WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

TEST METHOD FOR THE DETERMINATION OF BOND STRENGTH BETWEEN PRESTRESSING STEEL STRAND AND SELF-CONSOLIDATING CONCRETE (SCC)

---

1. PURPOSE

1.1 To establish a test method for the determination of the bond strength between prestressing steel strand and self-consolidating concrete (SCC).

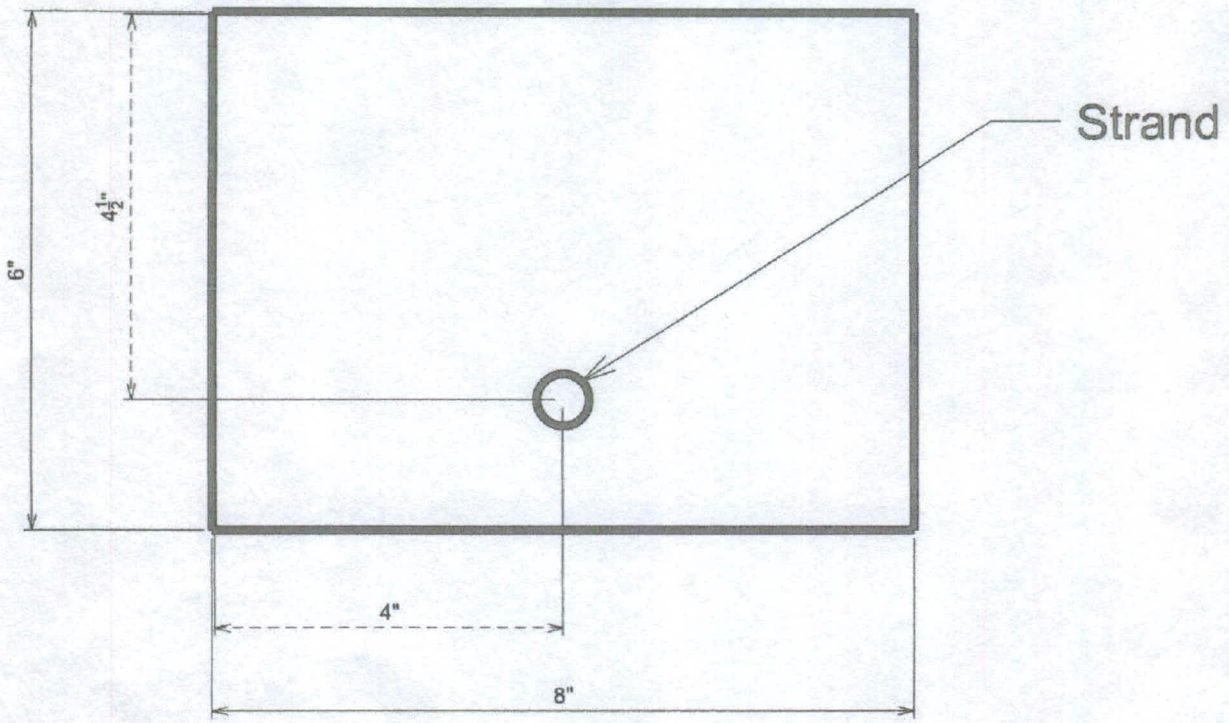
2. SCOPE

2.1 The test method set forth in this MP shall be used as part of the mix design qualification and approval process for SCC mixes used in the fabrication of prestressed concrete bridge members fabricated for the WVDOH.

3.0 PETERMAN BEAM TEST

3.1 The Peterman Beam Test shall be used to determine the bond capacity of AASHTO M203 Grade 270 0.520-inch (½-inch "oversize") diameter 7-wire steel strand (area of steel = 0.167 in^2) and AASHTO M203 Grade 270 0.600-inch diameter 7-wire steel strand (area of steel = 0.217 in^2) when used in conjunction with SCC. Each size of strand which will be used during the fabrication of prestressed concrete bridge members for the WVDOH must be tested.

3.2 An 8-inch wide x 6-inch tall x 11-ft 6-inch long concrete test beam, containing a single prestressing strand of the size being qualified, shall be constructed as shown in Figures 1, 2, & 3. The SCC mix being qualified and the Fabricator's standard batching, placement, curing, and de-tensioning methods shall be used to fabricate this test beam. The single prestressing strand shall be embedded along the centerline of the beam at a depth of 4.5-inch from the top.



