

3460303 SPECIFICATION
COMMENTS FROM INTERNAL/INDUSTRY REVIEW

Arthur Berger
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Comments: (11-14-19, Internal)

My suggested edits are in green text with yellow highlight.

- ~~346-3.3 Mass Concrete: When the Contract Documents designate any structure as mass concrete is designated in the Contract Documents~~, use a Specialty Engineer to develop and administer a Mass Concrete Control Plan (MCCP). Develop the MCCP in accordance with ~~section 207 of the ACI Manual Publications 207.1R Guide to Mass Concrete, ACI 207.2R Report on Thermal and Volume Change Effects on Cracking of Mass Concrete, and ACI 224R Control of Cracking in Concrete Structures of Concrete Practice~~ to ensure concrete core temperatures for any mass concrete element do not exceed ~~either~~ the maximum allowable core temperature of 180°F, ~~or and that~~ the ~~maximum~~ temperature differential ~~of 35°F~~ between the element core and surface ~~do not exceed the maximum allowable temperature differential of 35°F~~. Submit the MCCP to the Engineer for approval at least 14^o ~~calendar~~ days prior to the first anticipated mass concrete placement. Ensure the MCCP includes and fully describes the following:¶
- ~~every intervals no greater than six hours, beginning at the completion of concrete placement and continuing until decreasing core temperatures and temperature differentials are confirmed in accordance with the approved MCCP. Leave temperature control mechanisms in place until the concrete core temperature is within 50°F of the ambient temperature.~~ Within three days ~~working days~~ of the completion of temperature ~~monitoring recording for each concrete element~~, submit an ~~electronic, editable~~ report to the Engineer ~~which that~~ includes ~~the element identification all temperature readings, temperature differentials, date and time of any changes to the temperature control measures, all original temperature readings, data logger summaries and graphs, and results of the visual inspection of the sheets and the maximum core temperature and temperature differentials for each mass concrete element.~~¶
- → ~~If the first element of a group of elements with the same dimensions is placed in accordance with Upon successful performance of the approved MCCP, without exceeding either the maximum temperature or maximum temperature differential of the concrete, reduced monitoring of similar the remaining elements may be allowed requested. Submit any such Requests written approval from to the Engineer for reduced monitoring approval at least 14^o calendar days prior to the anticipated requested date of reduced monitoring. If approved, temperature monitoring is required the Specialty Engineer may monitor only for the initial element of a group of concrete elements meeting all of the following requirements:¶~~
- → → 12. Measures to prevent thermal shock.¶
 - → → 13. Active cooling measures, if used.¶
 - → ~~Do not place concrete until the MCCP is approved receives written approval, and fully comply with its requirements the approved MCCP. Any modifications must be submitted as addenda to the original MCCP and must be approved in writing by the Engineer. Ensure that, prior to the first concrete placement of each concrete element t~~The Specialty Engineer or approved designee ~~shall~~ personally inspects ~~and approve~~ the installation of ~~the~~ temperature measuring devices and verifies ~~iesy~~ that the ~~temperature data acquisition equipment is functioning properly process for recording temperature readings is effective for the first placement of each size and type mass component. The temperature data acquisition equipment must record~~

→ → → 4. The concrete mix design meets the mass concrete proportioning requirements of Standard Specification 346-2.3 and ¶

→ → → 5. The total cementitious material content of the concrete mix design is less than or equal to 750 pounds per cubic yard or less. ¶

→ → → 6. Temperature of the concrete is 95°F or less at placement. ¶

→ ~~If either the maximum allowable core temperature or temperature differential of any mass concrete element is exceeded,~~ Implement immediate corrective action as directed by the Specialty Engineer when either the core temperature or the temperature differential of any mass concrete element exceeds its maximum allowable value to remediate. The approval of the M CCP shall be revoked. Do not place any mass concrete elements until a revised M CCP has been approved in writing by the Engineer. Submit an Engineering Analysis Scope in accordance with 6-4 for approval, which addresses the structural integrity and durability of any mass concrete element which that is not cast in compliance with the approved M CCP or which exceeds the allowable core temperature or temperature differential. Submit all analyses and test results requested by the Engineer for any noncompliant mass concrete element to the satisfaction of the Engineer. There shall be no additional compensation or time granted. ~~Department will make no compensation, either monetary or time~~ for the analyses and tests or any impacts upon to the project related to or arising out of this issue. ¶

