Index 415-010 Bar Bending Details (FRP)

Design Criteria

ACI 440.1R-06 Guide for the Design and Construction of Structural Concrete Reinforced with FRP bars; ***ACI 440.6-08 Specification for Carbon and Glass Fiber-Reinforced Polymer Bar Materials for Concrete Reinforcement***; ***AASHTO LRFD Bridge Design Guide Specifications for GFRP-Reinforced Concrete 2nd Edition (AASHTO-GFRP2)***; ***Structures Detailing Manual (SDM); FDOT Design Manual (FDM).***

Design Assumptions and Limitations

Standard Plans Index 415-010 includes commonly used types, shapes and configurations of straight and bent pultruded reinforcing Fiber-Reinforced Polymer (FRP) reinforcing bars. This standard works with the REINFORCING BAR LIST that must be completed and included in the plans for cast-in-place concrete components where the reinforcing FRP reinforcing bars within the component are not considered incidental to the cost of the component.

Due to the manufacturing process of pultrusion, the bar bend types and properties are limited and cannot be field formed or modified. Because of these limitations, certain shapes must be obtained utilizing splices with correct development lengths established by the equations found in***AASHTO-GFRP2***. The Design Aids section below contains examples of typical composite shapes that can obtained using the single shapes located on ***Standard Plans*** Index 415-010.

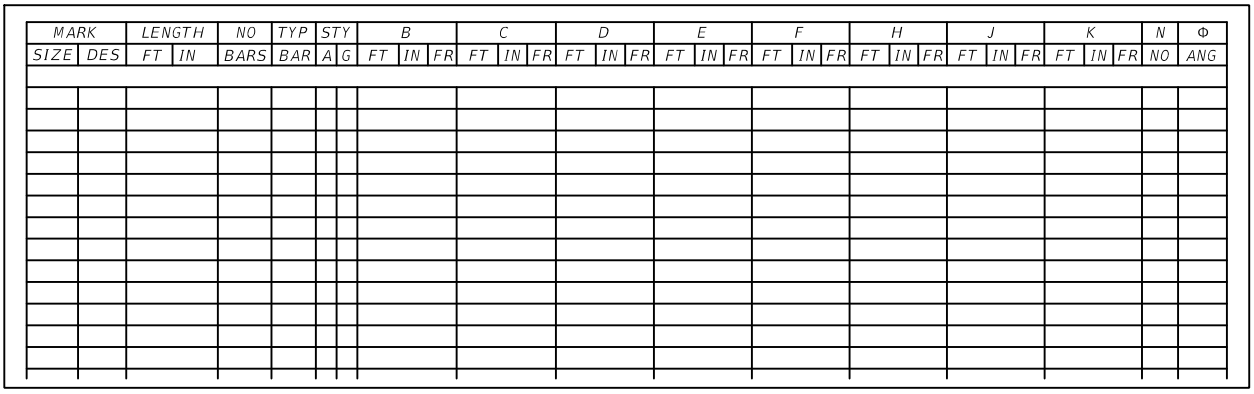
The number of different types of bent bars on a project should be keep to minimum to reduce fabrication costs. Where possible use fewer bent bar types lapped with varying straight bar lengths or other bent bars to generate additional bar types. Hooked and bent bars should be limited to maximum 15-feet long, and enclosed bent shapes formed from single bars such as U-bars or rectangular stirrups should be limited to a maximum of 5-feet in each direction.

Plan Content Requirements

Complete and include in the plans the REINFORCING BAR LIST. Do not include reinforcing FRP bars for drilled shafts, auger cast piles and standard traffic and pedestrian railings, and all precast components, e.g. prestressed concrete piles and beams, MSE wall copings and precast noise wall posts and panels. For additional information and guidance see the ***Specifications***, ***Standard Plans*** and/or ***Standard Plans Instructions*** for a given component.

The REINFORCING BAR LIST may be completed using the Rebar Application provided with the FDOT CADD Bar Menu (with manual modifications for the length definitions) or it may be prepared by other manual, automated or combination methods. See ***SDM*** 4.3 for FRP reinforcing bar detailing procedures.

