Florida Department of Transportation

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December 17, 2008

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

Re: Office of Design, Specifications
Section 400
Proposed Specification: 4002100

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.
This change was proposed by Steve Plotkin to specify that cracks in concrete are repaired based on the width of individual cracks in a Cracking Significance range.
Please review and transmit your comments, if any, within four weeks. Comments should be sent via Email to ST986RP 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 414-4110.

Sincerely,

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

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

DISPOSITION OF CRACKED CONCRETE.
(REV 12-04-08)

ARTICLE 400-21 (of the Supplemental Specifications) is deleted and the following substituted:

400-21 Disposition of Cracked ~~Cast-in-Place~~ Concrete.

400-21.1 General:-***The disposition of cracked concrete is described in this Article and applies to all cast-in-place concrete members, and once installed, to the precast and prestressed concrete members that are produced in accordance with 410, 450, 521, 534, 548 and 641.***
~~The investigation and disposition of cracked cast-in-place concrete *is*are described herein*in this Section, and applies to all cast-in-place concrete members and to all precast and prestressed concrete members after installation. See other Sections for the disposition of cracks in precast and prestressed concrete members prior to installation*.~~

400-21.2 Investigation, Documentation and Monitoring: ~~The Engineer will perform a thorough inspection of the concrete surfaces for cracks. If cracks are found, the Engineer will measure crack lengths and widths.~~ The Engineer will inspect concrete surfaces as soon as surfaces are fully visible after casting, between 7 and 31 days after the component has been burdened with full dead load, and a minimum of 7 days after the bridge has been opened to full unrestricted traffic. The Engineer will measure the width, length~~,~~ *and depth of each crack and establish* ~~termination points and~~ *the* precise location of *the crack termination points relative to permanent reference points on the member.* ~~all cracks and display, to scale, the results on a drawing referred to as a crack map~~. *The Engineer will determine if coring of the concrete is necessary when an accurate measurement of crack depth cannot be determined by use of a mechanical probe. The Engineer will monitor and document the growth of individual cracks at an inspection interval determined by the Engineer to determine if cracks are active or dormant after initial inspection. The Engineer will perform all final bridge deck crack measurements once the deck is free of all debris and before transverse grooves are cut and after planing is complete for decks that require planing.*

Provide the access, equipment and personnel needed for the Engineer to safely perform this work at no expense to the Department. Core cracks for use by the Engineer in locations and to depths specified by the Engineer at no expense to the Department.
~~After initial inspection, the Engineer will monitor and document the growth of individual cracks at an inspection interval determined by the Engineer. Provide the access, equipment and personnel needed for the Engineer to perform this work.~~

400-21.3 Classification of Cracks: The Engineer will classify cracks as either nonstructural or structural *and determine the cause*. *In general, nonstructural cracks are cracks 1/2 inch or less deep from the surface of the concrete; however, the Engineer may determine that a crack greater than 1/2 inch deep is nonstructural.*~~In general, nonstructural cracks are shallow depth cracks (between the surface of the concrete and the first layer of reinforcement), which form during curing.~~ *In general, structural cracks are cracks that extend deeper than 1/2 inch. A crack that is fully or partially underwater*

at any time during its service life will be classified as a structural crack. ~~Structural cracks are cracks that extend beyond the depth of the reinforcing steel, which can form as a result of excessive load or inadequate support conditions during casting or from uncontrolled temperature gradients.~~

~~The Contractor will be given an opportunity to~~ *R*~~r~~eview and comment on the Engineer's *crack* classification *and determination of cause* ~~of cracks.~~*; however, t*~~T~~he Engineer will make the final determination ~~as to whether cracks are nonstructural or structural~~.

