

9320303 NONMETALLIC ACCESSORY MATERIALS FOR CONCRETE PAVEMENT AND
CONCRETE STRUCTURES
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

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Comments: (6-5-17, Internal)

1. Should we call for seven samples of straight bars as there are seven straight bar tests?

→ → **932-3.4.1. Sampling:** The Engineer will select a minimum of **six straight bars** with minimum lengths of 7 feet each and a minimum of five bent bars from each **shipment**, **representing random** production LOTS, **per diameter** of FRP reinforcing for testing in accordance with Table 3-4. Testing shall be conducted, at the Contractor's expense, by a Department approved **ISO 17025-accredited independent** laboratory. Each test shall be replicated a minimum of three times **per production LOT**. Submit the test results to the Engineer for review and approval prior to installation. ¶

Response:

2. "representing a random production LOT, per bar size"

→ → **932-3.4.1. Sampling:** The Engineer will select a minimum of six straight bars with minimum lengths of 7 feet each and a minimum of five bent bars from each **shipment**, **representing random** production LOTS, **per diameter** of FRP reinforcing for testing in accordance with Table 3-4. Testing shall be conducted, at the Contractor's expense, by a Department approved **ISO 17025-accredited independent** laboratory. Each test shall be replicated a minimum of three times **per production LOT**. Submit the test results to the Engineer for review and approval prior to installation. ¶

Response:

3. Three times per project?

→ → **932-3.4.1. Sampling:** The Engineer will select a minimum of six straight bars with minimum lengths of 7 feet each and a minimum of five bent bars from each **shipment**, **representing random** production LOTS, **per diameter** of FRP reinforcing for testing in accordance with Table 3-4. Testing shall be conducted, at the Contractor's expense, by a Department approved **ISO 17025-accredited independent** laboratory. Each test shall be replicated a minimum of **three times** **per production LOT**. Submit the test results to the Engineer for review and approval prior to installation. ¶

Response:

4. "bent"

Property	Test Method	Requirement	Test Required for Straight Bar	Test Required for Bent Bar
Moisture Absorption	Procedure 7.1; 24 hours immersion at 122°F			portion ^b
Glass Transition Temperature	ASTM E1640 D7028 (DMA) [¶] or ASTM E1356 D3418 (DSC; T_{mg})	$\geq 230^{\circ}\text{F}$ [¶] $\geq 212^{\circ}\text{F}$	Yes	Yes -- bent portion ^b
Degree of Cure	ASTM E2160	$\geq 95\%$ of Total polymerization enthalpy	Yes	Yes -- bent portion ^b
Measured Cross-sectional Area	ASTM D7205 [¶]	Within the range listed in Table 3-1	Yes	Yes -- straight portion
Guaranteed Tensile Load ^a		\geq Value listed in Table 3-1	Yes	No
Tensile Modulus		$\geq 6,500$ ksi for GFRP [¶] $\geq 18,000$ ksi for CFRP	Yes	No

a - Guaranteed tensile load shall be equal to the average test result from all three lots minus three standard deviations.[¶]
b - Bent portion specimens shall be extracted from a central location within a 90° bend.

Response:

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Comments: (6-21-17)

Table - page 2.

1. Short term moisture absorption. Suggest reducing figure to 0.1%. Long term absorption, suggest reducing figure to 0.5% - although less could be considered (note, MTO Canada uses 0.45%)

Response:

2. Degree of cure, suggest increasing to 97% note, the reason to change the above is that these are generally considered to be reasonable indicators of long term durability.

Response:

3. Tensile modulus, suggest increasing to 8700 ksi note, reason to change is that higher modulus allows designers to use less rebar, which saves money. Lifting from 6500 to 8700 ksi allows a 25% saving in rebar Alkali resistance with load.

Response:

4. Suggest raising strain (and stress) levels to a microstrain of 3000. ACI suggests 2000 microstrain. But CSA uses 3000 microstrain. this higher strain will give a better indication of

quality of bars (i.e. force a quicker degradation). Note, many suppliers already tested to the CSA standard, so should be able to supply data without need to re-test.

Response:

5. Creep rupture - suggest including a creep rupture test - ACI 440-3R method B8, with a pass criteria of > 50% at 1 million hours (by extrapolation)

Response:

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Comments: (6-27-17)

Table 3-2 the Test Method for Glass Transition Temperature or Tg is ASTM D3418 by DSC.. this is inconsistent with proposed revisions of the ASTM D.30 GFRP bar specification which calls for the use of ASTM E1356 as a means to measure Tg. Also, to be consistent with proposed ASTM D30 GFRP bar specifications, consider further detailing the Tg to be the "midpoint temperature".. this clarification is needed as Tg could be "at onset, midpoint or return".. which give three very different values. Consider revision of the Tg test method to be consistent with industry standards in Tables: 3-2 and 3-4.

Response:

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Comments: (7-5-17)

932-3.4.1: "LOTs" should not be all caps.

Response:
