KENTUCKY TRANSPORTATION CENTER

Research Results

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Effects of Warning Devices on Curve Operating Speeds

[KTC-05-20/SPR-259-03-1F]

Principal Investigator:
Nick Stamatiadis
Study Advisory Chair:
Larry Irish

Purpose: Horizontal curves on rural roads are among the most hazardous situations for drivers. Drivers can be unaware of impending changes in the roadway geometry or do not adequately reduce their operating speed when they approach the curves. Currently, the standard treatment of the traditional warning signs with advisory speed plaques seems to have little effect in reducing speeds on the most dangerous curves. This study is designed to evaluate other methods of warning or alerting the driver in time for them to effectively reduce their speed in anticipation of the curve.

Objectives:

1. Evaluate the use of several warning signs, warning methods and pavement markings at problematic rural horizontal curves in relation to speed reduction.
2. Determine which of the warning devices are most effective in lowering speeds for traversing horizontal curves.

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Conclusions/Recommendations:

- A variety of treatments were evaluated in the field including: bright orange flags at existing signs, large arrows, lights at existing signs, new combination signs, chevrons, post delineators, transverse lines, rumble strips, as well as combinations of all of the above.
- In order to have the most significant impact on operating speed, it is best to use warning treatments in combination, particularly in combination with rumble strips.
- The most effective of these treatments were the transverse lines; the new combination horizontal alignment/ advisory speed signs; and flashing lights on both the existing warning sign and new combination warning signs.
- Rumble strips were the only means of conveying an audible or physical message to the driver that a reduction in speed is necessary.
- The use of lights on signs for added emphasis had a significant effect in impacting operating speeds.
- The speeds over the 85th percentile speed showed a reduction indicating that most treatments have the potential to affect these high speeds.

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Bearing Capacity Analysis and Design of Highway Base Materials Reinforced with Geofabrics

[KTC-05-21/SPR-238-02-1F]
Principal Investigator:
Tommy Hopkins
Study Advisory Chair:
Larry Trencamp

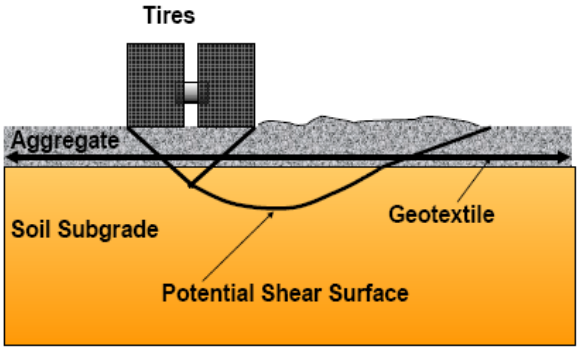
Purpose: Past research has shown that the use of chemical admixtures, such as hydrated lime and cement, are effective in increasing the strength of soil subgrade, particularly those that have large clay fractions and are very weak. However, situations arise when chemical stabilization is not a viable option due to restriction on placement temperature (<40 degrees F.) or when traffic must be routed immediately onto the finished roadway. Alternatives to these issues are: 1) placing a substantial aggregate layer on the soil subgrade; or 2) the use of geofabric that is placed between the subgrade and the aggregate layer.

Objectives:

1. Develop a design methodology to determine a factor of safety for finished flexible pavement to prevent premature rutting or failure.
2. Evaluate effectiveness of geofabric used in combination with aggregate base on weak subgrade material to avoid failure during and after construction.

Conclusions/Recommendations:

- Models were developed to analyze bearing capacity (or stability) of loads on a layer(s) consisting of either aggregate or a combination of aggregates and geofabric on weak subgrade soils.
- Use of these methods provide an efficient means for analyzing construction projects to determine the optimum conditions for restoring traffic to the roadway and minimizing the potential for pavement rutting or failure.



Configuration of bearing capacity model for analyzing highway aggregate bases reinforced with geofabrics.

