Kansas Department of Transportation

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New Anti-Icing System in District Six

In Kansas, winter invariably means dealing with snow and ice. How is the Kansas Department of Transportation (KDOT) preparing for winter weather? According to Jaci Vogel, Assistant Bureau Chief, Construction and Maintenance, one thing KDOT has done to prepare for the winter of 2000 is install a fixed automated anti-icing spray system in District Six.

An example of a spray nozzle spraying chemical onto the pavement surface.

The automated anti-icing spray system was installed by District Six forces in the summer of 2000 and will go into action this winter. The system is located on the U.S. Highway 50/83/400 and K-156 interchange bridge and ramps, along the east edge of Garden City. When icy or snowy conditions are predicted, there will be no delay, waiting for crews to mobilize and reach the bridge and ramps.

The automated system is structured to begin spraying anti-icing material onto the bridge and ramps after being triggered via pager by the local supervisor. After the system is operating properly, the next step will be to connect the system to Roadway Weather Information System (RWIS) to make the system totally automated.

The system, Odin Guardian Model, was manufactured by Odin Systems International, Inc., Barrington, Illinois. It consists of an on-site pump house, material storage tanks, 5,800 feet of pipe and spray nozzles. The spray nozzles are located in the pavement or bridge deck, flush with the road surface. Each nozzle is activated through a solenoid, which allows KDOT to choose the order in which the nozzles apply treatment.

KDOT chose to use Cryotech® CMAK (Calcium Magnesium Acetate with Potassium) as the anti-icing chemical to be used with the anti-icing spray system. CMAK was recommended by the system manufacturer, and has numerous advantages over other de-icing chemicals. For one, CMAK is a clear liquid, without suspended particles, and therefore won't settle within the lines of the system. In addition, CMAK does not contain chlorides, which are known to cause corrosion-related deterioration of bridges. It

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is environmentally safe, biodegradable, has low toxicity to aquatic organisms and humans and requires fewer applications than other anti-icing chemicals.

District Six obtained the anti-icing system because Area Supervisor, Dave Marsh, saw a display of the system at a conference and thought it had merit for this location. According to Ron Hall, District Six Maintenance Engineer, the bridge where the system is installed has a history of accidents, with ice as a contributing factor. In addition, one ramp has a hill, which trucks have a difficult time climbing in icy and snowy weather and the other ramps have curves. Funding for this project came from the Traffic Engineering Safety Set-Aside program.

This is the shed that houses the pump and controls and the storage tanks for the anti-icing system.

Advantages of this system include applying material quickly. As soon as the local supervisor sees the potential for snow or icing conditions, material can be applied to the pavement surface within one minute of the pager call, obviously much faster than a crew can get to the scene and treat the affected area. Once activated, the nozzles fire for two seconds and have a spray pattern no higher than one foot off the ground. Each nozzle fires twice, with a short time period between fires in case of interference by a passing automobile. After the system has fired each nozzle twice, it shuts down and waits for the next activation via pager.

The concept behind the system is to keep the bridge in the same condition as the highway, not letting the bridge freeze before the road. How many times the bridge needs treatment depends on the severity of the weather. For example, for a "frost event" one application will be enough to treat the bridge. However, for a severe winter storm additional treatments may be needed. The de-icing chemical applied to the pavement prevents the ice and snow from bonding with the pavement; therefore, snowplows can easily remove accumulated snow and ice.

Another advantage is a smaller amount of de-icing chemical will be used, as the material is applied right where it is needed. The system can be set to how long and often the material is applied, based upon road conditions.

A disadvantage of the system is the time involved in installation. Hall said, "We don't have a lot of experience with the system, it took a lot of effort to get it installed. We are now in the process of getting it running and fine tuning the system to spray in the right places." Hall said they are planning a public relations campaign in District Six to inform drivers of the system. Odin Systems says with the short spray time, only ½ percent of all drivers will ever see the nozzles go off.

Several other states have the Odin Spray System including Colorado, Nebraska, Virginia, Minnesota, Maryland, and Wisconsin. Canada, Chile and Norway have also installed the anti-icing spray system. KDOT will expand this system to cover the planned Mary St. interchange, 1/4 mile north of this location. KDOT plans to install another fixed location anti-icing system on I-70 near Hays in the near future.

For more information on the fixed anti-icing system, contact Ron Hall, District Six Maintenance Engineer, at PO Box 619, Garden City, KS 67846-0619, (316) 276-3241 or rhall@ksdot.org.