→ → → 5. Use the same temperature control measures used for the initial monitored element and keep in place for at least the same length of time as for the initial element. The Contractor and Engineer each have the option to have the temperature monitored to ensure the core temperature is within 50°F of ambient prior to termination of temperature control measures. ¶

→ → Install temperature measuring and recording devices for all mass concrete elements. Position the temperature sensors two inches inside the concrete surface for surface temperature measurements and at the expected location of the maximum temperature for core temperature measurements. Place the ambient temperature sensor in a location that protects it from direct exposure to rain, sun, or sources of radiated heat, such as concrete or asphalt pavement surfaces. Temperatures shall be recorded, starting at the time of concrete placement, and continuing until the maximum core temperature is within 50°F of the ambient temperature. Resume the recording of temperature monitoring of the temperatures device output for all elements if directed by the Engineer. No additional compensation or time will be granted by the Department. ~~will make no compensation, either monetary or time~~ for any impacts associated with or arising out of reduced monitoring of mass concrete elements. ¶

Response: Changes have been made prior to Industry review.

Ananth Prasad
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Comments: (11-19-19, Internal)

Page 1 Number 11 needs better wording to define 40F to 100F ambient temperature range. Since a mass concrete plan is written weeks and months ahead of the actual pours, is the ambient temperature range 40F to 100F based on the start of the placement, or the end of curing, or the average ambient temperature over the curing days required to control the temperatures? And then there is an execution and enforcement that needs to be right. Even though the ambient temperature right now is 65F, the plan needs to predict the maximum concrete placing temperature based on the anticipated ambient conditions while the concrete cures.

So the ambient temperature range cannot be a variable. For example, the low temperature in Tampa today is 60F, high 72F. Right now the temp is 65F. All of those temperatures are within the 40F to 100F ambient temperature range, so which one would be executed by or enforced on the contractor as far as maximum concrete placing temperature?

I advise using a reference website, like Southeast Regional Climate Center, that has historical ambient temperatures based on monthly average ambient or monthly maximum ambient or monthly minimum ambient. I like the monthly average ambient for modeling the anticipated thermal developments because the daily highs and lows are averaged for a month for as many years as there are records. It is possible for the department to also assign the years into which the average monthly ambient can be assigned. 1981 to 2010 is popular. Then decide which stations in Florida will be used. The international airports, for example. They usually have good temperature monitoring data that can be used for these applications.

Anyway, that is a lot of wordage for saying that the ambient temperature range 40F to 100F needs to be defined

Response: The temperature calculations are to be done, for ambient temperatures at the time of concrete placement of 40°, 50°, 60°, 70°, 80°, 90°, and 100°F, by the specialty engineer developing the mass concrete control plan (“Analysis of anticipated thermal developments for the various mass concrete elements for all anticipated ambient temperature ranges between 40°F and 100°F, in 10°F increments”). The maximum concrete temperature at placement shall be calculated for each of these ambient temperatures (“Include maximum concrete placement temperatures for each condition.”). This is straightforward language that will be understood by any specialty engineer approved to prepare mass concrete control plans.

The original language was “Analysis of anticipated thermal developments for the various mass concrete elements for all anticipated ambient temperature ranges”; however, specialty engineers have chosen to interpret this language as meaning to make two calculations, one at an average ambient winter temperature and one at an average ambient summer temperature. This presented very limited guidance for the contractor, which is why we have specified incremental ambient temperatures so that the contractor could interpolate between the two calculated concrete placement temperatures corresponding to the two ambient temperatures that bracket the actual ambient temperature at the time of placement.

In short, the change from “all anticipated ambient temperature ranges” to “all anticipated ambient temperature ranges between 40°F and 100°F, in 10°F increments” was made to enable the actual ambient temperature at concrete placement be used to provide a more accurate value for the maximum concrete temperature at placement, which reduces the chance of temperature exceedances during concrete curing.

