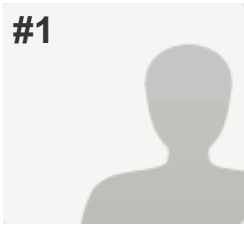


#1



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, March 18, 2015 10:26:58 AM
Last Modified: Wednesday, March 18, 2015 11:36:16 AM
Time Spent: 01:09:17
IP Address: 164.165.237.19

PAGE 1

Q1: State Representative

Name	Clint Hoops
Agency	Idaho Transportation Dept
State / Province	Idaho
Email	clint.hoops@itd.idaho.gov

Q2: What type of membrane curing compounds do you allow? Resin Based

Q3: Do you require different types of curing compounds for different applications? Yes,
 If yes, please explain:
 ASTM C309 Type 2 type B white pigmented for paving and bridge superstructure ASTM C309 Type 1-D Type B with fugitive dye almost everywhere else, curb, sidewalk, bridge sub-structure, median barriers

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	Yes
What is the minimum application rate for testing? Please answer in comments box below.	Yes
Comments:	1 gallon/ 150 sq. ft.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Please include a link to your requirements and specifications:	Standard Specifications http://itd.idaho.gov/manuals/Manual%20Production/SpecBook/SpecHome.htm Quality Assurance Manual http://itd.idaho.gov/manuals/Manual%20Production/QA/QAHome.htm

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gallon/150 sq. ft.
 Veriication is based on quantity of curing compound used

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	No
Climatic Conditions	No
Please explain:	Most non paving applications receive curing compound at 1 gal/ 150 sq ft. Paving - 1 gal/75 sq. ft.

Q8: What are your curing requirements for concrete paving?

curing compound -1gal/ 75ft²

Q9: What are your curing requirements for concrete pavement rehabilitation?

curing compound -1gal/ 75ft²

Q10: What are your curing requirements for concrete bridge decks?

curing compound ,1 gal/150ft² + 10 days wet cure

Q11: What are your curing requirements for colored concrete?

curing compound ,1 gal/150ft²

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	It depends
Do you require application of membrane curing compound after form removal?	Yes
Please explain:	Time varies by bridge element

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	Yes

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Yes

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following? *Respondent skipped this question*

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

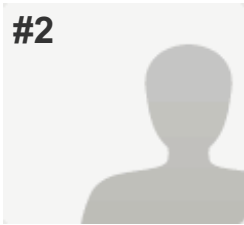
Q20: Do you use the maturity method for any of the following:

Curing	Yes
Opening to Traffic	Yes
Removal of Forms	Yes
If yes, please share specifications and procedures:	Develop maturity relationship per C 1074. Verify relationship at first placement (2 points) and every 10 days thereafter (single point) for continuous work or based on quantity for other applications

Q21: Any additional comments?

Respondent skipped this question

#2



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, March 18, 2015 12:06:02 PM
Last Modified: Wednesday, March 18, 2015 12:33:55 PM
Time Spent: 00:27:53
IP Address: 63.225.17.34

PAGE 1

Q1: State Representative

Name	Eric Prieve
Agency	Colorado DOT
State / Province	Colorado
Email	Eric.Prieve@state.co.us

Q2: What type of membrane curing compounds do you allow? Wax Based, Water Based, Other (please specify) Any that meet ASTM C309

Q3: Do you require different types of curing compounds for different applications? Yes, If yes, please explain: ASTM C309 Type 2 for most concrete. ASTM C309 Type 1 for colored concrete.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	Yes
Please include a link to your requirements and specifications:	https://www.codot.gov/business/designsupport/construction-specifications/2011-Specs/standard-special-provisions/sections-200-500-revisions/412lmfc/view

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

For pavement: An initial application of curing compound shall be applied under pressure by mechanical sprayers at the rate of not less than 1 gallon per 180 square feet of pavement surface. A second application of curing compound shall be applied within 30 minutes after the initial application. The second application rate shall be not less than 1 gallon per 180 square feet of pavement surface. Alternatively, the Contractor may apply the curing compound in one application of not less than 1 gallon per 120 square feet.

For all other concrete, as recommended by the manufacturer, but not to exceed 300 sq. ft per gallon. Must completely coat the surface.

Measure the use of curing compounds vs surface area of concrete

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	No
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

An initial application of curing compound shall be applied under pressure by mechanical sprayers at the rate of not less than 1 gallon per 180 square feet of pavement surface. A second application of curing compound shall be applied within 30 minutes after the initial application. The second application rate shall be not less than 1 gallon per 180 square feet of pavement surface. Alternatively, the Contractor may apply the curing compound in one application of not less than 1 gallon per 120 square feet.

Q9: What are your curing requirements for concrete pavement rehabilitation?

An initial application of curing compound shall be applied under pressure by mechanical sprayers at the rate of not less than 1 gallon per 180 square feet of pavement surface. A second application of curing compound shall be applied within 30 minutes after the initial application. The second application rate shall be not less than 1 gallon per 180 square feet of pavement surface. Alternatively, the Contractor may apply the curing compound in one application of not less than 1 gallon per 120 square feet.

Q10: What are your curing requirements for concrete bridge decks?

Except for when Class H & HT Concrete is used; Concrete bridge decks, including bridge curbs and bridge sidewalks shall be cured as follows:

(a) Decks placed from May 1 to September 30 shall be cured by the membrane forming curing compound method followed by the water cure method as follows:

1. Membrane Forming Curing Compound Method. A volatile organic content (VOC) compliant curing compound conforming to ASTM C 309, Type 2 shall be uniformly applied to the surface of the deck, curbs and sidewalks at the rate of 1 gallon per 100 square feet. The curing compound shall be applied as a fine spray using power operated spraying equipment. The power operated spraying equipment shall be equipped with an operational pressure gage and a means of controlling the pressure. Before and during application the curing compound shall be kept thoroughly mixed by recirculation or a tank agitator. The application shall be within 20 feet of the deck finishing operation. When the finishing operation is discontinued, all finished concrete shall be coated with curing compound within ½ hour. The curing compound shall be thoroughly mixed within one hour before use.

2. Water Cure Method. The water cure method shall be applied as soon as it can be without marring the surface. The surface of the concrete, including bridge curbs and bridge sidewalks, shall be entirely covered with wet burlap and polyethylene sheeting. Prior to being placed, the burlap shall be thoroughly saturated with water. The wet burlap and polyethylene sheeting shall extend at least twice the thickness of the bridge deck beyond the edges of the slab and shall be weighted to remain in contact with the surface. The wet burlap and polyethylene sheeting shall remain in contact and be kept wet for the entire curing period.

(b) Decks placed between November 1 and March 31 shall be cured by application of a membrane forming curing compound followed by the blanket method as follows:

1. Membrane Forming Curing Compound Method. This method shall be applied in accordance with subsection 601.16(a)1 above.

2. Blanket Method. Curing blankets with a minimum R-Value of 0.5 shall be placed on the deck as soon as they can be without marring the surface. Blankets shall be loosely laid (not stretched) and adjacent edges suitably overlapped with continuous weights along the lapped joints. The blankets shall remain in place for a minimum of five days after placement.

(c) Decks placed in April or October may be cured in accordance with either subsection 601.16(a) or 601.16(b) above.

(d) For decks above an elevation of 8,000 feet above mean sea level, the Engineer may modify the time of year requirements for the cure methods defined in subsection 601.16(a) and 601.16(b) above.

(e) Class H, Class HT and Class S50 concrete shall be cured as follows:

Water Cure Method. The water cure method shall be applied as soon as it can be without marring the surface. The surface of the concrete, including bridge curbs and bridge sidewalks, shall be entirely covered with wet burlap and polyethylene sheeting. Prior to being placed, the burlap shall be thoroughly saturated with water. The wet burlap and polyethylene sheeting shall extend at least twice the thickness of the bridge deck beyond the edges of the slab and shall be weighted to remain in contact with the surface. The wet burlap and polyethylene sheeting shall remain in contact and be kept wet for the entire curing period

Class H & HT concrete is for bare concrete decks. All other deck concrete is covered with an asphalt membrane and HMA.

Q11: What are your curing requirements for colored concrete?

A volatile organic content (VOC) compliant curing compound conforming to ASTM C 309, Type 1 shall be uniformly applied to the surface at the rate of 1 gallon per 100 square feet.

Q12: Do you require the application of membrane curing compound after completion of wet curing? No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? Yes

Please explain: We have eliminated minimum curing time in favor of minimal strength for form and falsework removal. Strength is measured via field cured cylinders or maturity meters.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? Yes

Please explain: We have eliminated minimum curing time in favor of minimal strength for form and falsework removal. Strength is measured via field cured cylinders or maturity meters.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,

Comments
The concrete surface may not be worked/re-finished after the application of evaporation retarders.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

If yes, what did you do to address it? Diamond grinding

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only Yes

Please share details of your experience - or a link to a report. <https://www.codot.gov/programs/research/pdfs/2014/ic.pdf/view>

Q19: What types of lightweight materials were used for internal curing? What % was used?

Respondent skipped this question

Q20: Do you use the maturity method for any of the following:

Curing Yes

Opening to Traffic Yes

Removal of Forms Yes

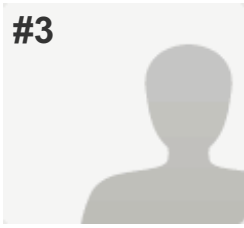
If yes, please share specifications and procedures:

<https://www.codot.gov/business/designsupport/construction-specifications/2011-Specs/standard-special-provisions/section-600-revisions/601cffa/view>

Q21: Any additional comments?

Respondent skipped this question

#3

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Wednesday, March 18, 2015 1:26:33 PM**Last Modified:** Wednesday, March 18, 2015 1:51:08 PM**Time Spent:** 00:24:34**IP Address:** 161.7.59.17

PAGE 1

Q1: State Representative

Name	Matt Needham
Agency	Montana DOT
State / Province	Montana
Email	maneedham@mt.gov

Q2: What type of membrane curing compounds do you allow?

Other (please specify) ASTM C 309

Q3: Do you require different types of curing compounds for different applications?

Yes,

If yes, please explain:
 ASTM C 309 Type 2, white pigmented for pavements. ASTM C 309 Type 1-D, for other.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	No
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gallon/150 sq ft.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

7-day wet cure or curing compound

Q9: What are your curing requirements for concrete pavement rehabilitation?

7-day wet cure or curing compound

Q10: What are your curing requirements for concrete bridge decks?

14-day wet cure

Q11: What are your curing requirements for colored concrete?

7-day wet cure or curing compound

Q12: Do you require the application of membrane curing compound after completion of wet curing? No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? It depends

Please explain: Remove forms at 80% design strength. If before 7 days, apply curing compound.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	It depends
Please explain:	Remove forms at 80% design strength. If before 7 days, apply curing compound. Deck is 14-day wet cure

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,
Comments Placed only after finishing. (not a finishing aide).

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No

Q17: Have you experienced any of the following?

Curling	No
Warping	No

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No
Other	No

Q19: What types of lightweight materials were used for internal curing? What % was used?

Respondent skipped this question

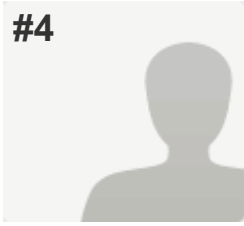
Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	No
Removal of Forms	No
If yes, please share specifications and procedures:	Specifications allow maturity method, but rarely used.

Q21: Any additional comments?

Respondent skipped this question

#4

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Wednesday, March 18, 2015 4:03:52 PM**Last Modified:** Wednesday, March 18, 2015 5:14:59 PM**Time Spent:** 01:11:06**IP Address:** 149.136.17.252

PAGE 1

Q1: State Representative

Name	Mehdi Parvini
Agency	Caltrans
State / Province	California
Email	mehdi.parvini@dot.ca.gov

Q2: What type of membrane curing compounds do you allow?

Poly Alpha Methyl Styrene-Based,
Water Based, Resin Based,
Other (please specify) Comply with ASTM C 309

Q3: Do you require different types of curing compounds for different applications?

Yes,
If yes, please explain:
For pavement, only white pigmented resin type curing compound is used.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

150 sq ft/gal.

Apply the curing compound using power-operated spraying equipment with an operational pressure gage and a means of controlling the pressure.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

40-1.03I Curing

Cure the concrete pavement's exposed area under section 90-1.03B using the waterproof membrane method or curing compound method. If using the curing compound method use with curing compound no. 1 or 2. If you remove the side forms are removed within 72 hours of the start of curing, also cure the concrete pavement edges.

Apply curing compound with mechanical sprayers. Reapply curing compound to saw cuts and disturbed areas.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as above.

Q10: What are your curing requirements for concrete bridge decks?

Given in the attached specification.

Q11: What are your curing requirements for colored concrete?

N/A

Q12: Do you require the application of membrane curing compound after completion of wet curing?

It Depends,
Please explain:
For waterproof membrane method.

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	Yes

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Comments No.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Q19: What types of lightweight materials were used for internal curing? What % was used?

N/A

Q20: Do you use the maturity method for any of the following:

Curing No

Opening to Traffic No

Removal of Forms No

Q21: Any additional comments?

90-1.03B Curing Concrete

90-1.03B(1) General

Cure newly placed concrete by the method specified for the type of work involved.

Cure mortar and grout by keeping the surface damp for 3 days.

90-1.03B(2) Water Method

The water method must consist of keeping the concrete continuously wet by applying water for a curing period of at least 7 days after the concrete is placed.

You may use cotton mats, rugs, carpets, or earth or sand blankets as a curing medium to retain the moisture during the curing period.

For curing structures, you may use a curing medium consisting of white opaque polyethylene sheeting extruded onto burlap. The polyethylene sheeting must have a minimum thickness of 4 mils and must be extruded onto 10-ounce burlap.

For curing columns, you may use a curing medium consisting of polyethylene sheeting with a minimum

thickness of 10 mils achieved in a single layer of material.

Keep the concrete surface damp by applying water with an atomizing nozzle that forms a mist and not a spray until the surface is covered with the curing medium. Do not apply the water under pressure directly on the concrete or allow the water to flow over or wash the concrete surface. At the end of the curing period, remove the curing medium.

If you use polyethylene sheeting or polyethylene sheeting on burlap as a curing medium:

1. Secure the sheeting and the sheeting joints as necessary to retain moisture
2. Keep the sheeting within 3 inches of the concrete at all points along the surface being cured
3. Monitor the concrete temperature during curing
4. Discontinue the use of these curing media if the concrete temperature cannot be maintained below 140 degrees F

90-1.03B(3) Curing Compound Method

90-1.03B(3)(a) General

The curing compound method must consist of uniformly spraying the concrete surfaces exposed to the air with a curing compound.

90-1.03B(3)(b) Materials

The curing compound must comply with the requirements shown in the following table for the curing compound number specified:

Curing compound no. ASTM C 309 classification

- 1 Pigmented, Type 2, Class Ba
- 2 Pigmented, Type 2, Class B
- 3 Pigmented, Type 2, Class A
- 4 Nonpigmented, Type 1, Class B
- 5 Nonpigmented, Type 1, Class A
- 6 Nonpigmented with fugitive dye, Type 1-D, Class A

aThe resin type must be poly-alpha-methylstyrene. The infrared scan for the dried vehicle must match the scan on file at METS.

If no curing compound number is specified, use any of the curing compounds shown in the table above.

The curing compound must be manufactured to:

1. Remain sprayable at temperatures above 40 degrees F
2. Control sagging, pigment settling, leveling, and de-emulsification
3. Maintain the specified properties for at least 1 year

Pigmented curing compounds must be manufactured such that the pigment does not settle badly, cake or thicken in the container, or become granular or curdled.

Settlement of pigment must be a thoroughly wetted, soft, mushy mass allowing the complete and easy vertical penetration of a paddle. Settled pigment must be easily predisposed, with minimum resistance to the sideways manual motion of the paddle across the bottom of the container, to form a smooth, uniform product of the proper consistency.

Do not dilute or alter the curing compound after manufacture.

The curing compound must be packaged in clean 274-gallon totes, 55-gallon barrels, or 5-gallon pails, or must be supplied from a suitable storage tank located at the job site. The containers must comply with 49 CFR 171-180. The 274-gallon totes and 55-gallon barrels must have removable lids and airtight fasteners. The 5-gallon pails must be round and have standard full open head and bail. Do not use lids with bungholes.

Containers must be filled in a way that prevents skinning.

Steel containers and lids must be lined with a coating that prevents destructive action by the compound or chemical agents in the air space above the compound. The coating must not come off the container or lid as skins.

Plastic containers and lids must not react with the curing compound.

Label each curing compound container with:

1. Manufacturer's name
2. ASTM C 309 classification
3. Batch number
4. Volume
5. Date of manufacture

6. Volatile organic compound content
7. Warning that curing compound containing pigment must be well stirred before using
8. Precautions concerning the handling and application of curing compound shown in compliance with 8 CA Code of Regs §§ 1500–1938 and 3200–6184
9. Statement that the contents fully comply with State air pollution control rules and regulations

90-1.03B(3)(c) Mixing

Before using a curing compound, completely redisperse settled or separated solids in containers, except tanks, by mixing at low speed in compliance with these specifications and the manufacturer's instructions. Mix manually using a paddle or mix using a mixing blade driven by a drill motor at low speed. Mixing blades must be the type used for mixing paint.

Keep on-site storage tanks clean and free of contaminants. Each tank must have a permanent system that completely redisperses settled material without introducing air or other foreign substances.

At the time of use, compounds containing pigments must be thoroughly mixed. Use a paddle to loosen all settled pigment from the container bottom and use a power-driven agitator to disperse the pigment uniformly throughout the vehicle.

Agitation must not introduce air or other foreign substances into the curing compound.

90-1.03B(3)(d) Application

Apply the curing compound at a nominal rate of 150 sq ft/gal.

