



## Florida Department of Transportation

RON DESANTIS  
GOVERNOR

605 Suwannee Street  
Tallahassee, FL 32399-0450

KEVIN J. THIBAUT, P.E.  
SECRETARY

### **STRUCTURES DESIGN BULLETIN 20-06**

*(FHWA Approved: September 4, 2020)*

DATE: September 9, 2020

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Construction Engineers, District Consultant Project Management Engineers, District Structures Design Engineers, District Maintenance Engineers, District Program Management Engineers, District Materials Engineers, Structures Manual Holders

FROM: Robert V. Robertson, P. E., State Structures Design Engineer

DocuSigned by:  
Robert V. Robertson  
CB0D507ADC8049F...

COPIES: Courtney Drummond, Will Watts, Tim Lattner, Dan Hurtado, Rudy Powell, Tim Ruelke, Trey Tillander, Stefanie Maxwell, Scott Arnold, Paul Hiers, Joe Santos, Rafiq Darji (FHWA)

SUBJECT: Multirotational (MR) Bearings

This bulletin implements changes to the level of design and detailing required when using multirotational (MR) bearings. These changes affect the *Structures Design Guidelines (SDG)* and the *Structures Detailing Manual (SDM)*.

### **REQUIREMENTS**

1. Add the following after the first sentence of **SDG** 3.11.4.A:

See **SDG** 6.5.C for pedestal requirements when using multirotational (MR) bearings.

2. Replace the first and second sentence of **SDG** Section 5.11.A with the following:

Specify and detail bolted (not welded) field connections. Field welding of sole plates (without sliding surfaces) to the bottom flange of Steel I-Girders is permissible.

3. Add the following after the last sentence of **SDG** Section 6.5.C:

Spherical bearings require a Modified Special Provision that addresses materials, design, fabrication, testing, and installation requirements. For typical details and plan notes for multirotational (MR) bearings, see **SDM** 15.10. Use a minimum pedestal height of 5-inches and dimension the minimum required embedment of the pedestal reinforcing in the Plans. Detail the pedestal reinforcing to provide an embedment that is one-inch greater than the minimum required embedment shown in the Plans.

*Commentary: The additional one-inch embedment provides some tolerance to accommodate vertical adjustment should the actual MR bearing height be less than the height assumed*

during the design. If more than one inch of vertical adjustment is needed, the plan notes require the Contractor to submit revisions to the Engineer for approval.

4. Replace **SDG** Section 6.5.2.A.2 with the following:

Design bearing connections to allow for bearing replacement without having to remove the masonry plate or sole plate. Detail all steel bearing components with sliding surfaces (e.g., stainless-steel plates or PTFE plates), masonry plates and elastomeric components to be replaceable. Welded attachments are not considered a replaceable connection. For permissible Steel I-Girder connections, see **SDG** 5.11.A.

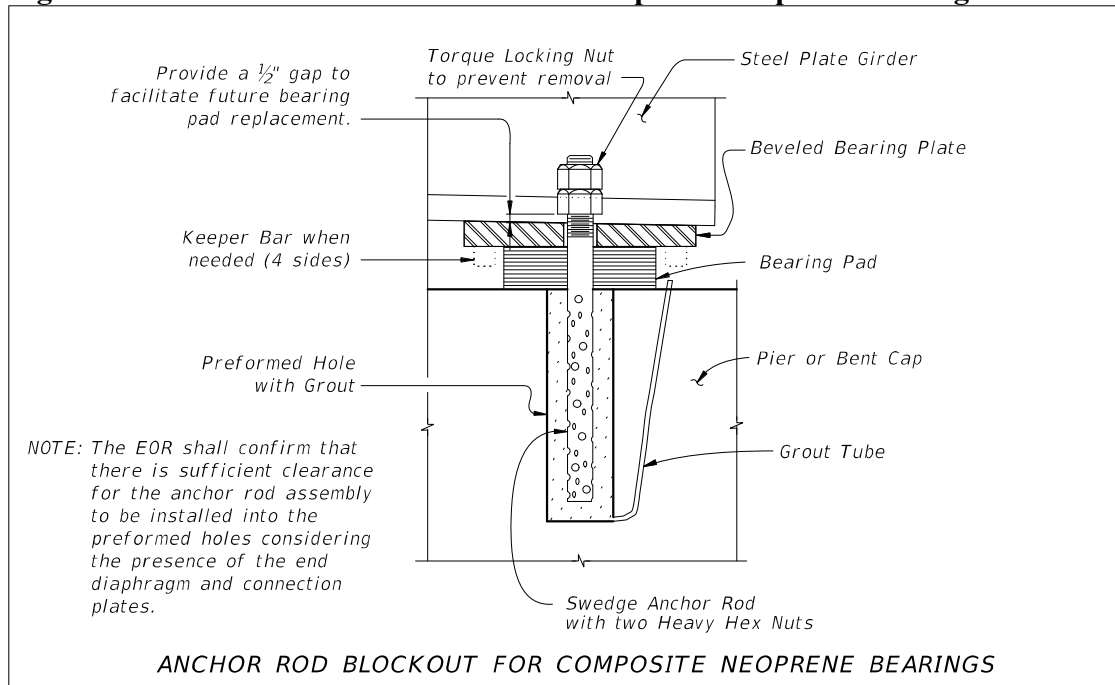
5. Replace **SDM** Section 13.7.O with the following:

- O. Preformed anchor rod blockouts shall be 4-inch diameter minimum. A larger size may be required to provide sufficient clearance for larger anchor rods, threaded couplers or grout/vent tubes. Completely detail blockouts and verify that there are no conflicts with reinforcement. Use either a corrugated galvanized metal form that is to be left in place or a smooth removable form. See Figure 13.7-4 and Figure 13.7-5 for anchor rod breakout details for composite neoprene and multirotational (MR) bearings, respectively.

*Commentary: These details ensure consistency with the requirements of Specifications Section 460-7.4.*

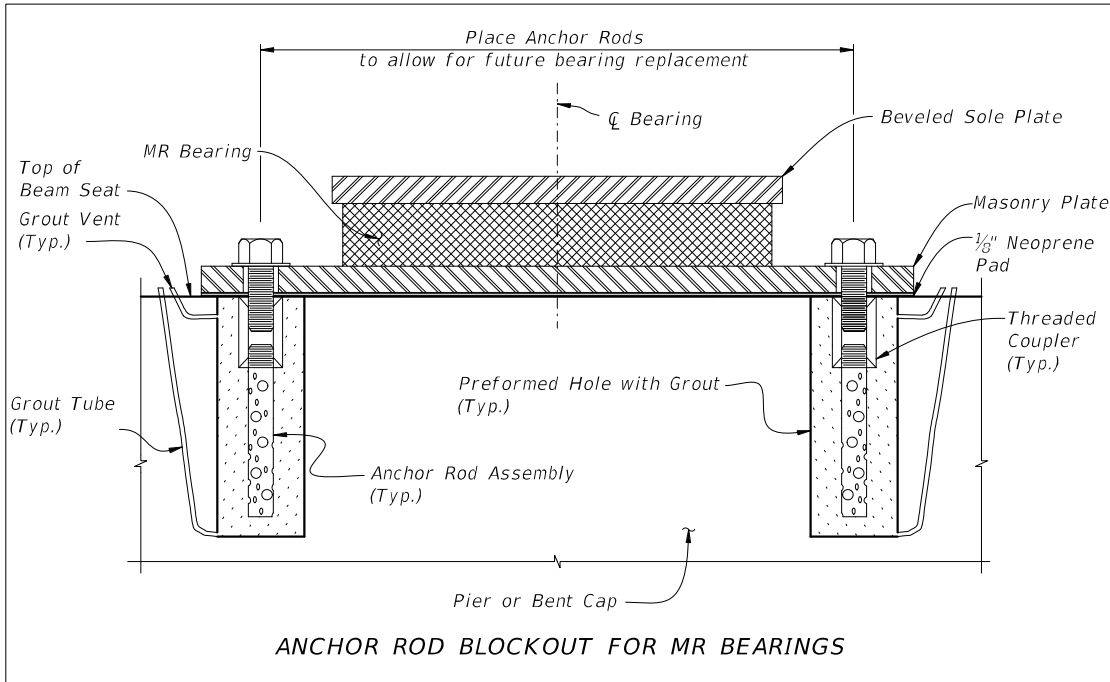
6. Replace **SDM** Figure 13.7-4 with the following:

**Figure 13.7-4 Anchor Rod Blockout for Composite Neoprene Bearings**



7. Replace *SDM* Figure 13.7-5 with the following:

**Figure 13.7-5 Anchor Rod Blockout for MR Bearings**



8. Revise the title of *SDM* Chapter 15 from “**SUPERSTRUCTURE – CONCRETE ELEMENTS**” to “**SUPERSTRUCTURE**”.

9. Add a new section to the *SDM* Chapter 15 as follows:

### **15.10 BEARINGS**

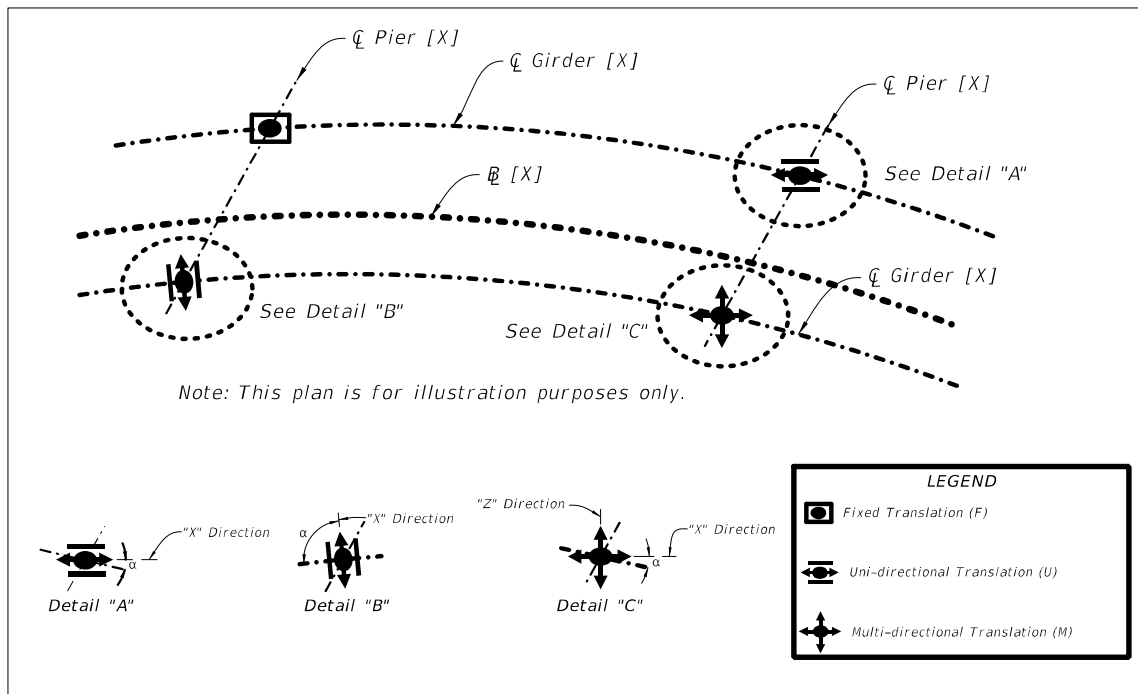
A. Include any applicable plan notes for MR bearings. The notes below are examples that are applicable to steel girders and concrete beams. Revisions, deletions and/or additional notes will be required based on project requirements. Do not repeat criteria that are already stated in the *Standard Specifications*, the *AASHTO LRFD Bridge Design Specifications* and the *AASHTO LRFD Bridge Construction Specifications*.

1. The MR bearings (pot or disc) shall be designed by the Contractor for the loads and movements shown in the MR Bearing Data table.
2. Pot and disc bearings shall not be mixed at the same substructure.
3. Dimension “D” is the assumed height of the MR bearing and was used to determine the beam seat elevations and pedestal heights. Any deviations from Dimension “D” due to the actual MR bearing height shall be accounted for by the Contractor at no further expense to the Department. The profile grade of the superstructure shall remain unchanged. If the height correction is one-inch or less, adjust the pedestal reinforcement to maintain the required cover and the minimum required embedment shown in the Plans. If vertical adjustment greater than one-inch is required, the Contractor shall submit revisions to the Engineer for approval.