400-21.*4*~~3.1~~ *Nonstructural* Cracking Significance ~~*of Nonstructural Cracks*~~**:** The Engineer will determine the ~~c~~*C*racking ~~s~~*S*ignificance ~~on the basis of total crack area as a percentage of concrete surface area~~. *The Cracking Significance will be determined on the basis of total crack surface area as a percentage of total concrete surface area.* Cracking *significance will* ~~shall~~ be categorized as Isolated, Occasional, Moderate or Severe according to the criteria in Tables 1 and 2. ~~Computations for purposes of determining~~ *C*~~c~~racking ~~s~~*S*ignificance *will* ~~shall~~ be d*etermined* ~~one~~ on a LOT by LOT basis. ~~where~~ *A* ~~a~~ LOT *will* ~~is~~ *typically be* made up of not more than 100 square feet *and not less than 25 square feet of concrete surface area for structures other than bridge decks or typically not more than 400 square feet or not less than 100 square feet for bridge decks.* ~~of concrete surface area on bridge substructures, or not more than~~ *A LOT will not extend beyond a single Elevation Range as shown in Table 1 or 2.* ~~Where cracking is localized, the LOT will be reduced to encompass only the immediate area of cracks. Individual evaluation and repairs will be performed on a LOT by LOT basis as directed by the Engineer.~~

~~The area to be used in Tables 1 or 2 is the summation of the product of the crack length times the average crack width of all the cracks in a LOT computed in square feet.~~

~~The Engineer will identify cracks that are not representative of the overall typical cracking of the LOT(s) and evaluate these separately.~~

~~The Contractor will be given an opportunity to~~ *R*~~r~~eview and comment on the Engineer's determination of ~~c~~*C*racking ~~s~~*S*ignificance~~.~~*; however, t*~~T~~he Engineer will make the final determination ~~of cracking significance with regard to Tables 1 and 2~~.

400-21.*5*~~4~~ Re*pair*~~solution~~ *Method*: *Repair or remove and replace cracked concrete as directed by the Engineer. Additional compensation or a time extension will not be approved for repair or removal and replacement of cracked concrete when the Engineer determines the cause to be the responsibility of the Contractor.* ~~Repair nonstructural cracks in accordance with Tables 1 or 2 where applicable. For disposition of structural cracks provide a structural evaluation and written recommendation by a Specialty Engineer.~~

~~Where Table 1 or 2 requires investigation to determine adequate repair or rejection, either replace the defective concrete or engage a Specialty Engineer to determine the structural and durability significance of the cracking and develop recommended repair methods for approval of the Engineer.~~

~~Cracks shown in Table 1 or 2 with no repair methods listed are considered unacceptable and the affected portions of the structure are required to be removed and replaced.~~

~~The Engineer will make the final determination of whether the cracked concrete shall be repaired or replaced, and must approve repair methods prior to start of the work.~~

~~No additional compensation or contract time shall be allowed for repairing or replacing cracked concrete that was caused by inadequate curing effort or inadequate construction practice as determined by the Engineer.~~

400-21.5.1 Nonstructural Cracks: *Repair each crack using the method as determined by the Engineer for each LOT in accordance with Table 1 or 2. When further investigation is required to determine repair or rejection, either remove and replace the cracked concrete or provide a structural evaluation signed and sealed by the Contractor's Engineer of Record that includes recommended repair methods and a determination of structural capacity and durability to the Engineer. Upon approval by the Engineer, repair the cracked concrete. Upon approval by the Engineer use epoxy injection in accordance with Section 411 to repair cracks in a member inside a dry cofferdam prior to flooding of the cofferdam. –"Reject and Replace" in Table 1 or 2 means there is no acceptable repair method.*

400-21.5.2 Structural Cracks: *Provide a structural evaluation signed and sealed by the Contractor's Engineer of Record that includes recommended repair methods and a determination of structural capacity and durability to the Engineer. Upon approval by the Engineer, repair the cracked concrete. Complete all repairs to cracks in a member inside a cofferdam prior to flooding the cofferdam.*

