Splice System to Connect Reinforcement Bars in Concrete Assemblies

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a splicing technique to connect multiple reinforcement bars for use in concrete structures in corrosive environments.

OVERVIEW

Concrete normally is a brittle material until reinforcement bars, or rebar, are incorporated to create a stronger and more flexible material referred to as “reinforced concrete.” Many concrete structures such as bridges, columns, foundations and floor systems would not be possible without the added tensile strength of rebar. Rebar commonly is made of carbon steel, which can be epoxy-coated, galvanized or clad in stainless steel for use in corrosive environments. Fiber-reinforced polymer rebar also is used in highly corrosive environments.

Reinforced concrete often is classified as either pre-cast concrete or cast-in-place concrete. Pre-cast concrete is formed in a controlled environment and then transported to a construction site, whereas cast-in-place concrete is poured into forms, which are constructed on-site and allowed to cure. The advantages of pre-cast concrete include improved material quality and the reduced cost and time associated with constructing forms on-site. However, it is difficult to connect pre-cast components using reinforcement bars in a strong, safe, durable and efficient manner.

Currently, many cast-in-place and pre-cast members use jointed spliced steel reinforcing bars. These connections are susceptible to corrosion, which could lead to compromised structure strength. In addition, steel splice connectors can be heavy, bulky and difficult to physically manipulate while connecting rebar. Some metallic connectors in precast members also need expensive and complex casting and finishing procedures. Fiber-reinforced polymer rebars have significant advantages over steel in terms of weight, durability and corrosion resistance. However, current splicing techniques have proven impractical and ill-suited for splicing multiple fiber-reinforced polymer rebars in pre-cast concrete applications. Therefore, a demand exists for a durable splicing technique that is suitable for multiple rebars, including steel, metallic or fiber-reinforced polymer (FRP).

THE INVENTION
UW-Madison researchers have developed a method for connecting multiple rebars, including steel, metallic and/or fiber-reinforced rebars, with a polymeric tube. The tube is specially reinforced to provide the strength and stiffness needed to transfer tension force from the first bar to the tube, and then from the tube to the second bar. Force is transferred between the reinforced tube and the bars by filling the space in the tube between the bars with a strong cementitious grout. In addition, a special method of treating the inner surface with locking structures provides a strong bond between the tube and the grout.

This system and method provides a rebar splicing system made at least partially from non-metallic, corrosion-resistant materials, which can be used for reinforcing concrete with a relatively long use life in highly corrosive environments. The splicing system may be especially attractive for joining precast components by using the durable polymer tube in combination with non-corroding FRP reinforcement bars in connection regions that are particularly susceptible to corrosion.

APPLICATIONS

- Reinforced pre-cast or cast-in-place concrete structures with corrosion resistance requirements

KEY BENEFITS

- Consists at least partially of non-metallic, corrosion-resistant materials
- Withstands highly corrosive environments over relatively long use life
- Allows components of similar material to thermally expand or contract at similar rates

STAGE OF DEVELOPMENT

Prototypes have been developed and mechanically tested, with further studies planned.

ADDITIONAL INFORMATION

Tech Fields
Engineering - Construction

CONTACT INFORMATION

For current licensing status, please contact Mark Staudt at mstaudt@warf.org or 608-960-9845.