4. The sole plate, masonry plate, anchor rod assembly, high strength bolt assembly, pedestal and beam seat elevation were established based on the assumed MR bearing size as shown in the Plans. Any deviation from these dimensions due to the actual size of the MR bearing shall be accounted for by the Contractor at no further expense to the Department. Revisions shall be submitted to the Engineer for approval and include signed and sealed calculations for the redesign of affected components including, but not limited to, the following: sole plate, masonry plate, anchor rod assembly, high-strength bolt assembly, pedestal and beam seat elevation.
5. The masonry plate shall be ASTM A709 Grade [XX], galvanized and/or painted.
6. The sole plate shall be ASTM A709 Grade [XX], galvanized and/or painted.
7. Swedged anchor rods shall be ASTM F1554 Grade [XX].
8. Removable hex head bolts shall be ASTM 449 Grade [XX] and shall be galvanized.
9. Threaded couplers shall be ASTM A563 and shall develop [XX] ksi stress in tension and shall be galvanized.
10. High strength bolt assembly for the connection between the bottom flange and sole plate shall according to ASTM F3125 Grade A325 and shall be galvanized and/or painted.
11. For expansion bearings, the coefficient of friction is [XX].
12. The color of the finish coat shall conform to AMS-STD-595, Color No. [XXXXXX].
13. The sole plate, masonry plate, high strength bolt assemblies and anchor rod assemblies shall be included in the pay item for multirotational bearings.

B. Provide a Plan view showing the MR bearing type and orientation. See Figure 15.10.B-1.

**Figure 15.10.B-1 MR Bearing Type and Orientation Plan**



C. Provide an MR Bearing Data table with all information necessary for the Contractor to design the bearings. An example is shown in Figure 15.10.C-1. Modify the table for project requirements. Provide temperature adjustments for expansions bearings.

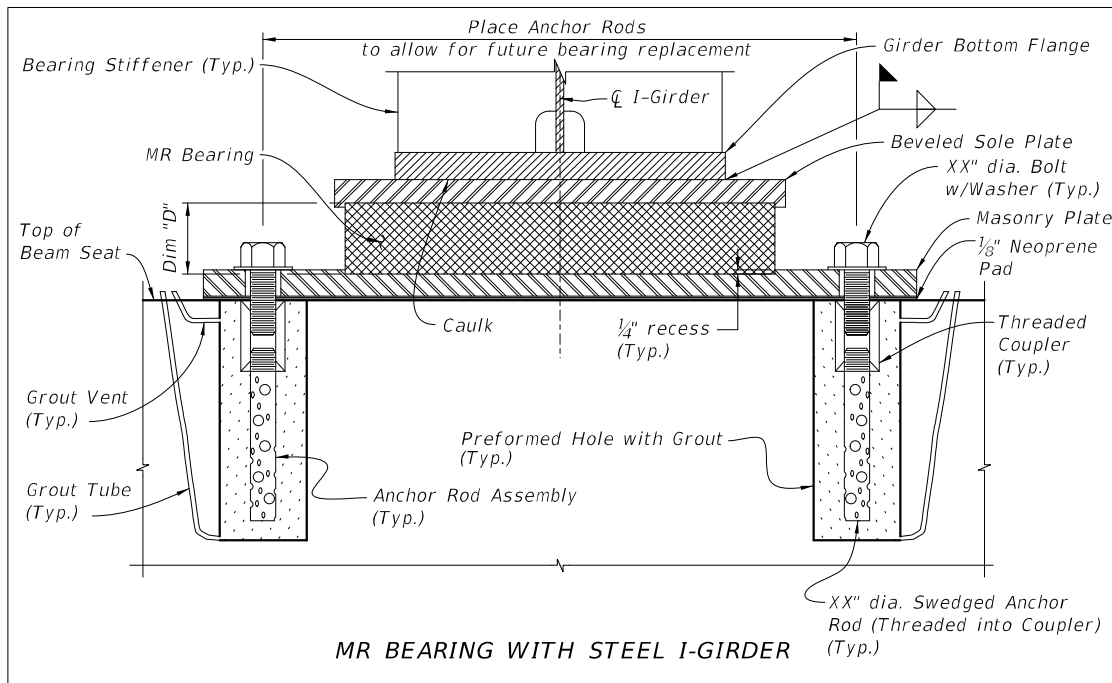
**Figure 15.10.C-1 MR Bearing Data Table**