At any point, the application rate must be within ± 50 sq ft/gal of the nominal rate. The average application rate must be within ± 25 sq ft/gal of the nominal rate when tested under California Test 535. Apply the curing compound such that there are no runs, sags, thin areas, skips, or holidays.

Apply the curing compound using power-operated spraying equipment with an operational pressure gage and a means of controlling the pressure. The Engineer may allow hand spraying for small and irregular areas that, in the Engineer's opinion, are not reasonably accessible to power-operated spraying equipment.

Apply the curing compound to the concrete after finishing the surface, immediately before the moisture sheen disappears from the concrete surface but before drying shrinkage or craze cracks start to appear.

If the concrete surface cracks or dries, immediately and continually apply water with an atomizing nozzle as specified in section 90-1.03B(2) until application of the curing compound is resumed or started. Do not apply the curing compound over freestanding water.

If the film of curing compound is damaged before the expiration of 7 days after the concrete is placed for structures and 72 hours for pavement, immediately repair it with additional compound.

90-1.03B(4) Waterproof Membrane Method

The waterproof membrane method must consist of:

1. Spraying the exposed finished concrete surfaces with water, using an atomizing nozzle that forms a mist and not a spray, until the concrete has set
2. Placing the waterproof curing membrane immediately after spraying
3. Keeping the membrane in place for at least 72 hours

The membrane must be sheeting material that complies with AASHTO M 171 for white reflective materials. Use sheeting material of such a width as to completely cover the entire concrete surface. Cement the sheeting joints together securely such that the joints are waterproof. The joint seams must have at least a 4-inch lap.

Securely weigh down the sheets by placing an earth bank on the sheet edges or by other means allowed by the Engineer.

If any portion of the sheets are damaged within 72 hours after being placed, immediately repair the damaged portion by cementing new sheets into place.

Do not use a membrane that is no longer waterproof or has been damaged such that it is unfit for curing concrete.

90-1.03B(5) Forms-In-Place Method

The forms-in-place method must consist of curing formed concrete surfaces by keeping the forms in place. Keep the forms in place for at least 7 days after the concrete is placed, except keep the forms in place for at least 5 days for concrete members over 20 inches in least dimension.

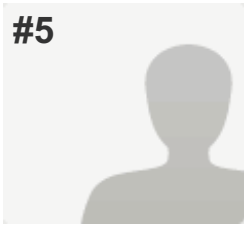
The joints in the forms and the joints between the end of the forms and the concrete must be kept moisture tight during the curing period. Reseal cracks in the forms and cracks between the forms and the concrete using authorized methods.

90-1.02J Curing Compound

Curing compound water loss must not exceed 0.15 ka/m² in 24 hours when tested under California Test 534.



#5



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, March 18, 2015 5:02:23 PM
Last Modified: Wednesday, March 18, 2015 5:52:51 PM
Time Spent: 00:50:27
IP Address: 168.178.122.37

PAGE 1

Q1: State Representative

Name	Bryan Lee
Agency	Utah Department of Transportation
State / Province	Utah
Email	bryanlee@utah.gov

Q2: What type of membrane curing compounds do you allow?

Other (please specify)
 Depends on the application

Q3: Do you require different types of curing compounds for different applications?

Yes,
 If yes, please explain:
 PCCP requires ASTM C 309 Type 2, Class A (white pigmented, no restrictions on solids dissolved in the vehicle) Structural, Architectural, curb/gutter, flatwork, sidewalk, driveway, slope protection - C309 Type 1 D Class A (clear with no restrictions) Concrete barrier requires Cure and Seal per ASTM C 1315 Type 1 Class A.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	No
Do you test field samples of membrane curing compounds for acceptance?	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No
Please include a link to your requirements and specifications:	http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:3694,03390 Concrete Curing

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

PCCP - Two applications at a combined rate of 100 ft²/gal

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

PCCP - Two applications at a combined rate of 100 ft²/gal - Protect until f'c

Q9: What are your curing requirements for concrete pavement rehabilitation? *Respondent skipped this question*

Q10: What are your curing requirements for concrete bridge decks?

Curing compound and 14 day wet cure

Q11: What are your curing requirements for colored concrete?

No specific requirements for color

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No,
Please explain:
Bridge decks receive curing compound before applying wet cure.

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? Yes

Please explain: Forms in place requirement depends on the product/application. Curing membrane is typically required after form removal.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: Keep falsework and forms in place under slabs, beams, girders for 14 days after the last day of concrete placement. Use curing compound if forms are removed before 14 days if approved by the Engineer.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Comments
We allow them but restrict them from being used as a finishing aid.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

Q18: Have you tried internal curing for any of the following applications?

Bridge Decks Yes

Please share details of your experience - or a link to a report. Sharing experience and report at NCC 2015.

Q19: What types of lightweight materials were used for internal curing? What % was used?

15 % Lightweight fine aggregate replacement with kiln fired expanded shale.

Q20: Do you use the maturity method for any of the following:

Opening to Traffic Yes

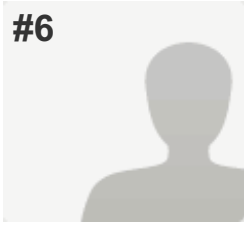
Removal of Forms Yes

If yes, please share specifications and procedures: Cold weather protection.

Q21: Any additional comments?

Respondent skipped this question

#6

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Thursday, March 19, 2015 10:20:41 AM**Last Modified:** Thursday, March 19, 2015 11:37:19 AM**Time Spent:** 01:16:38**IP Address:** 63.66.64.246

PAGE 1

Q1: State Representative

Name	Neal Fannin
Agency	Penn DOT
State / Province	PA
Email	nfannin@ pa.gov

Q2: What type of membrane curing compounds do you allow?	Poly Alpha Methyl Styrene-Based, Wax Based, Water Based
---	---

Q3: Do you require different types of curing compounds for different applications?	Yes, If yes, please explain: Bridge decks require intermediate cure with mono molecular film
---	--

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	Yes
Comments:	1 gallon / 150 square feet

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	Yes
Burlap Curing Blankets	Yes
Evaporation Retarders	Yes

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gallon per 150 SF. Inspector measures amount used and determines application rate by area covered.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	No
Climatic Conditions	No
Please explain:	Bridge Decks get double application

Q8: What are your curing requirements for concrete paving?

Can use white polyethylene but normally use white membrane curing compound. Applied immediately after final finishing and after forms removed at minimum of 1 gal/150 SF.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as above

Q10: What are your curing requirements for concrete bridge decks?

Monomolecular followed by 14 day minimum wet cure with burlap and white sheeting followed by white curing compound for 14 days (total 28 days)

Q11: What are your curing requirements for colored concrete?

No difference from above applications

Q12: Do you require the application of membrane curing compound after completion of wet curing?

It Depends,
Please explain: On Bridge decks only

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	No
Do you require application of membrane curing compound after form removal?	Yes

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	Yes

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,
Comments No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Other No

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

Curing Yes

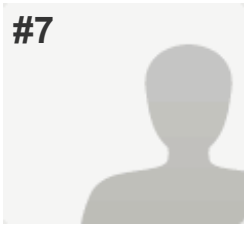
Opening to Traffic Yes

Removal of Forms Yes

If yes, please share specifications and procedures: PA test Method 640 establishes procedure for determining and calibrating maturity method parameters

Q21: Any additional comments? *Respondent skipped this question*

#7



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, March 20, 2015 8:34:35 AM
Last Modified: Friday, March 20, 2015 11:30:23 AM
Time Spent: 02:55:47
IP Address: 164.154.156.59

PAGE 1

Q1: State Representative

Name	Darin Hodges
Agency	South Dakota DOT
State / Province	SD
Email	darin.hodges@state.sd.us

Q2: What type of membrane curing compounds do you allow? Water Based, Linseed Oil

Q3: Do you require different types of curing compounds for different applications? Yes,
 If yes, please explain:
 We commonly still use a linseed oil curing compound for urban PCCP with curb and gutter.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	No
Do you test field samples of membrane curing compounds for acceptance?	Yes
What is the minimum application rate for testing? Please answer in comments box below.	Yes
Comments:	200 ft ² /gallon

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No
Please include a link to your requirements and specifications:	Approved product list: http://apps.sd.gov/HC60ApprovedProducts/Main.aspx

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gallon per 125 ft² for tined surfaces.
1 gallon per 150 ft² for un-tined surfaces

DOT Inspectors are to check rates for larger paving by surface area covered and amount in a barrel.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	Yes
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

P. Curing: Immediately after the finishing operations have been completed and marring of the concrete will not occur, the entire surface, and exposed edges of the pavement, shall be properly cured. The concrete shall not be left exposed for more than ½ hour between stages of curing or during the curing period. Curing shall be maintained for at least 72 hours after concrete placement. One of the following curing methods shall be used:

1. Cotton or Burlap Mats and White Polyethylene Sheeting: The surface of the concrete pavement and both pavement edges shall be covered with cotton or burlap mats. The mats shall be thoroughly saturated with water and placed with the wettest side down.

Immediately after placement, the mats shall be covered with white polyethylene sheeting placed in accordance with paragraph three below.

Combination burlap-polyethylene sheeting may be substituted for one layer of burlap and the polyethylene sheeting with the Engineer's approval.

The mats shall be kept moist by periodic applications of water.

2. Impervious Membrane Method: The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface. If the pavement is cured initially with jute or cotton mats, the impervious membrane shall be applied immediately upon removal of the mats. The curing compound shall not be applied during or immediately after rainfall.

Curing compound shall be applied under pressure by approved self-propelled mechanical sprayers. The curing compound may be applied in one or two applications. If applied in two applications, the second shall be applied within 30 minutes after the first.

The minimum application rate shall be one gallon per 150 square feet (one liter per foursquare meters) for carpet drag or broom finished surfaces and one gallon per 125 square feet (one liter per three square meters) for metal tined finished surfaces.

The sprayer equipment shall be equipped with a tank agitator and shall be fully atomizing. The spray fog shall be protected from the wind by a shield. During application the compound shall be thoroughly mixed and continuously agitated by mechanical means. Hand spraying of odd width or shapes and concrete surfaces exposed by form removal will be permitted.

Curing compound shall not be applied to the inside faces of joints to be sealed, unless the compound is completely removed by subsequent sawing operations. Curing membrane damaged or protective cover removed on the surface of the pavement during the sawing operation shall be repaired or replaced by the Contractor as directed by the Engineer at no cost to the Department.

Should the film become damaged within the curing period, the damaged portions shall be repaired immediately with additional compound.

Upon removal of side forms, the sides of the exposed slab shall be protected immediately with a curing treatment equal to that provided for the surface.

3. White Opaque Polyethylene Sheeting: The top surface and sides of the pavement shall be entirely covered with polyethylene sheeting. The units used shall be lapped at least 18 inches (450 mm). The sheeting shall be placed and weighted down to maintain intimate contact with the surface covered. The sheeting shall be sized so each unit as laid will extend beyond the edges of the slab at least twice the thickness of the pavement. In cold weather the substitution of dark sheeting for white sheeting will be permitted.

Q9: What are your curing requirements for concrete pavement rehabilitation?

the SDDOT commonly uses the following plan notes for pavement repair depending on how quickly the concrete is to be opened to traffic:

This is for 48 hours opening:

Concrete shall be cured with white pigmented curing compound (AASHTO M148, Type 2) applied as soon as practical at a rate of 125 square feet per gallon. Concrete shall be cured for a minimum of 48 hours before opening to traffic. The 48 hours is based upon a concrete surface temperature of 60°F or higher throughout the cure period. If the concrete temperature falls below 60°F, the cure time shall be extended or other measures taken, at no additional cost to the State. A strength of 4,000 psi must be attained prior to opening to traffic.

Upon placement of the concrete, repair areas shall be straight edged to ensure a smooth riding surface and shall be textured longitudinally with the pavement by finishing with a stiff broom. Repair areas shall then be checked with a 10' foot straight edge. The permissible longitudinal and transverse surface deviation shall be 1/8" in 10'.

Concrete shall be covered with suitable insulation blanket consisting of a layer of closed cell polystyrene foam protected by at least one layer of plastic. Insulation blanket shall have an R-value of at least 0.5, as rated by the manufacturer. Insulation blanket shall be left in place, except for joint sawing operations, until the 4000 psi is attained. Insulation blanket shall be overlapped on to the existing concrete by 4'. This requirement for covering repair areas with insulation blankets may be waived during periods of hot weather upon approval of the Engineer.

This is for 24 hour or less opening:

Fast Track Concrete shall be cured with white pigmented curing compound (AASHTO M148, Type 2) applied as soon as practical at a rate of 125 square feet per gallon.

Concrete shall be immediately covered with suitable insulation blanket consisting of a layer of closed cell polystyrene foam protected by at least one layer of plastic. Insulation blanket shall have an R value of at least 0.5, as rated by the manufacturer. Insulation blanket shall be left in place, except for joint sawing operations, until 3,500 psi strength is attained. Insulation blanket shall be overlapped on to the existing concrete by 4'. This requirement for covering repair areas with insulation blankets may be waived during periods of hot weather upon approval of the Engineer.

The concrete repair area shall be removed, replaced, and opened to traffic in the same day during daylight hours.

Q10: What are your curing requirements for concrete bridge decks?

The following is our special provision for Bridge Deck Finish and Curing:

I. DESCRIPTION

This work consists of the finishing and curing bridge deck concrete in accordance with Section 460 and the following.

II. MATERIALS

Materials shall be in accordance with Section 460.2.

III. CONSTRUCTION REQUIREMENTS

A. Concrete Placement: Concrete placed in bridge decks shall be placed in accordance with Section 460 except as modified by these provisions.

In order to achieve the best possible ambient conditions for placing concrete in the bridge deck, the bridge deck concrete shall be placed during the coolest nighttime hours when the ambient daytime temperature is forecasted to exceed 80 degrees Fahrenheit. The Contractor shall provide sufficient lighting to assure that the work area is adequately lighted for construction and inspection as approved by the Engineer. Adequate lighting shall also be provided in an area approved by the Engineer for the purpose of materials testing.

B. Bridge Deck and Approach Slab Finish: The concrete bridge deck surface shall be finished in accordance with Section 460.3 M.4 except as modified by the following:

As soon as the bridge deck has been struck off and finished by the finish machine, it shall be given a transverse drag finish in accordance with Section 460.3 M.4. The drag shall consist of burlap, astroturf, or other approved material attached to the carriage of the finish machine.

The finish machine shall be operated such that hand finish work behind the finish machine is kept to a minimum. Hand finish work of the concrete behind the finish machine will be allowed as necessary to assure that the top surface of the concrete is adequately finished and to assure a smooth ride, provided that the hand finishing is kept to a minimum such that there are no delays to tining and curing. Any transverse drag surface texture that is removed by hand finishing shall be replaced by broom finishing prior to tining. Tining of the concrete surface shall be in accordance with Section 460.3 M.4.c and shall be performed immediately after concrete finishing is completed.

Immediately after concrete finishing, a fog shall be applied to the exposed concrete surfaces until such time that wet burlap is in place in such a way as to prevent drying of the concrete surface. Maintain the fogging to produce a "gloss to semi-gloss water sheen" on the concrete surface until the wet burlap is applied. The bridge deck surfaces shall not be treated with curing compound.

Fogging equipment shall be capable of applying a fine fog mist in sufficient quantity to curb the effects of rapid evaporation of mixing water from the concrete resulting from wind, high temperature, or low humidity, or a combination of these factors. The fogging equipment shall be capable of being turned off and on as necessary, or as directed by the Engineer.

Only equipment capable of producing a fog or mist shall be used. Moisture from the fog applicators under pressure shall not be applied directly upon the concrete and cannot accumulate on the surface in a quantity sufficient to cause a flow or wash the surface.

Fog misting shall not be used to apply water to the surface of the concrete to facilitate lubrication for finishing purposes. Water on top of the fogged concrete surface shall not be worked into the surface of the concrete.

Fogging equipment shall be such that the fog spray is produced from nozzles that atomize the droplets and are capable of keeping a large area damp without depositing excess water. Use high pressure equipment that generates at least 1200 psi at 2.2 gpm (8.3 Mpa at 8.3 L/min) or low pressure equipment having nozzles capable of supplying a maximum flow rate of 1.6 gpm (6.1 L/min). Handheld weed sprayers are not allowed. Water shall not be allowed to drip, flow, or puddle on the concrete surface during fog misting.

The Contractor shall demonstrate the fog mist system at the bridge deck prepour inspection to verify that sufficient volume and coverage will be attained. A fogging system shall not be used until approved by the Engineer.

Apply fog spray upwind of the concrete placement during finishing, texturing and until the concrete is covered by wet burlap.

A single layer of wet burlap shall be placed as soon as possible, but in no case shall the wet burlap placement exceed a distance of 25 feet behind the finish machine. In the event of a delay in concrete placement or

finishing, the wet burlap shall be placed on as much of the exposed concrete behind the finish machine as is practical. The burlap shall be pre-wetted by soaking in water for a minimum of 4 hours and then draining the soaked burlap such that the free water is removed prior to placement. If non-woven polypropylene geotextile is used in lieu of burlap, pre-wetting may be done immediately prior to placement. Caution shall be used when placing wet burlap so that no damage occurs to the surface. Placement of dry burlap and then wetting the burlap once it is in place is not allowed.

The burlap shall be kept continuously wet by misting with water until such time that the concrete can support soaker hoses without causing deformation to the concrete. At that time, soaker hoses shall be placed on top of the burlap and the burlap and soaker hoses covered with polyethylene sheeting.

In lieu of the above, the Contractor may immediately cover the wet burlap with polyethylene sheeting. Once the concrete can be walked on without damaging it, the Contractor shall then pull back the polyethylene sheeting and place the soaker hoses between the burlap and polyethylene sheeting. The burlap shall not be exposed for such duration that it dries prior to being recovered with the polyethylene sheeting. The soaker hoses must be placed and recovered within 24 hours of completion of the deck pour.