Firgure 1. This drawing shows a cross section of the quality assurance test beam. (1 in = 25.4 mm)
Dimensional tolerance: +/- 1/8 inch

3.3 After de-tensioning, the ends of the strand shall be ground flush with the concrete at the ends of the test beam. Figure 1 shows the cross section at the end of beam.

3.4 Gradually load the test beam to $P_{85\%}$, which is the load necessary to produce 85% of the calculated nominal moment capacity of the section as shown in Figure 2. This can be accomplished by slowly lowering concrete dead-weight blocks using a forklift or other lifting device. The use of nylon slings to suspend the blocks facilitates the gradual loading process, as the nylon stretches during the loading process. Alternatively, several smaller weights may be sequentially loaded onto the beam.

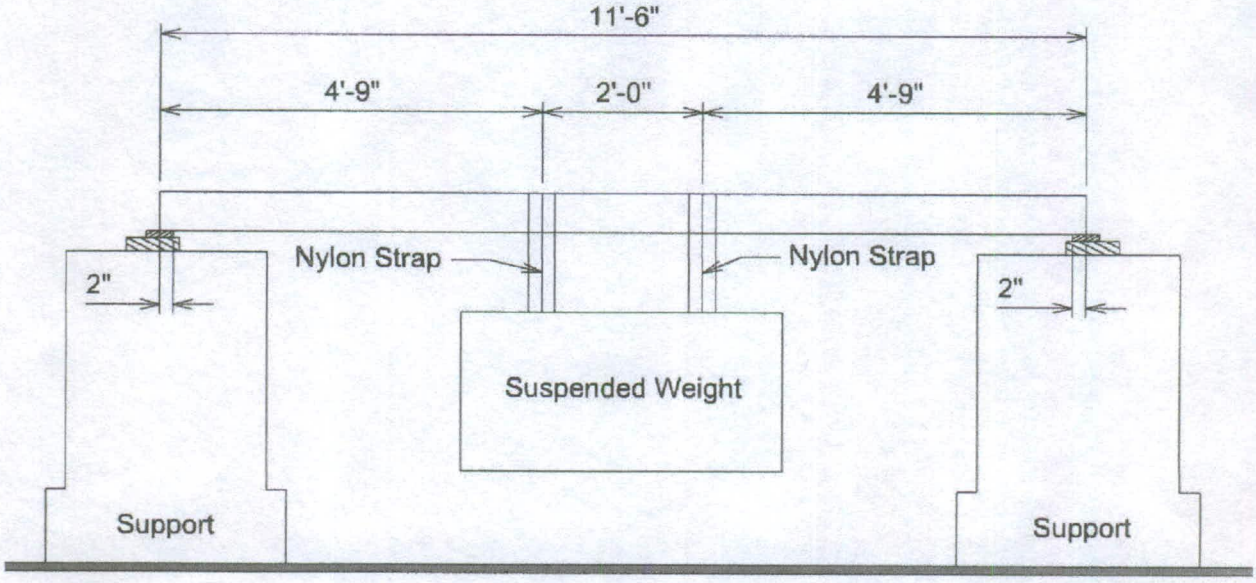


Figure 2. Test Setup

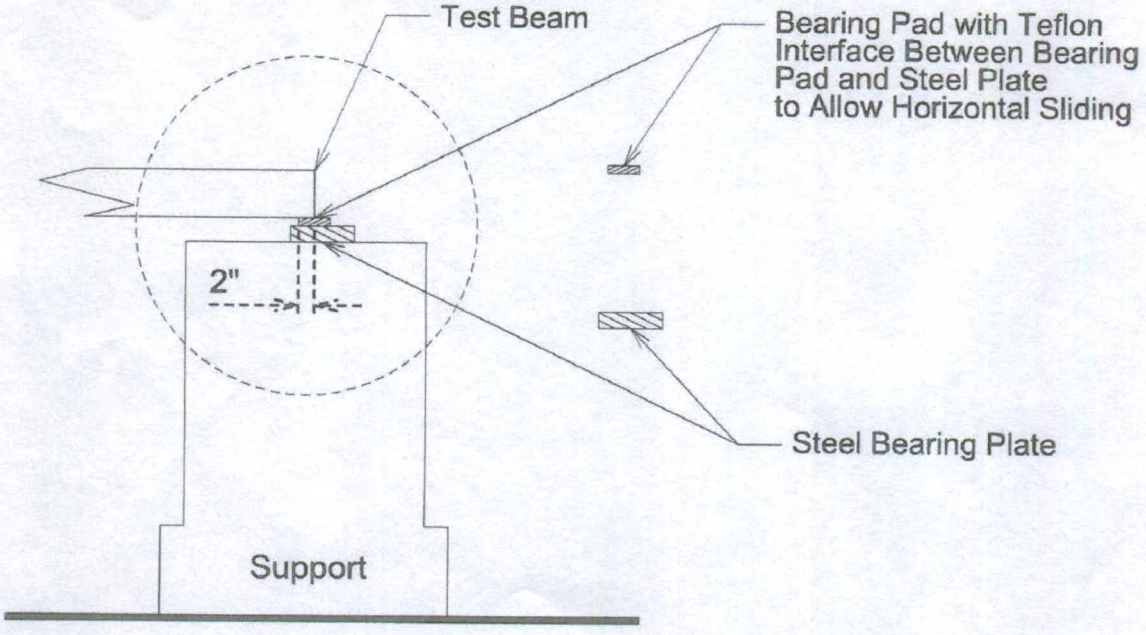


Figure 3. The test setup can be with neoprene bearing pads and bearing plates at each end, or one end of the test setup can have a slide bearing or roller (3 inch diameter minimum), while the other end has a standard neoprene bearing pad. The bearing pad (1 inch thickness minimum) has a Teflon interface on top of a stainless steel bearing plate (1/2 inch thickness minimum). Note: When this test is carried out at an actual facility, a protective fence and other safety measures should be used. (1 in = 25.4 mm. 1 ft = 0.305m). Dimensional Tolerance: +/- ¼ inch

3.5 Inspect the beam and document cracks and strand end-slip if present. With the ends of the strand ground initially flush with the end of the beam end, additional strand slip can be visually detected by noting any draw-in at the ends.