Table 1
CAST-IN-PLACE SUBSTRUCTURES AND SUPERSTRUCTURES OTHER THAN DECKS

	Crack Width [2] (inch)	Crack Total Area (In Percent of Concrete Surface) [1]											
		≤0.005%			0.005%-0.017%			0.017%-0.029%			>0.029%		
		Isolated			Occasional			Moderate			Severe		
		Environment			Environment			Environment			Environment		
		SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
Elevation 0 to 6 ft AMHW	x≤0.004	NT	NT	PS	NT	PS	PS	PS	PS				
	0.004< x ≤0.008	NT	PS	EI[3]	PS	EI[3]	EI[3]	PS					
	0.008< x ≤0.012	PS	PS	EI									
	0.012< x ≤0.016	PS	Investigate to Determine Appropriate Repair [4, 5] or Rejection										
	0.016< x ≤0.020												
	0.020< x ≤0.024									Reject and Replace			
	0.024< x ≤0.028												
	0.028< x												
Elevation 6 to 12 ft AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	x ≤0.004	NT	NT	PS	NT	PS	PS	PS	PS	PS	PS		
	0.004< x ≤0.008	NT	PS	EI[3]	PS	PS	EI[3]	PS	EI[3]				
	0.008< x ≤0.012	NT	PS	EI	EI	EI							
	0.012< x ≤0.016	PS	EI	EI	EI								
	0.016< x ≤0.020	EI											
	0.020< x ≤0.024		Investigate to Determine Appropriate Repair [4, 5] or Rejection							Reject and Replace			
	0.024< x ≤0.028												
	0.028< x												
Elevation 12 ft plus AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	x ≤0.004	NT	NT	NT	NT	PS	PS	PS	PS	PS	PS		
	0.004< x ≤0.008	NT	PS	PS	PS	PS	EI[3]	PS	EI[3]	EI[3]	PS		
	0.008< x ≤0.012	NT	PS	EI	EI	EI	EI	EI	EI				
	0.012< x ≤0.016	PS	EI	EI	EI	EI	EI						
	0.016< x	EI	EI	EI	EI								

	~~≤0.020~~												
	~~0.020< x ≤0.024~~	~~EI~~	~~Investigate to Determine Appropriate Repair [4, 5] or Rejection~~										
	~~0.024< x ≤0.028~~										~~Reject and Replace~~		
	~~0.028< x~~												

~~Table 2~~
~~CAST-IN-PLACE BRIDGE DECK~~

	~~Crack Width~~ [2] ~~(inch)~~	~~Crack Total Area (In Percent of Concrete Surface)~~ [1]											
		~~≤0.005%~~			~~0.005%-0.017%~~			~~0.017%-0.029%~~			~~>0.029%~~		
		~~Isolated~~			~~Occasional~~			~~Moderate~~			~~Severe~~		
		~~Environment~~			~~Environment~~			~~Environment~~			~~Environment~~		
		~~SA~~	~~MA~~	~~EA~~	~~SA~~	~~MA~~	~~EA~~	~~SA~~	~~MA~~	~~EA~~	~~SA~~	~~MA~~	~~EA~~
~~Up to 12 feet AMHW~~	~~x ≤0.004~~	~~NT~~	~~NT~~	~~PS~~	~~NT~~	~~PS~~	~~PS~~	~~PS~~	~~PS~~	~~PS~~			
	~~0.004< x ≤0.008~~	~~NT~~	~~NT~~	~~EI/M~~ [3]	~~NT~~	~~PS~~	~~EI/M~~ [3]	~~EI/M~~ [3]	~~EI/M~~ [3]	~~EI/M~~ [3]			
	~~0.008< x ≤0.012~~	~~NT~~	~~PS~~	~~EI/M~~	~~PS~~	~~EI/M~~	~~EI/M~~	~~EI/M~~	~~EI/M~~				
	~~0.012< x ≤0.016~~	~~PS~~	~~PS~~	~~EI/M~~	~~PS~~	~~EI/M~~							
	~~0.016< x ≤0.020~~	~~PS~~	~~PS~~	~~EI~~	~~EI~~								
	~~0.020 < x ≤0.024~~	~~PS~~	~~EI~~	~~EI~~		~~Investigate to Determine Appropriate Repair~~ [4, 5] ~~or Rejection~~					~~Reject and Replace~~		
	~~0.024< x ≤0.028~~	~~PS~~	~~EI~~										
	~~0.028< x~~												
~~12 feet plus AMHW or over Land~~	~~Crack Width~~	~~SA~~	~~MA~~	~~EA~~	~~SA~~	~~MA~~	~~EA~~	~~SA~~	~~MA~~	~~EA~~	~~SA~~	~~MA~~	~~EA~~
	~~x ≤0.004~~	~~NT~~	~~NT~~	~~PS~~	~~NT~~	~~NT~~	~~PS~~	~~PS~~	~~PS~~	~~PS~~			
	~~0.004< x ≤0.008~~	~~NT~~	~~NT~~	~~PS~~	~~NT~~	~~PS~~	~~EI/M~~ [3]	~~PS~~	~~EI/M~~ [3]	~~EI/M~~ [3]			
	~~0.008< x ≤0.012~~	~~NT~~	~~NT~~	~~EI/M~~	~~PS~~	~~PS~~	~~EI/M~~	~~EI/M~~	~~EI/M~~				
	~~0.012< x ≤0.016~~	~~NT~~	~~PS~~	~~EI/M~~	~~PS~~	~~EI/M~~							
	~~0.016< x ≤0.020~~	~~NT~~	~~PS~~	~~EI~~	~~PS~~	~~Investigate to Determine Appropriate Repair~~ [4, 5] ~~or Rejection~~							