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Corrosion Evaluation of Mechanically Stabilized Earth

[KTC-05-28/SPR 239-02-1F]
Principal Investigator:
Tommy Hopkins
Study Advisory Chair:
Mark Hite

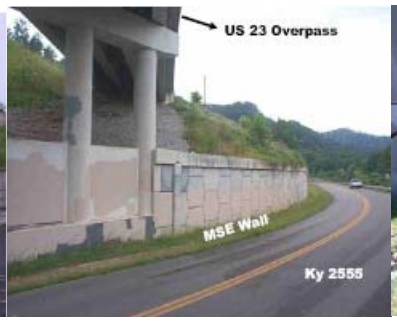
Purpose: Mechanically stabilized earth walls (MSE) have been used in Kentucky for several years. They frequently are used in urban areas where construction space is limited and they are more economical than conventional walls. These walls are designed with most of the load being transferred to the tensile elements (galvanized steel straps or grids) that are attached to the face of the wall. These MSE structures are expected to remain in service for many decades but little is known about the corrosive effects that might exist on the tensile elements and thus the long-term stability of the structure. This study was to evaluate the MSE walls in Kentucky to determine corrosion of the tensile elements.

Objectives:

1. Inventory existing MSE walls throughout Kentucky.
2. Examine the effects of corrosion on the tensile elements and the possible impacts to long-term stability.

Conclusions/Recommendations:

- 129 MSE walls have been built in Kentucky since 1970.
- Four walls were instrumented to detect possible corrosion of the tensile straps.
- Corrosion rates indicate that all MSE walls have corroded much less than the maximum amounts assumed in the design.
- Corrosion rates were more consistent when the backfill was uniform.
- Galvanized coating samples, from a wall constructed more than 20 years ago, indicated that the galvanization was still intact. The backfill at that site consisted of large size, well graded crushed limestone.



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Statewide Planning Scenario Synthesis: Transportation Congestion Measurement and Management

[KTC-05-32/SPR-303-05-1F]

Principal Investigator:
Doug Kreis
Study Advisory Chair:
Bruce Siria

Purpose: Traffic congestion is a growing problem that plagues our nation's transportation system. Billions of hours are lost each year due to congestion and that equates to over $60 billion being lost to our nations economy. Transportation agencies have not been able to keep pace with this congestion problem since they have neither the available right of way nor the financial capacity to build more lanes. This study examined the congestion crisis and suggested measures to address it in the most effective manner.

Objectives:

1. Review current practices for measuring congestion and its cost.
2. Evaluate practices to reduce congestion that did not involve building new capacity.
3. Review practices of 13 other states that have demonstrated leadership in the area of congestion management.

Conclusions/Recommendations:

- Most popular measures of congestion are not Level of Service (LOS) or volume to capacity ratio. The best measures were relatively direct measures of either the average time to traverse the distance between two points; or the average speed of vehicles; or the estimated delay computed by subtracting the expected travel time at free flow from the measured time at peak hour.
- Five of the 13 states are developing more complex measures of congestion. These measures tend to build on speed and time.
- Incident management programs, signal coordination, traffic management centers, and access management were the most frequently cited as the best or most effective means of congestion management.
- Traffic information on the web, HOV lanes and travel time information were considered among the least effective solutions.

Type of Solution	Number ranked first	Number Ranked Second	Number Ranked Third	Total Mentions
Ramp Meters	1	1	1	3
Incident Management	2	6	2	10
Signal Coordination	1	2	2	5
Access Management	3	0	1	4
Traffic Information on Web	0	1	0	1
Travel Times Information	1	0	0	1
Traffic Management Centers	2	3	0	5
HOV Lanes	1	0	0	1
511 Program	0	1	0	1

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Economic Costs of Low Safety Belt Usage in Motor Vehicle Crashes in Kentucky

[KTC-05-33/SPR-315-06-1F]
Principal Investigator:
Ken Agent
Study Advisory Chair:
Boyd Sigler