Water shall be run through the soaker hoses periodically as required to keep the burlap continuously wet, but at a minimum of once per day. These wet cure procedures shall be continued for a period of 7 days after completion of the deck pour.

Q11: What are your curing requirements for colored concrete?

Vary by plan note, but typically require a clear cure and seal product.

Q12: Do you require the application of membrane curing compound after completion of wet curing? No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? It depends

Please explain: 12 hour to remove side forms. If forms are removed within the 72 hour cure period then the formed sides must be cured.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? It depends

Please explain: SDDOT has a table for typical structural elements with associated concrete strength or time before form removal is allowed, and concrete strength is used primarily. But if forms are removed before the end of the 7 day cure period for structural concrete then curing compound or wet cure is to be used for the remainder.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,

Comments

They should not be used like water for a finishing aid. They are to be used to keep the surface workable until finishing can begin.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No

Q17: Have you experienced any of the following?

Curling

Yes

Warping

Yes

If yes, what did you do to address it?

We have shortened transverse joint spacing and tried some different types and application rates/timing of curing compounds.

Q18: Have you tried internal curing for any of the following applications?

Paving

No

Bridge Decks

No

Trial Batching/Research Only

No

Other

No

Q19: What types of lightweight materials were used for internal curing? What % was used?

NA

Q20: Do you use the maturity method for any of the following:

Curing

No

Opening to Traffic

No

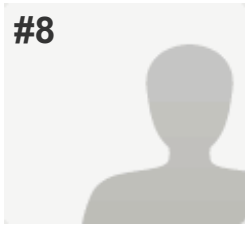
Removal of Forms

No

Q21: Any additional comments?

No

#8



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Monday, March 23, 2015 8:15:55 AM
Last Modified: Monday, March 23, 2015 1:31:28 PM
Time Spent: 05:15:32
IP Address: 130.39.255.10

PAGE 1

Q1: State Representative

Name	Tyson Rupnow
Agency	LADOTD
State / Province	LA
Email	Tyson.Rupnow@la.gov

Q2: What type of membrane curing compounds do you allow? Wax Based, Water Based

Q3: Do you require different types of curing compounds for different applications? No

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

MRD

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
--	----

Surface Texture	No
-----------------	----

Climatic Conditions	No
---------------------	----

Q8: What are your curing requirements for concrete paving?

membrane cure or burlap

Q9: What are your curing requirements for concrete pavement rehabilitation?

burlap wet cure

Q10: What are your curing requirements for concrete bridge decks?

10-day wet cure followed by membrane

Q11: What are your curing requirements for colored concrete?

N/A

Q12: Do you require the application of membrane curing compound after completion of wet curing?

Yes

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	It depends
---	------------

Do you require application of membrane curing compound after form removal?	No
--	----

Please explain:	Forms must remain in place until 3000 psi compressive strength has been reached.
-----------------	--

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	It depends
---	------------

Do you require application of membrane curing compound after form removal?	It depends
--	------------

Please explain:	Forms must remain in place until 3000 psi compressive strength has been reached. Concrete must then be subjected to continuous wet burlap on all surfaces until 10-14 days have elapsed from the placement of the concrete. If a class II finish is to be applied, no curing compound is required.
-----------------	--

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No,

Comments

But the majority of concrete pavements and bridge decks probably get the Pope's blessing treatment.

Q17: Have you experienced any of the following?

Curling

No

Warping

No

Q18: Have you tried internal curing for any of the following applications?

Paving

No

Bridge Decks

Yes

Please share details of your experience - or a link to a report.

Placed 65 cuyd in conjunction with a local municipality on two of five spans of a slab span bridge. 600+ CUYD are expected to be placed on a DOTD bridge project in April 2015.

Q19: What types of lightweight materials were used for internal curing? What % was used?

expanded clay, 20-25%

Q20: Do you use the maturity method for any of the following:

Curing

No

Opening to Traffic

No

Removal of Forms

Yes

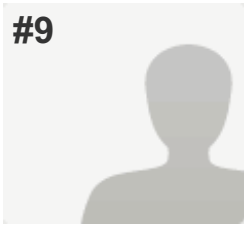
If yes, please share specifications and procedures:

no formal specifications at this time.

Q21: Any additional comments?

Respondent skipped this question

#9



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Monday, March 23, 2015 1:11:06 PM
Last Modified: Monday, March 23, 2015 2:13:38 PM
Time Spent: 01:02:31
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PAGE 1

Q1: State Representative

Name	James Krstulovich
Agency	Illinois Department of Transportation
State / Province	Illinois
Email	James.Krstulovich@illinois.gov

Q2: What type of membrane curing compounds do you allow?

Wax Based, Water Based, Resin Based, Linseed Oil,
 Other (please specify)
 "Linseed Oil" for membrane curing is a linseed oil emulsion consisting of 50 +/- 4% boiled linseed oil (ASTM D260) emulsified in water.

Q3: Do you require different types of curing compounds for different applications?

Yes,
 If yes, please explain:
 Only Type I, Class A (ASTM C309) for Substructure, Retaining Walls, and Pump Houses.
 Only Type 1-D, Class B (C309) for Base Course, Pavement Patching, and Precast (except Bridge Slabs, Piles and Caps, and other structural members). Only Type 2, Class A (C309) for Pavement and Shoulder. Any of the three for Driveway, Median, Barrier, Curb, Gutter, Sidewalk, Slope Wall, Paved Ditch, Catch Basin, Manhole, Inlet, Valve Vault, Foundation, Footing, Seal Coat, Culvert.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No
Comments:	Application rate: 2 coats @ 1 gal/250 sq ft

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No
Please include a link to your requirements and specifications:	Membrane curing compounds are tested per batch/lot; thus, are not provided an approved list. Explanation for understanding approved batch/lot numbers can be found here: http://www.idot.illinois.gov/Assets/uploads/files/Doing-Business/Manuals-Guides-&-Handbooks/Highways/Materials/Concrete/curing%20compound%20batch%20lot.pdf

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Application rate: 2 coats @ 1 gal/250 sq ft

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	Yes
Climatic Conditions	Yes
Other	Yes
Please explain:	The specifications require additional applications (@ the standard rate) as necessary based on lack of coverage when initially applied.

Q8: What are your curing requirements for concrete paving?

3 days cure via waterproof paper, polyethylene sheeting, wet burlap, membrane curing, or wet cotton mats.

Q9: What are your curing requirements for concrete pavement rehabilitation?

No more than 3 days* curing (same options as for pavement, except membrane curing can only be via Type 1-D, Class B). *Maintain curing only until opening to traffic.

Q10: What are your curing requirements for concrete bridge decks?

7 days cure via wet cotton mats.

Q11: What are your curing requirements for colored concrete?

n/a

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: For most cast-in-place items, forms shall remain in place for at least 24 hours. Curing (regardless of method) shall be resumed within 2 hours of form removal (if done during the specified curing period).

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? No

Please explain: Self-supporting substructure items and superstructure (except parapets, railings, curb, sidewalk, and median not placed monolithically with the deck) are required to have achieved a minimum strength, as well as completed the specified curing period, prior to form removal. Curing (regardless of method) shall be resumed within 2 hours of form removal (if done during the specified curing period).

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

If yes, what did you do to address it? Our JPCP design requires transverse joints to be doweled and longitudinal joints to be tied with rebar.

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only Yes

Other No

Please share details of your experience - or a link to a report. IDOT is currently drafting a specification for internal curing with lightweight fines, and currently only experimented with it via various university research projects concerning early bridge deck crack mitigation (Mondal and Hindi) and pavement slab mechanics (Roesler).

Q19: What types of lightweight materials were used for internal curing? What % was used?

Solite and Haydite, I believe. Approximately 20-30%.

Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No

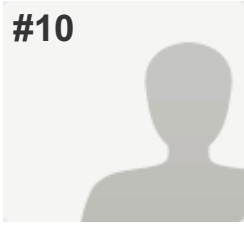
If yes, please share specifications and procedures:

Maturity is allowed for pavement and bridge deck patching only, but I am not aware of it actually being used outside of one particular patching job in the Chicago area some years ago. There does appear to be some interest gaining in the last couple of years. Refer to Illinois Modified AASHTO T 325 and Illinois Modified ASTM C 1074 for our maturity method requirements (see PDF pages 81-82 and 187-188, or document pages 127-128 and 233-234):
<http://www.idot.illinois.gov/Assets/uploads/files/Doing-Business/Manuals-Guides-&-Handbooks/Highways/Materials/testproceduresmanual2015.pdf>

Q21: Any additional comments?

Respondent skipped this question

#10

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Thursday, March 26, 2015 9:50:39 AM**Last Modified:** Thursday, March 26, 2015 10:21:36 AM**Time Spent:** 00:30:57**IP Address:** 204.62.25.101

PAGE 1

Q1: State Representative

Name	Kenny Seward
Agency	Oklahoma DOT
State / Province	Oklahoma
Email	kseward@odot.org

Q2: What type of membrane curing compounds do you allow?	Wax Based
---	-----------

Q3: Do you require different types of curing compounds for different applications?	No
---	----

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
---	-----

Do you test field samples of membrane curing compounds for acceptance?	No
--	----

Comments:	1 gallon per 200 square Feet
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Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gallon per 200 square feet

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	No
Climatic Conditions	Yes
Please explain:	For bonded overlays the application rate is 1 gallon per 100 square feet. For normal paving if the temperature is above 100 degrees the application rate is 1 gallon per 150 square feet

Q8: What are your curing requirements for concrete paving?

Wet burlap or cotton mats for 72 hours, curing compound or plastic sheeting for 72 hours.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same

Q10: What are your curing requirements for concrete bridge decks?

7 days of water curing

Q11: What are your curing requirements for colored concrete?

Same

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? Yes

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? It depends

Please explain: Leave forms in place for 7 days or until 80% of the required strength is obtained. If forms are removed before the 7 day limit apply curing compound at a rate of 1 gallon per 160 square feet.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

Curing Yes

Opening to Traffic Yes

Removal of Forms Yes

If yes, please share specifications and procedures: The contractor is allowed but they have only used it on a couple of projects and then only for early opening to traffic.

Q21: Any additional comments? *Respondent skipped this question*

#11

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Thursday, March 26, 2015 10:55:39 AM**Last Modified:** Thursday, March 26, 2015 12:25:46 PM**Time Spent:** 01:30:06**IP Address:** 156.75.252.71

PAGE 1

Q1: State Representative

Name	Michael Bergin
Agency	FDOT
State / Province	Florida
Email	michael.bergin@dot.state.fl.us

Q2: What type of membrane curing compounds do you allow?	Wax Based, Water Based, Resin Based, Linseed Oil
---	--

Q3: Do you require different types of curing compounds for different applications?	Yes, If yes, please explain: Silica fume concrete requires 72 hours of moist curing.
---	--

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
Comments:	0.06 gal/sy

Q5: Do you have an Approved/Qualified Products List for any of the following?

Plastic Curing Blankets	Yes
Burlap Curing Blankets	Yes
Evaporation Retarders	Yes
Please include a link to your requirements and specifications:	http://www.dot.state.fl.us/specificationsoffice/Implemented/SpecBooks/July2015/Files/925-715.pdf

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

0.06 gal/sy the contractor verifies to the Department that the correct volume is dispensed over the required surface area.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

1 gal/ 200 sf

Q9: What are your curing requirements for concrete pavement rehabilitation?

1 gal/ 200 sf

Q10: What are your curing requirements for concrete bridge decks?

1 gal/ 200 sf

Q11: What are your curing requirements for colored concrete?

1 gal/ 200 sf

Q12: Do you require the application of membrane curing compound after completion of wet curing?

Yes

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	No
---	----

Do you require application of membrane curing compound after form removal?	Yes
--	-----

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
---	-----

Do you require application of membrane curing compound after form removal?	Yes
--	-----

Please explain:	Forms are to be left in place until a minimum compressive strength of 4,000 psi has been reached. When forms are removed curing compound is applied.
-----------------	--

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,

Comments

We require the contractor to protect the concrete from high winds, high temperatures and low humidity. He is required to have a portable weather station on his project and if any of the criteria are met he has to cover the concrete, use an evaporation retarder, or some other method to protect the concrete.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No

Q17: Have you experienced any of the following?

Curling

Yes

Warping

Yes

If yes, what did you do to address it?

Curling and Warping are related to mix design and curing. The mix design should have the largest aggregate size for the application, low water to cementitious ratio, and fly ash or slag to minimize or prevent curling and warping of slabs. In addition, the curing must be applied as soon as the sheen has gone from the concrete surface and joints should be cut as soon as practically possible.

Q18: Have you tried internal curing for any of the following applications?

Paving

No

Bridge Decks

No

Trial Batching/Research Only

Yes

Please share details of your experience - or a link to a report.

We have a current research project on-going and is providing very promising data for its use in pavement and bridge decks. We hope to allow its use in the near future.

Q19: What types of lightweight materials were used for internal curing? What % was used?

best application so far is a 20% replacement of the fine aggregate with the LW fine aggregate

Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No

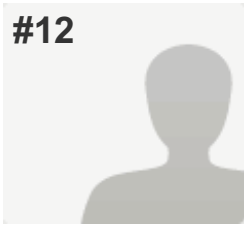
If yes, please share specifications and procedures:

Maturity has been used from time to time for different applications, but the method is really for later time strength development. We now have the means to approve a plan that intends to use the MM for opening to traffic 4 to 8 hours after the concrete has been placed.

Q21: Any additional comments?

Respondent skipped this question

#12



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, March 27, 2015 8:55:18 AM
Last Modified: Friday, March 27, 2015 10:14:59 AM
Time Spent: 01:19:41
IP Address: 164.119.51.237

PAGE 1

Q1: State Representative

Name	Lieska Halsey
Agency	Nebraska Department of Roads
State / Province	Nebraska
Email	lieska.halsey@nebraska.gov

Q2: What type of membrane curing compounds do you allow? Wax Based

Q3: Do you require different types of curing compounds for different applications? Yes,
 If yes, please explain:
 If the concrete is stained; such as medians, sidewalks, etc., we follow the manufacture recommendation on curing. Typically, a clear curing compound is used.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	Yes
Comments:	For pre-approval we test every lot for the curing compound. The application rate is per the manufactures recommendation.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Please include a link to your requirements and specifications:

SECTION 1012 -- LIQUID MEMBRANE-FORMING COMPOUNDS FOR CURING CONCRETE
 1012.01 -- Description Liquid membrane-forming compounds are intended for application to concrete surfaces to reduce the loss of water during the early-hardening period. White-pigmented compounds serve the additional purpose of reducing the temperature rise in concrete exposed to radiation from the sun.
 1012.02 -- Material Characteristics Liquid membrane-forming compounds shall conform to the requirements of AASHTO M 148, Type 2.
 1012.03 -- Acceptance Requirements
 1. All curing compounds to be approved must be from the current calendar year with no carry-over from the previous years.
 2. Approved compounds are on the NDR Approved Products List.
 3. Products not on the NDR Approved Products List shall be sampled and tested in accordance with requirements of the NDR Materials Sampling Guide

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

The curing compound shall be applied in 2 equal applications immediately following each other or other methods approved by the Engineer.

The total rate of applications shall be at a minimum of 1 Gal/100 SF of surface area for tined surfaces or 1 Gal/150 SF (of surface area for all other finishes).

For form paving, the sides of the pavement slab shall be covered with curing compound within 30 minutes after removal of the forms.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	Yes
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

For paving operations, the pavement shall be covered with curing compound within 45 minutes after the pass of the paving machine

Q9: What are your curing requirements for concrete pavement rehabilitation?

The application rate for finished concrete repairs is 1 gallons/150SF. If the concrete is to be overlaid with asphalt, then tack oil shall be used in place of white curing compound.

Q10: What are your curing requirements for concrete bridge decks?

The Contractor shall cure the concrete deck with wet burlap for at least 240 hours.

(1) The Contractor shall place uniformly saturated wet burlap on the concrete no later than 20 minutes after the finishing machine passes.

(2) The burlap shall be thoroughly wetted prior to placing it on the concrete. The burlap shall be kept continuously wet by means of a sprinkling or wetting system for the 10 days.

(3) The wet burlap shall be secured or weighed down so that it remains in contact with the concrete surface.

(4) After 96 hours, the Contractor may place white opaque polyethylene film over the wet burlap to reduce the amount of water needed.

After the 10 day wet cure, the Contractor shall apply an approved white pigment curing compound within 45 minutes of removing the wet burlap.

(1) The total rate of combined applications shall be a minimum of 1 Gal/150 SF of surface area.

(2) The Contractor shall cure the deck with the white pigment curing membrane for an additional 7 days. The Contractor may work on the bridge concrete rail during the 7 days provided caution is used to limit damage to the membrane.

After the completion of curing, the entire bridge deck and approaches are then longitudinally grooved.

(3) Curing compound shall not be applied to construction joints or reinforcing steel.

Q11: What are your curing requirements for colored concrete?

If the concrete is stained; such as medians, sidewalks, etc., we follow the manufacture recommendation on curing. Typically, a clear curing compound is used.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

Yes,

Please explain: See question 10.

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? It depends

Please explain: If the forms are stripped in less than 72 hours, then the edges shall be cured with a curing compound. If greater than 72 hours, then curing compound is not required.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? It depends

Please explain:

The following is from the specifications for forms: Falsework or bracing supporting concrete structures and forms supporting concrete floor slabs on girder bridges shall remain in place until tests show that the concrete has attained a compressive strength of at least 2,000 psi (14 Mg). In the absence of such tests, the requirements in Table 704.02 shall govern the length of time the falsework shall remain in place, exclusive of the time during which the air temperature is below 40°F (4°C) and the concrete is not protected. Table 704.02
 Minimum Formed Time Floor
 slabs..... 7 Days
 Walls..... 14 Days Columns
 7 Days Box Culvert
 Slabs..... 7 Days Do you require application of membrane curing compound after form removal? No additional covering or curing is required after the forms are removed if they were in place for at least 72 hours.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Yes,
 Comments No.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No

Q19: What types of lightweight materials were used for internal curing? What % was used?

