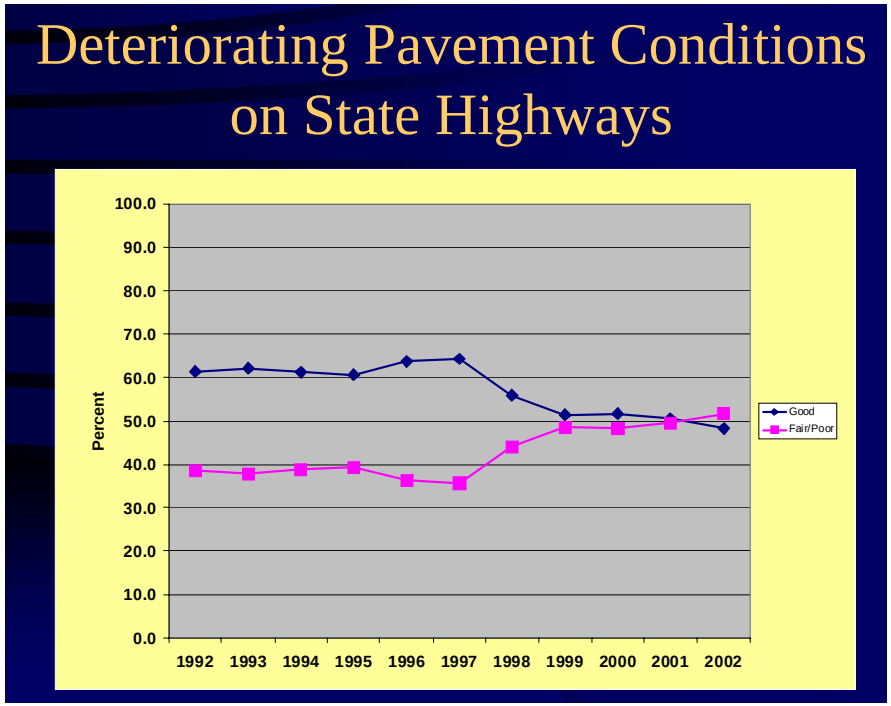
Needs and Analysis Tools

"Our projected needs, tools and strategies"

"Our Needs"

The demographic, geographic and financial profiles for Kentucky provide us with one set of challenges for our transportation system in Kentucky. However, we must look ahead to see how these challenges, combined with the current condition of our existing networks, and the increasing future demands on our existing networks will affect Kentucky's transportation needs for the next 25 years. Then we must look ahead to see what resources Kentucky has available to address these needs.



Source: KYTC Division of Maintenance

Bridges

At the current rate of federal bridge replacement program spending, it will take Kentucky over 93 years to replace all of the bridges which were rated as structurally deficient (having a sufficiency rating of 50 out of a possible 100 points) in 2003.

Pavement Deterioration

Since 2002, Kentucky has seen an increase in the percent of roadways whose pavements are rated "poor."

As much as 25 percent of our interstate system and 29 percent of our parkway system pavements have been rated as "poor" – more than ever before. This deficiency can be attributed to several factors: increased truck traffic on our interstate system, less funding for maintenance and rehabilitation of our existing roadways, less funding due to the eroding buying power of the transportation dollar, and the inability of our transportation resources to keep up with the consumer cost index. Therefore Kentucky has been unable to increase maintenance expenditures or move additional projects into the state's legislative highway program.

Until 2001, over 50 percent of Kentucky's pavements were rated "good." However Kentucky has seen this percentage steadily decline from approximately 64 percent in 1997 to about 48 percent in 2002.