"When trouble arises and things look bad, there is always one individual who perceives a solution and is willing to take command. Very often, that individual is crazy."
– 19 THINGS THAT IT TOOK ME 60 YEARS TO LEARN

Smoother Pavements Add Up to Savings at WesTrack

Just about everyone likes the more comfortable ride that comes from driving on smoother pavements. But as researchers at the WesTrack pavement testing facility near Reno, Nevada, have discovered, that's not the only thing to like-smoother pavements can also save you money.

From 1997 to 1999, four driverless trucks traveled an average of 15 hours a day around the 2.9-km (1.8-mi) oval track, simulating more than 10 years of Interstate-level traffic loads. Their runs were designed to evaluate how variations in hot-mix asphalt construction properties affect pavement performance and to validate the Superpave mix design and analysis procedures. During this time, the track's pavement sections developed varying amounts of roughness, rutting, and fatigue cracking, with some sections requiring major rehabilitation.

To determine the effect of pavement quality changes on fuel economy, data from two identical WesTrack vehicles were examined for periods just before and after a March 1998 track rehabilitation. Prior to the rehabilitation, the track was in rough condition, with fatigue cracking of various test sections and deterioration of areas that had been patched after core and slab sampling. The improvement resulting from the rehabilitation was evident in the international roughness index values (IRI) for the track, which showed that the average IRI had been reduced by at least 10 percent.

As part of the study of fuel economy, the fuel rate, fuel temperature, torque, and engine speed of the trucks were analyzed, as were fuel use data from daily inspections and refueling. The data showed that the average fuel mileage over an 8-week period before rehabilitation was 1.79 km/l (4.2 mi/gal). After rehabilitation, average fuel mileage over a 7-week period was 1.86 km/l (4.4 mi/gal), indicating a 4.5 percent improvement. All other factors, such as truck geometry, air temperature, and wind speed, were either identical before and after rehabilitation or compensated for within the comparison calculation. For a trucking company with a fleet operation of 1.6 million km (1 million mi), driving on smoother pavements would thus mean a savings of 46,600 l (10,260 gal) of fuel.

The increased pavement roughness at WesTrack also increased the frequency of failures in truck and trailer components. For example, trailer frames began to fracture and required reinforcing welds during the weeks just before pavement rehabilitation, and steering motors and other components loosened more frequently. During the 2.5 years of traffic loading at the track, eight of 17 trailer spring failures occurred within the 2 months prior to the March 1998 rehabilitation. Over these 2 months, 265,000 equivalent single axle loads (ESALS) were applied to the track. In contrast, the 350,000 ESALs applied in the 7 weeks after rehabilitation resulted in only one spring failure.

The final report on the WesTrack study will be issued at the end of this year. Copies will be available from the National Technical Information Service at 703-605-6000 (fax: 703-605-6900). A limited number of copies will also be available from the FHWA Report Center at 301-577-0818 (fax: 301-577-1421).

For more information, contact Terry Mitchell at FHWA, 202-493-3147 (fax: 202-493-3161; e-mail: terry.mitchell@fhwa.dot.gov).

The preceding article appeared in the April 2000 issue of Focus.

Concrete Pavement Smoothness Video Features Kansas Pavement

The Federal Highway Administration, Kansas Department of Transportation and the Missouri/Kansas Chapter of the American Concrete Pavement Association have teamed up to make a smoothness video on concrete pavements.

The video features Kansas pavements and construction procedures and John Madden, well-known football commentator. This video is being used by the FHWA to promote better pavement design and construction practices in the concrete pavement industry and State Department of Transportations. A similar video on asphalt pavement was released earlier featuring Arizona (see the Summer 1999 edition of the T² Digest).

The video debuted at the Enhancing Concrete Pavement Smoothness workshop on Tuesday, March 7, 2000 in Kansas City, Missouri, which was hosted by KDOT.

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The Best Steps To Ensure Quality Highways

by Kenneth R. Wykle

Today's consumers demand and receive better quality goods and services than ever before. We, in government highway agencies, are not immune to this insistence on excellence. Once, citizens just waited for their highway department to develop new solutions to traffic problems. Now, they are actively involved with those decisions from the onset. These days, a public hearing is more often a case of those of us in government doing a lot more of the hearing. Our customers want roads that are less costly, safer, better built, and longer lasting. In short, they want quality highways.

Survey results

This public demand for quality is exemplified in a national survey of drivers completed four years ago. When we asked what their key concerns were, those drivers responded loud and clear. They stated their number one issue to be pavement conditions. They rated that item higher than the environment, traffic flow, and even safety.