NA

Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No

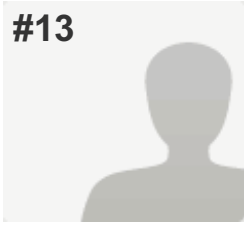
If yes, please share specifications and procedures:

When requested by the Contractor or the Department, the maturity method may be used. The maturity method will be performed in accordance with NDR C 1074 to determine the strength of concrete pavement for the purpose of early opening to traffic. Requests by the Contractor for use of the maturity method shall be on a project basis and shall be made in writing to the Engineer.

Q21: Any additional comments?

Respondent skipped this question

#13



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Monday, March 30, 2015 9:11:33 AM
Last Modified: Monday, March 30, 2015 11:10:23 AM
Time Spent: 01:58:49
IP Address: 170.142.177.41

PAGE 1

Q1: State Representative

Name	Jamie Waller
Agency	Tennessee Dept. of Transportation
State / Province	Tennessee
Email	jamie.waller@tn.gov

Q2: What type of membrane curing compounds do you allow? Water Based, Resin Based

Q3: Do you require different types of curing compounds for different applications? No

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds? Yes

Do you test field samples of membrane curing compounds for acceptance? No

Comments: The minimum application rate is stated as the manufacturers' recommendations.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Please include a link to your requirements and specifications:

Curing Compound QPL 12B is found at the following link below:
<http://www.tdot.state.tn.us/materials/reseval/docs/QualifiedProductsProcedures.pdf>
 TDOT Standard Specification 913.05 Liquid Membrane-Forming Compounds is found at the following link below:
http://www.tdot.state.tn.us/construction/2015_Spec_Book/TDOT_2015_Spec_Book_FINAL%20pdf.pdf

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

We use the manufacturer's recommended application rate. We verify the minimum rate by determining the coverage area in total square feet and determine how many gallons of compound are being poured. The rate is calculated and compared against what is recommended.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?**501.18 Curing**

Immediately after completing the finishing operations and as soon as marring of the concrete will not occur, cover and cure the entire surface of the newly placed concrete.

Where curing requires the use of water, ensure that sufficient water is available. Failure to provide a sufficient quantity of one of the curing materials specified in 913, or lack of water for wet-curing methods, shall be cause for immediate suspension of concreting operations. Do not leave the concrete exposed for more than 30 minutes between stages of curing or during the curing period.

Perform curing according to one of the following methods:

- A. Cotton or Burlap Mats
- B. Waterporrof Paper
- C. Impervious Membrane Method
- D. White Polyethylene Sheeting
- E. Curing in Cold Weather

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as normal concrete paving.

Q10: What are your curing requirements for concrete bridge decks?

604.23 Curing Concrete

Cure all concrete surfaces as specified below, except those surfaces protected by forms that remain in place 7 days or longer as specified in 604.19. Use curing materials that meet the requirements of 913. Begin curing on unformed surfaces immediately after the water sheen disappears and the surface finish is applied. On formed surfaces, begin curing immediately after removing forms.

When the temperature is expected to fall below 35 °F, protect the concrete as specified in 604.24.

Cure bridge decks and the top slabs of other structures located above the roadway subgrade elevation by using both the Membrane-Forming Compound Method and the Water Method. Use new burlap for each pour, except burlap may be reused on the same project if it is undamaged and deemed acceptable by the Engineer. The Contractor may cure all other concrete surfaces by either of the following methods.

A. Membrane-Forming Compound Method

B. Water Method

Q11: What are your curing requirements for colored concrete?

Same as normal concrete

Q12: Do you require the application of membrane curing compound after completion of wet curing?

It Depends,

Please explain:

TDOT Standard Spec 913.05 Liquid Membrane-Forming Compounds: Use either a Type 2 membrane or Type 1-D, Class B, membrane on bridge decks when applied in combination with the water method of curing.

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain:

501.19 Removing Forms The Contractor may remove forms once removal will not cause damage to the slab edges. Remove the forms carefully to avoid damaging the pavement. After the forms have been removed, cure the sides of the slab using one of the methods specified in 501.18. The Engineer will consider honeycombed areas to be defective work. Remove and replace all unsound material with satisfactory material at no cost to the Department. 501.18 Curing Immediately after completing the finishing operations and as soon as marring of the concrete will not occur, cover and cure the entire surface of the newly placed concrete. Where curing requires the use of water, ensure that sufficient water is available. Failure to provide a sufficient quantity of one of the curing materials specified in 913, or lack of water for wet-curing methods, shall be cause for immediate suspension of concreting operations. Do not leave the concrete exposed for more than 30 minutes between stages of curing or during the curing period. Perform curing according to one of the following methods: A. Cotton or Burlap Mats B. Waterporrof Paper C. Impervious Membrane Method D. White Polyethylene Sheeting E. Curing in Cold Weather

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: 604.23 Curing Concrete Cure all concrete surfaces as specified below, except those surfaces protected by forms that remain in place 7 days or longer as specified in 604.19. Use curing materials that meet the requirements of 913. Begin curing on unformed surfaces immediately after the water sheen disappears and the surface finish is applied. On formed surfaces, begin curing immediately after removing forms.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? Yes,
Comments
During concrete pavement placement, if excessive evaporation occurs, a light fog spray of water may be applied to aid in finishing. Added water to the surface of the concrete is not allowed using the hand method or mechanical method.

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Other No

Q19: What types of lightweight materials were used for internal curing? What % was used?

N/A

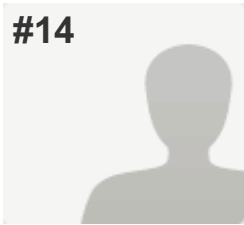
Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	No
Removal of Forms	No

Q21: Any additional comments?

Respondent skipped this question

#14



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Monday, March 30, 2015 10:50:42 AM
Last Modified: Monday, March 30, 2015 11:48:07 AM
Time Spent: 00:57:25
IP Address: 204.24.68.156

PAGE 1

Q1: State Representative

Name	John Staton
Agency	Michigan DOT
State / Province	Michigan
Email	statonj@michigan.gov

Q2: What type of membrane curing compounds do you allow?	Wax Based, Water Based, Resin Based, Linseed Oil
---	--

Q3: Do you require different types of curing compounds for different applications?	<p>Yes,</p> <p>If yes, please explain: Pavements: Pavement surface: White membrane ASTM C309 Type 2 Pavement base course: Transparent membrane ASTM C309 Type 1-D Class B Structures: Bridge decks: White pigment modified linseed oil ASTM C309 Type 2. Reflectance and dry time requirements do not apply. Other applications: Transparent membrane ASTM C309 Type 1-D Class B</p>
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Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds? Yes

Do you test field samples of membrane curing compounds for acceptance? No

Comments: Pavements: non-grooved surfaces: one coat of at least 1 gallon per 25 square yards
grooved surfaces: 2 coats of at least 1 gallon per 25 square yards each coat.
Second coat must dry sufficiently but do not allow more than 2 hours between coats.
Bridge decks: 1 gallon per 150 square feet.
Apply soaker hose, wet burlap and polyethylene cure after compound has dried. Maintain continuous wet cure for 7 days. Top surfaces other than bridge decks: 1 gallon per 150 square feet.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds No

Plastic Curing Blankets No

Burlap Curing Blankets No

Evaporation Retarders No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Grooved pavements: 2 coats of at least 1 gallon per 25 square yards each coat.

Bridges: 1 gallon per 150 square feet.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.) No

Surface Texture Yes

Climatic Conditions No

Q8: What are your curing requirements for concrete paving?

2 coats of at least 1 gallon per 25 square yards each coat.

Q9: What are your curing requirements for concrete pavement rehabilitation?

2 coats of at least 1 gallon per 25 square yards each coat.

Q10: What are your curing requirements for concrete bridge decks?

1 gallon per 150 square feet.

Q11: What are your curing requirements for colored concrete?

Per special provision. Refer to coloring system manufacturers recommendations.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? It depends

Please explain: Depends if forms are removed prior to minimum strength and 5 or 7 day cure period, depending on the application. If removing forms early, curing compound or wet cure of surface is required for remainder of cure period, depending application.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? It depends

Please explain: Cure surfaces by keeping them continuously wet for 5 or 7 days, depending on application, and until the concrete attains 70 percent of the minimum 28-day compressive strength. Alternatively, if the forms are removed prior to the above, a waterproof device or membrane curing compound must be immediately applied.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

If yes, what did you do to address it? If they do occur, it is most often surmised to be so... post-mortem. On occasion, ride quality or FWD could indicate curled or warped pavement in the event a forensic investigation is warranted.

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only Yes

Please share details of your experience - or a link to a report. Tried internal curing of ultra fast set pavement repair mixture via research at the University of Michigan.

Q19: What types of lightweight materials were used for internal curing? What % was used?

expanded shale.

Q20: Do you use the maturity method for any of the following:

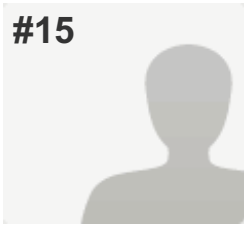
Opening to Traffic Yes

If yes, please share specifications and procedures: Only for pavement repairs.

Q21: Any additional comments?

Respondent skipped this question

#15

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Monday, March 30, 2015 9:21:45 AM**Last Modified:** Monday, March 30, 2015 3:28:14 PM**Time Spent:** 06:06:28**IP Address:** 164.110.221.225

PAGE 1

Q1: State Representative

Name	Mark Russell
Agency	Washington State DOT
State / Province	Washington
Email	russelm@wsdot.wa.gov

Q2: What type of membrane curing compounds do you allow?

Poly Alpha Methyl Styrene-Based, Wax Based, Water Based, Resin Based, Linseed Oil, Other (please specify)
Liquid membrane curing compound must meet the requirements of ASTM C309 Type 1 or 2, Class A or B

Q3: Do you require different types of curing compounds for different applications?

Yes,
If yes, please explain:
White pigmented curing compound (ASTM C309 Type 2) is required for certain applications (e.g. pavement, bridge decks). Other applications may use clear or white.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds? Yes

Do you test field samples of membrane curing compounds for acceptance? Yes

Comments: Curing compound products may be pre-approved. Each lot is sampled and tested and satisfactory test results are required prior to use. Testing requirements may be waived for small quantities in non-critical applications.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Minimum of one gallon per 150 square feet. There is no specific method to verify.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

Liquid membrane curing compound meeting ASTM C309 Type 2 (white) immediately following finishing. Minimum coverage of 1 gallon per 150 sf.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as concrete paving.

Q10: What are your curing requirements for concrete bridge decks?

Curing compound covered by white reflective sheeting or continuous wet curing. Concrete class 4000D requires both curing compound and wet curing.

Q11: What are your curing requirements for colored concrete?

Curing of colored concrete is done in accordance with manufacturer's requirements. A test panel is required prior to placing colored concrete on the project.

Q12: Do you require the application of membrane curing compound after completion of wet curing?	No
--	----

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: Forms must stay in place a minimum of 12 hours after concrete placement. Curing compound must be applied after removal of forms.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? It depends

Please explain: Curing compound or wet curing is required after form removal.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No

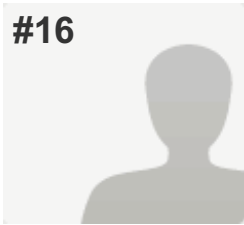
If yes, please share specifications and procedures:

WSDOT concrete pavement maturity specification is located at:
[http://www.wsdot.wa.gov/publications/fulltext/projectdev/gsp/pdf/5-05.3\(17\).OPT1.GR5.PDF](http://www.wsdot.wa.gov/publications/fulltext/projectdev/gsp/pdf/5-05.3(17).OPT1.GR5.PDF)

Q21: Any additional comments?

Respondent skipped this question

#16

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Monday, March 30, 2015 12:50:30 PM**Last Modified:** Monday, March 30, 2015 4:15:49 PM**Time Spent:** 03:25:19**IP Address:** 63.66.64.246

PAGE 1

Q1: State Representative

Name	Patricia Miller
Agency	PennDOT
State / Province	pennsylvania
Email	pimiller@PA.GOV

Q2: What type of membrane curing compounds do you allow?

Other (please specify)

We are currently working on a specification to allow poly Alpha Methyl Styrene based curing compounds. Section 711 - Pub 408 lists the types of curing compounds available to use in 711.1 CURING AND PROTECTING COVERS— (a) White Polyethylene Sheeting. AASHTO M 171, except minimum tensile strength requirements are as follows: Machine Direction Cross Machine Direction 7.0 lbs/lin. in. 7.0 lbs/lin. in. (b) White Polyethylene Sheeting—Burlap-Backed. 1. White Polyethylene Sheeting—natural burlap backed. AASHTO M 171. 2. White Polyethylene Sheeting—synthetic burlap backed. AASHTO M 171, except weight of synthetic burlap backed white polyethylene sheeting is 8.0 ounces per square yard. (c) White Polypropylene Sheeting—Polypropylene Fiber Backed. 1. White Polypropylene Sheeting—polypropylene fiber backed, with maximum moisture loss of 113 pounds per 1,000 square feet in 72 hours when testing according to ASTM C 156. 2. Daylight reflectance of white polypropylene sheeting is at least 70% when measured according to ASTM E 1347. 3. White Polypropylene Sheeting—polypropylene fiber backed, weighing not less than 6.0 ounces per square yard. 4. A white sheeting layer with a nominal thickness of 0.0040 inch and not less than 0.0030 inch. 5. Minimum strength requirements are as follows: Grab Tensile Strength Grab Tensile Elongation Puncture 120 lbs 50% 65 lbs ASTM D 4632 ASTM D 4632 ASTM D 4833 (d) Burlap. AASHTO M 182, Class 1. (e) Insulating Mats. Treated new wood fibers, rock wool, or glass fibers, completely enclosed on all sides within

fibers, completely enclosed on all sides within weather-proof covers of asphalt-saturated kraft crepe or polyethylene sheeting, and conforming to the following requirements: Asphalt-saturated crepe covers manufactured from extra heavy, two-ply, kraft crepe, totaling not less than 30 pounds per 1,000 square feet, on the weather side and of kraft paper or kraft crepe, of not less than 15 pounds per 1,000 square feet, on the reverse side. Polyethylene covers manufactured from sheeting of not less than 6 mils normal thickness on the weather side and of not less than 4 mils normal thickness on the reverse side. Fiber bonded to the covers of insulating mats over 24 inches in width, to prevent bunching of the mats during storage, shipping, or handling. (f) Foam Insulation. Molded, extruded, or spray-applied polyurethane or molded or extruded polystyrene, forming closed-cell foam insulation, with the cells uniformly distributed and conforming to the following requirements: Water absorption, percent by volume, tested according to ASTM D 2842—3.0 max. Density, lbs/cu. ft., tested according to ASTM D 1622—1.0 - 6.0 (g) Certification. Section 106.03(b)3 711.2 CURING COMPOUNDS— (a) Liquid Membrane-Forming Curing Compound, Clear or White. AASHTO M 148, Type 1-D, clear or translucent and containing a red fugitive dye; Type 2, white pigmented. Type 1-D and Type 2 to be certified, as specified in Section 106.03(b)3. (b) Liquid Membrane-Forming Curing Compound, Black. Emulsified asphalt, (Class E-1, Bulletin 25) or cut-back asphalt, (Class RC-70, ASTM D 2028), either conforming to the performance requirements of ASTM C 309 for Type 4. (c) Bridge Deck Intermediate Curing Compound. A monomolecular film, composed of a film-forming fatty alcohol, capable of retarding moisture evaporation from concrete. Use material from a manufacturer listed in Bulletin 15. (d) Certification. Section 106.03(b)3 Linseed oil can be used as a protective coating - Section 503 of our Pub 408: SECTION 503—PROTECTIVE COATING FOR CEMENT CONCRETE PAVEMENT 503.1 DESCRIPTION—This work is the application of protective coating, to concrete pavements and shoulders. 503.2 MATERIAL—Boiled Linseed Oil, AASHTO M 233, from a manufacturer listed in Bulletin 15. Certify as specified in Section 106.03(b)3. 503.3 CONSTRUCTION— (a) General. Thoroughly dry and clean concrete surfaces of all foreign matter, which would prevent protective coating penetration, adhesion, or drying. Allow a minimum of 28 days to elapse before applying protective coating on surfaces cured with white membrane curing compound. Allow 7 days to

elapse after removing curing covers and before applying protective coating on all other types of curing methods. Apply the protective coating before subjecting the concrete surface to deicing chemicals. (b) Application. Apply protective coating according to manufacturer recommendations. At a minimum, apply in two coats, at a rate of 1 L/11 m² (0.02 gallon per square yard) for each coat. Apply, as directed, by pressure-spray equipment, by portable hand spray equipment, by brushing, or by a combination of methods, to ensure complete coverage of treated concrete surfaces. Apply in weather suitable for drying when the air temperature and concrete surface temperature are between 2 °C and 40 °C (35F and 100F). Unless otherwise recommended by the manufacturer, allow the first application to dry for a period of at least 24 hours before the second application. If the initial application is made on concrete surfaces carrying traffic, close these surfaces for a period of at least 4 hours, until penetration is complete and tackiness has disappeared. After the second application, close surface to traffic for a period of at least 6 hours or until tackiness has disappeared and no pickup results from use. (c) Safety Precautions. Protect traffic, workers, and concrete surface against the occurrence of fire, if in the presence of flammable and volatile mineral spirits blended into the protective coating. Before using the treated pavement surface, satisfactorily correct slippery pavement conditions, other hazards, or inconvenience to traffic, resulting from the protective coating application as directed. Linseed oil can also be used as a protective coating for reinforced concrete surfaces - section 1019 of our Pub 408 : 1019.1 DESCRIPTION— This work is applying a protective coating on concrete surfaces. 1019.2 MATERIAL— (a) Boiled Linseed Oil. Section 503.2 Certify as specified in Section 106.03(b)3. 1019.3 CONSTRUCTION— (a) Boiled Linseed Oil. 1. Areas and Preparation. 1.a General. Thoroughly dry and clean the surfaces of dirt, debris, oil, grease, and foreign matter that would prevent protective coating penetration, adhesion, or drying. Do not use membrane-forming curing compound where linseed oil treatment is to be applied. Apply the protective coating as soon as possible after completion of a structure or portion of a structure.

