Concrete Pavement Progress

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The Ease of Repairing Streets and Roads

Avoiding the expense and delays of perpetual cover-ups

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Motorists, businesses, and the public at large experience the effects of a massive 'cover-up' every year around this time. That cover-up occurs when asphalt overlays are placed over existing concrete, which is still structurally sound and both cost-effective and simple to repair.

All too often, owners default to asphalt overlays, not realizing the effects of continually overlaying roadway systems with asphalt. In addition to the road-user delays and the costs of frequent overlays and perpetual repairs of asphalt pavements, the initial and life cycle costs typically far exceed those of placing concrete overlays. In addition, there are the unforeseen problems such as potholes, rutting, and shoving, which are common to asphalt pavements. But the performance problems, costs, and delays are avoidable.

The importance of avoiding these problems is further amplified because traffic congestion costs American motorists $67.5 billion a year in wasted time and fuel costs and results in motorists spending an additional 4.5 billion hours a year stuck in traffic, according to The Road Information Program, Washington, D.C.

When Good Pavements Go Bad
All pavements eventually need rehabilitation, repair, and eventual reconstruction. To learn more about pavement restoration strategies, read ACPA's "The Concrete Pavement Restoration Guide: Procedures for Preserving Concrete Pavements" (TB020P).

When concrete pavement restoration (CPR) methods are no longer an economically viable alternative, one strategy for restoring concrete pavement to like-new condition is unbonded concrete overlays, which are a more cost-effective means of restoring pavements to a smoother, safer roadway. For the complete guide to using unbonded overlays, read ACPA's "Guidelines for Unbonded Concrete Overlays" (TO05P).

The term 'unbonded' is used to describe a concrete pavement placed on top of another with a seperation layer that allows them to work independently. The separation layer's primary function is to separate the movement between the existing concrete pavement and the new concrete overlay. A properly designed and installed separation layer also provides some other key benefits to the overall pavement design.

Using an asphalt separation layer between the two concrete pavements eliminates any reflective cracking from the underlying concrete pavement and ensures no 'keying' action of the joints. Also, offsetting the joint layout by approximately 3 feet improves load transfer and reduces the chance of roughness due to pumping.

Pre-placement Repairs

Prior to placement of both the separation layer and the new concrete overlay, some minor pre-placement repairs may need to be completed to ensure the overlay has uniform support.

Photos illustrate the Outer Drive project between Ford Road and Hines Drive, Dearborn Heights, Mich. ACPA member Six-S Construction, Waterford, Mich. placed the unbonded overlay (left) over an existing concrete roadway. The pavement had been overlaid with asphalt, which rutted and cracked (right). The asphalt was milled, then a 1-inch separation layer was added to prevent reflective cracking and improve construction of the concrete overlay.

Because the existing concrete pavement's primary function is to act as the base for the new pavement, it must be treated as such to ensure it provides proper support to the overlay, including consideration of some repair.

During pre-overlay repair, other procedures can occur simultaneously to expedite construction. For example, new drainage systems and pavement widening can be incorporated into the new pavement. After these construction processes are complete, the paving may begin as soon as the separator layer is applied.

The required concrete overlay thickness will depend on several factors, but experience has shown that an unbonded concrete overlay between four and eight inches of plain, unreinforced pavement will perform well for most urban applications.

Using this strategy not only extends the life of the concrete pavement, but also avoids frequent overlays and repairs required when asphalt surfaces are used.

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Study Calls for More Durable, Long-Lasting Pavements

Report consistent with FHWA poll that says
67 percent of motorists favor more durable pavements

One in four major urban roads provides unacceptable ride, thereby costing the average motorist nearly $400 annually, according to a study released by The Road Information Program (TRIP) recently.

The report, "Keep Both Hands on the Wheel: Cities with the Bumpiest Rides and Strategies to Make our Roads Smoother," released by TRIP this month, links significant pavement deterioration on major urban roadways to the increase in urban traffic, particularly large trucks.

