Kentucky Transportation Center

Annual Report

2008

Director's Message

Paul E. Toussaint, PE

The Road Not Taken

The symbolic message, from the verses of Robert Frost's 1920 poem, depicts a story about an individual who has come to a point in life when a choice needs to be made. He contemplates deeply which path is the appropriate one to follow and ultimately chooses to take the path "less traveled".

No one could criticize the path taken, since either choice would lead to some unknown destination. However, years later that person might wonder--what would have happened if I had taken the other road? I think we have all had those thoughts at one time or another in our lives. The reality is that we never get the chance to go back and do things the "other way."

Now let's put this in the context of the transportation system in the U.S. In 1956 President Eisenhower was at that point where the "roads" diverged. He could not see beyond the horizon (of either path) but he knew that continuing down the easy road (status quo) did not reflect a vision for this country. President Eisenhower chose the path "less traveled" and in a manner that reflected true leadership we moved forward with the Interstate System. The problems were many-including funding, design, and the magnitude of the work to be done. The net result was a "path" that profoundly changed this nation by providing mobility, safety, and economic growth unprecedented in this country or any place on earth. I do not believe President Eisenhower ever questioned his decision or worried about "the road not taken."
Fast forward to 2008, and we are again at that critical decision point, "where the roads diverge". This time the choice is much more complicated, but in many ways much clearer. As we gaze down the "easy road" the scenario that will likely confront us will be dramatic. Continuing the status quo will mean that our present transportation system will rapidly deteriorate; congestion will increase; safety will decrease; funding will be sorely lacking; our energy supply and costs will continue to be uncertain; and the struggling economy may slide into third world status. Trillions of dollars invested in past infrastructure will have been wasted.

Or perhaps we might once again opt for the "road less traveled" and come forth with a vision that puts the U. S. back on the path of being a world leader. This will take the type of leadership provided by President Eisenhower and a move away from the partisan, petty politics of today. It will take a commitment for adequate funding and require an integration of all the modes so that we can improve efficiency, mobility and safety; conserve energy; generate alternate energy strategies; and vastly improve our economic future. The simple fact is that we can only make one choice. The opportunity is now and we will never get a second chance to travel this way again.

I close with the last few verses of Frost's poem:

I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I —
I took the one less traveled by,
And that has made all the difference.

R. Frost

Construction Management

Donn Hancher, Program Manager

The construction section's focus is on improving the efficiency and quality of construction highway projects in Kentucky. A recently completed project examined the effectiveness of the Cabinet's quality control and quality assurance (QC/QA) program. While contractor QC/QA programs can save money during project execution by eliminating duplicate testing, there are serious concerns about conflicts of interests. The question remains: are there adequate safeguards in place to ensure quality highway projects are being built for the Commonwealth? The study included a review of data from several projects as well as group interviews with the Cabinet and contractor staff. A nationwide study of highway agencies was conducted regarding their experience with the implementation of QC/QA specifications. The robust statistical analyses completed revealed that the QC/QA system is working well, and the agency's random inspection data when compared to the contractor reported QC data showed similar trends. The interviews and surveys revealed that all agency independent tests must be truly independent. All interviewees agreed that the Kentucky Transportation Cabinet's project inspection capabilities must be strengthened. However, it is critical for the verification regime to be truly independent. These and other recommendations are detailed in the research report (KTC 08-19/ SPR347-07-1F) released in the summer of 2008.

Traffic and Safety

Jerry Pigman, Program Manager

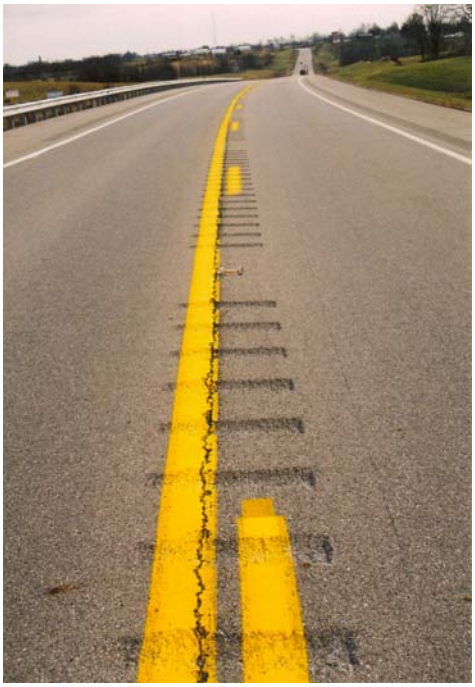
Pavement Markings and Guidance Devices

A series of research studies have addressed the general area of pavement markings and other forms of guidance-related devices that affect highway safety. Results indicate the markings and devices have positive benefits, in terms of improved safety, as well as cost savings associated with frequency of cycles of application. Specific analyses and evaluation included the following:

- Useful life of pavement markings
- Guidelines for use of edgelines on roadways
- Guidelines for rumble strips on roadways
- Use of raised pavement markers

Results indicated that painted lines on pavements had a useful life sufficient to warrant shifting to a program of restriping all roadways on a two-year or longer cycle, with accompanying cost savings of materials and personnel.

Based on crash analyses edgelines were determined to be a safety benefit and were recommended for nearly all widths of rural two-lane roads, with some applications when no centerline was present.



Rumble strips were found to be beneficial and recommended for roadways with a narrow paved shoulder. Rumble stripes (painted rumble strips) were recommended as a means to provide shoulder treatment and maximize lane width.

Research and evaluation has shown that raised pavement markers have a positive effect on safety, with only minor problems associated with dislodgement of the markers as a result of pavement surface conditions or other factors.

ITS Program

Joseph Crabtree, Program Manager

Measuring the Value of Kentucky Vehicle Enforcement Activities

The responsibility for monitoring commercial vehicles on Kentucky's roadways and enforcing the applicable laws and regulations falls primarily on the Commercial Vehicle Enforcement Division (CVE) of the Kentucky State Police. Their personnel are involved in a variety of activities including: size and weight enforcement; safety inspections; safety audits and compliance reviews; enforcement of tax, registration, fee, and insurance requirements; work zone speed enforcement; drug interdiction; and traffic monitoring and enforcement. The objective of this study was to identify, describe, and (where possible) quantify the benefits associated with the activities of Kentucky Vehicle Enforcement (KVE) . The study used data from four special enforcement initiatives: 1) a 48-hour enforcement "blitz" at the northbound Laurel County weigh station on I-75; 2) an enforcement emphasis on a "bypass" route commonly used by truckers to avoid the Laurel County weigh station; 3) a special evaluation of thermal imaging technology for identifying trucks with brake deficiencies; and 4) an enforcement emphasis on coal-haul roads in eastern Kentucky. The study identified multiple benefits provided by the activities of KVE, including: reductions in crashes, injuries, and fatalities; protection of the revenue streams that replenish Kentucky's Road Fund; reduced damage to Kentucky's surface transportation infrastructure; and creating a level playing field for Kentucky's motor carrier industry. Using the best estimates available for crash reductions, revenue protection, and infrastructure protection, KVE activities are worth between $70 million to $130 million annually.

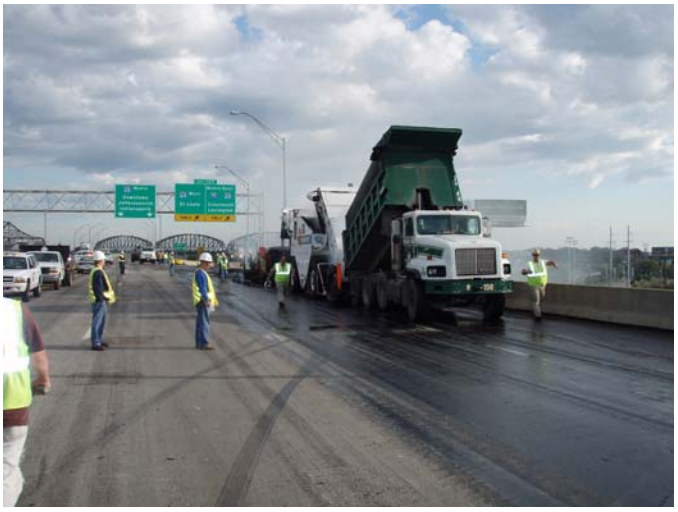
Pavements and Geotechnology

Clark Graves, Program Manager

Factors Affecting Asphalt Pavement Density and the Effect on Long Term Pavement Performance

This research evaluated the effects that initial construction density has on asphalt pavement performance and the construction variables which may affect the initial density. A laboratory study was also conducted to evaluate the effect variable density has on performance. Phase II of this is to be a targeted field and laboratory evaluation of the results obtained in Phase I.

