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Florida Department of Transportation

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ROADWAY DESIGN BULLETIN 24-03

(FHWA Approval: 08/12/2024)

DATE: *08/16/2024*

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Consultant Project Management Engineers, District Construction Engineers, District Roadway Design Engineers, District Drainage Engineers, District Pavement Design Engineers, District Materials and Research Engineers

FROM: Derwood Sheppard, P.E., State Roadway Design Engineer

DocuSigned by:
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COPIES: Will Watts, Dan Hurtado, Huiwei Shen, Jennifer Fortunas, Xiaoyan (Sue) Zheng, Lance Grace, Tim Lattner, Lora Hollingsworth, Jennifer Marshall, Rudy Powell, Howard Moseley, Will Potter, Bren George (FHWA), Rafiq Darji (FHWA)

SUBJECT: **Friction Course Policy**

This bulletin updates the Friction Course Policy in Chapter 4 of the ***2024 FDOT Flexible Pavement Design Manual (FPDM)***.

BACKGROUND

To improve pavement durability while maintaining high standards of safety, the Department is updating its Friction Course Policy.

IMPLEMENTATION

The requirements of this bulletin are effective immediately on all Design-Bid-Build projects for which the Phase II submittal has not yet been completed. Implementation of this bulletin for Design-Bid-Build projects after completion of the Phase II submittal is at the discretion of the districts.

The requirements of this bulletin are effective immediately on all Design-Build projects for which the final Request for Proposal (RFP) has not yet been released. Implementation of this bulletin for Design-Build projects after the final RFP has been released is at the discretion of the districts.

As noted in ***Appendix B*** of the ***FPDM***, deviations from the Friction Course Policy must be clearly documented in the Pavement Design Package and concurrence obtained by the District Design Engineer. ***FPDM***, ***Section B.4.4*** (*Documentation*) states:

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"*It is highly recommended that the Pavement Design Engineer become thoroughly familiar with the Department's Friction Course Policy. On projects where the policy is not adhered to, the reasons should be clearly documented in the Pavement Design Package.*"

Additionally, ***Section B.4.1*** (*Minimum Requirements*) says:

"*The Pavement Design Summary Sheet will show the approved pavement design, and each Pavement Design Summary Sheet will be signed and sealed by the District Pavement Design Engineer or the designated responsible Pavement Design Engineer. The District Design Engineer will sign for concurrence with the design.*"

REQUIREMENTS

1. Replace ***Chapter 4*** of the ***2024 FPDM*** with the following:

CHAPTER 4
FRICTION COURSE POLICY

4.1 FRICTION COURSE OPTIONS

There are two general types of friction courses currently in use by the Department, dense graded (FC-9.5 & FC-12.5) and open graded (FC-5). Their thickness is shown on the plans with spread rates determined by specification formula and paid for by the ton.

The Maximum Spread rate used for estimating quantities is as follows:

FC-9.5	110 lb/yd^2
FC-12.5	165 lb/yd^2
FC-5	80 lb/yd^2

Actual pay quantities will be based on the actual maximum specific gravity of the mixture used.

Friction Courses FC-12.5 and FC-9.5 are dense graded mixes which are typically placed 1½-in and 1-in thick respectively. These friction courses provide smooth riding surfaces with adequate friction numbers for skid resistance.

The FC-9.5 dense graded mix will allow a 1-in lift of friction course. On some projects, this thinner lift may allow room for an additional structural or overbuild lift, as in some curb and gutter sections, without milling into the base or overlaying friction course into the gutter.

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The other friction course, FC-5, consists of an open graded material. FC-5 is placed and shown on the typical section as ¾-in thick. FC-5 provides a skid resistant surface. The open graded texture of the mix provides for the rapid removal of water from between the tire and the pavement to reduce the potential for hydroplaning at higher speeds.

The appropriate Traffic Level is to be shown for dense-graded friction courses FC-9.5 and FC-12.5. For Traffic Levels B and C, PG 76-22 should be called for in the friction course. For Traffic Level E, PG 76-22 or High Polymer (HP) should be called for in the friction course.

4.2 FRICTION COURSE POLICY

A friction course will be placed on all roads and ramps with a design speed of 35 mph or higher, except for low volume two lane roads having a five-year projected AADT from the opening year of 3,000 vehicles per day or less. Place dense graded friction course (FC-9.5 or FC-12.5) on arterials and collectors. Place open graded friction course (FC-5) on limited access facilities.

