TEST METHOD FOR SHEAR PROPERTIES OF CONTINUOUS FIBER REINFORCING MATERIALS BY DOUBLE PLANE SHEAR (JSCE-E 540-1995)

1. SCOPE

This specifications specifies mainly the test method for shear properties of CFRM used in place of steel reinforcement or prestressing tendon in concrete, by direct application of double shear.

2. TEST PIECES

2.1 Preparation of test pieces

Test pieces shall as a rule not be subjected to any processing. For mesh-type CFRM, linear test pieces may be prepared by cutting away extraneous parts in such a way as not to affect the performance of the part to be tested. Test pieces should be as straight as possible; severely bent pieces should not be used.

2.2 Handling of test pieces

During the obtaining and preparation of test pieces, all deformation, heating, outdoor exposure to ultraviolet light etc. causing changes to the material properties of the test section of the test piece must be avoided.

2.3 Length of test pieces

Test pieces shall be of constant length regardless of the nominal diameter of the CFRM. Length shall not be less than 5 times the shear plane interval, and not more than 30 cm.

2.4 Number of test pieces

The number of test pieces shall not be less than three. If the test piece shows significant pull-out of fibers, indicating that failure is not due to shear, an additional test shall be performed on a separate test piece taken from the same lot.

3. TESTING MACHINE AND DEVICES

3.1 Testing machine

The testing machine to be used in load testing shall conform to JIS B 7733 (Compression Testing Machines). The testing machine shall have a loading capacity in excess of the tensile capacity of the test piece, and shall be capable of applying loading at the required loading rate. The testing machine must also be capable of giving readings of loading accurate to within 1% during the test.

3.2 Shear testing apparatus

The shear testing apparatus shall be constructed so that a rod-shaped test piece is sheared on two planes more or less simultaneously by two blades (edges) converging along the faces perpendicular to the axial

direction of the test piece. The discrepancy in the axial direction between the upper and lower blades shall be of the order of 0~0.5 mm, and shall be made as small as possible. The specifications distance between shear planes shall be 50 mm.

4. TEST TEMPERATURE

The test temperature shall generally be within the range 5~35°C. The specifications test temperature for test pieces sensitive to temperature shall be 20±2°C.

5. TEST METHOD

5.1 Mounting of test piece

The test piece shall be mounted in the center of the shear apparatus, touching the upper loading device. No gap should be visible between the contact surface of the loading device and the test piece.

5.2 Loading rate

The specifications loading rate shall be such that the shearing stress increases at a rate of 30~60 N/mm^2 per minute. Loading shall be applied uniformly without subjecting the test piece to shock.

5.3 Scope of test

Loading shall be continued until the test piece fails, and the failure load recorded to three significant digits. It should be noted that loading may decrease temporarily, owing to the presence of two rupture faces.

6. CALCULATION AND EXPRESSION OF TEST RESULTS

6.1 Handling of data

Whether the rupture surface is due to shear or not shall be determined by visual inspection. If pull-out of fibers etc. is obvious, the data shall be disregarded and additional tests shall be performed until the number of test pieces failing due to shear is not less than three.

6.2 Shear strength

Shear strength shall be calculated according to Eq. (1), and rounded off to 3 significant digits.

$$t = \frac{P}{2A} \qquad (1)$$

where

τ = shear strength (N/mm^2)
P = shear failure load (N)
A = nominal cross sectional area of test piece (mm^2)

7. TEST REPORT

The test report shall include the following items:
(1) Name of CFRM
(2) Type of fiber and fiber binding material, volume ratio of fiber
(3) Numbers or identification marks of test pieces
(4) Designation, nominal diameter, maximum cross sectional area
(5) Date of test, test temperature, loading rate
(6) Intervals between double shear faces
(7) Shear failure load for each test piece, average shear failure load and shear strength
(8) Failure mode of each test piece