Based on the results of the Phase I field study, two trends have been observed. The first being significant increases in surface pavement density as you move further away from the center-line joint. This finding confirms the importance of achieving a good construction joint between adjacent paving lanes. The second trend is the strong relationship between the temperature at which the asphalt is first rolled and pavement density across the mat. Significant improvement was observed by insuring the initial rolling occurs at appropriate temperatures.



The laboratory phase of the project was to identify the effects variable pavement density may have on ultimate performance. During this phase, a full characterization of pavement density using flexural fatigue (brittleness measure) and dynamic modulus (thickness design measure) was performed on the laboratory asphalt mixture. The results indicate as mixture air voids decrease (an increase in density), the number of cycles to failure will increase, indicating improved performance and resistance to cracking (less brittle). These results indicate that increasing pavement density (lowering air voids) will improve the pavement structure while also increasing durability (rutting and cracking resistance). These items will enhance the performance of our pavement surfaces and allow for longer periods between subsequent resurfacing, which lower the overall life-cycle-cost of the roadway. The second phase of this research will be to conduct controlled field experiments to better quantify these increased performance benefits.

Structures and Coatings

Issam Harik, Program Manager

Repair Using Steel Fiber Reinforced Polymer Sheets on US 150 Bridges

The US 150 bridges over Beech Fork River in Nelson County, KY and Cartwright Creek on the border of Washington-Nelson counties in Kentucky were built in 1955. Time, increased truck traffic and weight have caused the reinforced concrete girders of the five-span Beech Fork River Bridge and the three-span Cartwright Creek Bridge to develop diagonal cracks.

To remedy the problem, steel fiber reinforced polymer (SFRP) sheets were used as the means of retrofit due to their high strength, ease of application, and flexibility. Repair to the reinforced concrete girders was carried out by attaching the SFRP sheets to the vertical and bottom faces of the girders. Application of the SFRP was quickly executed with the use of special epoxy designed for use with the steel wire sheets. No traffic control was required and the repair was conducted without inconvenience to the traveling public. Construction of the retrofit was started and completed in May of 2007. Crack gauges are installed on the girders to monitor movement, and the effectiveness of the retrofit.

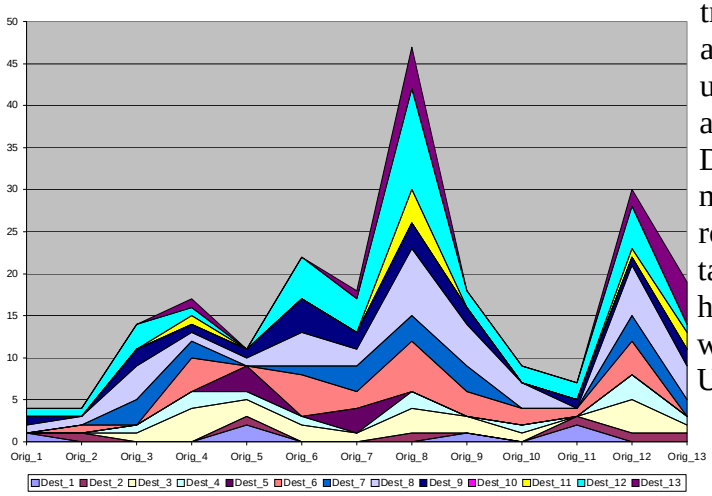
Accelerated Performance Testing of Category 2 Two-Coat Bridge Coatings Systems

This project was undertaken to obtain coatings performance test results on two-coat systems for use on maintenance painting of steel bridges. The current approved coatings systems are expensive three-coat systems. Samples of candidate coatings systems were provided by coatings manufacturers. The KyTC Division of Materials first subjected them to compositional testing and characterization, then Center personnel applied them on steel panels and subsequently subjected them to accelerated performance testing in weathering and corrosion test chambers. The panels were photographed and any significant changes noted with the results reported to KyTC at each 1,000 hour evaluation point. The testing ran for 5,000 hours (30 weeks) after which the panels were evaluated thoroughly for rusting, scribe undercutting, blistering, gloss retention and color stability. The results were evaluated by KyTC and the successful maintenance coatings systems were placed on the qualified products list for use in forthcoming bridge maintenance painting projects.