Coordinate with the District Pavement Design Engineer to determine the appropriate friction course to use on limited access ramps. The type of friction course used must be evaluated for long term maintenance, surface drainage, existing crash patterns, and pavement structural value.

- Dense graded friction course is typically used on ramps with heavy volumes of truck traffic and/or turning and stopping movements.

- FC-5 is typically only used on high speed ramps with long tangent sections and/or large radii (e.g., a ramp connecting two limited access facilities).

4.3 FRICTION COURSES 12.5 AND 9.5 (FC-12.5 and FC-9.5)

The following are some of the features of the use of FC-12.5 and FC-9.5:

- FC-12.5 and FC-9.5 are allowed directly on top of any structural course mix.

- FC-12.5 and FC-9.5 are considered part of the structural layer and may be considered as both a structural and friction course.

4.4 FRICTION COURSE 5 (FC-5)

The following are some of the limitations on the use of FC-5:

- Open graded friction courses such as FC-2 and FC-5 should not be overlaid (due to its potential to allow water into the pavement system) except when approved by the District Materials Engineer.

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- FC-5 should not sit after construction for more than four (4) months before being opened to traffic. If necessary, the FC-5 may need to be let under a separate contract.
- FC-5 may be placed directly on the milled surface provided the underlying layers are in good structural shape.
- FC-5 is to extend 8-in beyond the edge of the travel lane, onto the paved shoulder.
- FC-5 is not to be placed in median crossovers or gore areas.
- To minimize raveling/deterioration due to pavement sawcuts, FC-5 is not required on flexible pavement within proposed Toll facilities that utilize electronic data collection requiring loop installation in the pavement surface.

ATTACHMENT

Attachment A – FDOT Flexible Pavement Design Manual, Chapter 4 Markups

CONTACT

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Attachment

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Attachment A

FDOT Flexible Pavement Design Manual
Chapter 4 Markups

CHAPTER 4
FRICTION COURSE POLICY

4.1 FRICTION COURSE OPTIONS

There are two general types of friction courses currently in use by the Department, dense graded (FC-9.5 & FC-12.5) and open graded (FC-5). Their thickness is shown on the plans with spread rates determined by specification formula and paid for by the ton.

The Maximum Spread rate used for estimating quantities is as follows:

FC-9.5	110 lb/yd^2
FC-12.5	165 lb/yd^2
FC-5	80 lb/yd^2

Actual pay quantities will be based on the actual maximum specific gravity of the mixture used.

Friction Courses FC-12.5 and FC-9.5 are dense graded mixes which are typically placed 1½-in and 1-in thick respectively. These friction courses provide smooth riding surfaces with adequate friction numbers for skid resistance.

The FC-9.5 dense graded mix will allow a 1-in lift of friction course. On some projects, this thinner lift may allow room for an additional structural or overbuild lift, as in some curb and gutter sections, without milling into the base or overlaying friction course into the gutter.

The other friction course, FC-5, consists of an open graded material. FC-5 is placed and shown on the typical section as ¾-in thick. FC-5 provides a skid resistant surface. The open graded texture of the mix provides for the rapid removal of water from between the tire and the pavement to reduce the potential for hydroplaning at higher speeds.

~~A friction course will be placed on all roads and ramps with a design speed of 35 mph or higher, except for low volume two lane roads having a five year projected AADT from the opening year of 3,000 vehicles per day or less.~~

~~Use FC-5 on multi-lane flush shoulder roadways with a design speed of 50 mph or greater.~~

~~Use FC-12.5 or FC-9.5 on all other flush shoulder or curbed roadways. However, if there is a history of wet-weather crashes in a high-speed curbed section, FC-5 should be considered. ***Table 4.1*** summarizes these requirements.~~

The appropriate Traffic Level is to be shown for dense-graded friction courses FC-9.5 and FC-12.5. For Traffic Levels B and C, PG 76-22 should be called for in the friction course. For Traffic Level E, PG 76-22 or High Polymer (HP) should be called for in the friction course.

