CHAPTER 1: GENERAL

1.1 SCOPE

(1) This Recommendation (Construction) provides the general requirements relating specifically to the construction of concrete structures using Continuous Fiber Reinforcing Materials, hereafter called CFRM. The requirements given in this Recommendation are based on JSCE Standard Specification for Design and Construction of Concrete Structures (Construction), hereafter called JSCE Standard Specification (Construction).

(2) CFRM used in construction shall normally be materials meeting the requirements given in JSCE-E 131 "Quality Standards for Continuous Fiber Reinforcing Materials".

[COMMENT]:
CFRM may be used as tendons or as reinforcement in concrete, either singly or in conjunction with prestressing or reinforcing steel. This Recommendation (Construction) gives general requirements relating to the use of CFRM in concrete structures not specified in JSCE Standard Specification (1996). A wide range of CFRM of varying types and quality are available, but for the purposes of this Recommendation, CFRM used shall normally meet the requirement given in JSCE-E 131.

1.2 DEFINITIONS

The following terms are defined for general use in this Recommendation (Construction).

Reinforcement: Materials used to reinforce concrete. These include steel and continuous fiber reinforcing materials ("CFRM").

Continuous fiber: General term for continuous fibers used for concrete reinforcement. These include carbon fibers, aramid fibers, and glass fibers, etc.

Fiber binding materials: Binders are used to solidify continuous fibers together. These are generally plastic materials such as epoxy resin or vinylester resin.

Volume ratio of axial fiber: Ratio of the volume of the actual fiber and the volume of fiber arranged in the direction of strengthening of CFRM.

Continuous fiber reinforcing materials (CFRM): General term for dimensionally strengthened material for the purpose of reinforcing concrete on being formed by impregnating and hardening continuous fiber with fiber binding material, or only continuous fibers bundled or woven together.

CFRM tendons: CFRM used as prestressing materials to induce prestress in concrete mostly used in bar or strand forms.

CFRM reinforcement: CFRM other than those used as prestressing materials.

CFRM bar: CFRM in the form of bar similar to reinforcing or prestressing steel.

CFRM shape: CFRM in the form of sectional steel shape.

Continuous fiber reinforced concrete: Concrete reinforced with CFRM.

Continuous fiber prestressed concrete: Concrete reinforced by inducing prestress with CFRM.

Capacity of CFRM: Maximum load that CFRM can sustain.

Strength of CFRM: Value obtained by dividing the capacity of CFRM by the nominal cross-sectional area.

Characteristic value of capacity of CFRM: Value for the capacity of CFRM which guarantees that the probability of tested capacity being below this value is within the specified limit based on statistical interpretation of test results.

Specified value of capacity of CFRM: Value for the capacity of CFRM which is specified by other design codes or specifications, apart from the characteristic value of capacity of CFRM.

Guaranteed capacity of CFRM: Guaranteed capacity according to JSCE-E 131 "Quality Standards for Continuous Fiber Reinforcing Materials".

Design capacity of CFRM: Value obtained by dividing the characteristic value of capacity of CFRM by the material factor.

Characteristic value of ultimate strain of CFRM: Strain corresponding to the characteristic value of tensile capacity of CFRM.

Design ultimate strain of CFRM: Value obtained by dividing the characteristic value of ultimate strain of CFRM by the material coefficient.

Tensile rigidity of CFRM: Slope of the tensile force-strain curve for CFRM, when this curve is assumed to be linear.

Young's modulus of CFRM: Value obtained by dividing the tensile rigidity of CFRM by the nominal cross-sectional area.

Nominal cross-sectional area of CFRM: Value obtained by dividing the volume of CFRM by the length.

Bent section of CFRM: Section of CFRM set in a curved shaped by hardening with fiber binding material while continuous fibers are bent. May be in spiral form, stirrup form etc.

Curved placement of CFRM: Placement of straight CFRM in a curved layout.

Creep failure: Failure due to progressive loss of tensile capacity over time, when CFRM is subjected to a continuous static tensile load.

Creep failure capacity: Load-bearing capacity at time of creep failure.

Flexural compressive failure: Form of failure in members subjected to flexure, whereby the compressed section of concrete fails before CFRM for main reinforcement break.

Fiber breaking flexural failure: Form of failure in members subjected to flexure, whereby CFRM for main reinforcement break before failure of the compressed section of concrete.

Fiber breaking shear failure: Form of shear failure in members subject to shear forces, whereby CFRM for shear reinforcement break.

Tendon coating materials: Coating materials applied to tendons to prevent bonding with concrete.

Tendon protection materials: Materials used to protect tendons from physicochemical deterioration due to external forces.

[COMMENT]:

Definitions of shear reinforcement, hoop ties, spiral hoops, and tendons follow those given in JSCE Standard Specification (Design), where "steel" shall be taken to signify "CFRM". The nominal cross-sectional area of CFRM is obtained by dividing the volume of CFRM by the length. As volume generally includes elements not contributing to the strength of the reinforcement, the strength and Young's modulus of CFRM, obtained using the nominal sectional area, are generally not equal to those of the continuous fiber itself.