0.020< x ≤0.024	NT	PS	EI							Reject and Replace		
0.024< x ≤0.028	NT	PS										
0.028< x												

PS = Penetrant Sealer
EI = Epoxy Injection
NT = No Treatment
M = Methacrylate
AMHW = Above Mean High Water
SA = Slightly Aggressive
MA = Moderately Aggressive
EA = Extremely Aggressive

Table Notes (Both Tables)

(1) Calculate total crack area by multiplying the average of 3 width measurements on each crack by the length of the crack and adding the results of all the cracks within the designated representative LOT.

(2) Use the average width of all the cracks representative of the LOT to determine the table crack size.

(3) For cracks 0.004 inch to 0.008 inch, determine if injectable. If not injectable, use penetrant sealer or methacrylate as directed by the Engineer.

(4) (a) Perform epoxy injection of cracks in accordance with Section 411. Seal cracks with penetrant sealer or methacrylate as per Section 413. (b) Use methacrylate or penetrant sealer to repair cracks that are compatible with previously applied materials or remove such materials. (c) Use sealers to repair riding surfaces that are designed for that purpose.

(5) Seal the cracks after it has been determined that no additional growth will occur.

(6) Investigate cracks which occur underwater or at elevations below zero to determine appropriate repair.

Table 1
DISPOSITION OF CRACKED CONCRETE OTHER THAN BRIDGE DECKS
[see separate Key of Abbreviations and Footnotes for Tables 1 and 2]

Elev. Range	Crack Width Range (inch) [2] x = crack width	Cracking Significance Range per LOT [1]											
		Isolated Less than 0.005%			Occasional 0.005% to<0.017%			Moderate 0.017% to<0.029%			Severe 0.029% or gtr.		
		Environment Category											
		SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
Elevation: 0 to 6 ft AMHW	$x \leq 0.004$	NT	NT	PS (6)	NT	PS (6)	PS (6)	PS (6)	PS (6)				
	$0.004 < x \leq 0.008$	NT	PS (6)	EI (3)	PS (6)	EI (3)	EI (3)	PS (6)					
	$0.008 < x \leq 0.012$	NT	PS (6)	EI									
	$0.012 < x \leq 0.016$	PS (6)	Investigate to Determine Appropriate Repair [4, 5] or Rejection										
	$0.016 < x \leq 0.020$												
	$0.020 < x \leq 0.024$									Reject and Replace			
	$0.024 < x \leq 0.028$												
	$x > 0.028$												
Elev.: More Than 6 ft to 12 ft AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	$x \leq 0.004$	NT	NT	PS (6)	NT	PS (6)	PS (6)	PS (6)	PS (6)	PS (6)	PS (6)		
	$0.004 < x \leq 0.008$	NT	PS (6)	EI (3)	PS (6)	PS (6)	EI (3)	PS (6)	EI (3)				
	$0.008 < x \leq 0.012$	NT	PS (6)	EI	EI	EI							
	$0.012 < x \leq 0.016$	PS (6)	EI	EI	EI								
	$0.016 < x \leq 0.020$	EI											
	$0.020 < x \leq 0.024$		Investigate to Determine Appropriate Repair [4, 5] or Rejection							Reject and Replace			
	$0.024 < x \leq 0.028$												
	$x > 0.028$												
Elev.: Over Land	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	$x \leq 0.004$	NT	NT	NT	NT	PS	PS	PS	PS	PS	PS		