Q3: Do you require different types of curing compounds for different applications?

Yes,

If yes, please explain:

For Concrete Paving- section 501 in our

Publication 408: (I) Curing Concrete. Cure the entire surface immediately after finishing operations have been completed. Do not mar the concrete surface. After removing forms and correcting honeycombed areas, cure the sides with the same method as the surface. When using covers, secure over the entire surface and sides. The Representative will suspend concrete operations immediately if sufficient curing is not provided. Cure by the same method throughout the work unless directed to change by the Inspector. Have material available for emergency curing. If normal curing is delayed, apply an intermediate monomolecular film curing agent to all cement concrete patches before normal curing. Apply the monomolecular film in a light-fog application, using a pressure spray tank with an adjustable nozzle. Use a water-to-curing-agent ratio and rate of application both according to the manufacturer's recommendations. Agitate the solution before each application. Apply the curing agent in a continuous film, immediately after finishing and texturing operations are completed on any area. Do not provide any additional finishing after application of the monomolecular film. Apply additional applications as required, if surface drying is taking place and curing covers have not been placed. After application of the monomolecular film, provide normal curing as specified.

1. Normal Curing. Apply curing materials and maintain them as specified below, for a period of 96 hours for normal strength concrete or 72 hours for HES concrete. The Contractor may use methods other than those described below to protect and cure joints, if the procedure and materials are acceptable. The Representative may require a change in method if unsatisfactory results are obtained.

1.a White Polyethylene Curing. Use sheeting wide enough to cover the pavement surface and sides. Provide lengths consistent with pavement joint spacing. Overlap sheets a minimum of 12 inches and secure sides and seams to form a tight seal. After form removal, fold sheeting down over the sides for the full pavement depth, then secure with suitable material.

1.b White Polyethylene Burlap-Backed Curing. Use sheeting wide enough to cover the pavement surface and sides. Provide lengths consistent with pavement joint spacing. Overlap sheets a minimum of 12 inches, then secure sides and seams to form a tight seal. Saturate the burlap side with water, then place and secure with the burlap side down. After form removal, fold sheeting down over the sides for the full pavement depth, then secure with suitable material.

1.c White Membrane Forming Curing Compound. The Representative will allow this method of curing if the air temperature is above

method of curing if the air temperature is above 40F at the time of application and the air temperature is forecasted to remain above 40F a period of 4 hours after application. Following the final finishing, immediately after free water has left the pavement surface and while the surface is still damp, seal exposed concrete areas with an application of curing compound. Apply at a rate of 1 gallon per 150 square feet \pm 10% of surface area, or as directed. Using a self-propelled mechanical spreader, apply in a fine mist, without marring the concrete surface. Use atomizing type spraying equipment, equipped with a tank agitator providing continual compound agitation during application. Provide proper calibration to allow accurate control of the amount of material being placed. Use a hood to protect the spray device against the wind and control so the spray overlaps transversely 50%, to produce two coverages of a continuous, uniform membrane. Do not drip curing compound on the pavement. If rain falls on newly coated pavement before the film has dried sufficiently to resist damage or if film is damaged in any way before the pavement is cured, apply a new coat immediately, in an amount equal to the original specified application. After form removal, apply a uniform coat to the sides, at the rate specified for the surface. Manual spraying equipment may be used for spraying the sides and for any small or irregular areas not reached by surface spraying equipment. The Contractor may cure joints and protect them by use of tape, a strip of white polyethylene, or white polyethylene backed with burlap. During the curing period, to prevent moisture loss from concrete, in and adjacent to joints, use strips 3 inches to 6 inches wide, securely held in place on the pavement surface by an acceptable method, or place saturated rope strands in the joints. Just before the curing compound application or reapplication, carefully place rope without damaging or distorting the joints. Keep workmen, materials, and equipment off the membrane film during curing, unless adequate precautions are taken to protect the film.

1.d Burlap Curing. Place burlap in double-thickness by overlapping each strip one-half its width on the pavement surface. Keep this covering saturated with water for the full curing period. After sides are exposed, fold burlap down over the sides and secure with suitable material.

1.e White Polypropylene Fiber-Backed Curing. Use sheeting wide enough to cover the pavement surface and sides. Provide lengths consistent with pavement joint spacing. Overlap sheets a minimum of 12 inches, then secure sides and seams to form a tight seal. Saturate the burlap side with water, then place and secure with the burlap side down. After form removal, fold

sheeting down over the sides for the full pavement depth, then secure with suitable material. 1.f Black Membrane-Forming Curing Compound. Liquid Membrane-Forming Curing Compound, Black, may be used, provided the cement concrete pavement will be overlaid and is not accessible to traffic before the surface course is placed. Apply at a rate not to exceed 0.015 gallon per square yard to produce a uniform continuous film. Discontinue use of the compound if it becomes unsatisfactory as a curing agent; and resume curing by other methods, as specified. 2. Cold Weather Curing. If the forecasted air temperature during concrete curing is expected to fall below 40F, place high-low thermometers on the concrete surface and monitor concrete curing temperatures. Protect the pavement surface and sides to effectively maintain a temperature of not less than 40F for at least 4 days and until the concrete achieves a strength of 3,000 pounds per square inch. If at any time during this period the high-low thermometer falls between 40F and 35F, extend the cure period by an additional day. If at any time during the curing period the high-low thermometer temperature falls below 35F, the concrete will be considered defective. Remove and replace defective pavement as specified in Section 501.3(t) at no cost to the Department. For Concrete Structures - section 1001 of our Pub 408: (b) Concrete Curing Material and Admixtures. ~~→~~ Curing and Protecting Covers—Section 711.1 ~~→~~ Curing Compounds—Section 711.2(a) (clear only) and 711.2(c) ~~→~~ Concrete Admixtures—Section 711.3 Do not use admixtures containing chloride salts in bridge deck concrete. (p) Curing and Protection of Concrete. Begin curing as soon as the concrete has been placed and is sufficiently hardened. Cure concrete as specified in Section 1001.3(p) 3. Do not count as a curing day, a day on which the curing temperature drops below 50F at any time during that day, except for flood curing of footings. For bridge decks, during day 1 through day 7, do not count as a curing day, a day on which the curing temperature drops below 50F. During day 8 through day 14, do not count as a curing day, a day on which the curing temperature drops below 40F. If at any time during the curing period, the curing temperature falls below 35F, the Department will consider the work unsatisfactory and will reject it. 3. Normal Curing and Protection. 3.a Liquid Membrane-Forming Curing Compound. For surfaces cured by the membrane method, finish before application of the curing compound. During the finishing period, and until forms are removed, protect the concrete by the water method of curing. Apply the compound in two coats, by spraying, to provide a continuous

coats, by spraying, to provide a continuous, uniform membrane. For each coat, apply at least 1 gallon of compound per 300 square feet of concrete. On formed surfaces, apply the first coat immediately after stripping forms, and after acceptance of the concrete finish. If the surface is dry, soak the concrete with water, and apply the curing compound just as the surface film of water disappears. Apply the second application after the first application has set. During spray-curing operations, keep unsprayed surfaces wet with water. Apply compound to unformed surfaces immediately after finishing operations have been completed and after the surface film of water has disappeared. Do not apply membrane-curing compound to construction joint surfaces. Protect exposed steel during application of curing compounds. Water cure these areas, as specified in Section 1001.3(p)3.b. If membrane is damaged or membrane peels from concrete surfaces, repair immediately.

3.b Water Curing. Use a fog-spray, perforated pipe or hose watering system to keep forms and curing covers saturated during the curing period. For curing and protecting covers on endwalls, inlets, manholes, copings, bridge seats, and similar miscellaneous concrete, keep saturated using an acceptable method. Flood curing of concrete footings will be allowed if the water temperature is 40F or above. Use covers of either burlap-backed, white polyethylene sheeting, or a double thickness of burlap. For bridge decks, use only a double thickness of burlap. Use one type of cover for the duration of curing, unless a change in type is accepted. Place covers without marring the finished surface. Secure covers to prevent their being lifted and displaced. Saturate the covers prior to use and keep in a saturated condition for the curing period. Cure for a minimum of 7 days; cure bridge decks for a minimum of 14 days; when High Early-Strength concrete is used, cure for a minimum of 3 days. Cure for at least the minimum time stated above and until minimum compressive strengths are attained, as specified in Section 704.1(d)4.b, as determined from molded cylinder specimens tested according to PTM No. 604. As soon as the concrete has hardened sufficiently, place curing covers on the exposed concrete. If the double thickness of burlap method is used, place burlap so each strip overlaps one-half its width. As soon as forms or sections of forms are loosened or removed, cover the exposed concrete surfaces with pre-saturated curing covers, then keep saturated for the remainder of the curing period.

3.c Bridge Deck Intermediate Curing. Apply an intermediate monomolecular film curing agent to all concrete bridge decks. If directed, apply additional applications to prevent surface drying

before placement of curing covers. Apply the monomolecular film in a light-fog application, using a pressure spray tank with an adjustable nozzle. Use a water-to-curing agent ratio and rate of application, both according to the manufacturer's recommendations. Agitate the solution before each application. Apply the monomolecular film in a continuous film, immediately after the final finishing operation is completed on any area. Do not perform finishing after application of the curing agent. After application of the monomolecular film, complete curing using water.

4. Cool Weather Curing and Protection. If the forecasted air temperature during concrete curing is expected to drop to 50F but not below 35F, or if concrete is placed at an air temperature below 50F but above 35F, follow the requirements for normal curing and protection. In addition, cover burlap with polyethylene sheeting; and place insulating mats, as specified in Section 711.1(e), or place hay or straw, to a depth of at least 12 inches, over concrete not covered by forms. Keep the insulation mats, hay, or straw in place as required to maintain proper curing temperatures.

5. Cold Weather Curing and Protection. If the forecasted air temperature is expected to drop to 35F or lower, during concrete curing, or if concrete is to be placed at air temperatures below 35F, comply with the requirements specified for normal curing and protection, and use heating and/or insulation, as necessary, to maintain the curing temperature for the duration of the curing period. If forms are removed before the end of the curing period, provide additional heating or insulation, as necessary, to maintain the curing temperature for the remainder of the curing period. After the concrete has cured for the required length of time, gradually lower its temperature to that of the surrounding air. Do not allow the temperature of the concrete to drop more than 20F in any 24-hour period for the first 3 days after the curing period. Continue to record the air temperature and curing temperature during this 3-day period.

5.a Heating. Furnish and place sufficient canvas and frames, or another type of housing to enclose and protect the fresh concrete and forms. Before placing the concrete, furnish necessary fuel and sufficient acceptable heating apparatus; preferably steam-heating equipment. Keep the air surrounding the fresh concrete at a temperature above 50F but not more than 80F. Keep the concrete covers moist during the curing period.

5.b Insulating Mats or Foam Insulation. Insulating mats or foam insulation, as specified in Section 711.1(e) and Section 711.1(f), respectively, may be used to maintain curing temperature. Apply the mat insulation tightly against the forms. Seal the

mat insulation tightly against the forms. Seal the ends of the mat to exclude air and moisture. Overlap the insulation on previously placed concrete by 1 foot. When using steel forms, place the insulation tightly against the forms. In addition, insulate the framework of the steel forms, either by the use of the insulating mat material or foam insulation, or by draping polyethylene sheets or tarpaulins over the exposed members, to effectively reduce the heat loss. Immediately repair tears in the mat liner. Where tie rods extend through the insulated form, place close-fitting washers on the rod against the mat and secure, to provide adequate protection. Cover the tops of piers, abutments, and similar concrete surfaces with the insulation mat, tightly secured to prevent loss of heat. For the areas around protruding reinforcement that cannot be protected with the insulation mat, cover with a double thickness of burlap. Cover with enough straw or hay to prevent loss of heat from the concrete during the curing period. In addition, cover insulated areas with tarpaulins. Do not insulate bridge decks unless the underside is enclosed and preheated before the concrete is placed and the heat is maintained at the specified temperature during the entire curing period. When foam insulation is used, use a minimum thickness of 1 1/2 inches. The Contractor may use cracked molded foam boards only after repairs are made with an adhesive. Keep the insulation protection in place for the full curing period, but do not allow the concrete temperature to rise above 160F. Do not expose fresh concrete to subfreezing temperatures. Provide standby heat, if directed. Failure to properly place the insulation material or failure to maintain the necessary concrete temperature will be cause for the Representative to deny continued use of the material on the project, for curing in cold weather, and require the use of heating, as specified in Section 1001.3(p)5.a.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds? Yes

Do you test field samples of membrane curing compounds for acceptance? No

What is the minimum application rate for testing?
Please answer in comments box below. Yes

Comments: We normally do not test all field samples but we do pull a random amount thru our QA section for testing. If there seems to be a problem with the material in the field, samples are pulled and sent in for testing. For concrete paving - white membrane forming curing compound - Apply at a rate of 1 gallon per 150 square feet \pm 10% of surface area, or as directed

Q5: Do you have an Approved/Qualified Products List for any of the following?

Please include a link to your requirements and specifications: See above for specifications.....queston 1.

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Apply at a rate of 1 gallon per 150 square feet \pm 10% of surface area, or as directed. we do not officially verify the minimum rate but we pay attention to how much is used compared to area of pavement.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.) No

Surface Texture No

Climatic Conditions No

Q8: What are your curing requirements for concrete paving?

see question # 3

Q9: What are your curing requirements for concrete pavement rehabilitation?

(j) Curing of Concrete. For normal strength patches, immediately after finishing operations have been completed, cover and cure the patch surface as specified in Section 501.3(l).

For accelerated patches, cure concrete as specified in Section 501.3(l)1.b or using approved curing insulation materials. Apply white membrane-forming curing compound as specified in Section 501.3(l)1.c. The Contractor

may use black membrane-forming curing compound provided the patch area will not be accessible to traffic before placement of a surface course. Discontinue use of black membrane-forming curing compound if it performs unsatisfactorily as a curing agent, and resume curing by other methods as specified. Cure test cylinders under the same conditions as the concrete pavement patch. Provide insulation or heating of patches if the ambient temperature

drops below 80F during the curing operation. Control the curing temperature and monitor at least hourly to ensure that the concrete pavement patch does not experience a curing temperature change in excess of 40F within any 1-hour period during the curing operation. If a change in curing temperature in excess of 40F occurs in the concrete pavement patch within any 1-hour period, the work will be considered defective.

Q10: What are your curing requirements for concrete bridge decks?

see question # 3.

Q11: What are your curing requirements for colored concrete?

No different than what we normally require - for either paving or structures.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

Please explain:

SECTION 1019—PROTECTIVE COATING FOR REINFORCED CONCRETE SURFACES 1019.1 DESCRIPTION—This work is applying a protective coating on concrete surfaces. 1019.2 MATERIAL— (a) Boiled Linseed Oil. Section 503.2 Certify as specified in Section 106.03(b)3. (b) Epoxy Resin (For Abutments, Pier Caps, and Endwalls). A two-component, epoxy resin system, as follows: 1. General. An epoxy-type base polymer, thermosetting resin as follows: Composed of 100% reactive constituents (condensation products of the reaction of epichlorohydrin with bisphenol A). Essentially pure, diglycidyl-ether of bisphenol A, containing no more than trace amounts of hydrolyzable chlorine. Epoxide equivalent between 465 and 530. Reacting system consisting of a blend of condensation polymers of dimerized and trimerized unsaturated, fatty-acids and an aliphatic polyamine. Pigmentation added so the cured coating conforms to the Federal Color Standard 595, and as indicated. Nonskid material added, if directed 2. Physical Requirements of the Mixed Epoxy System. Viscosity—300 centipoises to 700 centipoises at 72F Pot Life—a minimum of 7 hours at 75F Minimum solids content—48% A cured system that does not exhibit amine blushing or sweating. When the pigmented finished coats are tested for abrasion, according to ASTM D 968, a minimum of 25 L of sand is required to

abrade a 1-mil thickness of coating. A 2 1/2-mil dry film thickness of the coating, tested by ASTM D 522, is required to pass a 1/8-inch diameter mandrel test, without splitting the film or causing loss of bond. 3. Sampling. A representative sample of each component will be taken for the required tests, either from a well blended bulk lot, before packaging or by withdrawing thief samples from no less than 5% of the containers comprising the lot or shipment. Unless the samples show evidence of variability, they may be blended into a single composite sample to represent that component. Package materials may be sampled by random selection of containers or each component from each lot. The entire lot of both components may be rejected if samples fail to meet any specified requirements. 4. Packaging and Marking. Furnish the two components in separate containers that are nonreactive with the contained materials. If directed, provide a container size so the recommended final mixture proportions can be obtained by combining one container of a component with one or more containers of the other component. Have containers marked as base polymer and reacting system, showing the mixing directions and usable temperature range. Have each container marked with the name of the manufacturer, the lot or batch number, the date of packaging, pigmentation, if any, and the quantity in pounds and gallons. Indicate the potential hazards on the package, according to the Federal Hazardous Products Labeling Act. 5. Certification. If directed, certify, as specified in Section 106.03(b)3. Provide either a copy of the manufacturer's dated test report or a statement, accompanied by a copy of the dated test results, showing the system has been sampled and tested. (c) Penetrating Sealers (For Reinforced Concrete Substructure Surfaces). Furnish a penetrating sealer from a manufacturer listed in Bulletin 15 as follows: Silicates in Water. Epoxies Dispersed in Water. Only use on surfaces that the sealer does not totally encapsulate the structural unit being treated. Organo-Silicon Compounds in Solvent. Resins in Mineral Spirits. Certify as specified in Section 106.03(b)3. (d) Penetrating Sealers (For Bridge Superstructure). A one-component, penetrating sealer material, composed of a minimum of 40% silane or siloxane material, with no petroleum distillates meeting the following properties: Water Absorption. The final average percent water absorbed, for concrete coated with the protective sealer, not greater than 20.0% of the final average percent water absorbed by the uncoated reference concrete. Moisture Vapor Transmission. The final average percent moisture loss, for concrete coated with the protective sealer. not

less than 75.0% of its final average percent water absorption. Chloride Ion Penetration. The final average absorbed chloride ion content, for concrete coated with the protective sealer, not greater than 15.0% of the final average absorbed chloride ion content of the uncoated reference concrete. Durability. The protective sealer does not show any signs of weathering, discoloration, or deterioration after 6 months of exposure to atmospheric conditions. Certify as specified in Section 106.03(b)3. 1019.3 CONSTRUCTION—

