Composite Repair

Paul Gugenheim

Abstract

High strength composites are being increasingly used in strengthening slabs, beams, and columns in bridges. These composites are being used in private industry and governmental entities for rehabilitation, emergency repair, column retrofits, beam strengthening, slab and wall reinforcement, and blast mitigation.

A composite is a combination of materials that when combined, function as a single element. Composite technology advanced rapidly in late 1960's as the Defense Department had specific interests in carbon fiber for use in defense applications, such as the F111 Stealth Fighter. Several leading defense contractors began producing high strength composites to meet the strong demand from the Defense Department and commercial aerospace industry. The use of high strength composites developed quickly from a need to advance defense technology beyond conventional means. Over twenty years of research and development have provided great design potential for these composites in all engineering disciplines. This technology is being taken into the structural engineering industry for design solutions to meet a wide range of structural needs. Today's complex buildings and regulations require various disciplines to work together as a team to produce an overall best result. This understanding allows us to bring each project to a successful completion. Through our dedication to continuous research and testing, we have set the standard for FRP (Fiber Reinforced Polymer) construction in the Southwest. In the presentation some of the research and most recent projects will be outlined.

Providing confinement and external reinforcement, the Fibrwrap TM System adds strength and ductility to existing concrete structures. Bi-directional, high strength hybrid fibers suspended in an epoxy matrix form the composite. In comparison to traditional A36 steel, the SEH51 E-Glass Fibrwrap TM System weighs one-third the weight of steel and has two times the tensile strength. By containing the concrete, damaged columns as well as under designed structures, retrofitted with the Fibrwrap TM System, will significantly increase in shear strength and ductility as well as flexural enhancement. The Fibrwrap TM Systems conforms to the existing structures during application, allowing retrofits of rectangles, octagons, squares, ovals, flares, and many other geometric shapes, without significantly altering the original architectural design. Structural design requirements, however, may require a high confinement that would necessitate a shape change. The inherent nature of composites allows application in areas of confinement up to one inch, due to the lightweight nature and the simple equipment required for installation. The system can be applied to beams, walls, slabs, and columns.

A potential application takes into account the bending moment and shear diagrams, material properties, and structural dynamics. This information, along with the design goals, allows our engineers to provide accurate design information, supporting calculations, and proper application technique.

Potential Applications are as follows:

Bridge Beams, columns, and slabs

Building beams, columns, slabs, and walls for flexural and shear reinforcement

Concrete brick wall facades

Water, fuel, and chemical tanks

Silos, elevators, and chimneys

Underground piping and sewage tanks

Piers, pipe racks, and pedestals in refineries

Wood and concrete pilings

Telephone and electric utility poles

Wood bridges, piers, piles, and docks

Blast mitigation and reinforcement

If you have any questions, please contact **Dr. C.Vipulanandan**