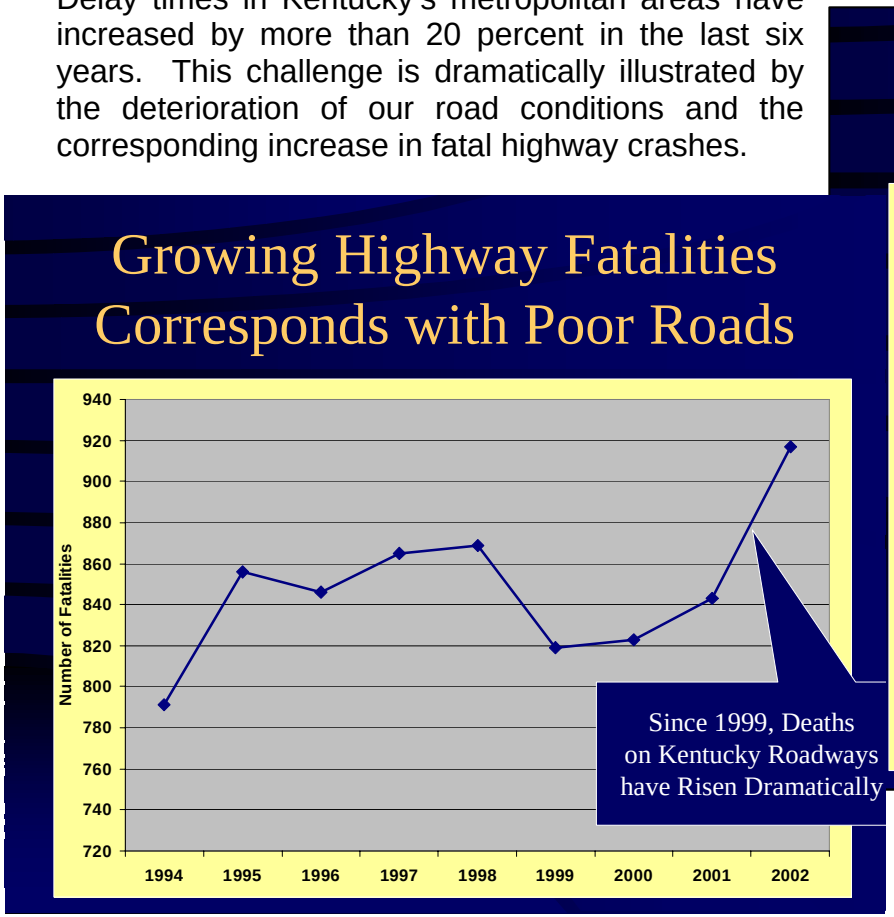
Conversely, the percentage of pavements that are rated "fair" or "poor" has steadily increased since 1997 to a level exceeding 50 percent for all pavements in 2002.

In fact, more of Kentucky's highway pavement is rated "fair" or "poor" at the present time than those rated in "good" condition. If the current resurfacing trend for the State Primary System continues, it will take 27 years to meet all resurfacing needs. At the current rate of accumulating resurfacing needs for the Rural Secondary System, it would take Kentucky 31 years to meet the current needs for the Rural Secondary System.