The final report of that survey said: "It is clear that the top priority for improving the nation's highways is to focus on the quality of the roadway surface. This is the factor that will most significantly increase public satisfaction with the highway system."

But how, exactly, does one get a quality highway? With the higher standards demanded by today's consumer, it cannot mean merely filling in potholes. A quality highway is one that is smooth and quiet and that lasts longer.

To respond to that call for quality, the Federal Highway Administration began working with other groups in the highway industry to raise the bar on highway quality. Largely through the efforts of state and local groups, construction contractors are finding, innovative ways of getting smoother road surfaces.

For example, several leading state transportation departments have developed programs that pay incentives to the contractor for building roadways to smoother standards. The smoother the final pavement, the greater the incentive. These incentives have stimulated contractors to be more aggressive in finding equipment and techniques, which will result in a final pavement product that meets those standards. Highway contractors have been so successful in building smoother pavements that new smoothness-measuring equipment and procedures were developed that are more precise and repeatable.

Yet another group has developed new approaches to maintaining highway networks. They found that the old saying of "if it ain't broke, don't fix it," isn't very appropriate for highway maintenance. They discovered that, done at the right time, minor treatments can extend the life of a pavement significantly, and at a fraction of the cost and disruption of rebuilding.

These new-generation highways are no more costly than their rougher predecessors, since contractors typically anticipate the incentives and reduce their initial construction bids. Studies have shown that roads that start out smoother stay that way longer. That means a cost-effective road in the long run and one that causes less damage to the cars and trucks that ride on them. Construction delays are reduced because the roads are rebuilt less frequently.

Others in the highway building industry, hearing about these innovations and wanting to provide such highways for their customers, have requested details. The FHWA has developed some how-to kits, which include videotapes, brochures, and other communications materials. The demand for the toolkits has been overwhelming. We have received requests, not just from across the country, but across the world, for details on pavement smoothness. Write to the FHWA, 400 7th St. SW, Washington, DC 20590, for a toolkit. (Editors note: see related article, "Concrete Pavement Smoothness Video Features Kansas Pavement," on page three.)

Just as in the private sector, the public's demand for a better product is resulting in highways that are better in every way, they truly can be called quality highways.

The preceding article was written by Kenneth R. Wykle, administrator of the Federal Highway Administration and appeared in the August 2000 issue of Better Roads.

The Right Road at the Right Time: Video Offers Keys to Preventive Maintenance Success

For highway agencies, times are changing. "It's no longer about constructing roads," says Jim Sorenson of the Federal Highway Administration (FHWA). "It's about preserving and maintaining the existing roads." And for an increasing number of States, preserving those roads means using preventive maintenance techniques. Instead of waiting until a road has significantly deteriorated before rehabilitating it, preventive maintenance involves applying carefully timed, cost-effective treatments to roads experiencing only light to moderate distress. These treatments help retard pavement deterioration, improve the function/condition of the highway system, and can extend the life of a structurally sound pavement by 5 to 10 years.

In order to assist highway agency managers in using preventive maintenance techniques, FHWA, the Foundation for Pavement Preservation, and the American Association of State Highway and Transportation Officials (AASHTO) Lead States Team for Pavement Preservation have prepared a new videotape, ***Preventive Maintenance: Project Selection*****. The video is a follow-up to an earlier FHWA release, *Protecting Our Pavements: PREVENTIVE Maintenance,* which was aimed at upper-level management. The new video is geared more toward the maintenance supervisors and program managers who make the daily decisions to implement various preventive maintenance treatments.**

The video takes an in-depth look at the project selection process, highlighting the key factors for achieving optimum results with preventive maintenance. It recommends that highway agencies take the following steps:

• Select the right road - Evaluate road conditions in order to determine which roads are good candidates for preventive maintenance. In evaluating a road, an agency should measure such factors as distress (cracking), ride quality (roughness), pavement deformation or faulting, and friction. An agency should also took at climate/environmental conditions and whether the road has a high or low volume of traffic. The best candidates for preventive maintenance are roads that are still structurally sound and are experiencing a slow to normal rate of deterioration.

• Select the right treatment - Agencies need to be familiar with a number of treatments and applications, such as crack and joint sealing, surface seals (including chip seals, slurry seals, and micro-surfacing), and overlays, in order to apply the right preventive maintenance technique to the right roads.