~~TABLE 4.1~~
~~FRICTION COURSE POLICY~~

~~Design Speed (mph)~~	~~Two Lane~~	~~Multilane~~
~~Flush Shoulder Roadways~~		
~~≤ 45~~	~~FC-12.5 or FC-9.5~~	~~FC-12.5 or FC-9.5~~
~~≥ 50~~		~~FC-5~~
~~Curbed Roadways~~		
~~All~~	~~FC-12.5 or FC-9.5~~	~~FC-12.5 or FC-9.5~~

~~NOTES:~~

~~1. Include a friction course on all roads and ramps with a design speed ≥ 35 mph, except for two lane roads having a five-year projected AADT (from the opening year) of 3000 vehicles per day or less.~~

~~2. FC-5 should be considered for multilane curbed roadways with design speeds ≥ 50 mph when there is a history of wet weather crashes.~~

4.2 FRICTION COURSE POLICY

A friction course will be placed on all roads and ramps with a design speed of 35 mph or higher, except for low volume two lane roads having a five-year projected AADT from the opening year of 3,000 vehicles per day or less. Place dense graded friction course (FC-9.5 or FC-12.5) on arterials and collectors. Place open graded friction course (FC-5) on limited access facilities.

Coordinate with the District Pavement Design Engineer to determine the appropriate friction course to use on limited access ramps. The type of friction course used must be

evaluated for long term maintenance, surface drainage, existing crash patterns, and pavement structural value.

- Dense graded friction course is typically used on ramps with heavy volumes of truck traffic and/or turning and stopping movements.

- FC-5 is typically only used on high speed ramps with long tangent sections and/or large radii (e.g., a ramp connecting two limited access facilities).

4.3~~2~~ FRICTION COURSES 12.5 AND 9.5 (FC-12.5 and FC-9.5)

The following are some of the features of the use of FC-12.5 and FC-9.5:

- FC-12.5 and FC-9.5 are allowed directly on top of any structural course mix.

- FC-12.5 and FC-9.5 are considered part of the structural layer and may be considered as both a structural and friction course.

- ~~Coordinate with the District Pavement Design Engineer to determine the appropriate friction course to use on limited access ramps. The type of friction course used must be evaluated for long term maintenance, surface drainage, existing crash patterns, and pavement structural value.~~

    - ~~Dense graded friction course is typically used on ramps with heavy volumes of truck traffic and/or turning and stopping movements.~~

    - ~~FC-5 is typically only used on high speed ramps with long tangent sections and/or large radii (e.g., a ramp connecting two limited access facilities).~~

4.4~~3~~ FRICTION COURSE 5 (FC-5)

The following are some of the limitations on the use of FC-5:

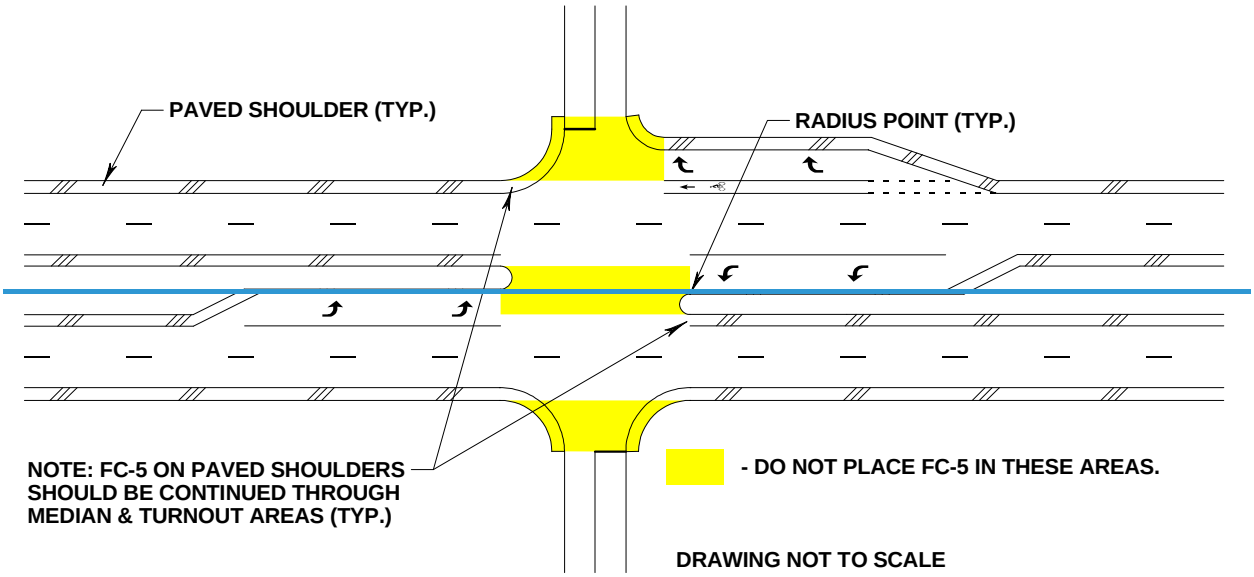
- ~~**On all roads that require FC-5:**~~

- Open graded friction courses such as FC-2 and FC-5 should not be overlaid (due to its potential to allow water into the pavement system) except when approved by the District Materials Engineer.

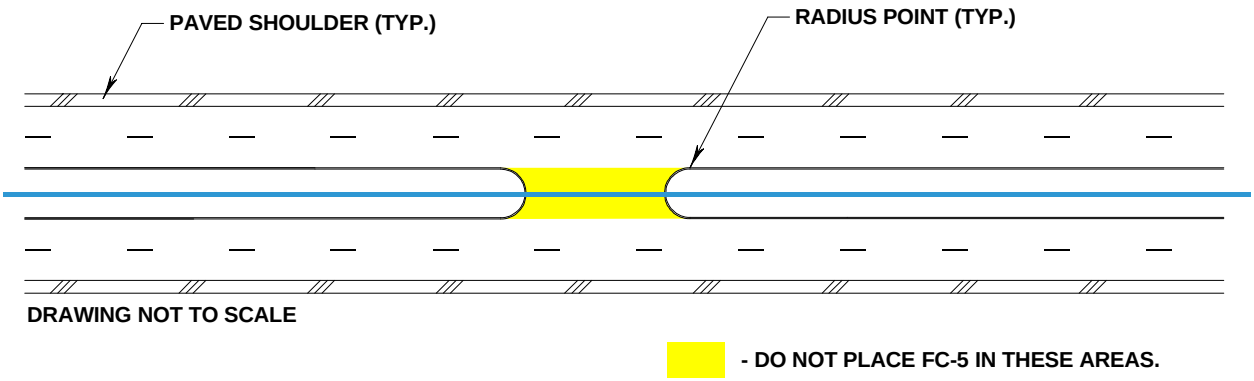
- FC-5 should not sit after construction for more than four (4) months before being opened to traffic. If necessary, the FC-5 may need to be let under a separate contract.

- FC-5 may be placed directly on the milled surface provided the underlying layers are in good structural shape.
- ~~**On multi-lane non-limited access facilities:**~~
- ~~FC-5 typically covers the deceleration areas of turn lanes. This is illustrated in ***Figure 4.1***.~~
- ~~FC-5 is not to be placed in median openings, turn outs, or gore areas on these facilities. This is illustrated in ***Figures 4.1*** and ***4.2***.~~
- ~~FC-5 is to be placed over the entire paved shoulder.~~
- ~~FC-5 should not be placed in the turning area of signalized intersections, as shown in ***Figure 4.3***. An exception to this is where both of the intersecting roads qualify for FC-5, then the entire intersection should use FC-5.~~
- ~~**On limited access facilities:**~~
- FC-5 is to extend 8-in beyond the edge of the travel lane, onto the paved shoulder.
- FC-5 is not to be placed in median crossovers or gore areas.
- To minimize raveling/deterioration due to pavement sawcuts, FC-5 is not required on flexible pavement within proposed Toll facilities that utilize electronic data collection requiring loop installation in the pavement surface.

~~FIGURE 4.1~~
~~TYPICAL LIMITS OF FC-5~~
~~FOR MULTI-LANE NON-LIMITED ACCESS FACILITIES~~
~~NON-SIGNALIZED INTERSECTION/MEDIAN OPENING~~



~~FIGURE 4.2~~
~~TYPICAL LIMITS OF FC-5~~
~~FOR MULTI-LANE NON-LIMITED ACCESS FACILITIES~~
~~MEDIAN OPENING (NO TURN LANES)~~



~~FIGURE 4.3~~
~~TYPICAL LIMITS OF FC-5~~
~~FOR MULTI-LANE NON-LIMITED ACCESS FACILITIES~~
~~SIGNALIZED INTERSECTION~~

