CALIFORNIA DEPARTMENT OF TRANSPORTATION

AUTHORIZATION PROCEDURES AND ACCEPTANCE CRITERIA OF ULTRA-HIGH PERFORMANCE CONCRETE

FOR

FIELD CAST CONNECTIONS, LINK SLABS, BEAM END REPAIRS AND JOINT HEADERS

The following procedures are required to authorize Ultra-High Performance Concrete (UHPC) for inclusion on the Authorized Material List (AML). This authorization is for UHPC to be used for field cast connections, link slabs, beam end repairs and joint headers. This program is administered by Materials Engineering and Testing Services.

1. **For new materials the manufacturer must provide:**

   A. Authorized Material List Submittal Form TL-9502, <http://cefs.dot.ca.gov/jsp/forms.jsp>
   B. Material data sheet with detailed performance information, properties, and installation instructions. Submitted data in this document should indicate that the UHPC will meet the performance acceptance criteria as shown in Section 2 below.
   C. Safety Data Sheet(s).
   D. When requested, send a sample to the Concrete Materials Testing Branch.

2. **Performance acceptance criteria:**

   UHPC must be a low permeability cementitious composite material that consists of an optimized gradation of granular constituents with a discontinuous pore structure, a low water to cementitious materials ratio and a high percentage of discontinuous internal steel fibers.

   The submittal package must include the following:

   A. Ratios of field mixed ingredients and mix procedures.
   B. Product's material characteristics to demonstrate compliance with Table 1 requirements.
   C. Product's test results to show compliance with Table 2 requirements.

Table 1: Material Characteristic Criteria for UHPC.

Material Characteristic	Requirement
Minimum Steel Fiber Strength	190 ksi
Steel Fiber Dimensions	Length 0.5±0.03 inch Diameter 0.008±0.0003 inch
Minimum Steel Fiber (% by Volume)	2%
Maximum Water to Cementitious Material Ratio	0.25

Table 2: Performance Acceptance Criteria for UHPC.

Performance Characteristic	Test Method	Requirement
Density	ASTM C138	Report only, lb/ft^3
Static Flow	ASTM C1437*	8-10 inches, uniform fiber distribution and no matrix segregation
Compressive Strength at 2, 4, 7 and 14 days	ASTM C39*	Report only, ksi
Minimum Compressive Strength at 28 days	ASTM C39*	18 ksi
Tensile Strength for Direct Tension at 28 days	AASHTO T397	Effective Cracking Strength $f_{t,cr}$ > or = 0.8 ksi Crack Localization Stress, $f_{t,loc}$ > or = $f_{t,cr}$ Crack Localization Strain, $\varepsilon_{t,loc}$ > or = 0.0025
Bond Strength	ASTM C1583	Minimum of 400 psi and Complete failure in substrate concrete**
Modulus of Elasticity at 28 days	ASTM C469*	6,500 – 9,400 ksi
Maximum Long-Term Shrinkage at 28 days	ASTM C157*	800 microstrains
Maximum Chloride Ion Penetrability	ASTM C1202*	250 coulombs at 28 days (without fibers)
Scaling Resistance	ASTM C672	Y < 3
Maximum Abrasion Resistance	ASTM C944*	Total loss of 0.1 oz.
Freeze Thaw, Minimum Relative Dynamic Modulus (RDM)	ASTM C666A*	95% after 300 cycles
Alkali-Silica Reaction***	ASTM C1260	Innocuous

*Modified per ASTM C1856.
**Substrate concrete must be a minimum strength of 4 ksi at 28 days.
***Material must be mixed from a pre-bag mix without fibers with manufacturers recommended water.

3. **Send the submittal and sample to the Concrete Materials Testing Branch.**

   California Department of Transportation Laboratory
   Attention: Spencer Adams
   Materials Engineering and Testing Services
   5900 Folsom Boulevard
   Sacramento, CA 95819

   When the submittal package has been evaluated and reviewed, the Department will notify the manufacturer of the findings. When any discrepancies are resolved to the satisfaction of the Department, the material will be placed on the AML.

   The authorization date will be valid for up to 3 years.

   The Department reserves the right to sample, test, and remove the product from the AML at any time.

4. **Reauthorization:**

   The manufacturer should submit its package with current information to the Concrete Materials Testing Branch at least three (3) months prior to the listed expiration date.

   If you have any questions about this program, please contact Spencer Adams by phone at (916) 227-2783 or via email sent to <spencer.adams@dot.ca.gov>.