LOCATION	GIRDER	TYPE (F,U,or M)	NO. REQ'D	SERVICE VERTICAL LOADS			FACTORED HORIZ. LOAD (KIPS)	FACTORED MOVEMENT		FACTORED ROTATION		DIM "D" (IN)	ANGLE $\alpha$ (DEG)
				DL (KIPS)	LL <sub>MIN</sub> (KIPS)	LL <sub>MAX</sub> (KIPS)		X (IN)	Z (IN)	DL (RAD)	TOTAL (RAD)		

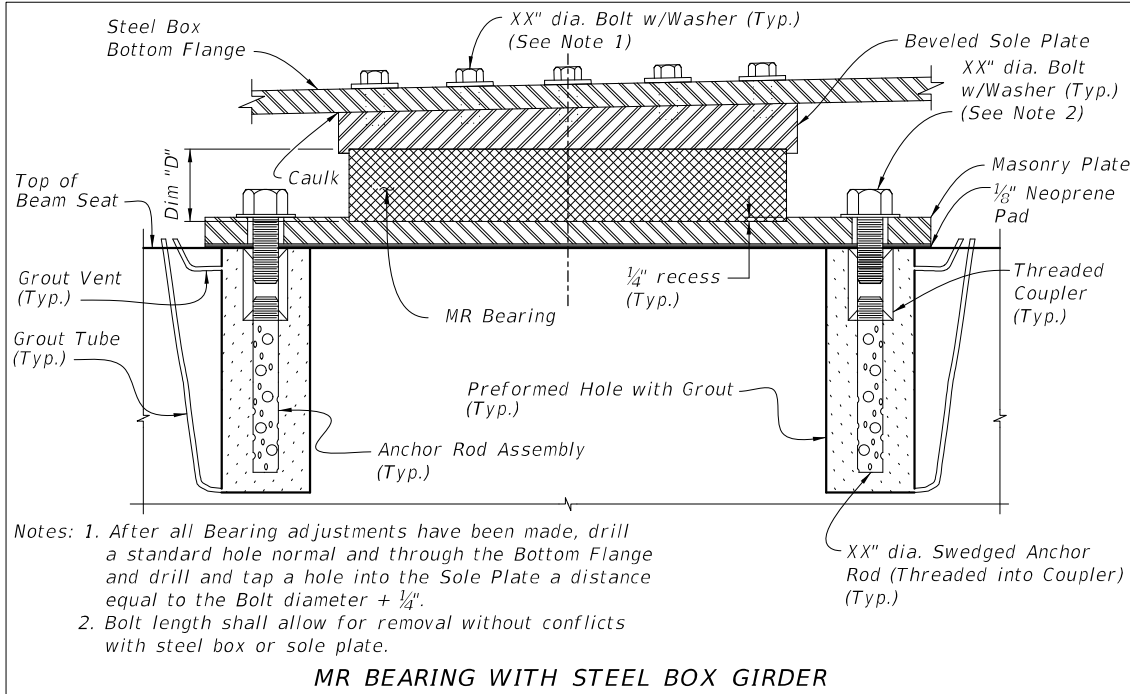
NOTES:  
 1. DL IS DEFINED AS DEAD LOAD.  
 LL IS DEFINED AS LIVE LOAD INCLUDING THE DYNAMIC LOAD ALLOWANCE AS APPLICABLE.  
 2. THE TOTAL FACTORED ROTATION DOES NOT INCLUDE TOLERANCES OR ALLOWANCES FOR UNCERTAINTIES PER LRFD 14.4.2.2.  
 THESE SHALL BE INCLUDED IN THE DESIGN OF THE MR BEARING.  
 3. THE FACTORED MOVEMENT IS THE MAXIMUM ONE WAY MOVEMENT (EXPANSION OR CONTRACTION) OF THE SUPERSTRUCTURE  
 WHEN BEARINGS ARE SET AT 70 DEGREES. ADJUST BEARINGS ACCORDINGLY FOR INSTALLATION TEMPERATURE OTHER THAN 70 DEGREES.

D. Provide a plan and elevation for each type of bearing assembly including the sole plate, masonry plate, connections to the MR bearing and anchor rod assembly. The MR bearing itself shall be shown only as an outline with hatching. See Figures 15.10.D-1 through Figure 15.10.D-3.