Federal Transit Administration Public Transit Participation Project (PTP II)

Theodore Grossardt, Program Manager

This project is funded by the FTA to help transit agencies improve the public participation in their business planning and design. PSA researchers are using the FTA grant to develop Structured Public Involvement processes for LexTran, and helping to train LexTran personnel to use their own Audience Response System. The lessons learned on how to use ARS systems for transit planning and the challenges of adoption will be part of the resulting user guide researchers will prepare. The accompanying graphic shows Origin-Destination data gathered from public meetings in Lexington to help design the routes for a new downtown trolley. The tallest spike in the surface shows that the highest anticipated need for connections will be between the downtown and the U.K. Campus.



Technology Transfer

Patsy Anderson, Program Manager

The Technology Transfer Program shares transportation knowledge and puts research and new technologies into practice. These opportunities come through a safety circuit rider program, a transportation library, publications, Roads Scholar and Road Master Programs, and special interest training designed to solve specific problems.

Classroom training continues to be the primary method for information transfer and during the past year 229 workshops were conducted, an increase of 15 per cent over the previous year. Attendance totaled 6,703.

The Transportation Library and quarterly publications are valuable resources, especially for roadway workers in remote rural areas. The library is part of the University Libraries Network and has access to worldwide data bases.

Highlighted Project: Work Zone Traffic Control Employee Qualification Program

Kentucky crash statistics show an average of 642 collisions and four fatalities annually are occurring in construction and maintenance work zones. The Kentucky Transportation Cabinet responded to changes in federal regulations governing work zone safety by issuing new policies and procedures which call for a more skilled work force. The Technology Transfer Program worked with the Transportation Cabinet in building a qualification program to provide needed training to individuals working on Kentucky's highways, whether they are employed by governmental agencies, utilities, or private industry. The principal course text for all courses is the *Manual on Uniform Traffic Control Devices.* The three levels of proficiency currently covered by this qualification program are:

- **Flagger** – teaches proper methods, proper use of personal protective equipment, and communication techniques with workers and motorists. Through 15 presentations, 356 flaggers were qualified.
- **Technician** – teaches proper placement and maintenance of devices and how to interpret traffic control plans. 914 technicians were qualified through 39 presentations.
- **Supervisor** – intended for individuals who supervise technicians and flaggers and who are responsible for implementing the Traffic Control Plan. 405 supervisors were qualified through 21 presentations.

Sus-tain' a-ble (ability to support) *Transportation*

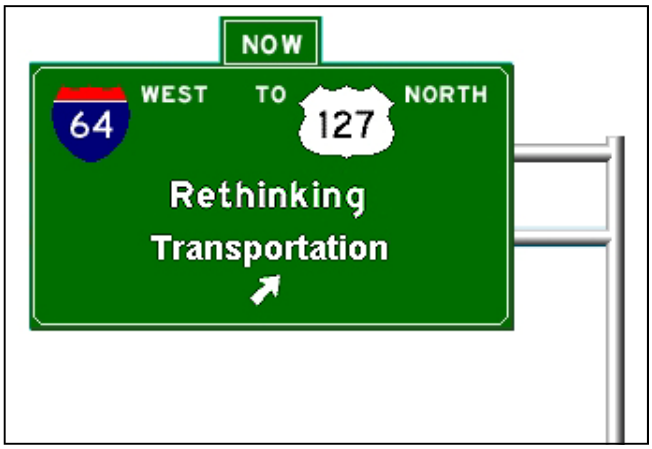
Sustainability is not a new topic, but it may be the most important of our time. We are in a period of scarce capital and at the same time have a fragile system of roads and bridges. The reasons for the scarce capital started even before the decade-long call for no new taxes. Our surface transportation system of deteriorating roads and bridges did not get worn out over night**. Simply put – we did not establish a funding source to adequately support the system we have built.**

The basic problem may sound familiar – not enough revenue to meet the costs! We have "managed" to get many things we do badly out of kilter with the reality of funding them. As a result, some would say we are in for a "long emergency."

