Winter 2011

THE CONNCRETE TIMES

The Connecticut Concrete Promotion Council (CCPC) of the Connecticut Ready Mixed Concrete Association
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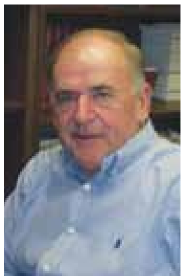
DIRECTOR'S MESSAGE



We have seen the beginning of 2011 unfold with mixed reports of financial conditions within the construction industry. The housing market is the most severely affected by record low new home prices and huge inventories. I have the opportunity, as a member of the local Construction Specifications Institute, to exchange news and ideas with many of the area's specification writers and it appears that design firms are hiring and projects are on the drawing boards. These green shoots are appearing and hopefully, we will experience a more confident attitude about construction in the Connecticut market.

Pervious concrete has continued to be a focal point of the CCPC and this past winter gave us an opportunity to present programs to groups such as the American Society of Landscape Architects, engineering firms, Rotary Clubs, and local municipalities. Their interest has been piqued by projects such as the Green Capitol in Hartford and Subway Sandwich World Headquarters in Milford. The programs have ranged from a description of the placement process to discussing sources of stormwater runoff and its remediation.

The Connecticut Department of Environment recently held a workshop to educate firms about the permitting process and possible cause and effects of stormwater runoff. The CCPC will continue to be available as a resource for future pervious concrete inquiries.

All the best,

Jim Langlois

ON THE CONCRETE SCENE

PERVIOUS CONCRETE = SUBWAY SANDWICH'S ANSWER

At the recently acquired training center, proprietors of Subway Sandwich's World Headquarters in Milford, CT, and the design partners were looking for the answer to being "green." Codespoti & Associates, P.C., located in Orange, CT, was responsible for the site planning and design of the property and City Point Construction Company, of West Haven, CT, was the general contractor.

The "green" answer was to use pervious concrete to construct 30,000 square feet of parking area which was completed in the fall of 2010. The balance of the parking area or 60,000 square feet would be completed using pervious during the spring of 2011. The pervious design was accomplished through a co-operative effort of the National Ready-Mixed Concrete Association (NRMCA) and their Concrete Parking Lot Design Assistance Program and the Ohio Concrete Association (CPLDAP). The CPLDAP is an effort to ensure a comfort level for designers who may not have experience with concrete design for parking areas. This program is available through the Connecticut Concrete Promotion Council and the NRMCA.

Construction of the project began in earnest on November 8th. The pervious concrete was a typical design

Continued on inside back cover

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FOR THE RECORD

AT THE CAPITOL: Committee Considers Bill on Corrosive Effects of Chemical Road Treatments; CCIA Hosts EPA-DEP Industrial Stormwater Program

by Matthew Hallisey,
CCIA Director of Government Relations & Legislative Council

The legislature's Transportation Committee considered a bill this session that would have required the state Department of Transportation to analyze the corrosive effects of chemical road treatments on roads, bridges, highways or other infrastructure. The bill arose out of concerns expressed by the Motor Transport Association of Connecticut about the documented corrosive effect on trucks of substances applied during winter storms to prevent accumulation of snow and ice.

As many concrete manufacturers and ready-mixed suppliers know, de-icing solutions applied by ConnDOT have led to deterioration of state roads and highways in recent years. The trucking industry expressed similar concerns as well as potential adverse affects of such chemicals on the environment. In support of House Bill 6571, CRMCA submitted to the committee a study, Effects of Various Deicing Chemicals on Pavement Concrete Deterioration, which evaluated different deicers on Iowa highway concrete and found significant concrete crumbling and damage to concrete from solutions of chemicals tested.

The agency opposed the bill, testifying that it uses less salt per lane mile than neighboring states; there are ongoing studies on the issue and the bill would duplicate those efforts; and it does not have the resources of $250,000 it estimates would be required to conduct the study. While the bill did not move forward, the agency has pledged to continue to work to develop and adjust, as necessary, its snow and ice guidelines as new guidance is issued.