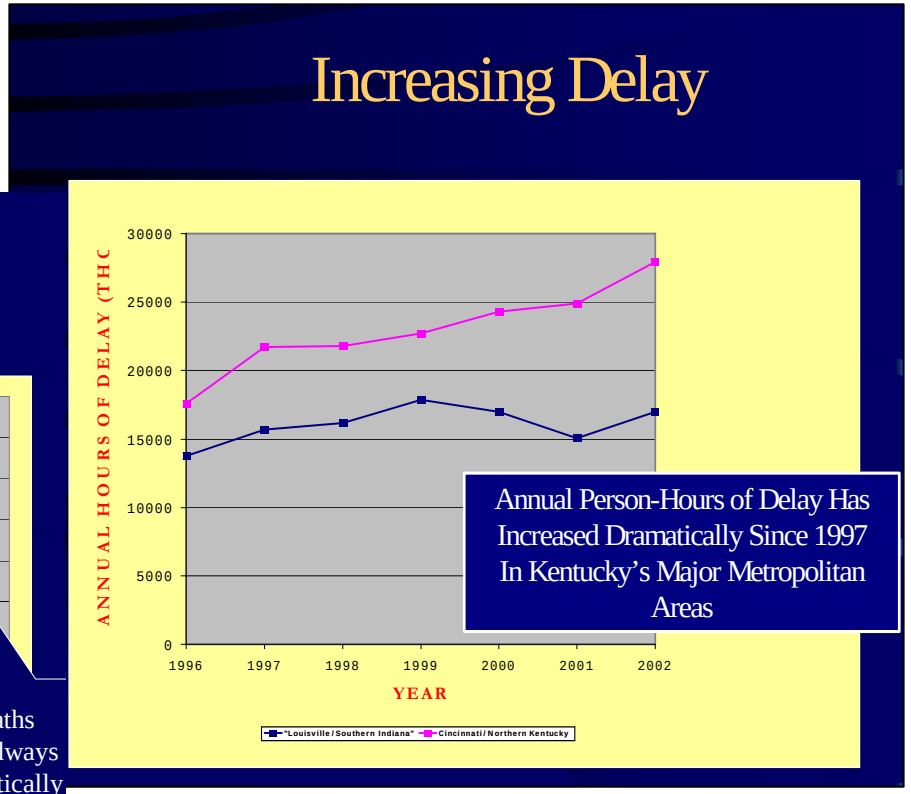
Increased Delays

With deteriorating pavement conditions in Kentucky, we can expect increased hours of delay per driver, increased cost of vehicle operation for drivers, an increase in highway crashes, and increased numbers of highway fatalities.

Delay times in Kentucky's metropolitan areas have increased by more than 20 percent in the last six years. This challenge is dramatically illustrated by the deterioration of our road conditions and the corresponding increase in fatal highway crashes.



Source: KYTC Division of Maintenance



Source: KYTC Division of Maintenance

Increased Crashes

Kentucky's highway crashes are increasing as our pavement deteriorates. In 2002, 130,347 collisions were reported in Kentucky with 32,393 injury collisions and 915 fatalities. The total number of collisions in 2005 increased to 152,925 with 985 fatalities. As indicated in this chart, most of our collisions (51%) occur on U.S. and State Routes, other than Interstates and Parkways. Twenty-nine percent of all collisions and fifty-one percent of all fatal collisions occur on state maintained roadways.

COLLISION LOCATIONS
2005

- Interstates – 31% of traffic
  - 7% of total collisions
  - 9% of fatal collisions
- Parkways – 5% of traffic
  - 1% of total collisions
  - 2% of fatal collisions
- U.S. / State Routes – 64% of traffic
  - 51% of total collisions
  - 74% of fatal collisions

With increasing traffic demand, a lack of increased funding, and the declining buying power of our existing funds, KYTC's ability to adequately manage our state highway system is being challenged. Traffic volumes are expected to increase by more than 60 percent over the next twenty years.

Kentucky has clearly lagged behind in its ability to maintain and improve the highway system in a timely manner. Projects for improved safety, increased travel efficiency, economic development, and even for maintaining our existing system are in jeopardy.

With the current and projected funds we cannot possibly meet or address the needs that we have identified. Therefore, we have developed and identified specific tools and strategies to help us focus and direct our limited funds in the most effective manner and hopefully, get the greatest return on our limited dollar.

Air, Rail, Public Transit and Water Transportation

As noted in the Assessment of Current Conditions Section of this document, Kentucky receives very limited funds for the air and public transit programs and does not receive federal or state funds for rail and water transportation programs. While the needs for these programs are great, the funding sources are certainly not. Therefore, we have not included the specific needs for these modes in this document, but rather have incorporated those mode-specific plans by reference so that we might provide complete data and identified needs for those programs as well.

"Our Strategy and Tools"

Kentucky's Highway Network

Our highway transportation network serves various transportation needs, principally access and connectivity. Those elements of the highway transportation system in Kentucky, whose primary function is connectivity, are more appropriately the administrative responsibility of the Kentucky Transportation Cabinet. Conversely, those elements of the highway transportation system in Kentucky whose primary function is access are more appropriately the administrative responsibility of local units of government. There are more than 78,000 miles of streets and highways in Kentucky. The Kentucky Transportation Cabinet is administratively responsible for over 27,500 miles of this network. While only one-third of the total mileage, the state responsible system serves nearly ninety percent of the vehicle-miles of travel within the Commonwealth.