Kevin Hayden
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Comments: (11-26-19, Industry)

• Page 1 - In the first paragraph, second sentence, the ACI publications are listed. With the exception of its first use, “ACI Publications”, I recommend removal of all subsequent uses of “ACI” listed before each publication number. • Page 1 – In the last paragraph, first sentence, I

recommend adding the word “has” between “MCCP and “received”. • Page 2 – In the last paragraph, fourth sentence, I recommend restructuring the sentence to state: “Temperatures shall be continuously recorded from the start time of concrete placement until the maximum core temperature...”. • Page 2 – In the last paragraph, last sentence, I recommend removal of the comma located between “Department” and “for any impacts”. • Page 3 – In the fourth paragraph (“Temperature monitoring may be omitted...”), I recommend the comma after “Contractor’s option” be removed.

Response:

John Westphal
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Comments: (12-2-19, Industry)

346-3.3, under bullet 11, should it read "maximum allowable concrete placement"? 346-3.3, 3rd paragraph, suggest "reduced monitoring of the remaining elements may be allowed upon the Engineer's approval". 346-3.3, 4th paragraph, sentence beginning with "Temperatures shall be recorded..." conflicts somewhat with 2nd paragraph regarding time to start monitoring: is it at time of concreting or time of completion? Suggest clarifying and state only once. 346-3.3, 5th paragraph, should it be "Instrumentation and temperature monitoring"?

Response:

David Westcott
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Comments: (12-6-19, Industry)

346-3.3 Mass Concrete 11. 11. Analysis of anticipated thermal developments for the various mass concrete elements for all anticipated ambient temperature ranges between 40°F and 100°F, in 10°F increments. Include maximum concrete placement temperatures for each condition. Comment: How would the varying maximum concrete placement temperatures be communicated to the producer? Who has the responsibility of communicating the maximum temperature for the respective concrete placement? The concern is that this could lead to rejection at no fault of the producer.

Response:

Larry Jones
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Comments: (12-12-19, Industry)

The maximum allowable core temp for mass concrete in 346-3.3 needs to be reduced from 180 deg F to 160 deg F in accordance with the current (2017) AASHTO LRFD Bridge Design Specification (5.14.2.5). 5.14 is a new durability chapter in the AASHTO LRFD BDS.

Response:

Ananth Prasad
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Comments: (12-16-19, Industry)

See the comments below. We need to address these comments before the spec is implemented. So therefore, I ask that this spec be held from implementation until these comments are resolved.

Some of my yellow comments:

Position the temperature sensors two inches inside the concrete surface for surface

We typically tie the thermocouple to reinforcing that has 4” of specified clearance. I would be more comfortable with two inches +/- or “inside the concrete surface as shown in the M CCP.”

I’m okay with items 1-6, I missed “for any” and thought they were only addressing drilled shafts. I would like to have the following comments passed to them for their review and comments.

Item 11 on the first page is the most requiring better definition of all anticipated ambient temperature ranges between 40F to 100F.

It seems to me that all anticipated ambient temperature ranges would mean the ambient temperature during the curing and monitoring period.

It doesn't say that.

More likely they mean the average ambient temperature during the curing and monitoring period.

The average would include the highs and lows during the days of curing and monitoring.

But even using the average ambient opens the door to all sorts of opinion when it comes time to pour mass concrete. Someone from QC would be required to evaluate the ambient temperatures in the future, and conceivably submit in writing to the PA what the anticipated ambient temperature range will be for the pour.

Meaning, everyone (QC, VT, FDOT) would have an opinion.

So, Item 11 is trouble. There are other potential mis-applications to Item 11 than what I have said here.

I recommend using the average ambient based on the historic monthly average for the project area. These data are available. Possibly use the international airport in the project area. They have good historic records.

As part of revising this spec, the FDOT could look over the historic data and decide (or not) to use 1981 to 2010 (like USACE), or maybe 1989 to 2019, for the historic monthly average ambient. So if a mass pour is made in December, everyone can see in the mccc what the average ambient is. There are bound to be cold spells and hot spells during any month, but that is also part of a historic average.

In this way it is not opinion.