(a) Boiled Linseed Oil. 1. Areas and Preparation. 1.a General. Thoroughly dry and clean the surfaces of dirt, debris, oil, grease, and foreign matter that would prevent protective coating penetration, adhesion, or drying. Do not use membrane-forming curing compound where linseed oil treatment is to be applied. Apply the protective coating as soon as possible after completion of a structure or portion of a structure. 2. Application. Section 503.3(b) 3. Safety Precautions. Section 503.3(c) (b) Epoxy Resin. 1. Substructures (Subject to Staining). If indicated, apply epoxy resin protective coating as follows: 1.a Surface Preparation. Clean sound, dry, new concrete surfaces, of laitance or other potential bond-inhibiting matter. Do not apply epoxy until 28 days after placing concrete, unless allowed to apply sooner. Do not use membrane-forming curing compounds where epoxy treatment is to be applied. Clean old concrete surfaces of oil, grease, and potential bond-inhibiting matter by acid etching, using a 10% to 15% muriatic-acid solution. Spread the acid solution and allow it to react for 3 minutes to 5 minutes or until bubbling has subsided. Flush the surface with clear water and allow to dry. Where, in the Representative's opinion, acid etching is insufficient to clean the concrete, sandblast or use another acceptable method of mechanical abrading. Sandblast steel surfaces until bright metal is exposed. Then immediately apply the protective coating to prevent the reoccurrence of oxidation. 1.b Mixing. Measure and mix, as recommended by the manufacturer of the epoxy, in a clean mixing container. Thoroughly mix the epoxy using a 400 rpm to 600 rpm (low speed, ± 2-inch) electric drill, and paddle-type mixer. After mixing, let the material stand for an induction period of one hour before application. 1.c Application. Apply the mix by brush, roller, or spray. If applied by roller, use a first-quality, long-nap roller for rough surfaces and a short-nap roller for smooth surfaces. If applied by spray, use an externally atomized spray gun. For spray application, use a thinner of the type and quantity recommended by the manufacturer of the epoxy. Apply two thin,

uniform coats of the mixed material, each approximately 2 mils to 3 mils dry film thickness (4 mils to 5 mils wet thickness). Apply the second coat 24 hours after the application of the first coat. Use a rate of cover recommended by the manufacturer of the epoxy. Apply at temperatures between 60F and 90F. (c) Penetrating Sealers. 1. Substructures. 1.a Surface Preparation. Thoroughly dry and clean the surfaces of dirt, debris, oil, grease, and foreign matter that would prevent protective coating penetration, adhesion, or drying. 1.b Application. Apply penetrating sealer, which does not discolor the concrete, to areas indicated according to the manufacturer's instructions. 2. Bridge Superstructure. Provide a penetrating sealer meeting the material requirements of Section 1019.2(d) and apply according to the manufacturer's recommended application procedures to exposed concrete surfaces of bridge decks; curbs, sidewalks, and divisors; and to inside and top surfaces of barrier. Apply the penetrating sealer after the completion of the specified concrete wet cure period, followed by an initial drying period of a minimum of 14 days after the wet curing period and the concrete surface is dry.

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? Yes

Please explain: Section 501 of Pub 408 - Removal of Forms. Do not remove forms from freshly placed concrete until it has set. Remove the forms carefully to avoid pavement damage.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? No

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Respondent skipped this question

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No

Q19: What types of lightweight materials were used for internal curing? What % was used?

N/A

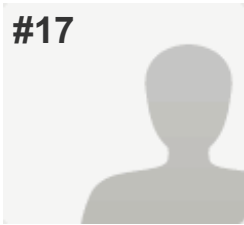
Q20: Do you use the maturity method for any of the following:

If yes, please share specifications and procedures:	maturity meter is used to estimate compressive strength. PTM No. 640 is the test method used.
---	---

Q21: Any additional comments?

Respondent skipped this question

#17

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Tuesday, March 31, 2015 9:15:55 AM**Last Modified:** Tuesday, March 31, 2015 11:06:37 AM**Time Spent:** 01:50:42**IP Address:** 205.174.143.2

PAGE 1

Q1: State Representative

Name	Drew Waldrop
Agency	Alabama Department of Transportation
State / Province	AL
Email	waldropa@dot.state.al.us

Q2: What type of membrane curing compounds do you allow?	Poly Alpha Methyl Styrene-Based, Wax Based, Water Based, Resin Based, Linseed Oil
---	---

Q3: Do you require different types of curing compounds for different applications?	Yes, If yes, please explain: All compounds must be ASTM C309, Class A. Concrete pavement requires Type 2, white pigmented.
---	---

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No
Comments:	N/A. All concrete curing cpd's are tested & approved via NTPEP.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No

Please include a link to your requirements and specifications:

Approval Requirements:
<http://www.dot.state.al.us/mtweb/Testing/M SDSAR/doc/pro/II30ProcedureforEvaluation andMaintenanceFebruary2010.pdf>
 Specification:
<http://www.dot.state.al.us/conweb/doc/Specifications/2012%20GASP%20Summary/12-0356.pdf> Spec Book (for additional language, not covered in 12-0356):
<http://www.dot.state.al.us/conweb/doc/Specifications/2012%20DRAFT%20Standard%20Specs.pdf>

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Min of 1 gal/100 sf for pavement. Inspectors monitor application.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	No
Climatic Conditions	No
Other	Yes

Please explain:

Paving: 1 gal/100 sf Other applications: 1 gal/200 sf

Q8: What are your curing requirements for concrete paving?

(m) CURING.

1. DURATION OF CURING.

Immediately after the finishing operations have been completed and as soon as marring of concrete will not occur, the entire pavement surface shall be cured for a minimum period of 72 hours.

2. OPTIONAL CURING METHODS.

The Contractor shall cure the concrete by either placing an impervious membrane or by moist curing. The curing method chosen by the Contractor shall be sufficient to prevent plastic shrinkage cracking.

a. Curing by Using an Impervious Membrane.

The impervious membrane shall meet the requirements given in Section 830.

The impervious membrane material shall be applied in accordance with the requirements given in Section 830 except that the rate of application shall be a minimum of 1 gallon per 100 square feet of surface area or a greater rate if recommended by the manufacturer. The impervious membrane material shall be applied under pressure by mechanical sprayers. Spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be thoroughly mixed. During application, the compound shall be stirred continuously by mechanical methods. Hand spraying of areas of irregular widths or shapes and on surfaces exposed by form removal will be permitted. When hand spraying is used the membrane material shall be applied in two applications.

The impervious membrane shall not be applied to the inside faces of joints to be sealed.

b. Moist Curing

Moist curing shall be either by fog spraying or by saturated burlap or burlap sheeting in accordance with the following.

- FOG SPRAYING:

Fog spraying shall be done with nozzles or sprinklers designed for this purpose. When using this method, the Contractor shall maintain a complete and continuous moist condition of the concrete surface. Intermittent fog spraying is not acceptable. Care shall be taken that erosion of the surface does not occur.

- BURLAP OR BURLAP SHEETING:

Saturated burlap or saturated white-burlap-polyethylene sheeting may be used for curing. The burlap and white-burlap-polyethylene sheeting shall be furnished in accordance with the requirements given in Section 830. These curing materials shall be clean and free from any injurious substances that can cause deleterious effects to the concrete or cause discoloration. The burlap and burlap sheeting shall be completely saturated before being placed on the concrete and shall be maintained in that condition for the entire curing period. All edges of burlap and burlap sheeting shall extend at least 18 inches beyond the concrete surface. Where two individual sheets join, their edges shall overlap at least 12 inches. All edges and overlaps shall be secured to ensure that the concrete surface is completely covered during the entire curing period. The burlap material shall be kept in contact with the concrete surface at all times. Alternate cycles of wetting and drying will not be allowed.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as concrete pavement, except that traffic may be opened back up as soon as 6 hours, depending on cylinder strengths.

Q10: What are your curing requirements for concrete bridge decks?

Saturated burlap or saturated white-burlap-polyethylene sheeting may be used for curing. The burlap and white-burlap-polyethylene sheeting shall be furnished in accordance with the requirements given in Section 830. These curing materials shall be clean and free from any injurious substances that can cause deleterious effects to the concrete or cause discoloration. The burlap and burlap sheeting shall be completely saturated before being placed on the concrete and shall be maintained in that condition for the entire curing period. All edges of burlap and burlap sheeting shall extend at least 18 inches beyond the concrete surface. Where two individual sheets join, their edges shall overlap at least 12 inches. All edges and overlaps shall be secured to ensure that the concrete surface is completely covered during the entire curing period. The burlap material shall be kept in contact with the concrete surface at all times. Alternate cycles of wetting and drying will not be allowed.

Q11: What are your curing requirements for colored concrete?

No special requirements.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain:

(o) REMOVAL OF FORMS. Forms shall not be removed from freshly placed concrete until it has set for at least 12 hours, except auxiliary forms used temporarily in widened areas. They shall be removed carefully so as to avoid damage to the pavement. After the forms have been removed, the ends of all joints shall be cleaned, after which the sides of the slab shall be covered with earth or other approved curing agent.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? No

Please explain:

Form removal is dependent upon concrete set time

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,

Comments

We require the use of a monomolecular evaporation barrier OR continuous fogging after screeding takes place. If MEB is used, it must be applied at a min rate of 1 gal/200 sf.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No
Other	No

Q19: What types of lightweight materials were used for internal curing? What % was used?

N/A

Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No

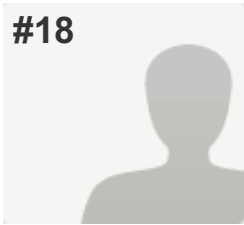
If yes, please share specifications and procedures:

Only in pavement and prestress operations:
 2. MATURITY METERS. "Maturity Meters" may be proposed only for use in estimating the compressive strength of the concrete for opening the pavement to traffic. The use of the maturity meters shall conform to the requirements given in ALDOT-425, "Maturity Method to Determine Early-Age Strengths of Concrete". The maturity meters used in establishing the Strength-Maturity relationship shall be the same ones used in estimating the early age compressive strength of the concrete in the pavement. The manufacturer's serial number of the maturity meter shall be shown on each strength-maturity relationship submitted to the Engineer. When verification tests indicate the strength-maturity relationship is invalid, maturity testing shall be discontinued until a new strength-maturity relationship is developed. Compressive strength by testing cylinders shall be used for the determination of the early age compressive strength until the Contractor completes testing to reestablish the correlation between the early age compressive strength and the maturity meter readings.
 ALDOT-425:
http://www.dot.state.al.us/mtweb/Testing/testing_manual/doc/pro/ALDOT425.pdf

Q21: Any additional comments?

None

#18

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Tuesday, March 31, 2015 11:39:56 AM**Last Modified:** Tuesday, March 31, 2015 11:58:36 AM**Time Spent:** 00:18:39**IP Address:** 199.90.35.12

PAGE 1

Q1: State Representative

Name	Richard Burley
Agency	NCDOT
State / Province	NC
Email	rburley@ncdot.gov

Q2: What type of membrane curing compounds do you allow?

Wax Based, Water Based,
Other (please specify)
Polyethylene Film Wet Burlap Water Liquid membrane curing compounds shall meet AASHTO M 148, except that when tested in the water retention test described in AASHTO T 155 the curing compound shall restrict the loss of water in the test specimen at the time of application of the compound to not more than 0.007 oz/sq.in. The curing compound shall be Type 2, white pigmented, except where clear type is required for a particular application, the curing compound shall be Type 1D, clear or translucent with fugitive dye. Spray the entire surface of the concrete uniformly with a wax-free, resin-base curing compound conforming to Article 1026-2. Use clear curing compound to which a fugitive dye

Q3: Do you require different types of curing compounds for different applications?

No

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	Yes
Burlap Curing Blankets	Yes
Evaporation Retarders	No
Please include a link to your requirements and specifications:	NCDOT Specifications, SECTION 1026 Curing Agents for Concrete

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

After final finish and immediately after the free surface moisture has disappeared, use a minimum application rate of 0.0067 gal/sf when the application equipment is mechanically operated. Provide an inline flow-metering device to ensure the proper application rate is provided. Apply the curing compound such that puddling or ponding does not occur on the fresh concrete surface.

Use mechanically operated application equipment designed to apply a uniformly agitated continuous flow of the curing compound at the prescribed rate to all concrete surfaces.

Hand spraying shall only be permitted for irregular widths or shapes and surfaces exposed by removal of forms. The rate of application for these areas shall be 0.01 gal/sf.

Also the rate is checked by gallons and square yard computations.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	Yes
Climatic Conditions	Yes

Q8: What are your curing requirements for concrete paving?

NCDOT SPECS
SECTION 700
GENERAL REQUIREMENTS FOR
PORTLAND CEMENT CONCRETE PAVEMENT
700-8 PROTECTION OF PORTLAND CEMENT CONCRETE PAVEMENT
700-9 CURING

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as #8.

Q10: What are your curing requirements for concrete bridge decks?

Same as #8.

Q11: What are your curing requirements for colored concrete?

Respondent skipped this question

Q12: Do you require the application of membrane curing compound after completion of wet curing?

Respondent skipped this question

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain:

700-10 REMOVING FORMS Do not remove forms from freshly placed concrete for at least 12 hours after placement and until the concrete has hardened sufficiently to resist spalling, cracking or any other damage. Repair any honeycombed areas along the sides or edges of the slab by filling with mortar immediately after the forms have been removed. Use mortar consisting of one part cement to 2 parts fine aggregate.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain:

Yes, see NCDOT Specs Section 420 Article: 15 CURING CONCRETE

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

Yes,

Comments
700-7 FINISHING Finish concrete pavement or concrete shoulders in accordance with Article 710-6 or 720-7, respectively. Do not use excessive water for finishing.

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No

Q19: What types of lightweight materials were used for internal curing? What % was used?

Respondent skipped this question

Q20: Do you use the maturity method for any of the following:

Curing	Yes
Opening to Traffic	Yes
Removal of Forms	No

If yes, please share specifications and procedures:

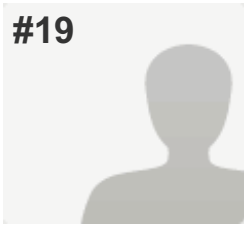
See Section 700-13.
<https://connect.ncdot.gov/resources/Specifications/Specification%20Resources/2012%20Standard%20Specifications.pdf>

Q21: Any additional comments?

Link to NCDOT Specs. See Section 700.

<https://connect.ncdot.gov/resources/Specifications/Specification%20Resources/2012%20Standard%20Specifications.pdf>

#19

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Wednesday, April 01, 2015 9:54:21 AM**Last Modified:** Wednesday, April 01, 2015 10:14:38 AM**Time Spent:** 00:20:17**IP Address:** 130.47.34.2

PAGE 1

Q1: State Representative

Name	Peter Kemp
Agency	Wisconsin DOT
State / Province	WI
Email	peter.kemp@dot.wi.gov

Q2: What type of membrane curing compounds do you allow?	Poly Alpha Methyl Styrene-Based, Linseed Oil
---	--

Q3: Do you require different types of curing compounds for different applications?	Yes, If yes, please explain: We also require clear C1315 Cure and Seals for colored concrete, and wax-based cure for concrete that will be overlaid.
---	--

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Comments:	We source sample and test all batches of curing compound prior to approval for use. We follow application rate in C309.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Please include a link to your requirements and specifications:	http://roadwaystandards.dot.wi.gov/standards/stndspec/ss-04-00.pdf http://roadwaystandards.dot.wi.gov/standards/stndspec/ss-05-00.pdf

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

For tined surfaces - 150 sf/gal
Other surfaces - 200 sf/gal

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	Yes
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

Membrane cure is standard, poly sheeting is an alternate method

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same

Q10: What are your curing requirements for concrete bridge decks?

Continuous wet cure

Q11: What are your curing requirements for colored concrete?

Clear Cure and Seal compounds

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	Yes

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	It depends
Please explain:	If PCC has reached opening strength, then curing compound is not needed.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

If yes, what did you do to address it? ?????????? - no solution known

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only Yes

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

Curing Yes

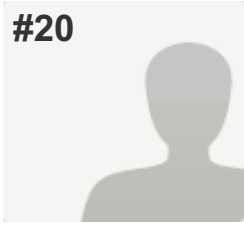
Opening to Traffic Yes

Removal of Forms Yes

If yes, please share specifications and procedures: <http://roadwaystandards.dot.wi.gov/standards/stndspec/ss-04-00.pdf>
<http://roadwaystandards.dot.wi.gov/standards/stndspec/ss-05-00.pdf>
<http://roadwaystandards.dot.wi.gov/standards/cmm/cm-04-00toc.pdf>

Q21: Any additional comments? *Respondent skipped this question*

#20



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Wednesday, April 01, 2015 11:24:30 AM
Last Modified: Wednesday, April 01, 2015 12:16:35 PM
Time Spent: 00:52:05
IP Address: 156.63.133.8

PAGE 1

Q1: State Representative

Name	Dan Miller
Agency	Ohio Department of Transportation
State / Province	Ohio
Email	daniel.miller@dot.state.oh.us

Q2: What type of membrane curing compounds do you allow? Wax Based, Water Based, Resin Based

Q3: Do you require different types of curing compounds for different applications? Yes,
 If yes, please explain:
 Structural items can use either Type I, ID. Pavements requires Type 2 with a minimum reflectance of 65%, which differs from ASTM C309 (60%).