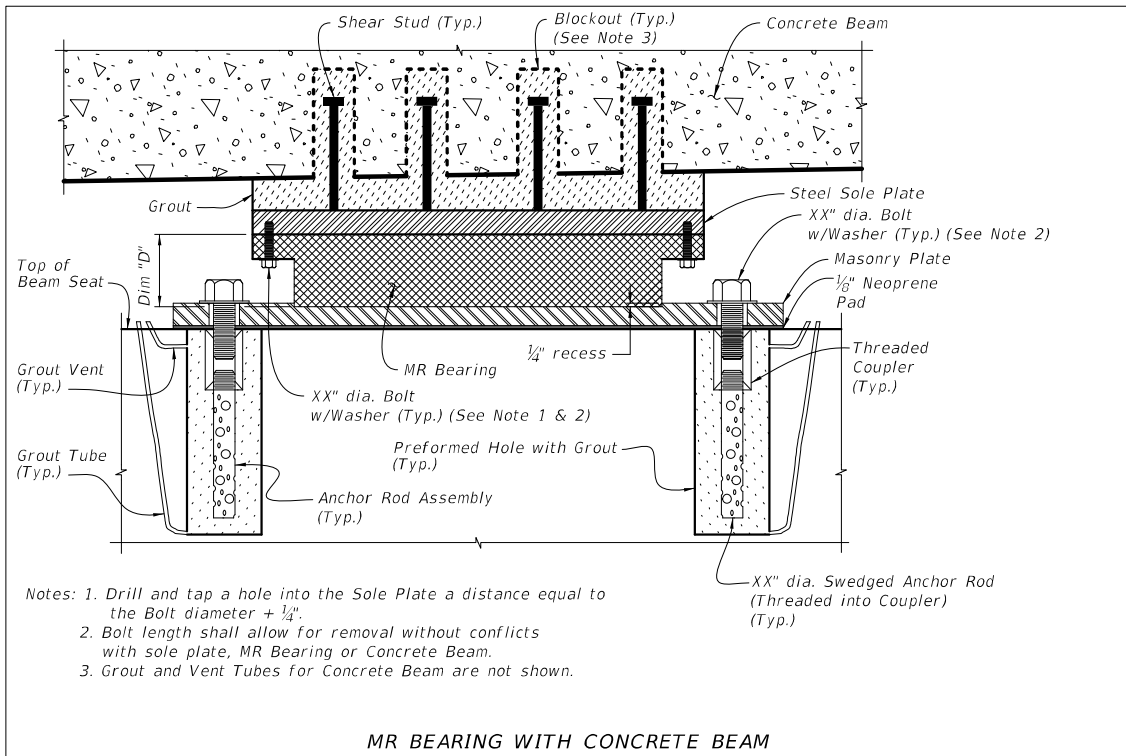
**Figure 15.10.D-1 MR Bearing with Steel I-Girder**



**Figure 15.10.D-2 MR Bearing with Steel Box Girder**



**Figure 15.10.D-3 MR Bearing with Concrete Beam**



## **BACKGROUND**

For Department bridge projects, the selection of the MR bearing type and design is placed upon the Contractor. Designers have been showing specific details in the Plans when MR bearings are required. In many cases, the actual supplied MR bearing type and dimensions differed from what was shown in the Plans. Additionally, designers have been showing pot bearings in the Plans on the majority of projects where MR bearings are required; however, the family of MR bearings also includes disc and spherical types. Section 461 of the Specifications includes only pot and disc bearings, with a Modified Special Provision required for spherical bearings.

The requirements of this bulletin direct the designer to show MR bearings only as an outline with hatching and provide the required design loads and movements in a data table for the Contractor to design the bearing. The designer is also required to provide details in the Plans regarding the connection of the MR bearing to both the sole and masonry plates.

## **IMPLEMENTATION**

These requirements are effective immediately on all design-bid-build projects at 30% plans or less. These requirements may be implemented immediately on all other design-bid-build projects at the discretion of the District.

These requirements are effective immediately on all design-build projects for which the final RFP has not been released. Design-build projects that have had the final RFP released are exempt from these requirements unless otherwise directed by the District.

## **CONTACT**

Ben Goldsberry, P.E.  
Assistant State Structures Design Engineer  
Phone (850) 414-4278  
[Ben.Goldsberry@dot.state.fl.us](mailto:Ben.Goldsberry@dot.state.fl.us)

RVR/BG