						(6)	(6)	(6)	(6)	(6)	(6)		
	0.004< x ≤ 0.008	NT	PS (6)	PS (6)	PS (6)	PS (6)	EI (3)	PS (6)	EI (3)	EI (3)	PS (6)		
	0.008< x ≤ 0.012	NT	PS (6)	EI	EI	EI	EI	EI	EI				
	0.012< x ≤ 0.016	PS (6)	EI	EI	EI	EI	EI						
	0.016< x ≤ 0.020	EI	EI	EI	EI								
	0.020< x ≤ 0.024	EI	Investigate to Determine Appropriate Repair (4, 5) or Rejection										
	0.024< x ≤ 0.028										Reject and Replace		
	x > 0.028												

Table 2
DISPOSITION OF CRACKED CONCRETE BRIDGE DECKS
[see separate Key of Abbreviations and Footnotes for Tables 1 and 2]

Elev. Range	Crack Width Range (inch) [2] x = crack width	Cracking Significance Range per LOT [1]											
		Isolated less than 0.005%			Occasional 0.005% to<0.017%			Moderate 0.017% to<0.029%			Severe 0.029% or gtr.		
		Environment Category											
		SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
Elevation: 12 feet or Less AMHW	x ≤ 0.004	NT	NT	NT	NT	NT	NT	NT	NT	NT			
	0.004< x ≤ 0.008	NT	NT	EI/M	NT	NT	EI/M	EI/M	EI/M	EI/M			
	0.008< x ≤ 0.012	NT	NT	EI/M	NT	EI/M	EI/M	EI/M	EI/M				
	0.012< x ≤ 0.016	NT	NT	EI/M	NT	EI/M							
	0.016< x ≤ 0.020	EI/M	EI/M	EI	EI								
	0.020< x ≤ 0.024	EI/M	EI	EI	Investigate to Determine Appropriate Repair [4, 5] or Rejection						Reject and Replace		
	0.024< x ≤ 0.028	EI/M	EI										
	x > 0.028												
Elevation: Over Land or More Than 12 feet AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	x ≤ 0.004	NT	NT	NT	NT	NT	NT	NT	NT	NT			
	0.004< x ≤ 0.008	NT	NT	NT	NT	NT	EI/M	NT	EI/M	EI/M			
	0.008< x ≤ 0.012	NT	NT	EI/M	NT	NT	EI/M	EI/M	EI/M				
	0.012< x ≤ 0.016	NT	NT	EI/M	NT	EI/M							
	0.016< x ≤ 0.020	NT	EI/M	EI	EI/M								
	0.020< x ≤ 0.024	NT	EI/M	EI	Investigate to Determine Appropriate Repair [4, 5] or Rejection						Reject and Replace		
	0.024< x ≤ 0.028	NT	EI/M										
	x > 0.028												

Key of Abbreviations and Footnotes for Tables 1 and 2		
Type Abbreviation	*Abbreviation*	*Definition*
Repair Method	*EI*	*Epoxy Injection*
	M	*Methacrylate*
	NT	*No Treatment Required*
	PS	*Penetrant Sealer*
Environment Category	*EA*	*Extremely Aggressive*
	MA	*Moderately Aggressive*
	SA	*Slightly Aggressive*
Reference Elevation	*AMHW*	*Above Mean High Water*

Footnotes

(1) Cracking Significance Range is determined by computing the ratio of Total Cracked Surface Area (TCSA) to Total Surface Area (TSA) per LOT in percent [(TCSA/TSA) x 100] then by identifying the Cracking Significance Range in which that value falls. TCSA is the sum of the surface areas of the individual cracks in the LOT. The surface area of an individual crack is determined by taking width measurements of the crack at 3 representative locations and then computing their average which is then multiplied by the crack length.