The complex issue of transportation sustainability reaches beyond the infrastructure to the very choices we make of where to live and work and how dependent we are on the private auto or the long distance over-the-road truck. There are more efficient ways to develop our settlement patterns, move people, gain access to services and receive the goods we need.

The needed changes -- for sustainability -- must also address the future energy supply and the need to reduce air pollution. Increased passenger and freight rail services may become part of the solution along with more fuel efficient and alternative fuel vehicles.

What is the practical solution to the imbalance as far as our roads and bridges are concerned? First, we need stable and fair sources of revenue that track the system's user demand. Second, we need a service provider that can maintain and develop the system efficiently. Now that sounds reasonably straight forward, but the trouble is that our legacy burdened solutions of producing revenue and delivering services are no longer viable.



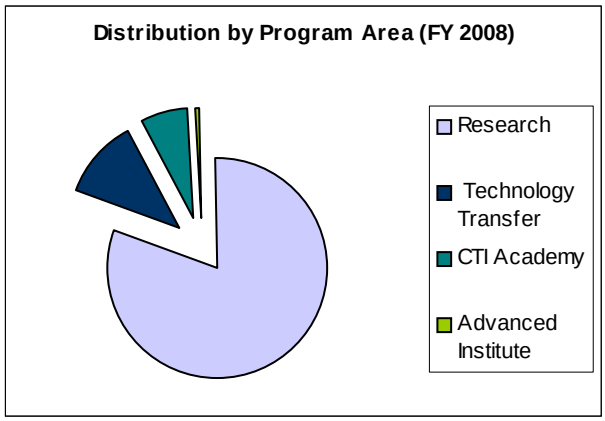
A complete rethink is now required. The Kentucky Transportation Center held its first "rethinking" conference on transportation sustainability in 2008. Also, the Kentucky Department of Highways began a new initiative of seeking "practical solutions" for transportation project needs. Presentations and discussions from the conference focused on: energy, vehicles and culture issues. The Center also completed a research project for the Cabinet that explored the potential of applying practical design principles to transportation projects. Documentation of both of these efforts can be found on the Center's website. Any of this rethinking must be followed by hard choices and action.

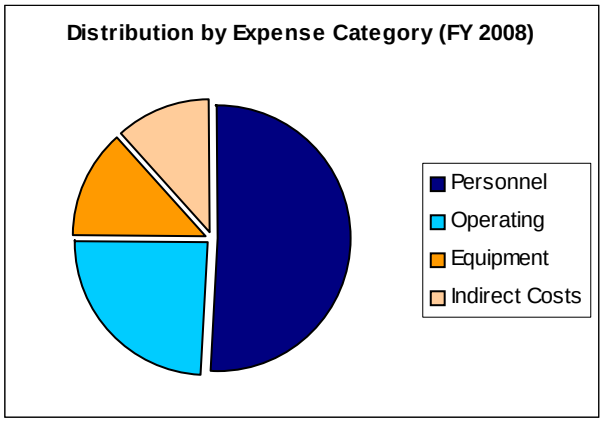
Financial Snapshot

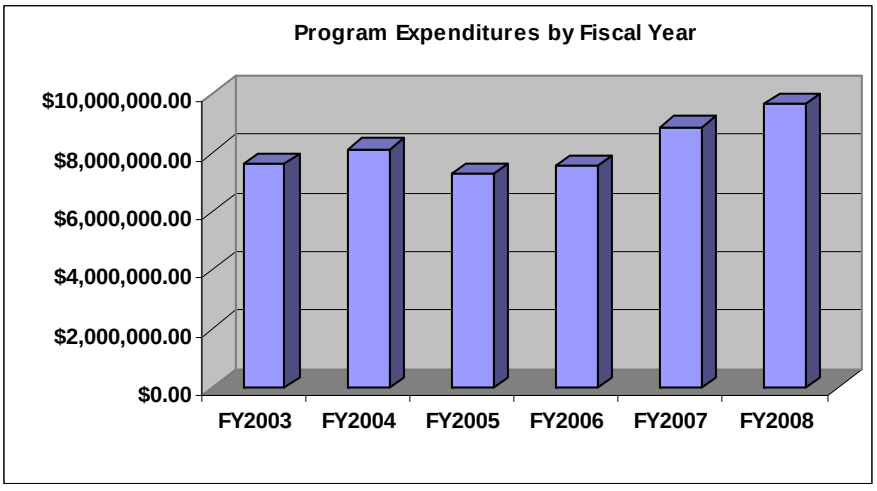
FY08 Expenditures*

		Research**	Technology Transfer	CTI Academy	Advanced Institute	Total Program
Personnel		3,723,556	614,144	299,776	64,851	4,702,327
Operating		3,044,589	659,404	130,413	1,125	3,835,530
Equipment		36,639	5,624	0	0	42,263
Indirect Costs		987,733	0	100,127	2,938	1.090,798
Total Program		7,792,517	1,279,172	530,315	68,914	9,670,918