Meanwhile, in March CCIA hosted an Industrial Stormwater General Permit Compliance Workshop attended by many CRMCA members. The program featured a senior enforcement counsel and an inspector from U.S. EPA Region I in Boston and a stormwater permit engineer from the state Department of Environmental Protection. Last August, DEP issued a General Permit for the Discharge of Stormwater Associated with Industrial Activities, which is effective October 1, 2011. In March, DEP published a Guidance Document for Preparing a Stormwater Pollution Prevention Plan to provide general guidance for developing and implementing a site-specific Stormwater Pollution Prevention Plan for an industrial activity and to assist facilities in complying with the requirements of the General Permit.

The EPA inspector imparted seemingly simple, yet important practical advice for site owners and operators of facilities confronted with an inspection: provide safety information, be professional, cooperate, ask and answer questions, and take notes and photographs. His presentation also featured examples of common process wastewater violations and poor and good best management practices by concrete manufacturers and at sand and gravel pits. An inspector, he said, generally knows when corners are being cut.

SETTING NEW SITES

HIGH OIL PRICES SHOW CONCRETE AS RESPONSIBLE CHOICE

from Douglas O'Neill, LEED® AP
National Resource Director
National Ready Mixed Concrete Association
Phone: 585.436.8310 /doneill@nrmca.org

Environmental concerns coupled with rising oil and asphalt prices have given communities and individuals across the country cause to re-evaluate their choice of paving materials. The reason many towns, property managers and home owners paved their streets, parking lots and driveways with asphalt revolved around initial costs. It was simply cheaper to pave with asphalt, initially.

Times have changed! In many areas initial cost of concrete is comparable to asphalt, and as we all know the life cycle cost of concrete is significantly lower than that of asphalt. There has been no better time to consider concrete paving than right now. With our current focus on sustainability, the concepts of durability, water quality, the heat island effect and energy efficiency are now being considered by the same people who up until recently made decisions based solely on initial costs. Towns are realizing that they are spending significantly more resources on repair and maintenance on their existing asphalt streets, and are looking at concrete as a solution.

The concerns over polluted stormwater due to the residue picked up from asphalt pavements are another reason communities are looking to concrete. Many towns have already banned the use of Coal Tar Asphalt sealants due to carcinogens found leeching into waterways from recently sealed asphalt parking lots and driveways. Light colored roofs and pavements are helping urban areas stay cooler in the summer heat, thus lowering the energy requirements on buildings to keep their occupants comfortable.

The main reason that concrete has been considered more expensive than asphalt over the years is that concrete pavements have been overdesigned. Many designers have been using outdated ASHHTO or state DOT designs which add unnecessary thickness to the concrete sections, add costly reinforcement that in most cases is not

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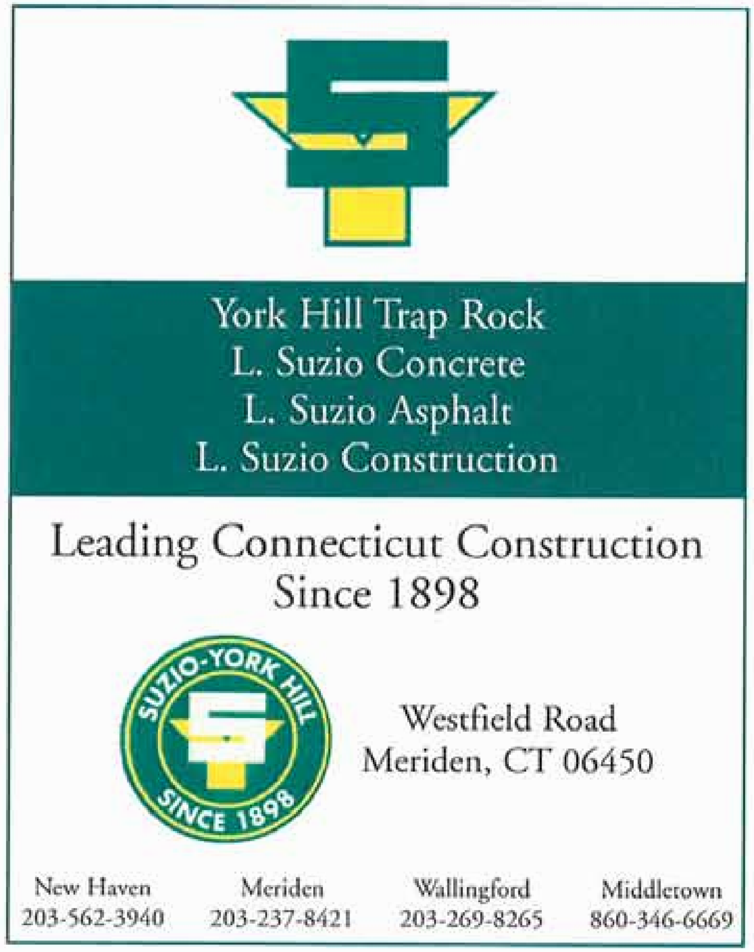

STRATEGIES FOR SUCCESS

Schedule, registration forms, and information available at CCPC office.

CASHO EQUIPMENT & TECHNICAL SHOW
Mountain Ridge, Wallingford, CT
5/12, 9:00 AM

FULL DEPTH RECLAMATION with CEMENT
Rutgers Univ., Piscataway, NJ
5/12, 8:00 AM-12:30 PM

INTERNATIONAL CONCRETE SUSTAINABILITY CONFERENCE
Hyatt Regency & MIT, Boston, MA
8/9-11

ACI FIELD TECH CERTIFICATION
CCIA Offices & Tilcon
9/8 • 9/10 • 9/15 • 9/17

AMERICAN CONCRETE INSTITUTE (ACI) FALL CHAPTER & CERTIFICATION ROUNDTABLE
TBA Hartford, CT
9/26-27

ACI FIELD TECH CERTIFICATION
CCIA Offices & Tilcon
10/27 •10/29 • 11/3 •11/5

ENGINEERING PROPERTIES OF PERVIOUS CONCRETE

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Fresh Properties

The plastic pervious concrete mixture is stiff compared to traditional concrete. Slumps, when measured, are generally less than ¾ inches (20 mm), although slumps as high as 2 inches (50 mm) have been used. When placed and compacted, the aggregates are tightly adhered to one another and exhibit the characteristic open matrix.

For quality control and quality assurance, unit weight or bulk density is the preferred measurement because some fresh concrete properties, such as slump, are not meaningful for pervious concrete. Conventional cast-cylinder strength tests are also of little value, because the field consolidation of pervious concrete is difficult to reproduce in cylindrical test specimens, and strengths are heavily dependent on the void content. Unit weights of pervious concrete mixtures are approximately 70% of traditional concrete mixtures.

Concrete working time is typically reduced for pervious concrete mixtures. Usually, one hour between mixing and placing is all that is recommended. However, this can be controlled using retarders and hydration stabilizers that extend the working time by as much as 1.5 hours, depending on the dosage.

Hardened Properties

Density and Porosity

The density of pervious concrete depends on the properties and proportions of the materials used, and on the compaction procedures used in placement. In-place densities on the order of 100 lb/ft³ to 125 lb/ft³ (1600 kg/m³ to 2000 kg/m³) are common, which is in the upper range of lightweight concretes. A pavement 5 inches (125 mm) thick with 20% voids will be able to store 1 inch (25 mm) of a sustained rainstorm in its voids, which covers the vast majority of rainfall events in the U.S. When placed on a 6-inch (150-mm) thick layer of open-graded gravel or crushed rock subbase, the storage capacity increases to as much as 3 inches (75 mm) of precipitation (see Figure 3 below and Hydrological Design Considerations).

Subgrade Permeability

The flow rate through pervious concrete depends on the materials and placing operations. Typical flow rates for water through pervious concrete are 3gal/ft²/min (288 in./hr, 120 L/m²/min, or 0.2 cm/s) to 8 gal/ft²/min (770 in./hr, 320 L/m²/min, or 0.54 cm/s), with rates of up to 17 gal/ft²/min (1650 in./hr, 700 L/m²/min, 1.2 cm/s). Even higher rates have been measured in the laboratory.

Compressive Strength

Pervious concrete mixtures can develop compressive strengths in the range of 500 to 4000 psi (3.5 MPa to 28 MPa), which is suitable for a wide range of applications. Typical values are about 2500 psi (17 MPa). As with any concrete, the properties and combinations of specific materials, as well as placement techniques and environmental conditions, will dictate the actual in-place strength. Drilled

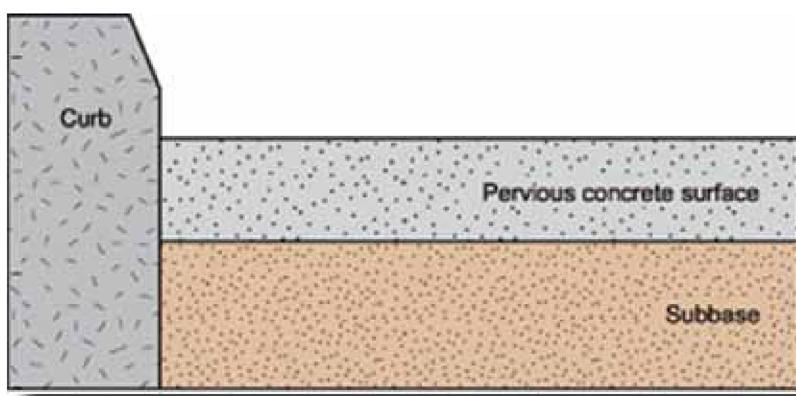

Figure 3. Typical cross section of pervious concrete pavement. On level subgrades, stormwater storage is provided in the pervious concrete surface layer (15% to 25% voids), the subbase (20% to 40% voids), and above the surface to the height of the curb (100% voids).

cores are the best measure of in-place strengths, as compaction differences make cast cylinders less representative of field concrete.

Flexural Strength

Flexural strength in pervious concretes generally ranges between about 150 psi (1 MPa) and 550 psi (3.8 MPa). Many factors influence the flexural strength, particularly degree of compaction, porosity, and the aggregate-to-cement (A/C) ratio. However, the typical application constructed with pervious concrete does not require the measurement of flexural strength for design.

Shrinkage

Drying shrinkage of pervious concrete develops sooner, but is much less than conventional concrete. Specific values will depend on the mixtures and materials used, but values on the order of .002 have been reported, roughly half that of conventional concrete mixtures. The material's low paste and mortar content is a possible explanation. Roughly 50% to 80% of shrinkage occurs in the first 10 days, compared to 20% to 30% in the same period for conventional concrete. Because of this lower shrinkage and the surface texture, many pervious concretes are made without control joints and allowed to crack randomly.

Durability

Freeze-Thaw Resistance

Freeze-thaw resistance of pervious concrete in the field appears to depend on the saturation level of the voids in the concrete at the time of freezing. In the field, it appears that the rapid draining characteristics of pervious concrete prevent saturation from occurring. Anecdotal evidence also suggests that snow-covered pervious concrete clears quicker, possibly because its voids allow the snow to thaw more quickly than it would on conventional pavements. In fact, several pervious concrete placements in North Carolina and Tennessee have been in service for over 10 years.

Note that the porosity of pervious concrete from the large voids is distinctly different from the microscopic air voids that provide protection to the paste in conventional concrete in a freeze-thaw environment. When the large open voids are saturated, complete freezing can cause severe damage in only a few cycles. Standardized testing by ASTM C 666 may not represent field conditions fairly, as the large open voids are kept saturated in the test, and because the rate of freezing and thawing is rapid. It has been shown that even after 80 cycles of slow freezing and thawing (one cycle/day), pervious concrete mixtures maintain more than 95% of their relative dynamic modulus, while the same mixtures showed less than 50% when tested at a more rapid rate (five to six cycles/day). It was noted that better performance also could be expected in the field because of the rapid draining characteristics of pervious concrete.

Research indicates that entrained air in the paste dramatically improves freeze-thaw protection for pervious concrete. In addition to the use of air-entraining agents in the cement paste, placing the pervious concrete on a minimum of 6 inches (150 mm), and often up to 12 (300 mm) or even 18 inches (450 mm) of a drainable rock base, such as 1-inch (25-mm) crushed stone, is normally recommended in freeze-thaw environments where any substantial moisture will be encountered during freezing conditions.