(2) Crack Width Range is determined by computing the width of an individual crack as computed in (1) above and then identifying the range in which that individual crack width falls.

(3) When the Engineer determines that a crack in the 0.004 inch to 0.008 inch width range cannot be injected then for Table 1 use penetrant sealer unless the surface is horizontal, in which case, use methacrylate if the manufacturer's recommendations allow it to be used and if it can be applied effectively as determined by the Engineer.

(4) (a) Perform epoxy injection of cracks in accordance with Section 411. Seal cracks with penetrant sealer or methacrylate as per Section 413. (b) Use only methacrylate or penetrant sealer that is compatible, according to manufacturer's recommendations, with previously applied materials such as curing compound or paint or remove such materials prior to application.

(5) When possible, prior to final acceptance of the project, seal cracks only after it has been determined that no additional growth will occur.

(6) Methacrylate shall be used on horizontal surfaces in lieu of penetrant sealer if the manufacturer's recommendations allow it to be used and if it can be applied effectively as determined by the Engineer.

DISPOSITION OF CRACKED CONCRETE.
(REV 12-04-08)

ARTICLE 400-21 (of the Supplemental Specifications) is deleted and the following substituted:

400-21 Disposition of Cracked Concrete.

400-21.1 General: The disposition of cracked concrete is described in this Article and applies to all cast-in-place concrete members, and once installed, to the precast and prestressed concrete members that are produced in accordance with 410, 450, 521, 534, 548 and 641.

400-21.2 Investigation, Documentation and Monitoring: The Engineer will inspect concrete surfaces as soon as surfaces are fully visible after casting, between 7 and 31 days after the component has been burdened with full dead load, and a minimum of 7 days after the bridge has been opened to full unrestricted traffic. The Engineer will measure the width, length and depth of each crack and establish the precise location of the crack termination points relative to permanent reference points on the member. The Engineer will determine if coring of the concrete is necessary when an accurate measurement of crack depth cannot be determined by use of a mechanical probe. The Engineer will monitor and document the growth of individual cracks at an inspection interval determined by the Engineer to determine if cracks are active or dormant after initial inspection. The Engineer will perform all final bridge deck crack measurements once the deck is free of all debris and before transverse grooves are cut and after planing is complete for decks that require planing.

Provide the access, equipment and personnel needed for the Engineer to safely perform this work at no expense to the Department. Core cracks for use by the Engineer in locations and to depths specified by the Engineer at no expense to the Department.

400-21.3 Classification of Cracks: The Engineer will classify cracks as either nonstructural or structural and determine the cause. In general, nonstructural cracks are cracks 1/2 inch or less deep from the surface of the concrete; however, the Engineer may determine that a crack greater than 1/2 inch deep is nonstructural. In general, structural cracks are cracks that extend deeper than 1/2 inch. A crack that is fully or partially underwater at any time during its service life will be classified as a structural crack.

Review and comment on the Engineer's crack classification and determination of cause; however, the Engineer will make the final determination.

400-21.4 Nonstructural Cracking Significance: The Engineer will determine the Cracking Significance. The Cracking Significance will be determined on the basis of total crack surface area as a percentage of total concrete surface area. Cracking significance will be categorized as Isolated, Occasional, Moderate or Severe according to the criteria in Tables 1 and 2. Cracking Significance will be determined on a LOT by LOT basis. A LOT will typically be made up of not more than 100 square feet and not less than 25 square feet of concrete surface area for structures other than bridge decks or typically not more than 400 square feet or not less than 100 square feet for bridge decks. A LOT will not extend beyond a single Elevation Range as shown in Table 1 or 2.

Review and comment on the Engineer's determination of Cracking Significance; however, the Engineer will make the final determination.

