Background

- FRP embedded bars are becoming more popular for use in areas of construction where durability is a primary concern. However, since FRP reinforcement is a relatively new concept, accurate design equations concerning FRP are deficient.

Approach

- Database of 45 specimens collected and categorized. Each specimen’s bond characterization for a given embedment length was recorded so as to be entered into the nonlinear model.
- Parameters recorded in database for respective specimens include:
  - Assigned Specimen #
  - Bar Type (GFRP, CFRP)
  - Bar Coating
  - Bar Deformations
  - Diameter
  - Length of recorded embedment
  - Concrete Strength
  - Confinement
  - Modulus of Elasticity of Bar
  - Ultimate Tensile Strength of Bar
- Nonlinear model analyzed for varying diameters and development lengths. Results were compared against failure criteria in order to determine critical development length.
- Design equation developed from results, taking into account variances in previously mentioned parameters.

OBJECTIVES

- To investigate the current ACI 440 equations for development length of straight embedded FPP bars in concrete.
- Attempt to derive a more suitable development length equation by means of incorporating the use of finite element analysis.

Schematic

- One-dimensional FE model used

Bond of FRP to Concrete

- Database of 45 specimens collected and categorized. Each specimen’s bond characterization for a given embedment length was recorded so as to be entered into the nonlinear model.

Bond Stress Distribution

- One-dimensional FE model used