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	Yes
Comments:	200 sq. yds./gallon for structural concrete 150 sq. yds/gallon for concrete pavements

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Please include a link to your requirements and specifications:

http://www.dot.state.oh.us/Divisions/ConstructionMgt/OnlineDocs/Specifications/2013CMS/2013_CMS_11142012_FINAL.PDF
See Item 705 page 728 for information regarding curing blankets/ curing compounds. We require bulap curing blankets to meet AASHTO M182, Class 2 We require plastic curing blankets to meet AASHTO M171

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

200 sq. yds./gallon for structural concrete
150 sq. yds/gallon for concrete pavements

Computed by knowing the discharge rate based on the amount of concrete covered.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	Yes
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

150 sq. yds/gallon for concrete pavements.
Pavements requires Type 2 with a minimum reflectance of 65%,

Q9: What are your curing requirements for concrete pavement rehabilitation?

150 sq. yds/gallon for concrete pavements.
Pavements requires Type 2 with a minimum reflectance of 65%,

Q10: What are your curing requirements for concrete bridge decks?

Method A- wet cure with burlap
Method B- Curing membrane

Q11: What are your curing requirements for colored concrete?

N/A

Q12: Do you require the application of membrane curing compound after completion of wet curing?

Yes,

Please explain:

See page 335 of spec book link table 511.14-2

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No**Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?**

No,

Comments

Fogging is allowed to control setting times, but no "blessing" of the concrete is allowed.

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks Yes

Please share details of your experience - or a link to a report. <ftp://ftp.mdt.mt.gov/research/LIBRARY/FH-WA-OH-2007-06.PDF> (Delatte, Mack, Cleary, 2007)**Q19: What types of lightweight materials were used for internal curing? What % was used?**

Lightweight coarse aggregate - 25%

Lightweight fine aggregate- 17%

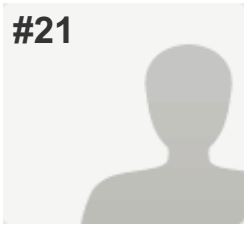
Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	Yes
If yes, please share specifications and procedures:	http://www.dot.state.oh.us/Divisions/ConstructionMgt/Specification%20Files/1098_01162015_for_2013.pdf

Q21: Any additional comments?

Respondent skipped this question

#21

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Wednesday, April 01, 2015 2:25:34 PM**Last Modified:** Wednesday, April 01, 2015 2:54:49 PM**Time Spent:** 00:29:15**IP Address:** 204.64.21.50

PAGE 1

Q1: State Representative

Name	Andy Naranjo
Agency	TxDOT
State / Province	TX
Email	andy.naranjo@txdot.gov

Q2: What type of membrane curing compounds do you allow?	Resin Based
---	-------------

Q3: Do you require different types of curing compounds for different applications?	No
---	----

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
---	-----

Do you test field samples of membrane curing compounds for acceptance?	Yes
--	-----

What is the minimum application rate for testing? Please answer in comments box below.	Yes
---	-----

Comments:	8 to 9 mils
-----------	-------------

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
---------------------------	-----

Plastic Curing Blankets	No
-------------------------	----

Burlap Curing Blankets	No
------------------------	----

Evaporation Retarders	Yes
-----------------------	-----

Other	No
-------	----

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

2 applications of 180 sf/gal

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

2 applications of 180 sf/gal. 1st coat within 10 min. after texturing and 2nd coat within 30 min. after texturing. Cure for at least 3 days.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as above, or cure until open to traffic strengths are met.

Q10: What are your curing requirements for concrete bridge decks?

Use curing compound as interim curing, water cure required for 10 days.

Q11: What are your curing requirements for colored concrete?

Rarely specified anymore.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? It depends

Please explain: If forms are removed prior to 72 hrs then curing compound is applied.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? It depends

Please explain: At least 12hr from initial set. 4 days for mass concrete placements. Structural concrete require a 4 day cure. if forms are removed prior to 4 days, then other approved curing methods are applied.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Yes

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving Yes

Bridge Decks No

Trial Batching/Research Only No

Other No

Please share details of your experience - or a link to a report. Small test section placed with lightweight aggregate in Dallas Dist. We were not looking at internal curing at the time, just use of lightwieght aggregate.

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

Curing No

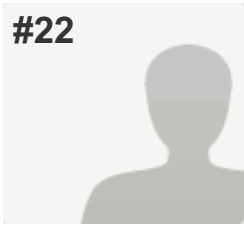
Opening to Traffic Yes

Removal of Forms No

If yes, please share specifications and procedures: Maturity is allowed for determining time of opening strength.

Q21: Any additional comments? *Respondent skipped this question*

#22

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Wednesday, April 01, 2015 3:05:35 PM**Last Modified:** Wednesday, April 01, 2015 3:20:05 PM**Time Spent:** 00:14:29**IP Address:** 167.154.74.168

PAGE 1

Q1: State Representative

Name	kelly yokotake
Agency	NDOT
State / Province	nevada
Email	kyokotake@dot.state.nv.us

Q2: What type of membrane curing compounds do you allow?	Poly Alpha Methyl Styrene-Based, Wax Based, Water Based, Resin Based
---	--

Q3: Do you require different types of curing compounds for different applications?	Yes, If yes, please explain: Bridge decks and approach slabs use PAM. PCCP uses white pigmented resin or water based curing. all other concrete uses clear with red fugitive dye.
---	--

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
Comments:	N/A

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1gal/100ft2

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.) No

Surface Texture No

Climatic Conditions No

Q8: What are your curing requirements for concrete paving?

2 applications of 1gal/100ft2 both directions

Q9: What are your curing requirements for concrete pavement rehabilitation?

same as above

Q10: What are your curing requirements for concrete bridge decks?

after 10 days wet cure apply PAM at a rate of 1gal/135ft2

Q11: What are your curing requirements for colored concrete?

none, dont do colored concrete

Q12: Do you require the application of membrane curing compound after completion of wet curing? Yes

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? No

Please explain: only when forms are removed immediately after placement

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? It depends

Please explain: on how long forms are in place

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

If yes, what did you do to address it? dowel bar retrofit and profile grinding

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

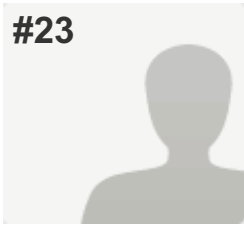
Curing No

Opening to Traffic No

Removal of Forms No

Q21: Any additional comments? *Respondent skipped this question*

#23

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Thursday, April 02, 2015 9:25:34 AM**Last Modified:** Thursday, April 02, 2015 11:53:14 AM**Time Spent:** 02:27:39**IP Address:** 108.59.48.4

PAGE 1

Q1: State Representative

Name	Anthony Zander
Agency	INDOT
State / Province	Indiana
Email	azander@indot.in.gov

Q2: What type of membrane curing compounds do you allow?

Other (please specify)
 INDOT does not have a restriction as to the type of liquid membrane curing compound that can be used as long as it meets the requirements of ASTM C 309 Type 2. INDOT does have an exception to ASTM C 309 in that the drying time is determined on a glass surface.

Q3: Do you require different types of curing compounds for different applications?

Yes,
 If yes, please explain:
 For PCCP a white pigment curing compound is allowed For slip formed Concrete Median Barrier a Curing-Sealing material is allowed. Section 912.02 of the INDOT Standard Specifications provides the material requirements.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	Yes
Comments:	200 ft ² per gallon as required by ASTM C 309 for Type 2 liquid membrane forming curing compound.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	Yes
Other	Yes

Please include a link to your requirements and specifications:

The list of three Evaporation Retarders is presented in the unique special provision for high performance concrete bridge decks as a list. Burlap Cloth is presented in 912.01(a), Waterproof Paper Blankets is presented in 912.01(b), White Polyethylene Sheeting, Film is presented in 912.01(c), White Burlap Polyethylene Sheet is presented in 912.01(d), Liquid Membrane Forming Compounds is presented in 912.01(e), and Polyethylene Film is presented in 912.01(f). See link below. Curing-Sealing materials is presented in 912.02, see link below.
<http://www.in.gov/dot/div/contracts/standards/book/sep13/9-2014.pdf>

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Rate of 150 ft² per gallon. Applied in two applications

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	Yes

Please explain:

A new coat of curing compound shall be applied to areas damaged by rain or other means during the curing period. The recoating shall be applied as soon as possible and at a rate equal to that specified for the original coat.

Q8: What are your curing requirements for concrete paving?

This is governed by 504.04(a). Immediately after the water has disappeared, a uniform coating shall be applied at the minimum application rate of 1 gallon per 150 ft², using two applications. The curing compound may be warmed in a water bath during cold weather at a temperature not exceeding 100 deg F. Thinning with solvents is not allowed. Non-uniform film rates will result in the discontinuous of that application method. Areas damaged by rain or other means shall receive a new coat at the same rate, as soon as possible

Q9: What are your curing requirements for concrete pavement rehabilitation?

The same as identified in item 8 above.

Q10: What are your curing requirements for concrete bridge decks?

Governed by 702.22 of INDOT Standard Specifications. Continuous water curing is required for 168 hours commencing immediately after the surface is able to support the protective covering of cotton mats, burlap, or other satisfactory material and shall be kept continuously and thoroughly wet during the curing period.

Membrane forming curing compound can be used on bridge decks but only if the deck will not subsequently be treated with a sealer, which is rare.

Q11: What are your curing requirements for colored concrete?

Colored concrete is typically governed by a unique special provision that was written by the Design Consultant. Curing requirements are usually vague or contradict the requirements recommended by the manufacturer of the pigment.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? Yes

Please explain: Forms may be removed as soon as the PCCP has hardened sufficiently to prevent edge spalling of other damage. Immediately after the forms are removed the sides of the PCCP shall be cured (e.g. apply curing compound).

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? It depends

Do you require application of membrane curing compound after form removal? No

Please explain:

The forms for any portion of the structure shall not be removed until the concrete is strong enough to withstand damage. If field operations are not controlled by beams or cylinder tests the standard specification requires that the forms stay in place for a minimum period of time, exclusive of days when the ambient temperature is below 40 deg F (i.e. centering under beams 15 days, slabs 7 days, walls columns, sides of beams and all other parts 12 hours). If high-early strength cement is used the periods may be reduced. If fly ash or ggbfs is used in the structural concrete or if a Type IP or IP-A cement is used the form removal shall be governed by test beams (i.e. girders, arches and similar units 390 psi flexural strength; interior bent or pier caps 480 psi flexural strength). In order to obtain a satisfactory surface finish, forms for railings, parapets and exposed vertical surfaces shall be removed no less than 12 hours and no more than 48 hours after the concrete is placed, depending on weather conditions. A protective covering is needed after form removal. Application of a curing compound is not required and in some cases would not be allowed if the structural element is to receive a surface treatment (e.g. concrete sealer).

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,

Comments

Use of evaporative retarder are specified for specialty concretes (e.g. Internal Cure High Performance Concrete in bridge decks or VES-LMC Overlays). Use of evaporative retarders for such specialty concrete is governed by a specific unique special provision which provides a listing of three products. INDOT has not expanded use of evaporation retarders to conventional LMC Overlay, but it would probably be a good idea.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No,

Comments

The INDOT Standard Specifications do not allow it, but it is common practice by Contractors and the Department does little to enforce the specification. For example some HPC's require the use of fogging to raise the humidity of a the surface of the finished and textured surface of a bridge deck. Many times during the fogging process the workman will aim the fogger right at the spinning drum of the finishing machine. Many times Contractors miss use evaporative retarders as finishing aids, particularly when hand finishing the gutter area of a deck along the railing.

Q17: Have you experienced any of the following?

Curling

Yes

Warping

Yes

If yes, what did you do to address it?

I am sure INDOT has experience both curling and warping in PCCP. INDOT requires higher opening to traffic strengths (i.e. 425 psi flexural strength) for long lengths of pavement patching to account for the additional curling stresses. Currently for newly constructed PCCP the OTT requirement is 550 psi flexural strength.

Q18: Have you tried internal curing for any of the following applications?

Paving

No

Bridge Decks

Yes

Other

Yes

Please share details of your experience - or a link to a report.

INDOT currently has an Experimental Feature Study for 6 bridges built with IC-HPC in 2013, 2014 and 2015. The specification for IC-HPC only exists as a unique special provision. The Department plans on submitting an interim report to the FHWA later this year. INDOT not only plans to use IC-HPC in bridge decks, but in deck railing and reinforced concrete bridge approach slabs as well.

Q19: What types of lightweight materials were used for internal curing? What % was used?

So far INDOT has only used expanded shale lightweight fine aggregate material. The LWT FA makes up about 45-49 percent of the total FA volume for the mix.

Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No

If yes, please share specifications and procedures:

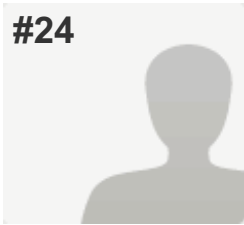
Use of maturity is an option that is available for determining OTT for newly constructed QC/QA PCCP using ITM 402. See the following link. It is not used for conventional PCCP construction.

http://www.in.gov/indot/div/mt/itm/pubs/402_testing.pdf In the past, INDOT Standard Specifications also allow maturity as an option for OTT for full depth pavement patches; however, current research is being done to determine the accuracy of the Nurse-Saul Function and the effects of elevated temperature in the patch concrete on the strength and durability of the patch.

Q21: Any additional comments?

Respondent skipped this question

#24

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Thursday, April 02, 2015 12:22:07 PM**Last Modified:** Thursday, April 02, 2015 12:56:34 PM**Time Spent:** 00:34:27**IP Address:** 165.206.209.230

PAGE 1

Q1: State Representative

Name	Kevin Merryman/Todd Hanson
Agency	Iowa DOT
State / Province	Iowa
Email	kevin.merryman@dot.iowa.gov

Q2: What type of membrane curing compounds do you allow?	Wax Based, Water Based, Resin Based
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Q3: Do you require different types of curing compounds for different applications?	Yes, If yes, please explain: White pigmented for paving. Clear for barrier rail.
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Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
Comments:	N/A

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Please include a link to your requirements and specifications:	http://www.iowadot.gov/erl/current/GS/content/4105.htm

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

0.067 gallon per square yard for paving
200 square feet per gallon for barrier rail

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

<http://www.iowadot.gov/erl/current/GS/content/2301.htm#Section230103K>

Q9: What are your curing requirements for concrete pavement rehabilitation?

After the concrete has been finished and surface water has disappeared, cure the concrete. Place curing materials no later than 20 minutes after completing finishing operations. Cure concrete by completely covering it with an insulating blanket-type cover consisting of a layer of closed cell polystyrene foam protected by at least one layer of plastic film, rated by the manufacturer with a minimum R-value of 0.5 (0.08805 for metric units). Cover the blanket-type cover completely with insulation board having the following properties: cellulosic fiber sheathing with a nominal 3/4 inch (19 mm) thickness. The board may be wrapped with plastic film to protect it from rain. Place the board over the patch and adjacent surface and hold it tightly in place with weights to retain all possible heat in the concrete.

Q10: What are your curing requirements for concrete bridge decks?

Curing Concrete Decks.

Use burlap prewetted with sufficient water, prior to placement, to prevent absorption of moisture from the concrete surface. Keep the burlap wet.

1. Place the first layer of prewetted burlap in the following manner:

a. Interstate and Primary Projects.

Place on the concrete within 10 minutes after final finishing.

b. Other Projects.

Immediately after final finishing and grooving, cover the area finished with white pigmented curing compound meeting requirements of Article 4105.05 applied at a maximum rate of 135 square feet per gallon (3.3 square meters per liter). Place the first layer of prewetted burlap on the concrete within 30 minutes after the concrete has been finished and grooved. Burlap placement beyond 30 minutes may be allowed, up to an additional 30 minutes, if approved by the Engineer based upon environmental conditions at time of deck placement.

2. As soon as practical, but no later than 2 hours after placing the first layer, place a second layer of burlap on the deck.

3. Apply water to the burlap covering for a period of 4 calendar days. Use a pressure sprinkling system that is effective in keeping the burlap wet during the moist curing period. The system may be interrupted only to replenish the water supply, during periods of natural moisture, or during construction contiguous to the concrete being cured. The Engineer may approve interruptions for periods longer than 4 hours on the basis of the method for keeping the concrete moist.

4. Maintain continuous contact, except as noted above, between all parts of the concrete deck and the burlap during the 4 calendar day moist curing period.

5. On concrete decks placed after October 1 and prior to April 1, after 20 hours of the application of water, the Contractor may substitute the application of a moisture proof plastic film no less than 3.4 mils (86 μm) thick over the wet burlap in lieu of applying water. Maintain intimate contact between the surface of the concrete, the burlap, and the plastic film.

Q11: What are your curing requirements for colored concrete?

Curing and Sealing Compound for Integrally Colored Concrete:

1. Comply with ASTM C309 and ASTM 3315 for use with integrally colored concrete.

a) Use to cure exterior flatwork that will be allowed to weather naturally with no or only occasional maintenance.

b) Clear, solvent-borne, non-yellowing and VOC-compliant.

Q12: Do you require the application of membrane curing compound after completion of wet curing? No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? It depends

Please explain: Curing compound required if forms removed before opening strength is achieved.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? No

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling Yes

Warping Yes

If yes, what did you do to address it? TBD

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks Yes

Trial Batching/Research Only Yes

Please share details of your experience - or a link to a report. Field application for bridge deck was half of deck on a county project.

Q19: What types of lightweight materials were used for internal curing? What % was used?