400-21.5 Repair Method: Repair or remove and replace cracked concrete as directed by the Engineer. Additional compensation or a time extension will not be approved for repair or removal and replacement of cracked concrete when the Engineer determines the cause to be the responsibility of the Contractor.

400-21.5.1 Nonstructural Cracks: Repair each crack using the method as determined by the Engineer for each LOT in accordance with Table 1 or 2. When further investigation is required to determine repair or rejection, either remove and replace the cracked concrete or provide a structural evaluation signed and sealed by the Contractor's Engineer of Record that includes recommended repair methods and a determination of structural capacity and durability to the Engineer. Upon approval by the Engineer, repair the cracked concrete. Upon approval by the Engineer use epoxy injection in accordance with Section 411 to repair cracks in a member inside a dry cofferdam prior to flooding of the cofferdam. "Reject and Replace" in Table 1 or 2 means there is no acceptable repair method.

400-21.5.2 Structural Cracks: Provide a structural evaluation signed and sealed by the Contractor's Engineer of Record that includes recommended repair methods and a determination of structural capacity and durability to the Engineer. Upon approval by the Engineer, repair the cracked concrete. Complete all repairs to cracks in a member inside a cofferdam prior to flooding the cofferdam.

Table 1
DISPOSITION OF CRACKED CONCRETE OTHER THAN BRIDGE DECKS
[see separate Key of Abbreviations and Footnotes for Tables 1 and 2]

Elev. Range	Crack Width Range (inch) [2]	Cracking Significance Range per LOT [1]											
		Isolated Less than 0.005%			Occasional 0.005% to<0.017%			Moderate 0.017% to<0.029%			Severe 0.029% or gtr.		
	x = crack width	Environment Category											
		SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
Elevation: 0 to 6 ft AMHW	x ≤ 0.004	NT	NT	PS (6)	NT	PS (6)	PS (6)	PS (6)	PS (6)				
	0.004< x ≤ 0.008	NT	PS (6)	EI (3)	PS (6)	EI (3)	EI (3)	PS (6)					
	0.008< x ≤ 0.012	NT	PS (6)	EI									
	0.012< x ≤ 0.016	PS (6)	Investigate to Determine Appropriate Repair [4, 5] or Rejection										
	0.016< x ≤ 0.020												
	0.020< x ≤ 0.024									Reject and Replace			
	0.024< x ≤ 0.028												
	x > 0.028												
Elev.: More Than 6 ft to 12 ft AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	x ≤ 0.004	NT	NT	PS (6)	NT	PS (6)	PS (6)	PS (6)	PS (6)	PS (6)	PS (6)		
	0.004< x ≤ 0.008	NT	PS (6)	EI (3)	PS (6)	PS (6)	EI (3)	PS (6)	EI (3)				
	0.008< x ≤ 0.012	NT	PS (6)	EI	EI	EI							
	0.012< x ≤ 0.016	PS (6)	EI	EI	EI								
	0.016< x ≤ 0.020	EI											
	0.020< x ≤ 0.024		Investigate to Determine Appropriate Repair [4, 5] or Rejection							Reject and Replace			
	0.024< x ≤ 0.028												
	x > 0.028												
Elev.: Over Land	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	x ≤ 0.004	N	NT	NT	N	PS	PS	PS	PS	PS	PS		

		T			T	(6)	(6)	(6)	(6)	(6)	(6)		
	0.004< x ≤ 0.008	NT	PS (6)	PS (6)	PS (6)	PS (6)	EI (3)	PS (6)	EI (3)	EI (3)	PS (6)		
	0.008< x ≤ 0.012	NT	PS (6)	EI	EI	EI	EI	EI	EI				
	0.012< x ≤ 0.016	PS (6)	EI	EI	EI	EI	EI						
	0.016< x ≤ 0.020	EI	EI	EI	EI								
	0.020< x ≤ 0.024	EI	Investigate to Determine Appropriate Repair (4, 5) or Rejection										
	0.024< x ≤ 0.028										Reject and Replace		
	x > 0.028												