Purpose:

In 2004 813 people were killed in crashes on Kentucky's roadways and 3,984 treated as hospital inpatients. These figures exclude motorcyclists, pedestrians and others involved in motor vehicle crashes where seatbelts do not apply. Based on past national statistics, it is estimated that approximately 38,000 others are treated and released from emergency facilities. Kentucky's seatbelt usage in 2004 was 66% and was 14% below the national average, and correspondingly Kentucky has one of the highest fatality rates in the nation at 2.1/100MVM. The effectiveness of safety belts in preventing death and injuries has been established by NHTSA. The economic impacts of this situation are enormous. This study's purpose is to document these costs and provide further rationale for the adoption of a primary seatbelt law in Kentucky. States that have such laws show reduced injury and fatality rates.

Objectives:

1. Estimate short and long-term medical costs savings to public health insurance programs that would result from amending Kentucky's mandatory safety belt law to allow primary enforcement.

Conclusions/Recommendations:

- The database was developed and placed into operation.
- Details of the database development have been documented and furnished to the Cabinet.
- Some elements of geotech information have been added to the database by KTC research staff.
- Significant training will be required in order for this tool to become a routine part of the Cabinet's operation. Motor vehicle crashes create a considerable burden on Kentucky's medical resources.
- Primary enforcement legislation would increase the usage of seatbelts resulting in fewer injuries and reduce costs to Medicaid and other payers.
- Implementing primary enforcement would save at least $118 million in direct medical costs over a ten-year period. This includes about $34 million savings in Medicaid costs.
- Kentucky medical and related costs from crashes total $1.9 billion (this includes fatal, injury and property damage only crashes).
- The economic savings alone support the modification of Kentucky's current law on seatbelts to allow primary enforcement. It will save lives, reduce injuries and save public funds.

Effectiveness of Safety Belts in Preventing Fatal Injury for Kentucky, 2004

Vehicle type and seating position	Lap belts		Lap/shoulder belts	
	Effectiveness	Number of occupants hospitalized in KY	Effectiveness	Number of occupants hospitalized in KY
Passenger cars, front seat	35%	2	45%	178
Passenger cars, rear seat	32%	0	44%	9
Light trucks, front seat	50%	2	60%	80
Light trucks, rear seat	63%	0	73%	4
Total	-	4	-	271

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Kentucky Highway Research Projects Underway for 2005/2006

- Speed Estimation and Data Base Program (06-305)
- High Level Benefit Cost Analysis (06-306)
- Extended Use Investigation of Ground Penetrating Radar (06-307)
- ESAL Forecasting Estimation Update for Superpave (06-308)
- Evaluation of Extended Truck Weight Impacts (06-309)
- Diamond Grinding Effects on Pavement Performance (06-310)
- Best Practices Tracking for On-Site Erosion Control (06-311)
- Environmental Content for Construction Inspection Training (06-312)
- Stockpiling Potential for Hydrated Lime-Soil Mixture (06-313)
- Economic Costs of Low Seatbelt Usage In Kentucky (06-315)
- Low-Cost Safety Measures at Signalized Intersections (06-316)
- Traffic Control for Emergency Responders (06-317)
- Development of Traffic Sign Inventory System (06-318)
- Evaluation of Pavement Rumble Strips Effectiveness (06-319)

If you have a transportation issue that needs studied or a research project idea, please let us know. You can call any staff person or simply go to our web site's home page and click on the research idea button. You will be asked to provide a brief statement about the issue or idea and some contact information. Give it a try!

OUR MISSION

We provide services to the transportation community
through research, technology transfer and education.
We create and participate in partnerships
to promote safe and effective
transportation systems.

OUR VALUES

Teamwork
Listening and communicating along with
courtesy and respect for others.

Honesty and Ethical Behavior
Delivering the highest quality
products and services.

Continuous Improvement
In all that we do.

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