Sulfate Resistance

Aggressive chemicals in soils or water, such as acids and sulfates, are a concern to conventional concrete and pervious concrete alike, and the mechanisms for attack are similar. However, the open

"Engineering Properties," continued from previous page

structure of pervious concrete may make it more susceptible to attack over a larger area. Pervious concretes can be used in areas of high-sulfate soils and groundwaters if isolated from them. Placing the pervious concrete over a 6-inch (150-mm) layer of 1-inch (25-mm) maximum top size aggregate provides a pavement base, stormwater storage, and isolation for the pervious concrete. Unless these precautions are taken in aggressive environments, recommendations from ACI 201 on water-to-cement ratio and material types/proportions should be followed strictly.

Abrasion Resistance

Because of the rougher surface texture and open structure of pervious concrete, abrasion and raveling of aggregate particles can be a problem, particularly where snowplows are used to clear pavements. This is one reason why applications such as highways are generally not suitable for pervious concretes. However, anecdotal evidence indicates that pervious concrete pavements allow snow to melt faster, requiring less plowing.

Most pervious concrete pavements will have a few loose aggregates on the surface in the early weeks after opening to traffic. These rocks were loosely bound to the surface initially, and popped out because of traffic loading. After the first few weeks, the rate of surface raveling is reduced considerably and the pavement surface becomes much more stable. Proper compaction and curing techniques reduce the occurrence of surface raveling.

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"NRMC Releases Sustainability Initiatives Document," continued from page 3

needed and require the same sub-base under concrete as they would under asphalt; all reasons for the inflated costs of concrete.

Design teams are now realizing the effectiveness of using ACI330, the Guide for the Design and Construction of Concrete Parking Lots, which is the industry standard for proper parking lot design and construction. In this guide, designers are shown how to properly determine sub-base requirements and pavement thicknesses based on soil conditions and average daily truck traffic. ACI 330 highlights proper jointing requirements, construction details and curing procedures along with covering issues like materials and testing.

NRMCA and the CCPC are currently offering seminars and webinars on ACI 330 in order to educate the design community on the merits of proper design and construction of concrete parking lots. For more information contact Doug O'Neill at doneill@nrmca.org.

THINK GREEN:
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INTERNATIONAL
CONCRETE SUSTAINABILITY CONFERENCE
AUGUST 9-11, 2011 - BOSTON

Join the National Ready Mixed Concrete Association for the 2011 International Concrete Sustainability Conference, August 9-11, 2011, in Cambridge (Boston), MA, at the Hyatt Regency Cambridge and the Massachusetts Institute of Technology campus.

The sixth annual Concrete Sustainability Conference will provide learning and networking opportunities on the latest advances, technical knowledge, continuing research, tools and solutions for sustainable concrete manufacturing and construction.

"Pervious Concrete = Subway Sandwich's Answer," Continued from cover

with a layer of non-woven geotech fabric and a base of 12" of ¾" stone and 6 " of pervious concrete using a $^{3}/_{8}$" stone. The six hundred cubic yards of concrete for this project was produced by The Beard Concrete Company of Milford, CT. The concrete pours and placement were completed on November 13th and the 6 mil poly was left in place to enhance the cement hydration process.

This project utilized a unique process of placement and the accompanying photos will help with the explanation. A 120 foot telebelt was utilized for the conveying of the concrete to the respective areas of the parking lot. A laser screed was used for the placement. The combination of the telebelt and the laser screed allowed for a quick delivery and placement to difficult areas of a large project and represented their first use in New England for pervious concrete. Seven days after the final pervious placement, the poly was removed and joints were saw cut. Photos that accompany this article will demonstrate the size of the project and the equipment that made the placement a unique and valuable lesson.

From a size standpoint, the Subway Sandwich project will be one of the five largest in New England and will generate a tremendous amount of curiousity and interest from design firms to Inland/Wetland organizations and owners, like Subway, interested in doing the "green" thing.

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Your CONNCRETE TIMES CONNECTION

IN THIS ISSUE

Credit: Newsletter Concept and Design: Ann Beaudin and Andrea Beaudin

WELCOME NEW MEMBERS

To become a member of a growing professional trade organization, contact Jim Langlois at CCPC 860.529.6855