Response:

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Comments: (12-16-19, Industry)

Comment on Subarticle Section 3.3 Mass Concrete- Second Sentence The prospered sentence is very lengthy and the addition of the word “either” has changed the intent of the allowable core and differential temperature requirements. It shows the choice of either core temperature or differential temperature requirements, not both requirements. It is recommended to include the proposed revision in two short sentences. Use either word “and”, or use the word “neither”, which are included in the following options: Option 1: Develop the MCCP meeting the requirements of ACI Publications 207.1R Guide to Mass Concrete, ACI 207.2R Report on Thermal and Volume Change Effects on Cracking of Mass Concrete, and ACI 224R Control of Cracking in Concrete Structures. Ensure that the concrete core temperatures for any mass concrete element do not exceed 180°F and differential temperatures between the element core and surface do exceed 35°F. Option 2: Develop the MCCP meeting the requirements of ACI Publications 207.1R Guide to Mass Concrete, ACI 207.2R Report on Thermal and Volume Change Effects on Cracking of Mass Concrete, and ACI 224R Control of Cracking in Concrete Structures. Ensure that neither the concrete core temperatures for any mass concrete element exceed 180°F, nor the differential temperatures between the element core and surface exceed 35°F.

Response:

Brendon Pridmore
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Comments: (12-19-19, Industry)

The duration allowed for Engineer review of MCCP revisions is problematic. Suspension of the MCCP can result from many issues; placement temperature, curing temperatures, 'cold joints' resulting from time between trucks, temperature sensor malfunction, irregularities on the element surface. Upon suspension of the MCCP, the contractor in many cases will have multiple sets of forms, expensive equipment, rebar deliveries and a rebar sub-contractor working in concert along a path of successive, interdependent movements. Bringing this entire train of costly elements to a complete stop for two weeks while the MCCP revision is reviewed is in many cases, completely unnecessary and seemingly punitive. While the initial MCCP submittal warrants a significant amount of time to be reviewed, most revisions are very simple changes that don't warrant such a long duration. The addition of more insulating blankets, or a change from slag to ash in the mix design for example. A shortened window for review of MCCP revisions would ensure that MCCP suspensions do not cause excessive cost overruns - which will ultimately translate into higher bid prices for the Mass Concrete pay item. It may be helpful and more practical to identify certain types of revisions to the MCCP that would require a longer review duration, and other types that would require a shorter duration.

Response:

Larry Jones
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Comments: (12-20-19, Industry)

Jose & Patrick,

We are having an issue with the temperature 4 inches from the edge of 30-inch augercast piles (cast with 8ksi grout) approaching 200 deg. These are bridge foundation piles for high profile bridges. I assume part of the high temp issue is the contractor using over 1100#/cy cement (over 1500#/cy total CM), another may be the lack of coarse aggregate. Fortunately we are monitoring these piles with the Thermal Integrity Testing System; the dimensions of the piles would not classify them as mass concrete under our current dimension based guidelines.

Should I revise the Developmental Specification (for future projects) to consider all augercast piles for bridges as mass concrete, or perhaps all augercast piles using grout with more than 750#/cy total CM? The largest expected pile diameter is 36-inches currently, however, 48-inch piles are cast in other parts of the country. I can make the revision temporary until ACIP piles can be specifically addressed in 346-3.3.

Also, please consider reducing the maximum allowable core temp for mass concrete in 346-3.3 from 180 deg to 160 deg F in accordance with the current (2017) AASHTO LRFD Bridge Design Specification (5.14.2.5). 5.14 is a new durability chapter in the AASHTO LRFD BDS.

Thanks for your help.

If you have any questions, please let me know. Have a great day.

(Additional email. 12-20-19)

Additional recommended revisions are attached. If you disagree with any, just omit them from what you add as my comments.

