

# Out in the cold

Constructing concrete out in the cold may now be more affordable, thanks to a new standard approved by the American Society for Testing and Materials (ASTM). Designers can recommend use of ASTM C 1622, *Standard Specification for Cold Weather Admixture Systems*, that would enable contractors to continue their work even when the temperature of the concrete is expected to fall as low as 23 F, without the expense of traditional protections, in order to maintain important progress schedules.

Per ASTM C 1622, the combination of commercially available chemical admixtures

comprising a cold weather admixture system will depress the freezing point of the concrete mix water and accelerate the hydration rate of the cement in the concrete. (A side benefit of this concrete is enhanced freeze-thaw durability.)

This capability has existed for over 25 years, but until now the use required special acceptance standards. In 1992, a partnership of the U.S Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL), with WR Grace & Co. and Master Builders Technologies (now Degussa) led to two successful prototypes. With interest, funding and other support

U.S. Army Cold Regions  
Research and Engineering  
Laboratory (CRREL)



from the Department of Defense and the Federal Highway Administration, CRREL's principal researcher on this program, Charles J. Korhonen, achieved his objective with ASTM's approval of C 1622 on September 15, 2005.

More on this can be read in the article, Breaking the Freeze Barrier, appearing in the November 2005 issue of *Concrete International* magazine, or on the CRREL website at [http://www.crrel.usace.army.mil/concrete/ACPA\\_briefing\\_2005.ppt](http://www.crrel.usace.army.mil/concrete/ACPA_briefing_2005.ppt).



## CFA's cold weather research

Local members of the Concrete Foundations Association (CFA) have been touring Ohio informing audiences of some very important research that they conducted in our state in 2003. Audiences have included builders, building officials, architects and engineers. The *CFA Cold Weather Research Report 2004* is aimed at improving the knowledge base used to define building codes affecting cold weather wall construction.

Nationally, the CFA's report has been referenced with proposed updates of the American Concrete Institute's (ACI) committee report 306R *Cold Weather Concreting*, and ACI 306.1 *Standard Specification for Cold Weather Concreting* as well as a reference for currently available, ACI 332-04 *Requirements for Residential Concrete Construction* which is the latest concrete code produced by ACI. Although it may be a year or more before ACI approves and publishes their two updated 306 documents the *Cold Weather Research Report 2004* is available now from the CFA.

Following is an abbreviated summary of the research results:

- Ambient temperatures should not set the restriction for cold weather

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## Cold weather concrete in the park

Cold weather concrete will facilitate more boating opportunity for Springfield OH residents. A five - lane reinforced concrete boat launching ramp has just been constructed on the shore of C.J. Brown Reservoir, in Buck Creek State Park, just east of that City. Oglesby Construction, Inc. was the concrete subcontractor for this Ohio Department of Natural Resources (ODNR) project.

In November 2005, general contractor, Brumbaugh Construction, of Arcanum OH, began site preparation for the ramps. Permanent sheet piling was driven to form a breakwater pier, and to create the ramp walls. Then soil was excavated to form an inclined subgrade 100 ft wide, 85 ft long that sloped down to 7 ft below water level. Brumbaugh's crew compacted the subgrade, then placed and compacted a 4 in. layer of crushed aggregate base, per Ohio Department of Transportation (ODOT) Specification 304.

From February 1 through February 23, 2006, Oglesby Construction, Inc., a concrete paving contractor, from Norwalk OH, installed the 8 in. thick concrete boat ramp, in multiple lanes, much as they would for a wide concrete parking lot. However, unlike a parking lot, the ODNR boat ramp design required the concrete slab to be continuously reinforced with one mat of No. 4 reinforcing steel, at 12 in. by 12 in. spacing, chaired at mid-slab.



*No. 8 coarse aggregate in concrete mix facilitated sharp definition of ODNR's v-grooved surface for new boat ramp in Buck Creek State Park.*

Surface texture was also different for the concrete boat ramp. The ODNR design specifies a one-inch deep V-grooved, saw-tooth macro texture that is tooled into the surface of the fresh concrete in a herringbone pattern, after strike-off. The saw tooth ridges between grooves provide positive gripping action for boat-trailer towing vehicles. The grooves are herringboned to facilitate drainage of the surface above the water level.

Oglesby's crew used ODOT specification 499 Class S concrete, with No. 8 coarse aggregate, for better definition of the surface grooving. Because of low air temperatures during the placements, the ready mix producer, Bryce Hill, Inc., of Springfield OH, used heated water to batch the concrete, and added a non-chloride accelerating ad-

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## CFA's cold weather research, Continued from page 8

wall construction. For all mixes tested, internal concrete temperatures significantly lagged ambient temperature drops – remaining much longer above the freezing point.