3.6 Sustain the load a minimum of 24 hours to see if there are increasing signs of distress, such as increased strand slippage at the ends, increased cracking, concrete crushing, and the like.

3.7 Load the beam with the additional 15% of the load ($P_{15\%}$) which will give the total load ($P_{100\%}$) required to give a full nominal moment (M_n) of the section and hold that load for at least 10 minutes. If the beam has not collapsed, it has successfully passed the test, and the SCC mix being qualified shall be considered to have acceptable bonding characteristics to the size of strand being tested.

3.8 Tables 1 and 2 are the prescribed loads for specified compressive strengths of concrete for Areas of Steel Reinforcement of 0.167 $inch^2$ and 0.217 $inch^2$ respectively. Note the specified minimum compressive strength of concrete at the time of initial prestress is 4000 psi.

Table 1. Prescribed Loadings for Specified Compressive Strength of Concrete for when the Area of Reinforcement is 0.167 $inch^2$.

$f_{c`}$ (psi)	$P_{85\%}$ (lbs)	$P_{15\%}$ (lbs)	$P_{100\%}$ (lbs)
5000	4440	840	5280
6000	4560	860	5420
7000	4650	880	5530
8000	4720	890	5570
9000	4770	900	5670
10000	4820	910	5730

Table 2. Prescribed Loadings for Specified Compressive Strength of Concrete for when the Area of Reinforcement is 0.217 inch^2.

$f_{c'}$ (psi)	$P_{85\%}$ (lbs)	$P_{15\%}$ (lbs)	$P_{100\%}$ (lbs)
5000	5580	990	6570
6000	5780	1020	6800
7000	5920	1040	6960
8000	6020	1060	7080
9000	6100	1080	7180
10000	6170	1090	7260

Ronald L. Stanevich, P.E.
Director
Materials Control, Soils and Testing Division

RLS:Ml