~~SUBARTICLE 346-3.3 is deleted and the following substituted.~~

160 **346-3.3 Mass Concrete:** When the Contract Documents designate any structure as mass concrete ~~is designated in the Contract Documents~~, use a Specialty Engineer to develop and administer a Mass Concrete Control Plan (MCCP). Develop the MCCP in accordance with ~~section 207 of the ACI Manual~~ Publications 207.1R Guide to Mass Concrete, ACI 207.2R Report on Thermal and Volume Change Effects on Cracking of Mass Concrete, and ACI 224R Control of Cracking in Concrete Structures ~~of Concrete Practice~~ to ensure concrete core temperatures for ~~any~~ mass concrete element do not exceed either the maximum allowable core temperature of 180°F ~~or and that~~ the maximum temperature differential of 35 F between the element core and surface ~~do not exceed the maximum allowable temperature differential of 35°F~~. Submit the MCCP to the Engineer for approval at least 14 calendar days prior to the first anticipated mass concrete placement. Ensure the MCCP includes and fully describes the following:

markable ??

and record

working

temperature readings at least once per hour, beginning at the completion of concrete placement and continuing until the core temperature is within 50°F of the ambient temperature. The Specialty Engineer shall be available for immediate consultation during the monitoring period of any mass concrete element. Monitor ~~record~~ temperature measuring device readings at least once every intervals no greater than six hours, beginning at the completion of concrete placement and continuing until decreasing core temperatures and temperature differentials are confirmed in accordance with the approved MCCP. Leave temperature control mechanisms in place until the concrete core temperature is within 50°F of the ambient temperature. Within three ~~working~~ days of the completion of temperature monitoring ~~recording for each concrete element~~, submit an electronic, ~~editable~~ report to the Engineer ~~which that~~ includes the element identification ~~all~~ temperature readings, temperature differentials, date ~~and time of any changes to the temperature control measures, all original temperature readings, data logger summaries, and graphs, and results of the visual inspection of the sheets and the maximum core temperature and temperature differentials for each mass concrete element.~~

Submit requests for

If the first element of a group of elements with the same dimensions is placed in accordance with ~~Upon successful performance of the approved MCCP, without exceeding either the maximum temperature or maximum temperature differential of the concrete, reduced~~ monitoring of ~~similar~~ the remaining elements may be ~~allowed~~ requested. ~~Submit any such~~ Requests ~~written~~ approval from ~~to~~ the Engineer for ~~reduced monitoring~~ approval at least 14 calendar days prior to the ~~anticipated~~ requested date of reduced monitoring. If approved, ~~temperature monitoring is required~~ the Specialty Engineer may monitor only for the initial element of a group of concrete elements meeting all of the following requirements:

with written approval

1. All elements have the same ~~least cross sectional~~ dimensions.
2. All elements have the same concrete mix design.
3. All elements have the same insulation R value and active cooling measures (if used).
4. Ambient temperatures during concrete placement for all elements ~~are~~ within minus 10°F ~~or plus 5°F~~ of the ambient temperature during placement of the initial element.

Install temperature measuring ~~and recording~~ devices for all mass concrete elements. ~~Position the temperature sensors two inches inside the concrete surface for surface temperature measurements and at the expected location of the maximum temperature for core temperature measurements. Place the ambient temperature sensor in a location that protects it from direct exposure to rain, sun, or sources of radiated heat, such as concrete or asphalt pavement surfaces. Temperatures shall be recorded, starting at the time of concrete placement, and continuing until the maximum core temperature is within 50°F of the ambient temperature. Resume the recording of temperature monitoring of the temperatures device output for all elements if directed by the Engineer. No additional compensation or time will be granted by the Department will make no compensation, either monetary or time, for any impacts associated with or arising out of reduced~~ monitoring of mass concrete elements.

6. Temperature of the concrete is 95°F or less at placement.

~~If either the maximum allowable core temperature or temperature differential of any mass concrete element is exceeded, Implement immediate corrective action as directed by the Specialty Engineer when either the core temperature or the temperature differential of any mass concrete element exceeds its maximum allowable value to remediate.~~ The approval of the MCCP shall be revoked. Do not place any mass concrete elements until a revised MCCP has been approved in writing by the Engineer. Submit an Engineering Analysis Scope in accordance with 6-4 for approval, which addresses the structural integrity and durability of any mass concrete element ~~which~~that is not cast in compliance with the approved MCCP or which exceeds the allowable core temperature or temperature differential. Submit all analyses and test results requested by the Engineer for any noncompliant mass concrete element to the satisfaction of the Engineer. There must be no additional compensation or time granted~~The Department will make no compensation, either monetary or time,~~ for the analyses and tests or any impacts upon the project related to or arising out of this issue.

No

will be

Response:
