance

Roadway Feature	Individual Absolute Deviation	Average Absolute Deviation
Tangent section (including turn lanes)	0.4%	0.2%
Superelevated curve	0.4%	0.2%
Shoulder	0.5%	0.5%

CONCLUSION

Cross slopes of roadway pavement play an important role in the ride quality, pavement drainage, traffic safety and pavement life preservation. Therefore, careful attention must be accorded to the accuracy of cross slopes from the design phase through the final construction stage.

Thank You

