



## Florida Department of Transportation

CHARLIE CRIST  
GOVERNOR

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Tallahassee, FL 32399-0450

STEPHANIE KOPELOUSOS  
SECRETARY

November 18, 2010

Monica Gourdine  
Program Operations Engineer  
Federal Highway Administration  
545 John Knox Road, Suite 200  
Tallahassee, Florida 32303

Re: Office of Design, Specifications  
Section 453  
Proposed Specification: **4530405 Epoxy Jointing of Precast Segments.**

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

These changes were proposed by Charles Boyd of the State Structures Design Office to delete references to ASTM C 881 and provide compressive yield and bond strength requirements. ASTM C 881 does not address FDOT defined slow-set epoxies.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4280.

Sincerely,

signature on file

Rudy Powell, Jr., P.E.  
State Specifications Engineer

RP/dt

Attachment

cc: Gregory Jones, Chief Civil Litigation  
Florida Transportation Builders' Assoc.  
State Construction Engineer

**EPOXY JOINTING OF PRECAST SEGMENTS.**(REV ~~1197-15917822-10~~)

SUBARTICLE 453-4.5-1 (of the Supplemental Specifications) is deleted and the following substituted:

**453-4.5 Physical Requirements:**

**453-4.5.1 General:** Epoxy bonding agents proportioned as designated by the manufacturer and mixed in accordance with the manufacturer's recommendations shall meet the requirements of ASTM C 881. For the properties listed below, modify the ASTM test procedures as noted. The components of the epoxy-bonding agent shall be conditioned to the temperature at which testing is to be done prior to mixing the test specimen.

**453-4.5.2 Contact Time (~~O~~pen Time) and Contact Strength:** The contact time (open time) of the mixed epoxy-bonding agent shall be:

Normal-Set Epoxy ..... 60 -Minutes, Minimum

Slow-Set Epoxy ..... 6 -Hours, Minimum

The above contact time (open time) will be deemed acceptable if a slant cylinder test specimen, prepared and tested in accordance with the conditions below, sustains the following stress (contact strength) on the slant plane calculated as the axial (vertical) load divided by the area of the slant ellipse:

Normal-Set Epoxy ..... 1,000 psi at 48 hours after joining

Slow-Set Epoxy ..... 1,000 psi at 14 days after joining

The cement mortar/concrete material for the slant-cylinder test shall have a compressive strength of at least 4,500 psi at 28 days when tested to ASTM C 39. The slant-cylinder test procedure must be in accordance with ASTM C 882 with the following modifications:

1. ~~Delay~~ *Joining* of the sloped surfaces ~~shall be delayed~~ for the following period of time, measured from the time the epoxy was mixed:

Normal-Set Epoxy ..... 60 -Minutes

Slow-Set Epoxy ..... 6 -Hours

2. During the period between mixing of the epoxy and joining of the sloped surfaces, the specimens will be uncovered and maintained at the maximum temperature of the application range for the formulation tested.

3. ~~Assemble the specimens together and~~ *After joining*, cure at the maximum temperature of the formulation range (~~48 hours for normal set and 14 days for slow set epoxies~~) *at the time periods specified above* prior to testing.

For slow-set epoxy, ~~an~~ *prepare an* additional test specimen ~~shall be made and tested it~~ to failure at ~~36~~24 hours. The formulation of the slow-set epoxy is acceptable only if the epoxy-bonding agent exhibits a brittle break.

**453-4.5.3 Compressive Yield Strength:** The compressive yield strength of the epoxy-bonding agent shall be:

*Normal-Set Epoxy ..... 2,000 psi at 24 hours*

*..... 6,000 psi at 48 hours*

*Slow-Set Epoxy ..... 2,000 psi at 7 days*

*..... 6,000 psi at 14 days*

~~in accordance with ASTM C881 when tested using~~ *Determine compressive yield strength in accordance with* ASTM ~~Method D -695~~ with the following conditions:

1. ~~Pour the E~~epoxy--bonding agent ~~shall be poured~~ into the mold for forming specimens within ten minutes after starting mixing of the components.
2. *Prior to testing, cure* ~~T~~the specimens ~~shall be cured~~ at the minimum temperature of the formulation range for ~~the time~~ *a period* ~~s of 24 hours~~ *specified above.*

**453-4.5.4 Bond Strength:** Bond strength shall be:

*Normal-Set Epoxy* ..... *1,000 psi at 48 hours after joining*

*Slow-Set Epoxy*..... *1,000 psi at 14 days after joining*

~~in accordance with ASTM C 881 and the test is~~ *Determine the bond strength in accordance with* ~~conducted on a slant cylinder according to~~ ASTM C 882 with the following modifications:-

—————1. The test cylinder of concrete shall have a compressive strength of at least 6,000 psi at seven days age.

—————2. ~~The specimens shall be prepared as defined in Subarticle 453-4.5.2.~~

*2. Delay joining of the sloped surfaces for the following period of time, measured from the time the epoxy was mixed:*

*Normal-Set Epoxy* ..... *60 Minutes*

*Slow-Set Epoxy*..... *6 Hours*

*3. During the period between mixing of the epoxy and joining of the sloped surfaces, the specimens will be uncovered and maintained at the minimum temperature of the application range for the formulation tested.*

~~4. Assemble the specimens together and~~ *After joining, cure at the minimum temperature of the formulation range for the time periods specified above* ~~(48 hours for normal set and 14 days for slow set epoxies)~~ *prior to testing.*

SUBARTICLE 453-5.1 (of the Supplemental Specifications) is deleted and the following substituted:

**453-5.1 General:** Apply an epoxy bonding agent meeting the requirements of this Section to mating surfaces of all match-cast precast concrete segments.