* Expenditure detail by subcategory of expense is available on request. (1-800-432-0719)
** The research/study program for FY 08 consisted of over 100 projects conducted for the following agencies: the Kentucky Transportation Cabinet, USDOT/FHWA, USDOT/FMCSA, NSF, TRB/NCHRP, NORPASS, and various other public jurisdictions. Some work is done in cooperation with other universities including: Northwestern University, University of Louisville, University of Tennessee, and Calspan-University of Buffalo Research Center and also in partnership with firms and organizations such as Michael Baker, Inc., HMB Professional Engineers, Wilbur Smith and Associates and the Asphalt Institute.







Reports Published in 2008

KTC-08-01/SPR328-07-1I	"Crash History after Installation of Traffic Signals (Warranted vs Unwarranted)," Kenneth R. Agent and Eric R. Green, January 2008.
KTC-08-02/SPR330-07-1I	"Use of Edge Line Markings on Rural Two-Lane Highways," Kenneth R. Agent and Eric R. Green, January 2008.
KTC-08-03/SPR332-07-1F	"Measuring the Value of Kentucky Vehicle Enforcement Activities," Jennifer Walton, Joe Crabtree, Candice Wallace and Jerry Pigman, January 2008.
KTC-08-04/SPR319-06-1F	"Evaluation of the Effectiveness of Pavement Rumble Strips," Adam Kirk, January 2008.
KTC-08-05/SPR290-05-2F	"Access Management Implementation in Kentucky Technical Support Document and Status Report," Barry House, January 2008.
KTC-08-06/PL14-07-1F	"Traffic Forecasting Report - 2007," David Hamilton, January 2008.
KTC-08-07/KH60-07-1F	"Investigations of Voids/Cracking on the I-275 Twin Bridges over the Ohio River in Kenton County," Brad W. Rister and Theodore Hopwood, March 2008.
KTC-08-08/TA23-05-1F	"CSS Noise Impact Mitigation Protocols," Theodore Grossardt and Lou Cohn, March 2008.
KTC-08-09/SPR328-07-2F	"Operational and Safety Efficiency of Traffic Signal Installation," Nikiforos Stamatiadis, Chris Jones, and Nithin Agarwal, May 2008.
KTC-08-10/UI56-07-1F	"Evaluation of 70mph Speed Limit in Kentucky," Kenneth R. Agent, May 2008.
KTC-08-11/SPR316-06-1F	"Low Cost Safety Measures at Signalized Intersections," Kenneth R. Agent, May 2008.
KTC-08-12/SPR261-03-1F	"Equivalent Barge and Flotilla Impact Forces on Bridge Piers," Peng Yuan and Issam E. Harik, May 2008.
KTC-08-13/SPR261-03-2F	"Multi-Barge Flotilla Impact Forces on Bridges," Peng Yuan, Issam E. Harik, and Michael T. Davidson, May 2008.

KTC-08-14/SPR329-06-1F "Evaluation of Median Barrier Safety Issues," Kenneth R. Agent and Jerry G. Pigman, June 2008.

KTC-08-15/SPR359-08-1F "Technology Scan for Electronic Toll Collection," Joseph D. Crabtree, Candice Wallace, and Natasha J. Mamaril, June 2008.

KTC-08-16/SPR360-08-1F "Compost for Steep Slope Erosion," Sudhir Palle, Steve Higgins, and Theodore Hopwood, June 2008.

KTC-08-17/SPR349-07-1F "Future Management Strategies for State Maintained Wetlands and Steam Mitigation Sites," Sudhir Palle and Theodore Hopwood, June 2008.

KTC-08-18/SPR340-07-1I "Evaluation and Calibration of a New Bearing Capacity Model," Tommy C. Hopkins and Liecheng Sun, June 2008.

KTC-08-19/SPR347-07-1F "QC/QA: Evaluation of Effectiveness in Kentucky," Kamyar C. Mahboub, Paul M. Goodrum, Andy Glasgow, Jason Enlow, Nicholas Hendrix, and Moin Uddin, June 2008.

KTC-08-20/FR155-06-1F "Experimental Concepts Coating Application on the Median Barrier of I-65 in Louisville," Rick Younce, Theodore Hopwood, and Sudhir Palle, June 2008.

KTC-08-21/SPR330-07-1I "Evaluation of Pavement Marking Performance," Eric R. Green and Kenneth R. Agent, June 2008.

ITC-08-22/KSP1-08-1I "Evaluation of Kentucky's Click it or Ticket," 2008 Campaign, Kenneth R. Agent and Eric R. Green, July 2008.

KTC-08-23/KH53-06-1F "Structural Evaluation of the John A. Roebling Suspension Bridge - Element Level Analysis," Ching Chiaw Choo and Issam Harik, July 2008.

KTC-08-24/KH54-06-1F "Structural Evaluation of the John A. Roebling Suspension Bridge," Ching Chiaw Choo and Issam Harik, July 2008.

KTC-08-25/FR92-99-1F "Barge Impact Forces on Bridges Piers: An Experimental Study," Chee Hoang Goo, Vasudavan Krishnappanaidu, Issam Harik, Srinivasa Lingiredy and Scott Yost, August 2008.

KTC-08-26/KSP1-08-2F "2008 Safety Belt Usage Survey in Kentucky," Kenneth R. Agent and Eric Green, August 2008.

KTC-08-27/RSF20-06-1I	"Preliminary Evaluation of USDOT Number Readers and License Plate Readers at Kentucky Weigh Stations," Joseph D. Crabtree and Natasha A. Mamaril, August 2008.
KTC-08-28/FR165-07-1F	"Monitoring Culvert Load with Shallow Filling Under Geofoam Areas," Liecheng Sun and Tommy F. Hopkins, August 2008.
KTC-08-29/KSP2-08-1F	"Analysis of Traffic Crash Data in Kentucky (2003-2007)," Eric R. Green, Kenneth R. Agent, and Jerry G. Pigman, August 2008.
KTC-08-30/SPR369-08-1F	"Practical Solution Concepts for Planning and Designing Roadways in Kentucky," Nikiforos Stamatiadis, Adam Kirk, Don Hartman, and Jerry Pigman, August 2008.
KTC-08-31/SPR307-05-1F	"Investigation of the Extended Use of GPR for Measuring In-situ Material Quality," Brad Rister and Clark Graves, September 2008.
KTC-08-32/PL13-08-1F	"Annual Update for Estimating Esals," Jerry G. Pigman, Clark Graves, David Cain, and Neil Tollner, October 2008.

FY 2009 SPR Projects

Use of GPR for Rapid Inspection of Bridge Decks (Study #09-370)
Evaluation of Non-Nuclear Methods for Compaction Quality Control (Study 09-371)
Evaluation of Intelligent Compaction (Study #09-372)
Evaluation of Effectiveness of Internal Drainage Layers in Pavement (Study #09-373)
Identification of Pavement Performance Factors (Study #09-374)
Provide GIS Tools for Early Identification of Potential Archeological Sites Throughout the Bluegrass Region (Study #09-375)
Analysis of Truck Volumes and Trends (Study #09-376)
Flourescing Coatings to Facilitate Night Time Inspection During Bridge Maintenance Painting (Study #09-377)
Automated Chemical Stabilization of Leaded Paint Residue from Bridge Maintenance Painting (Study #09-378)
Temperature Movement in Bridges at Expansion Joints (Study #09-379)
Improving Intersection Design Practices (Study #09-380)
Evaluation of the Effectiveness of In-House Staff vs. External Sources (Study #09-381)
Best Management Practices for Exchange Information between the TOC and District Offices (Study #09-382)
Demonstration of DSRC Technology for Travel Time Monitoring (Study #09-383)
Change Orders/Lessons Learned (Study #09-384)
Develop and Asset Management System to Compliment the Video Log (Study #09-386)
Best Practices for Getting Information to Motorists Using WiFi or Other Emerging Technologies (Study #09-387)

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