Table 2
DISPOSITION OF CRACKED CONCRETE BRIDGE DECKS
[see separate Key of Abbreviations and Footnotes for Tables 1 and 2]

Elev. Range	Crack Width Range (inch) [2] x = crack width	Cracking Significance Range per LOT [1]											
		Isolated less than 0.005%			Occasional 0.005% to<0.017%			Moderate 0.017% to<0.029%			Severe 0.029% or gtr.		
		Environment Category											
		SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
Elevation: 12 feet or Less AMHW	x ≤ 0.004	NT	NT	NT	NT	NT	NT	NT	NT	NT			
	0.004< x ≤ 0.008	NT	NT	EI/M	NT	NT	EI/M	EI/M	EI/M	EI/M			
	0.008< x ≤ 0.012	NT	NT	EI/M	NT	EI/M	EI/M	EI/M	EI/M				
	0.012< x ≤ 0.016	NT	NT	EI/M	NT	EI/M							
	0.016< x ≤ 0.020	EI/M	EI/M	EI	EI								
	0.020< x ≤ 0.024	EI/M	EI	EI		Investigate to Determine Appropriate Repair [4, 5] or Rejection					Reject and Replace		
	0.024< x ≤ 0.028	EI/M	EI										
	x > 0.028												
Elevation: Over Land or More Than 12 feet AMHW	Crack Width	SA	MA	EA	SA	MA	EA	SA	MA	EA	SA	MA	EA
	x ≤ 0.004	NT	NT	NT	NT	NT	NT	NT	NT	NT			
	0.004< x ≤ 0.008	NT	NT	NT	NT	NT	EI/M	NT	EI/M	EI/M			
	0.008< x ≤ 0.012	NT	NT	EI/M	NT	NT	EI/M	EI/M	EI/M				
	0.012< x ≤ 0.016	NT	NT	EI/M	NT	EI/M							
	0.016< x ≤ 0.020	NT	EI/M	EI	EI/M								
	0.020< x ≤ 0.024	NT	EI/M	EI		Investigate to Determine Appropriate Repair [4, 5] or Rejection					Reject and Replace		
	0.024< x ≤ 0.028	NT	EI/M										
	x > 0.028												

Key of Abbreviations and Footnotes for Tables 1 and 2		
Type Abbreviation	Abbreviation	Definition
Repair Method	EI	Epoxy Injection
	M	Methacrylate
	NT	No Treatment Required
	PS	Penetrant Sealer
Environment Category	EA	Extremely Aggressive
	MA	Moderately Aggressive
	SA	Slightly Aggressive
Reference Elevation	AMHW	Above Mean High Water

Footnotes

(1) Cracking Significance Range is determined by computing the ratio of Total Cracked Surface Area (TCSA) to Total Surface Area (TSA) per LOT in percent [(TCSA/TSA) x 100] then by identifying the Cracking Significance Range in which that value falls. TCSA is the sum of the surface areas of the individual cracks in the LOT. The surface area of an individual crack is determined by taking width measurements of the crack at 3 representative locations and then computing their average which is then multiplied by the crack length.

(2) Crack Width Range is determined by computing the width of an individual crack as computed in (1) above and then identifying the range in which that individual crack width falls.

(3) When the Engineer determines that a crack in the 0.004 inch to 0.008 inch width range cannot be injected then for Table 1 use penetrant sealer unless the surface is horizontal, in which case, use methacrylate if the manufacturer's recommendations allow it to be used and if it can be applied effectively as determined by the Engineer.

(4) (a) Perform epoxy injection of cracks in accordance with Section 411. Seal cracks with penetrant sealer or methacrylate as per Section 413. (b) Use only methacrylate or penetrant sealer that is compatible, according to manufacturer's recommendations, with previously applied materials such as curing compound or paint or remove such materials prior to application.

(5) When possible, prior to final acceptance of the project, seal cracks only after it has been determined that no additional growth will occur.

(6) Methacrylate shall be used on horizontal surfaces in lieu of penetrant sealer if the manufacturer's recommendations allow it to be used and if it can be applied effectively as determined by the Engineer.