TRIP reports that travel on urban roads increased by 30 percent between 1991 and 2001, and notes travel by large commercial trucks increased by 46 percent during the same time period. Vehicle travel is projected to increase by 42 percent by 2020, while travel by heavy trucks is projected to increase by 49 percent.

The TRIP study reports that a desirable goal for state and local governments is to maintain 75 percent of roads in good condition, but adds only three of the nation's urban areas (with populations of 1 million or more) achieve this goal. Only 14 major urban areas have at least 50 percent of their major roads in good condition. These major arterial routes carry 78 percent of the more than 1.7 trillion miles driven annually in urban America, according to the report.

The report also states that the increased use of more durable, long-lasting pavement materials is consistent with a recent public opinion poll, which found that 67 percent of motorists favored more durable pavements. The 2000 Federal Highway Administration poll surveyed 2,000 people.

Among TRIP's recommendations are the following:

- When critical routes are constructed or reconstructed, consider using pavement designs that will provide a longer-lasting surface.
- Build and rebuild roads and highways with the highest level of smoothness.
- Ensure foundations for road and highway pavements are built properly and maintained in good condition.
- Implement a pavement preservation program that postpones the need for significant rehabilitation by performing initial maintenance on road surfaces while they are still in good condition.

- Resurface roads in a timely fashion using a pavement material that is designed to be the most durable, given the local climate and the level and mix of traffic on the road.
- Invest adequately to ensure that 75 percent of local road surfaces are in good condition. Click here to view the study or visit the TRIP website, www.tripnet.org.

Concrete Answers the Call

As cited in the TRIP study, durable, long-lasting pavement materials is extremely important.

- Concrete pavements are so durable that they often exceed their design lives and in some cases handle three times more traffic than they were designed to carry ... years or even decades after the period for which they were designed.
- The durability of concrete minimizes the need for repair and annual maintenance.
- A recent study on tire/pavement noise conducted by the National Center for Asphalt Technology (NCAT) demonstrated that concrete pavements are just as quiet as asphalt pavements. In fact, one section of diamond-ground concrete was the quietest among the eight other sections tested (including a variety of asphalt pavements measured by NCAT researchers).
- Older concrete pavements showing signs of surface wear and roughness can be diamond-ground to restore them to a smooth, like-new condition.
- Concrete pavements can be designed for whatever the owner needs and can be placed quickly under traffic ... They can be constructed or reconstructed to meet a wide range of performance, longevity, and budgetary requirements.

Salt Lake City Street Stands Test of Time, Pavement Turns 96-Years Old

Project wins ACPA Pavement Achievement Award

Constructed in 1907, B Street in Salt Lake City has withstood the test of time with little maintenance or rehabilitation and is a testament of the durability and longevity of concrete pavements for streets and local roads.

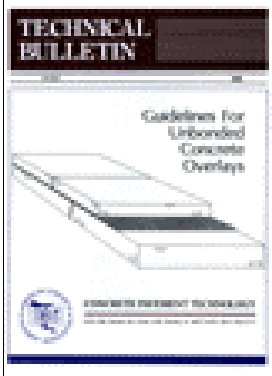
The Salt Lake City Corporation and B Street, which turns 96-years old this year, were awarded the 2002 ACPA Lifetime Award for Pavement Achievement (Streets & Local Roads) in recognition of its outstanding performance and more than 95 years of service to the community.

Construction on the Cathedral of the Madeleine on South Temple began in 1899 and was completed in 1909. During the construction of the Romanesque exterior, Gothic interior cathedral, B Street was built in 1907.

This "96-Year Concrete Pavement" has served the taxpayers of Salt Lake City well. Although constructed with only 6 inches of concrete, there has been almost no maintenance required. B Street runs from South Temple to 1st Avenue.

John J. Schmidt was the contractor awarded the project in September of 1907. The total cost was a mere $1,618. The constructed pavement area was 8,250 square feet. The contractor chose to use a two-lift construction method. Initially, 4 ½-inches of portland cement concrete pavement was placed. The final lift was 1 ½-inches of concrete mortar.
Utility patches are present but the majority of the pavement is still in-service. There are no plans to reconstruct this street, which proves concrete pavements to be long-lasting and can give outstanding performance for generations.