• Act quickly - There is usually only a brief window of time during which preventive maintenance treatments can be applied and be cost-effective and worthwhile. Agencies must identify what needs to be done at a site and turn the job around quickly.

"Preventive maintenance is now an integral part of Michigan's highway program," says Larry Galehouse of the Michigan Department of Transportation (DOT), who is featured in the video. "We will never go back to not doing it." Between 1992 and 1996, preventative maintenance treatments saved Michigan an estimated $700 million.

(Editors Note: To obtain a copy of the video, please contact Bill Jacobs at (785)291-3847 or billj@ksdot.org or contact your local FHWA division office or the Foundation for Pavement Preservation at 202-367-1167 (fax 202-367-2166; e-mail: fpp@dc.sba.com). Copies can also be obtained from the International Slurry Surfacing Association, Asphalt Emulsion Manufacturers Association, and Asphalt Recycling and Reclaiming Association. These organizations can be reached at 410-267-0023 (fax: 410-267-7546; e-mail krissoff@compuserve.com). For more information on the video, contact Jim Sorenson at FHWA at 202-366-1333 (fax: 202-366-9981; e-mail james.sorenson@fhwa.dot.gov).

The preceding article appeared in the June 2000 issue of Focus.

Smoothness Video con't

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The video will be included in a smoothness kit, which will include promotional items relating to concrete pavement smoothness. Copies of the video and accompanying information will be available in the near future.

RESEARCH

RECENT PUBLICATIONS

NOTE: The Kansas Department of Transportation conducts an extensive research program. The published reports consist of K-TRAN research reports, Federally funded and Kansas sponsored reports. Interested individuals may obtain a complete listing of all available reports at http://kdotweb/KDOTOrg/BurMatrlRes/Publications.htm. Complete copies of reports can be obtained by submitting requests to Mr. William L. Jacobs, Technology Transfer Engineer (785) 291-3847 or e-mail: billj@ksdot.org. For technical information on any report, please contact the person listed below.

Wetland Mitigation Effectiveness - Development of Cost Effective Methods and Procedures for Kansas Report number: K-TRAN: KU-96-2, by Kelly Kindscher, Kansas Biological Survey and Ernie Pogge, University of Kansas, Department of Civil and Environmental Engineering.

The objective of this research project was to examine wetland status, success rate, and the potential for continued development of wetlands at six Kansas Department of Transportation (KDOT) wetland mitigation sites.

Six wetlands were constructed to compensate for impacts caused by KDOT road projects in accordance with the Army Corps of Engineers 404 permit process. At each mitigation site the vegetation, soils, and hydrology were studied to assess the sites current and future ability to function as a wetland.

The report recommends that all six mitigation sites be classified as wetlands based on the delineation techniques established by the U.S. Army Corps of Engineers. The report predicts that although all sites were highly varied in vegetation, soils and hydrology, it is likely that the sites with the greatest diversity of vegetation, highest soil quality and best hydrology will continue to develop as wetlands in the future.

For technical information on this report, please contact Kelly Kindscher, Kansas Biological Survey, Foley Hall, Lawrence, KS 66045, telephone: 785-864-7698; e-mail: k-kindscher@ukans.edu.

Soils Sampling and Testing Training Guide for Field and Laboratory Technicians on Roadway Construction, Report Number: K-TRAN: KSU-96-10, by Eugene R. Russell and Mike Renk, Kansas State University, Department of Civil Engineering.

The development and implementation of Quality Assurance/Quality Control specifications by Kansas Department of Transportation (KDOT) has been a driving force behind the development of a soils training and certification program. The objective of this research project was to develop a training guide for field and laboratory technicians responsible for sampling and testing soils used in roadway construction. Soils training and certification will increase knowledge of laboratory, production, and field inspectors.

A soils guide (manual) was written that can be used for reference and training. Although KDOT currently uses a different Soils Manual for their certification programs, this manual will serve as a reference document and will be available to the certification instructors.

For technical information on this report, please contact Eugene R. Russell, Kansas State University, Fiedler Hall, Manhattan, KS 66506, telephone: 785-532-1588; e-mail: geno@ksdot.org.

Sequence Stratigraphy of the Lane-Island Creek Shales and the Farley Limestone in Northeastern Kansas and Geologic Factors Affecting the Quality of Limestone Aggregates, Report Number: K-TRAN: KU-97-1, by J. McKirahan, R. H. Goldstein and E. K. Franseen, University of Kansas, Department of Geology.