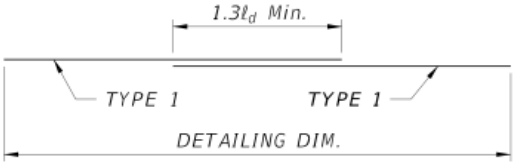
Include a reference to ***Standard Plans*** Index 415-010 on the REINFORCING BAR LIST sheets.



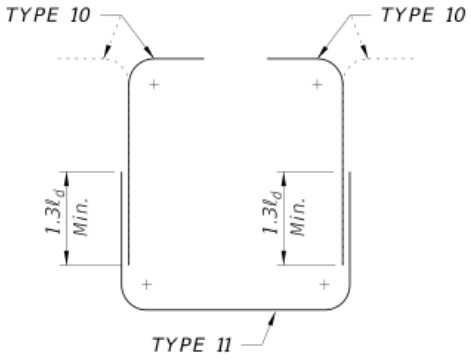
Payment

Item number	Item Description	Unit Measure
415-10-AA	FRP Reinforcing Bars	LF

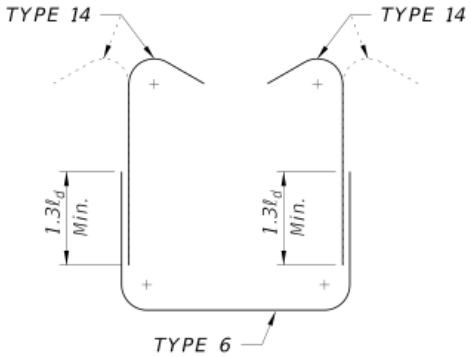
Design Aids



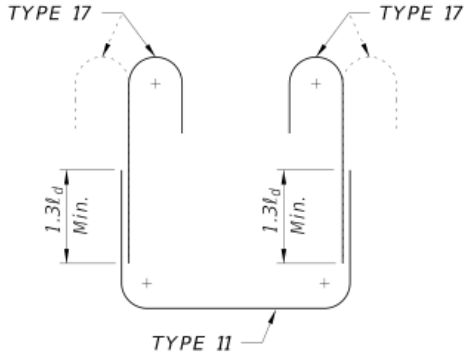
LAPPED STRAIGHT BARS (TYPE 2)



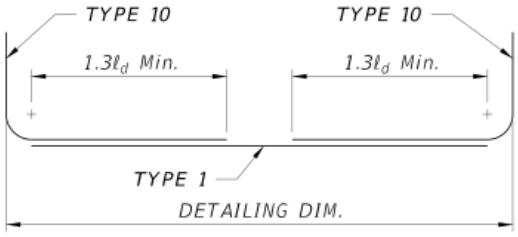
OPEN STIRRUP 1



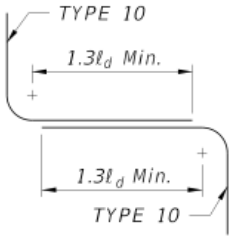
OPEN STIRRUP 2



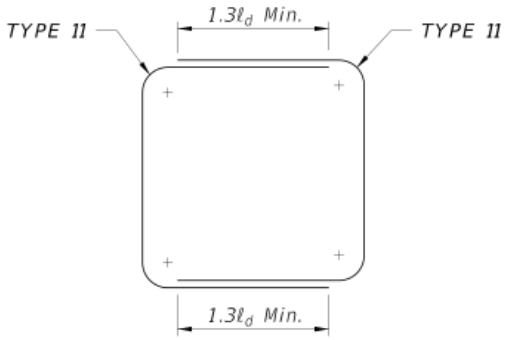
OPEN STIRRUP 3



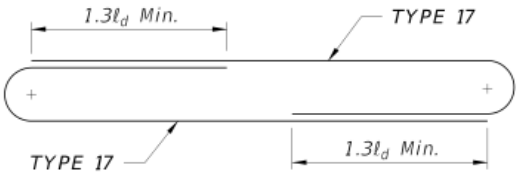
LONG LEG U SHAPE



Z BAR SHAPE



CLOSED STIRRUP 1



CLOSED STIRRUP 2

NOTE: See Developmental Standard D415-010 for referenced Single Bar Bending Types.

TYP. COMPOSITE SHAPES