LWFA - expanded shale - % unknown

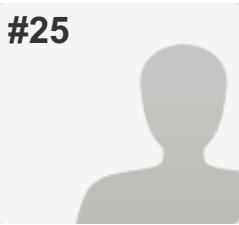
Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	Yes
If yes, please share specifications and procedures:	http://www.iowadot.gov/erl/current/IM/content/383.htm

Q21: Any additional comments?

Respondent skipped this question

#25

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Friday, April 03, 2015 10:29:22 AM**Last Modified:** Friday, April 03, 2015 11:20:05 AM**Time Spent:** 00:50:42**IP Address:** 163.191.102.70

PAGE 1

Q1: State Representative

Name	Steve Gillen
Agency	Illinois Tollway
State / Province	IL
Email	sgillen@getipass.com

Q2: What type of membrane curing compounds do you allow?

Poly Alpha Methyl Styrene-Based, Wax Based, Water Based, Resin Based, Linseed Oil, Other (please specify)

The Tollway follows the Illinois Department of Transportation (IDOT) requirements. The membrane curing compounds must conform to AASHTO M 148 or be an approved linseed oil emulsion.

Q3: Do you require different types of curing compounds for different applications?

Yes,

If yes, please explain:
The different types within AASHTO M 148 are required based on the type of construction. Linseed oil emulsion is the only membrane curing compound allowed for superstructures except bridge decks that require a protective coat.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds? No

Do you test field samples of membrane curing compounds for acceptance? No

Comments: The Tollway does not perform additional testing and approval. We only allow membrane curing compounds that IDOT has inspected and approved.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	No
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Other	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

We follow the IDOT requirement of 2 applications, each at a rate of 1 gallon per 250 SF. Yield checks are done to verify the minimum rate.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

The concrete needs to be cured for 3 days using waterproof paper, polyethylene sheeting, wetted burlap, membrane curing, or wetted cotton mats

Q9: What are your curing requirements for concrete pavement rehabilitation?

The concrete needs to be cured until opening strength is met using waterproof paper, polyethylene sheeting, wetted burlap, membrane curing, or wetted cotton mats

Q10: What are your curing requirements for concrete bridge decks?

The concrete needs to be cured for 7 days using wetted cotton mats

Q11: What are your curing requirements for colored concrete?

There aren't specific requirements for colored concrete

Q12: Do you require the application of membrane curing compound after completion of wet curing?	No
--	----

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	It depends
Please explain:	Membrane curing compound is only required if forms are removed during the specified curing period.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
Do you require application of membrane curing compound after form removal?	It depends
Please explain:	Membrane curing compound is only required if forms are removed during the specified curing period.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling	No
Warping	No

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	Yes
Trial Batching/Research Only	Yes
Please share details of your experience - or a link to a report.	http://www.illinoistollway.com/documents/10157/90097/High-Performance+Concrete+for+Bridge+Decks-Final+Report.pdf The Tollway is funding research to use internal curing for CRCP. Demonstration sections will be built on the Tollway mainline in 2016.

Q19: What types of lightweight materials were used for internal curing? What % was used?

water-cooled expanded blast furnace slag sand

Q20: Do you use the maturity method for any of the following:

Curing No

Opening to Traffic No

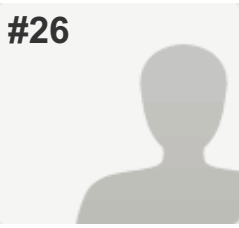
Removal of Forms No

If yes, please share specifications and procedures: We have a specification, but haven't used it yet.

Q21: Any additional comments?

Respondent skipped this question

#26

**COMPLETE**

Collector: Web Link 1 (Web Link)
Started: Friday, April 03, 2015 10:50:15 AM
Last Modified: Friday, April 03, 2015 1:36:28 PM
Time Spent: 02:46:13
IP Address: 168.166.124.100

PAGE 1

Q1: State Representative

Name	Brett Trautman
Agency	MoDOT
State / Province	Missouri
Email	Brett.Trautman@modot.mo.gov

Q2: What type of membrane curing compounds do you allow?

Wax Based, Water Based, Resin Based,
 Other (please specify)
 Curing compounds comply with ASTM C309.

Q3: Do you require different types of curing compounds for different applications?

Yes,
 If yes, please explain:
 Pavements - Type 2 (white) Structures (not being sealed) - Type 1-D Bridge Decks - Apply Type 1-D followed by 7 day wet cure

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds? Yes

Do you test field samples of membrane curing compounds for acceptance? Yes

Comments: If issues or questions arise in the field, MoDOT obtains a sample of curing compound for laboratory testing. Determine water retention properties, % solids and reflectance (if Type 2). Water retention performed in accordance with ASTM C 156. Samples normally taken from the supplier.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No
Please include a link to your requirements and specifications:	http://www.modot.org/business/standards_and_specs/Sec1055.pdf

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Rate depends on the item. Pavement is 1 gallon per 200 square feet while structures are 1 gallon per 150 square feet.

Field inspectors do a visual review for uniform, consistent application. Also monitor the quantity being applied for each days placement and calculate the application rate.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No

Q8: What are your curing requirements for concrete paving?

Type 2 (white) at 1 gallon for each 200 square feet in accordance with ASTM C309.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Partial Depth Repairs - Type 2 (white) at 1 gallon for each 200 square feet.

Full Depth Repairs - Type 2 (white) at 1 gallon for each 200 square feet if the final surface. If going to be overlaid with HMA apply emulsion at a rate of 0.1 gallon per square yard.

Q10: What are your curing requirements for concrete bridge decks?

Type 1-D (dissipating) at 1 gallon for each 150 square feet in accordance with ASTM C309.

Q11: What are your curing requirements for colored concrete?

Type 1-D (clear) at 1 gallon for each 200 square feet in accordance with ASTM C309.

Q12: Do you require the application of membrane curing compound after completion of wet curing?	No
--	----

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? No

Do you require application of membrane curing compound after form removal? Yes

Please explain: For hand pours, forms are typically removed the next day unless the concrete is not gaining strength normally. Curing compound is to applied to the sides of the pavement to facilitate hydration. Curing compound would have been placed on the surface immediately after textured.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: Form removal from under any structural concrete unit shall not be started until the concrete has attained at least the following strength (Section 703.3.2.13): Class B - 2,750 psi Class B-1 - 3,000 psi Class B-2 - 3,000 psi

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?

Yes,

Comments
Allow use when utilizing silica fume concrete for a deck overlay (Section 505.30.8.2.1). Have the following restrictions: 1) Use judiciously 2) Use to only prevent the surface from drying until wet burlap can be placed 3) Do not use to increase surface workability Have occasionally allowed on other concrete projects with the same limitations.

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?

No,

Comments
Missouri specifications do not allow (Section 502.4.8.2) but unfortunately field inspectors do allow water to aid in finishing.

Q17: Have you experienced any of the following?

Curling	Yes
Warping	Yes
If yes, what did you do to address it?	Have seen but not enough to cause performace issues.

Q18: Have you tried internal curing for any of the following applications?

Paving	No
Bridge Decks	No
Trial Batching/Research Only	No
Please share details of your experience - or a link to a report.	Later this year, planning to batch concrete utilizing lightweight sand to determine fresh and harden concrete properties. Currently looking for a bridge project to utilize internal curing.

Q19: What types of lightweight materials were used for internal curing? What % was used?

n/a

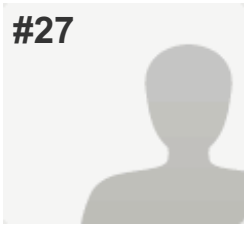
Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	Yes
If yes, please share specifications and procedures:	http://www.modot.org/business/standards_and_specs/Sec0507.pdf

Q21: Any additional comments?

Are any states utilizing lithium silicate for curing concrete bridge decks? We have been getting several request to use this material.

#27



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Friday, April 03, 2015 10:25:11 AM
Last Modified: Friday, April 03, 2015 2:15:15 PM
Time Spent: 03:50:03
IP Address: 158.123.9.179

PAGE 1

Q1: State Representative

Name	Christopher Hart
Agency	Rhode Island Department of Transportation
State / Province	RI
Email	christopher.hart@dot.ri.gov

Q2: What type of membrane curing compounds do you allow?	Poly Alpha Methyl Styrene-Based, Water Based, Resin Based
---	--

Q3: Do you require different types of curing compounds for different applications?	No
---	----

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	Yes
Other	No
Please include a link to your requirements and specifications:	http://www.dot.ri.gov/business/bluebook.php -Curing Materials Specifications-Subsection M.02.04 http://www.dot.ri.gov/business/approved_materials.php -Approved Materials List-Concrete-Curing Materials

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

Application rates are in accordance with the manufacturers recommendations.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

Water, Curing Compound or Waterproof Membrane.
Any of the methods listed in Subsection 601.03.8:
<http://www.dot.ri.gov/business/bluebook.php>

Q9: What are your curing requirements for concrete pavement rehabilitation?

Water, Curing Compound or Waterproof Membrane.
Any of the methods listed in Subsection 601.03.8:
<http://www.dot.ri.gov/business/bluebook.php>

Q10: What are your curing requirements for concrete bridge decks?

14 Day continuous moist cure with wet burlap and polyethylene sheeting, or burlene. See Subsection 814.03.8 for bridge deck curing:
<http://www.dot.ri.gov/business/bluebook.php>

Q11: What are your curing requirements for colored concrete?

Cured per the color admixture manufacturers recommendations.

Q12: Do you require the application of membrane curing compound after completion of wet curing? No

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? No

Please explain: 5 days minimum

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? No

Please explain: Typically forms may not be removed until concrete has reached 28-day strength as indicated by field cured cylinders. See Subsection 808.03.10 for additional details. <http://www.dot.ri.gov/business/bluebook.php>

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Yes,
Comments No

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Trial Batching/Research Only No

Other No

Q19: What types of lightweight materials were used for internal curing? What % was used?

N/A

Q20: Do you use the maturity method for any of the following:

Curing Yes

Opening to Traffic No

Removal of Forms Yes

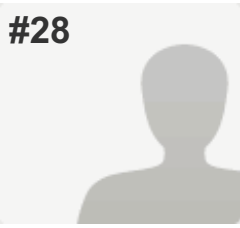
If yes, please share specifications and procedures:

For Mass Concrete placements only. See Section 607.
http://www.dot.ri.gov/documents/doingbusiness/Compilation_Approved_Specifications_Supp_14.pdf

Q21: Any additional comments?

Respondent skipped this question

#28

**COMPLETE****Collector:** Web Link 1 (Web Link)**Started:** Monday, April 06, 2015 10:46:28 AM**Last Modified:** Monday, April 06, 2015 11:37:39 AM**Time Spent:** 00:51:10**IP Address:** 165.201.162.178

PAGE 1

Q1: State Representative

Name	Will Lindquist
Agency	Kansas Department of Transportation
State / Province	Kansas
Email	wlindquist@ksdot.org

Q2: What type of membrane curing compounds do you allow?

Poly Alpha Methyl Styrene-Based, Wax Based, Water Based, Resin Based, Other (please specify)
Poly alpha methyle styrene and resin based materials are not specifically excluded, however, contractors are not using them to our knowledge.

Q3: Do you require different types of curing compounds for different applications?

Yes,
If yes, please explain:
For concrete structures, a Type 2 white liquid membrane forming compound is required for bridge decks, and a Type 1D liquid membrane forming compound is required if forms are removed before the end of the 4-day curing period.

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
Comments:	The membrane curing compounds are tested in accordance with ASTM C309.

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	Yes
Other	No

Please include a link to your requirements and specifications:

Liquid Membrane Forming Compounds:
<http://www.ksdot.org/Assets/wwwksdotorg/bureaus/burConsMain/specprov/2015/1404.pdf>
 Precure/Finishing Aid (Evaporation Retarder):
<http://www.ksdot.org/Assets/wwwksdotorg/bureaus/burConsMain/specprov/2015/1403.pdf>

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gallon / 150 sq. ft. for pavement applied in 1 coat. 1 gallon / 200 sq. ft. for structural concrete. 2 coats are required for monolithic bridge decks (with no overlay), bridge overlays, and other unformed surfaces.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
Surface Texture	No
Climatic Conditions	No
Other	No

Q8: What are your curing requirements for concrete paving?

Pavements are cured using wet burlap, liquid membrane-forming compounds, white polyethylene sheeting, concrete curing blankets or reinforced white polyethylene sheeting for a minimum of 4 days. Maintain a minimum concrete temperature of 40F at the concrete surface.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Depends on the opening time. If time allows, then the requirements are the same as for concrete paving.

Q10: What are your curing requirements for concrete bridge decks?

Monolithic bridge decks and bridge overlays require a 14-day wet cure followed by 7-days with a curing membrane. Bridge subdecks require a 14-day wet cure.

Q11: What are your curing requirements for colored concrete?

No extra requirements.

Q12: Do you require the application of membrane curing compound after completion of wet curing?

It Depends,

Please explain:

Monolithic bridge decks without an overlay and bridge overlays require a 14-day wet cure with burlap and white polyethylene sheeting followed by 2 coats of Type 2 white liquid membrane forming compound. Link to specification: <http://www.ksdot.org/Assets/wwwksdotorg/bureaus/burConsMain/specprov/2015/710.pdf>

Q13: Form removal for concrete pavement and flatwork:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: Forms are required to be in place for a minimum of 12 hours followed by application of a Type 2 White Liquid Membrane-Forming Compound.

Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place? Yes

Do you require application of membrane curing compound after form removal? Yes

Please explain: The minimum cure time is 4 days for "formed sides and ends of bridge wearing surfaces, bridge curbs and other formed surfaces." If the forms are removed before the end of the 4-day cure period (done with Engineer's permission), cure the surface with an application of Type 1D liquid membrane forming compound.

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use? Yes

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements? No

Q17: Have you experienced any of the following?

Curling	Yes
Warping	Yes
If yes, what did you do to address it?	Principally by controlling permeability requirements.

Q18: Have you tried internal curing for any of the following applications?

Paving	Yes
Bridge Decks	No
Trial Batching/Research Only	Yes
Please share details of your experience - or a link to a report.	Dave Meggers presentation.

Q19: What types of lightweight materials were used for internal curing? What % was used?

Expanded shale. The percent replacement is based on the absorption of the material. The target is to add a total of 7% of the total cementitious material in water.

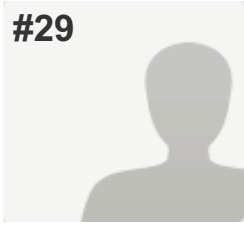
Q20: Do you use the maturity method for any of the following:

Curing	No
Opening to Traffic	Yes
Removal of Forms	No
If yes, please share specifications and procedures:	Contractors are permitted to use a calibrated maturity meter, however, they are rarely used. See section 501.4i(3): http://www.ksdot.org/Assets/wwwksdotorg/bureaus/burConsMain/specprov/2015/501.pdf

Q21: Any additional comments?

Respondent skipped this question

#29



COMPLETE

Collector: Web Link 1 (Web Link)
Started: Tuesday, April 07, 2015 9:19:13 AM
Last Modified: Tuesday, April 07, 2015 9:37:43 AM
Time Spent: 00:18:30
IP Address: 143.100.37.25

PAGE 1

Q1: State Representative

Name	Jay Page
Agency	Department of Transportation
State / Province	Georgia
Email	jpage@dot.ga.gov

Q2: What type of membrane curing compounds do you allow? Wax Based

Q3: Do you require different types of curing compounds for different applications? No

Q4: Membrane Curing Compounds

Do you pre-approve membrane curing compounds?	Yes
Do you test field samples of membrane curing compounds for acceptance?	No
What is the minimum application rate for testing? Please answer in comments box below.	No

Q5: Do you have an Approved/Qualified Products List for any of the following?

Membrane Curing Compounds	Yes
Plastic Curing Blankets	No
Burlap Curing Blankets	No
Evaporation Retarders	No

Q6: What is the minimum field application rate of membrane curing compound? How do you verify they are using the minimum rate?

1 gal for 150 sq. ft.

Q7: Do you adjust the minimum field application rate for any of the following?

Type of concrete (ie., paving, curb and gutter, CPR, etc.)	No
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Surface Texture	No
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Climatic Conditions	No
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Q8: What are your curing requirements for concrete paving?

Immediately after finishing the concrete, cure the entire surface when the concrete will not mar with either an Impervious Membrane curing method or White Polyethylene sheeting.

Q9: What are your curing requirements for concrete pavement rehabilitation?

Same as previously stated

Q10: What are your curing requirements for concrete bridge decks?

Begin curing unformed surfaces when water sheen disappears from the surface and the surface finish is applied fog the surface to keep film of water on the surface. Keep wet until after applying the sheet curing covers. As soon as the concrete sets enough to prevent damage, cover deck with two-layer curing material according to AASHTO M 171. Minimum 5 day curing period is required.

Q11: What are your curing requirements for colored concrete?

Same as previously stated

Q12: Do you require the application of membrane curing compound after completion of wet curing?	No
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Q13: Form removal for concrete pavement and flatwork:	<i>Respondent skipped this question</i>
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Q14: Form removal for bridge substructure, superstructure, retaining walls:

Do you require a minimum time forms must remain in place?	Yes
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Do you require application of membrane curing compound after form removal?	No
--	----

Q15: Do you allow evaporation retarders? If yes, do you have any restrictions on their use?	No
--	----

Q16: Do you allow adding water to the surface to aid in finishing? If yes, what types of concrete placements?	Yes, Comments Fogging Method
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Q17: Have you experienced any of the following?

Curling No

Warping No

Q18: Have you tried internal curing for any of the following applications?

Paving No

Bridge Decks No

Q19: What types of lightweight materials were used for internal curing? What % was used? *Respondent skipped this question*

Q20: Do you use the maturity method for any of the following:

Curing No

Opening to Traffic No

Removal of Forms No

Q21: Any additional comments? *Respondent skipped this question*