Procedures should be implemented for rapidly evaluating durability of limestone aggregate to prevent use of substandard material in highway construction and to assure availability of highly durable aggregate. The objective of this study is to evaluate lithologic (rock type) variables

that control durability of limestone aggregate. The Farley Limestone (Pennsylvanian, Missourian) is one of many limestone units quarried in Kansas for production of highly durable, Class 1 aggregate. By understanding the lithologic factors that control durability of aggregate from the Farley, an analog for other limestone units can be developed.

Limestones containing low percentages of diffuse or disseminated clay are more likely to produce aggregates of high durability. Aggregates containing multiple clay minerals exhibit reduced durability. Smectite, even in small quantities, negatively impacts durability, whereas illite apparently has little impact on durability. If changes in clay content deleterious to aggregate quality can be identified during lateral production of a ledge, then quarrying can be halted or can proceed in another direction while physical tests are run. Such a procedure could prevent use of substandard concrete in highway construction projects. Aggregate-producing phylloid-algal limestones of the lower Farley Limestone thicken into the local depositional lows. However, fine quartz-, feldspar-, and clay-rich sediments (siliciclastics) also seem to be deposited preferentially in paleotopographic lows. Thus, local paleotopographic low areas most distal from sources of siliciclastics can be predicted as the prime areas for location of durable aggregate.

For technical information on this report, please contact R.H. Goldstein, University of Kansas, Department of Geology, Lindley Hall, Lawrence, KS 66045, telephone: 785-864-2738; e-mail: gold@ukans.edu.

Crack Sealing and Repair of Older Serviceable Bridges Using Polymer Sealers, Report Number: FHWA-KS-98-4, by David A. Meggers, Kansas Department of Transportation.

The objective of this study is to determine the feasibility of using High Molecular Weight Methacrylate (HMWM) and EPOXY Healer Sealers for crack sealing and repair of older serviceable bridges.

The results of the field portion of the study were inconclusive. Chloride concentration levels of the sealed sections and the control sections were inconsistent. The results of the laboratory tests on the sealers tested in the field, in addition to an additional sealer added for later evaluation, indicated a definite difference in the performance of the four sealers. The laboratory tests indicated that the sealing of cracks in a new bridge deck may be beneficial, as the sealed beams did not deteriorate as quickly as the unsealed beams. The differences in the performance of the sealers appears to be tied more to material properties such as viscosity, flexibility, and tensile strength, rather than to penetration. The EPOXY and one of the HMWM sealers performed well in protecting the test beams throughout the laboratory evaluation.

The results of the study indicated that the sealer must be properly applied shortly after the cracks are formed to maximize the penetration and protection of the structure. Attempts should be made to clean the cracks before application of the sealers. The optimum sealer would be one with a relatively low viscosity, 0.5 Pa·s or less, tensile elongation of ten (10) percent or more and a tensile strength of at least eight (8) MPa.

For technical information on this report, please contact David A. Meggers, Kansas Department of Transportation, 2300 SW Van Buren St., Topeka, KS 66611-1195, telephone: 785-291-3845; e-mail: meggers@ksdot.org.

Coordination of Local Road Classification With the State Highway System Classification; Impact and Clarification of Related Language in the LVR, Report Number K-TRAN: KSU/KU-94-2, by Eugene R. Russell, Russell Ewy and Bob L. Smith, Kansas State University, Thomas Mulinazzi, University of Kansas and E. Dean Landman, Kansas Department of Transportation.

The objective of this research is to relate the local classification system to a system of statewide major and minor collectors and local roads. This would allow the whole classification system to be used as a basis to consider changes in the state statutes. In addition, it would tie the various components of the classification system into a hierarchy of maintenance requirements, roadside clearance, barrier requirements, geometric guidelines and signing needs.

The report recommends the implementation of an A through H system with the H (local roads) subdivided into access categories and road surface type. Helping to create acceptable but reduced guidelines for the operation of lower volume roads and streets could save state and local governments in the long term. In addition, the A through H system ties into common functional classification, but gives a further breakdown that is both more detailed and usable in a statewide plan that includes a wide variety of road types from Interstate to primitive roads.

For technical information on this report, please contact Dr. Eugene R. Russell, Kansas State University, Fiedler Hall, Manhattan, KS 66506, telephone: 785-532-1588; e-mail: geno@ksu.edu or Thomas Mulinazzi, University of Kansas, Learned Hall, Lawrence, KS 66045, telephone: 785-864-2928, e-mail: tomm@ukans.edu.

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