COMMENTARY ON THE TEST METHOD FOR PERFORMANCE OF ANCHORAGES AND COUPLERS IN PRESTRESSED CONCRETE USING CONTINUOUS FIBER REINFORCING MATERIALS (JSCE-E 537-1995)

INTRODUCTION

Some studies have been made on test methods for anchorages for use with CFRM tendons in prestressed concrete as part of the Joint Research on New Materials for Use as Tendons in Prestressed Concrete Bridges, which in turn is a part of the Ministry of Construction Comprehensive Technology Development Project for Construction-related New Materials Utilization. The present test method references the following standards, among others:

JSCE "Standard Specification for Design and Construction of Concrete Structures" (1991 edition)
JSCE "Prestressed Concrete Design and Construction Guidelines" (Concrete Library No. 66)

1. SCOPE

The present test proposal is to be applied to anchorages and couplers for CFRM in prestressed concrete structures or members constructed by pre- or post-tensioning. Detailing of tests for special structures subject to unusual loads, located in unusual environments etc. must therefore be determined as appropriate for the structure in question, based on the test method given here.

The anchoring methods currently in use include anchoring of diagonals in cable-stayed bridges, ground anchors etc., but these are not covered in the present test. Anchorage and coupler performance after long periods of use, fatigue performance etc. are also not covered by this test, as these are expected to be influenced by relaxation of the CFRM etc.

2. DEFINITIONS

Terminology for this test is based on the "Recommendation for Design and Construction for Concrete Structures using Continuous Fiber Reinforcing Materials" and the "Quality Standard for Continuous Fiber Reinforcing Materials", with certain additions relating to CFRM used as tendons etc. CFRM used as tendons in prestressed concrete are referred to here as CFRM tendons.

3. TEST METHOD FOR PERFORMANCE OF ANCHORAGES
4. TEST METHOD FOR PERFORMANCE OF COUPLERS
5. TEST METHOD FOR PERFORMANCE OF ANCHORING SECTIONS

The test methods given are based on the JSCE "Proposed Performance Test Methods for Anchorages and Couplers used in Prestressed Concrete Construction", with extra provision being made in sections 3 and 4 for testing of anchorage and coupler performance, expressed in terms of tensile capacity. The "Test Method for Tensile Properties of Continuous Fiber Reinforcing Materials" is referenced with regard to the loading rate, test temperature, and number of test pieces.

Tests 3 and 4 are intended for newly developed devices and devices with a minimal performance record in testing the performance (capacity) of anchorages and couplers. Test 5 is intended to check the performance of an anchoring section comprising and anchorage, anchorage reinforcement etc., focusing in particular on the performance of the surrounding concrete. Test 5 is thus to be used in checking the performance of an anchoring section designed using anchorages checked according to tests 3 and 4.

The standard length of CFRM has been set at 3 meters. This is because CFRM anchorages and couplers are commonly used in so-called multi-types, where multiple CFRM are anchored or connected, and if the individual CFRM are of diverse lengths or incorrectly set at the time of tensioning, the tension will be concentrated on a small number of them which will consequently rupture (fail) before the others, giving inaccurate test results. This is best avoided by making the CFRM as long as possible, but as the test results should be on the conservative side, giving a low tensile capacity, and as the members actually used in prestressed concrete will be longer than 3 meters, this was selected as the standard length for the test. If the test does not involve multiple CFRM, the CFRM length may be shorter than 3 meters, but the minimum length given in the "Test Method for Tensile Properties of Continuous Fiber Reinforcing Materials" must be adhered to.

(Comment on 3.4, 4.4) If one end of the CFRM or other tendon is fitted with an anchorage or coupler other than the type to be tested, the performance of the other anchorage or coupler must first be confirmed to be equivalent or superior to that of the anchorage or coupler to be tested.

(Comment on 3.5, 4.5) Mode of failure here refers to the condition of the test piece at which the tensile capacity is reached, e.g. "failure of CFRM (giving location of rupture)", "pull-out of CFRM from anchorage", etc.

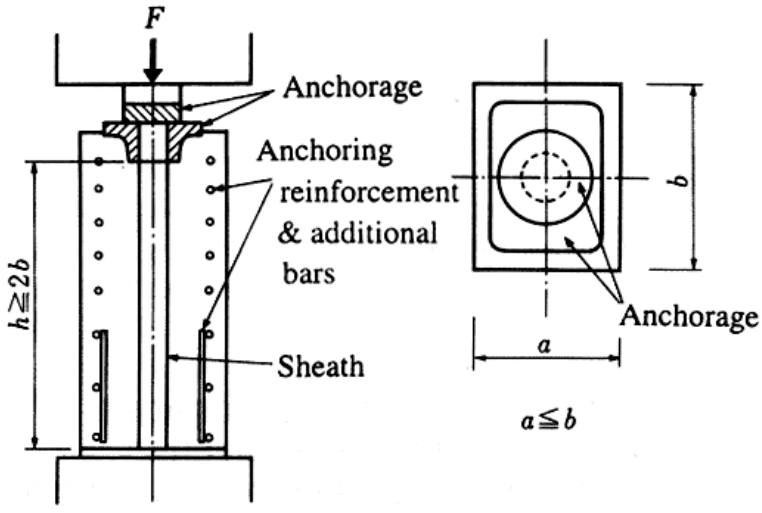

Fig. C 1 Test piece & loading method

(Comment on 5.2.1) The minimum allowable distance in determining the length of one side of the concrete test piece can be obtained by reference to "Duyvidag Method Design and Construction Guidelines", Chapter 4 "Structural Detailing", 4.1 " Minimum Layout Distances", in JSCE "Prestressed Concrete Design and Construction Guidelines".

(Comment on 5.2.2) As the proportion of steel and CFRM arranged in the anchorage reinforcement will vary depending on the design, test conditions should approximate the actual design as closely as possible. Further, as the quantities of anchorage reinforcement and additional bars installed relative to the proposed anchorage will also depend on the actual design, the quantities in the test piece should follow the actual design.

(Comment on 5.2.3, 5.3.2) JSCE "Proposed Performance Test Methods for Anchorages nad Couplers used in Prestressed Concrete Construction" requires that concrete strength at the time of test should be "... sufficient to bear the prestressing level prescribed for the anchorage. Concrete strength at time of testing must not exceed the design strength." The present test requires compressive strength at 28 days of 30±3 N/mm^2, with the test being performed when the concrete has reached a compressive strength of 24±3 N/mm^2. The reason for this is that the performance test proposed here is considered as a means of checking the performance of the anchorage, i.e. a separate test. The requirement for loading when the concrete has reached a compressive strength of 24±3 N/mm^2 is based on the general practice of prestressing at compressive strengths of 21~24 N/mm^2.

Concrete quality and the timing of loading may vary depending on the technique used, and in such a case, test conditions should be determined based on the proposed technique.

(Comment on 5.3.1) Adequate safety measures should be in place when conducting tests involving tensioning of tendons, owing to the inherent dangers of the technique.

6. TEST REPORT

Mode of failure here refers to the condition of the test piece at which the tensile failure capacity is reached, e.g. "failure of CFRM (giving location of failure)", "pull-out of CFRM from anchorage", etc.