Prior to the manufacture of epoxy for the project, a site meeting will be held with representatives from the; Engineer, Contractor and epoxy manufacturer, to discuss the selection of the proper formulations, storage and handling, mixing and application of the epoxy.

Have the necessary cleaning materials immediately available at the location of the segment joining, in the event that the segments must be separated and cleaned or epoxy reapplied.

Include in the erection manual required by Section 452, details of erection and post-tensioning operations which assure that the time elapsing between mixing components of the first batch of epoxy bonding agent applied to the joining surfaces of precast concrete segments and the application of a compressive contact pressure across the joint does not exceed 70% of the open time for the particular formulation of epoxy bonding agent used. Also, include details of how the minimum, closing, contact pressure of approximately 40 psi will be applied uniformly to each joint to which epoxy is applied during the epoxy curing period. Contact

pressure may be attained through combinations of weight and temporary and/or permanent post-tensioning.

**EPOXY JOINTING OF PRECAST SEGMENTS.**  
**(REV 11-18-10)**

SUBARTICLE 453-4.5 (of the Supplemental Specifications) is deleted and the following substituted:

**453-4.5 Physical Requirements:**

**453-4.5.1 General:** Epoxy bonding agents proportioned as designated by the manufacturer and mixed in accordance with the manufacturer's recommendations shall meet the requirements of ASTM C 881. For the properties listed below, modify the ASTM test procedures as noted. The components of the epoxy-bonding agent shall be conditioned to the temperature at which testing is to be done prior to mixing the test specimen.

**453-4.5.2 Contact Time (Open Time) and Contact Strength:** The contact time (open time) of the mixed epoxy-bonding agent shall be:

Normal-Set Epoxy ..... 60 Minutes, Minimum  
Slow-Set Epoxy ..... 6 Hours, Minimum

The above contact time (open time) will be deemed acceptable if a slant cylinder test specimen, prepared and tested in accordance with the conditions below, sustains the following stress (contact strength) on the slant plane calculated as the axial (vertical) load divided by the area of the slant ellipse:

Normal-Set Epoxy ..... 1,000 psi at 48 hours after joining  
Slow-Set Epoxy ..... 1,000 psi at 14 days after joining

The cement mortar/concrete material for the slant-cylinder test shall have a compressive strength of at least 4,500 psi at 28 days when tested to ASTM C 39. The slant-cylinder test procedure must be in accordance with ASTM C 882 with the following modifications:

1. Delay joining of the sloped surfaces for the following period of time, measured from the time the epoxy was mixed:

Normal-Set Epoxy ..... 60 Minutes  
Slow-Set Epoxy ..... 6 Hours

2. During the period between mixing of the epoxy and joining of the sloped surfaces, the specimens will be uncovered and maintained at the maximum temperature of the application range for the formulation tested.

3. After joining, cure at the maximum temperature of the formulation range at the time periods specified above prior to testing.

For slow-set epoxy, prepare an additional test specimen and test it to failure at 36 hours. The formulation of the slow-set epoxy is acceptable only if the epoxy-bonding agent exhibits a brittle break.

**453-4.5.3 Compressive Yield Strength:** The compressive yield strength of the epoxy-bonding agent shall be:

Normal-Set Epoxy ..... 2,000 psi at 24 hours  
..... 6,000 psi at 48 hours

Slow-Set Epoxy ..... 2,000 psi at 7 days  
..... 6,000 psi at 14 days

Determine compressive yield strength in accordance with ASTM D 695 with the following conditions:

1. Pour the epoxy-bonding agent into the mold for forming specimens within ten minutes after starting mixing of the components.
2. Prior to testing, cure the specimens at the minimum temperature of the formulation range for the time periods specified above.

**453-4.5.4 Bond Strength:** Bond strength shall be:

Normal-Set Epoxy .....	1,000 psi at 48 hours after joining
Slow-Set Epoxy .....	1,000 psi at 14 days after joining

Determine the bond strength in accordance with ASTM C 882 with the following modifications:

1. The test cylinder of concrete shall have a compressive strength of at least 6,000 psi at seven days age.
2. Delay joining of the sloped surfaces for the following period of time, measured from the time the epoxy was mixed:
 

Normal-Set Epoxy .....	60 Minutes
Slow-Set Epoxy .....	6 Hours
3. During the period between mixing of the epoxy and joining of the sloped surfaces, the specimens will be uncovered and maintained at the minimum temperature of the application range for the formulation tested.
4. After joining, cure at the minimum temperature of the formulation range for the time periods specified above prior to testing.

SUBARTICLE 453-5.1 (of the Supplemental Specifications) is deleted and the following substituted:

**453-5.1 General:** Apply an epoxy bonding agent meeting the requirements of this Section to mating surfaces of all match-cast precast concrete segments.

Prior to the manufacture of epoxy for the project, a site meeting will be held with representatives from the Engineer, Contractor and epoxy manufacturer, to discuss the selection of the proper formulations, storage and handling, mixing and application of the epoxy.

Have the necessary cleaning materials immediately available at the location of the segment joining, in the event that the segments must be separated and cleaned or epoxy reapplied.

Include in the erection manual required by Section 452, details of erection and post-tensioning operations which assure that the time elapsing between mixing components of the first batch of epoxy bonding agent applied to the joining surfaces of precast concrete segments and the application of a compressive contact pressure across the joint does not exceed 70% of the open time for the particular formulation of epoxy bonding agent used. Also, include details of how the minimum, closing, contact pressure of approximately 40 psi will be applied uniformly to each joint to which epoxy is applied during the epoxy curing period. Contact pressure may be attained through combinations of weight and temporary and/or permanent post-tensioning.