ACPA Literature Showcase
Guidelines for Unbonded Concrete Overlays



This 16-page bulletin (TB005P) explains the necessary design and construction features for this rapidly growing rehabilitation strategy.

The text includes job-site factors and performance of unbonded overlay projects throughout the United States. The cost of this publication is $6.00. To order this publication, visit the ACPA website at www.pavement.com, call toll-free 1-800-868-6733; or fax requests to 847-966-9666.

New Cold-Weather Mix as Strong, Durable as Normal Mix

Mix is also one-third less expensive than conventional cold temperature mix

Story contributed by the U.S. Army Corps of Engineers Hanover, N.H.

On a cold winter morning, a dozen New Hampshire Department of Transportation (NHDOT) workers are squinting and shuffling around to stay warm. The thermometer reads 5º F as a concrete truck rumbles down the hill, stops, and the workers begin to set up the chute. A few minutes later, the high-slump concrete mix is being placed into the curbing forms on a secondary road bridge.

Workers place concrete in cold weather (left) and collect samples of the concrete mix for testing (right).

Researchers from the Engineer Research and Development Center's (ERDC) Cold Regions Research and Engineering Laboratory (CRREL) watch over the work, and occasionally take samples from the mixture. This is their experiment, and as the concrete starts to set-up, everything looks good.

"We're rewriting how cold weather transportation concreting can be applied."

- Lynette Barna CRREL researcher

Normally, concrete is not placed when the temperature is below 40° F, but a CRREL-designed concrete admixture is changing that long-held rule. After two years of laboratory and in-field testing, CRREL researchers say the concrete is just as strong and durable as material placed in normal temperatures, and the cold-weather mix is one-third cheaper than a conventional concrete construction mix placed in cold temperatures. Ten states, including Vermont and New Hampshire, are underwriting extensive testing of the cold-weather concrete mix, which could extend the transportation construction season by up to 60 days in the northern United States, and 120 days in moderate climates.

Two readily-available ingredients make the differences between conventional concrete and the cold weather prototype, according to CRREL principal investigator Charles Korhonen.

"The admixture accomplishes two things. We're lowering the freezing point of the concrete, similar to anti-freeze in a car's radiator, and we're forcing the concrete to gain strength faster than normal." Korhonen says motorists, in particular, should welcome the new technology.

"Work normally done in the summer creates construction zones and slow moving traffic, leading to frustration and lost time. But if some projects can be moved to low-traffic winter months, there'd be far less problems and roadway hazards for both drivers and workers." In addition, the process could improve transportation infrastructure in cold weather regions by extending the construction season, while allowing longer seasonal employment and greater use of construction equipment.

"We're rewriting how cold weather transportation concreting can be applied," said CRREL researcher Lynette Barna, who hopes to see the admixture process accepted by the concrete industry and commercial users. Previous to the cold weather admixture, concrete could only be placed and cured in temperatures below 40° F by using heated tents or thermal blankets to enclose the construction area.

The biggest hurdle in widespread use and availability of the cold weather admixture is the lack of an industry standard. Currently, the American Society for Testing and Materials doesn't recognize the process, but that may change soon. Korhonen believes "we've proven this works, so ASTM will hopefully develop standards, and then commercial producers will start to manufacture it, and my hope is that it's going to change many rules about concrete construction."

The admixture has been field tested so far in North Woodstock, Littleton and West Lebanon, N.H., as well as Rhinelander, Wisc. (Photos and story: U.S. Army Corps of Engineers)

Technical Tip

Making the Cut

A guide to making utility cuts properly, easily

Many cities are facing the challenge of making utility cuts in existing city streets to either update or make repairs to existing systems. Often, the type of pavement selected is based on the perceptions about how readily future upgrades and repairs can be made.