- All mixes continued to gain strength even at early ages and low temperatures, all wall specimens eventually froze and returned to appropriate strength gain once the concrete temperature climbed above the freezing point.
- Maturity prediction was validated as an accurate means of determining in-place concrete strength as strengths determined from maturity curves closely matched core and cylinder

breaks.

- Admixtures that reduce water content enhance strength gain at lower temperatures.
- The benchmark of attaining 500 psi strength before freezing although appropriate, is less important in residential walls than controlling the amount of “free” water in mix.
- Strength gains were similar whether wall samples were covered or not.
- Faster strength gain occurs with Type III cement, and with accelerating admixtures.

A few recommendations from the CFA report are:

- The mixes used in this research pro-

vide a sound basis for a contractor and ready mix supplier to work together to design mixes that will perform well based on the expected variables for a placement, but they should be refined with localized testing.

- Have some mix designs available with documented maturity history.
- Concrete placed early in the day may take advantage of solar heat gain for faster strength development.

For additional information please go the Concrete Foundations Association's website, [www.cfawalls.org](http://www.cfawalls.org).

## Architectural concrete, Continued from page 9

dersides of the arched pier caps. These insets were also stained with sandstone colors to highlight the architectural features.

The bridge itself consisted of prefabricated,

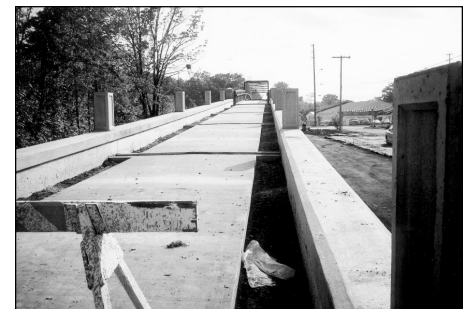


The completed structure has a reinforced concrete deck on corrugated steel deck forms.

prepared steel truss sections which were shipped from Minnesota and erected at the site in one day. The main span of 104 ft over Mahoning Avenue was shipped in two pieces, field bolted together and erected as one piece. The truss sections were shipped with the corrugated metal deck form already in place.

After erection, a concrete deck was cast on the metal decking (6 in. thick measured over the top of the corrugations). An 8 in. thick pavement was then cast on top of the fill for the two approach ramps. Ohio Department of Transportation specification 499, Class C concrete was used throughout the project.

Overall, this bridge is very aesthetically pleasing, using a blend of architectural treatments on the exposed concrete which tran-



Cast-in-place concrete approach ramp slabs are 8 in. thick (designed for maintenance vehicles).

sitions into the haunched, green colored trusses. The cost of this structure was \$1.6 million. A.P. O'Horo Company of Youngstown, OH was the contractor who completed the entire structure within the allotted time of 150 days.

## More excitement to come at Maumee River Crossing, Continued from page 1

All of the precast trapezoidal box segments have been completed and are now in the process of being erected for the main structures. The sections for the southbound I-280 lanes have now been erected over the river from the south bank to the main tower (central pylon). The overhead truss (AG-1) has been located to the northbound lanes at the south river bank, and is now constructing spans north to the pylon.

Since the central pylon is located outside of the Maumee River channel, the mainline sections south of the tower are being supported by steel temporary tower piers. Once all of the northbound segments from the south riverbank to the central pylon have been erected, construction of the main

span over the shipping channel of the Maumee River can begin.

Erection high above the shipping channel will be exciting to witness because these segments will be cantilevered northward out over the river and held in place by the permanent cable stays. The stays will be threaded through the central pylon and connected to the previously-completed, south-erly spans. Once the north spans are completed, the temporary supports on the south side can be removed and the main spans of the Veterans' Glass City Skyway will be self supporting.

Meanwhile, the segments for the approaches from the north end of the bridge

project are also being erected using cranes and assembly trusses. That portion of the structure work is growing southward toward the north riverbank.

Late this summer (2006) we are planning to host another tour of this once in-a-lifetime project. We will be coordinating the tour so that everyone can observe the cantilever sections being erected over the river. This will be an exciting opportunity to see the construction of a state-of-the-art cable stayed bridge as well as stand in the midst of approximately 190,000 cubic yards of concrete and 3,000 precast concrete segments. Watch for further details of this upcoming event.