A common *mis*perception is that concrete pavements are too hard to repair, but the truth is utility cuts and repairs can be made easily.

By following a few simple guidelines, utility cut repairs are made simple and do not adversely impact long term concrete pavement performance. Asphalt appearance and smoothness, on the other hand, are dramatically affected by utility cuts made after the pavement has been placed in service.

Utility cuts in asphalt pavements can reduce the service life of that pavement section by up to 50 percent. A recent study completed in the Pacific Northwest showed that even if the utility cut was properly backfilled and patched with asphalt pavement, the repaired areas required resurfacing much sooner than the concrete sections. In fact, the pavements initially constructed of concrete and patched with concrete showed no reduction in service life.

Photos depict utility cuts in concrete (L) and asphalt (R).

The ease of repairs, as well as the long term effects are especially important given the impact of closures and the traveling public's growing concern about frequent disruptions.

The repair procedure for a utility cut in a concrete pavement is similar to that of a full depth concrete pavement repair. By following these six basic steps, the long-term pavement performance is not impacted.

1. Locate and isolate utility for upgrade or repair
2. Remove the designated pavement section as outlined
3. Make utility upgrade or repair as required
4. Replace and prepare subgrade for concrete pavement patch
5. Place, finish, and cure concrete pavement patch
6. Open to traffic

Today there are several products and materials available through the ready mix concrete industry that both simplify and improve the repair process. First, the use of Controlled Low-Strength Material (CLSM), commonly referred to as flowable fill, can greatly speed up the backfilling process. Primarily, flowable fill consists of a mixture of cement, pozzolan, air entraining admixture, sand, and water. The exact proportions depend on local practices and procedures, and are readily available from the local ready mix concrete supplier. Also, conventional granular backfilling procedures may be used to obtain satisfactory performance, if properly compacted.

When selecting a concrete mixture, there are a few options that need to be considered. Using a concrete mixture that was specified during the original construction is a good starting point. If that information is not readily available, then a common mix design with a compressive strength of 4000 psi at 28 days will perform well. If the utility cut is in a major arterial, the use of a combination of chemical admixtures and cementitious materials will allow the pavement to open to traffic in a matter of a few hours.

For additional information, see ACPA publications "Utility Cuts and Full-Depth Repairs in Concrete Streets" (IS235P) and "Full Depth Repair and Utility Cuts for Concrete Pavements" (PA169P). To order ACPA publications, go to the ACPA website, www.pavement.com; call toll-free 1-800-868-6733; or fax requests to 847-966-9666.

Contact Scott Haislip at 847-966-2272 for more information or if you have any questions about this article. Would you like to submit a technical question? Send an e-mail to ACPA or call Bill Davenport or James Martinez at 847-966-2272.

Concrete Pavement News Digest

ACPA Seeks Director of Highways ... The American Concrete Pavement Association is seeking a Director of Highways, responsible for planning and implementing programs expanding the use of concrete pavements in the construction, rehabilitation, and maintenance of highways throughout the United States ... The candidate will be responsible for providing technical support to paving contractors and working closely with FHWA, AASHTO, TRB, other industry associations, and related organizations ...

Visit ACPA's website for more information, www.pavement.com ... Interested individuals should send confidential resume/salary history to: Robb Jolly, AIA, American Concrete Pavement Association, 5420 Old Orchard Road, Ste. A-100, Skokie, IL 60077.

AASHTO to Add ACPA Notation to Smoothness Standards ... ACPA met recently with an expert task group of American Association of State Highway & Transportation Officials (AASHTO) to review recent research on profilers and to comment on specifications, practices, and provisional standards.

After reviewing industry sponsored research, AASHTO agreed to add a notation about the questionable repeatability and reproducibility of current inertial profilers on coarse-textured pavements, including transverse and longitudinal tined concrete ...

The provisional standard is expected to be approved at the AASHTO Subcommittee on Materials meeting in August. The documents reviewed were:

- Standard Equipment Specification for an Inertial Profiler (PP50-02)
- Standard Practice for Certification of Profiling Systems (PP51-02)
- Standard Practice for Operating Inertial Profilers (PP52-02)
- Standard Practice for Determining Ride Quality (PP53-02)

Also on the subject of smoothness, ACPA reports that visitors to its website have downloaded a report more than 5,000 times since January. The report details the final results of the ACPA and Michigan Concrete Pavement Association smoothness study.

Conducted by Steve Karamihas, University of Michigan Transportation Research Institute, the study shows that current high speed and lightweight profilers are not able to reproduce profiles sufficiently on any surface types, concrete or asphalt, with the poorest reproducibility observed on both transverse and longitudinal tined concrete.

The findings are evidence that it is premature to use current lightweight or high-speed surface profilers for construction acceptance specifications. Access the report on

ACPA's website at www.pavement.com. If you have any questions regarding the report, please contact Mike Ayers at 847-966-2272.

IPRF Announces Approval of 2003 Airfield Research Program ... The Innovative Pavement Research Foundation (IPRF) announced recently that its Program Coordination Group approved the 2003 research program ... Approved for 2003 were:

1. Project 03-1: Design and Construction Guide for In Pavement Lighting (Publication Required)
2. Project 03-2: Combined Materials Test Procedure for ASR Mitigation (Publication Required)
3. Project 03-3: Design and Construction Guide for Concrete Pavements at Airplane De-icing Facilities (Publication Required)
4. Project 03-4: ASTM C-78 Flexural Test Precision Statement
5. Project 03-5: Applications Guide for the Use of the Maturity Meter for Opening Pavements to Traffic (Publication Required)
6. Project 03-6: Performance Evaluation of Airfield Pavements Constructed Using Design-Build
7. Project 03-7: Demonstration Project

The IPRF also will be providing program management for the research approved by the legislature in 2003 for Alkali Silica Reactivity (ASR) mitigation. Two projects were approved under that program :

1. Evaluate the Effect of Pavement Deicing Salts on ASR
2. Evaluate the Performance of Lithium in Treating Existing ASR Pavements

IPRF Announces Airfield Pavement Research Requests ... The Innovative Pavement Research Foundation is requesting research proposals on an airfield pavement project ... Project 2: Innovative Testing Standards for Acceptance Criteria for Concrete Pavement is part of the IPRF and Federal Aviation Administration's Cooperative Agreement of 2000. Budget parameters are $640,000. The announcement appears on the IPRF website homepage. The deadline for submitting proposals is 4 p.m. (EST), June 23, 2003 ... To learn more about the project requirements, visit the IPRF website, www.iprf.org ... For additional information about the project, or other details about ACPA's airfield pavement research initiatives, contact Jim Lafrenz at 202-842-1010.

New Issue of ACPA Research & Technology Update covers rained-on concrete pavements ... "How to Handle Rained-On Concrete Pavements" explains how to prevent and repair rain damage to freshly-placed concrete pavements. Diamond grinding is highlighted as the primary remedial technique for a rained-on concrete surface. Download past R&T Updates free on the ACPA website, www.pavement.com.

ACPA Announces Fall Airport Pavement Design Seminar ... Responding to strong demand, ACPA has scheduled the Fall 2003 Airport Pavement Design Seminar ... The Spring 2003 Airport Design Seminar (February 25 - 27) sold out within weeks of its announcement ... ACPA urges those interested to sign up as soon as possible ... Scheduled for October 7- 9 at ACPA offices in Chicago, the three-day seminar is geared toward entry-level and project engineers.

The seminar will consist of: A comparative analysis of the Federal Aviation Administration, Portland Cement Association, and military design methods, an explanation of FAA specifications and design requirements, preparation for construction and construction techniques for pavements, concrete mix designs, and adjustments ... The seminar is $650.00 for ACPA members, FAA employees, and state aviation officials; $875 for nonmembers ... To register, contact Polina Demidova at 847-966-2272 ... For more information or questions about the seminar, contact Jim Lafrenz at 202-842-1010.

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