Within this state system, there is a further stratification of priority elements. In actuality, there is a highway network encompassing approximately 5,000 miles which serves approximately 58 percent of the total travel on streets and highways within the Commonwealth.

This network is composed of the following elements:

- Kentucky portion of the National Highway System: 2870 miles
- Other Urban and Rural Roadways Functionally Classified as Principal Arterial Routes: 550 miles
- Kentucky portion of the National Truck Network not on Principal Arterial Routes: 730 miles
- Additional mileage intended to enhance statewide geographic coverage: 850 miles

The National Highway System (NHS) is a 160,000 mile network of roadways important to the nations' economy, defense, and mobility. Principal arterial routes include all NHS segments as well as other highways with significant traffic volumes and long average trip lengths. The National Truck Network (NN) consists of those designated roadway segments over which increased dimension vehicles (102 inch-wide trailers) may legally operate. Each of these administratively designated highway systems have been defined for purposes associated with a particular aspect of transportation system management and operation deemed to be of critical importance.

HERS Analysis Tool

Kentucky must focus on new policies for optimizing the decision-making process for selecting how our limited revenues are committed. With cash balances stabilized and overall program levels diminished, the Cabinet must ensure that available revenues are targeted to the greatest needs and produce the highest possible benefits.

In order to assist in this task, the Cabinet is utilizing the Highway Economic Requirements System, State Version (HERS-ST) developed by the Federal Highway Administration. FHWA describes HERS-ST as an engineering/economic analysis tool that uses engineering standards to identify highway deficiencies, and then applies economic criteria to select the most cost-effective mix of improvements for system-wide implementation. A national

level model of HERS has been used by FHWA to analyze future highway investment needs. HERS is the basis for the Conditions and Performance Report submitted biennially to Congress by FHWA. In the state level HERS-ST, each potential highway improvement is subjected to a rigorous benefit-cost analysis that considers travel time, safety, and vehicle operating costs. HERS-ST then uses incremental benefit-cost analyses to optimize highway investments. For a given level of investment, HERS-ST can predict resulting system conditions and user costs. Additional details about HERS-ST may be found at http://www.fhwa.dot.gov/infrastructure/asstmgmt/hersindex.htm.

It should be noted that HERS-ST does not include estimates of the indirect benefits of transportation investments. These various types of potential indirect benefits include positive changes in incomes, property values, employment, and real wages. Even conservative estimates have projected an additional 33 percent in indirect economic benefits over and above direct benefits.

The Kentucky Transportation Cabinet initially applied the HERS-ST model to several alternative investment scenarios:

- Existing Funding Levels
- "Full Engineering Needs"
- Derived Investment Level for Maintaining Current User Costs

Each of these scenarios is described in some detail below followed by a discussion of a final alternative investment scenario.

Existing Funding Levels

Historic and current fiscal data were gathered from appropriate KYTC offices. Data for expenditure categories not expressly considered in the HERS-ST analysis process were segregated to enable rational analyses of HERS-ST information; these categories were categorically funded safety projects ($19.5 million annually), bridge rehabilitation and replacement projects ($134 million annually), and routine maintenance activities ($240 million annually). HERS-ST then analyzed an existing investment level of $475 million for pavement rehabilitation, major widening, and other reconstruction projects. (Note: While the safety, bridge, and routine maintenance investment levels include consideration of all facilities for which either the Cabinet has administrative responsibility or are expressly eligible under federal program funding guidance, HERS-ST does not consider local roads or those functionally classified as Rural Minor Collectors; this has the approximate effect of excluding the Rural Secondary System from the HERS-ST analysis.)

For purposes of this evaluation, the following funding figures were used for "existing funding levels:"

Total Yearly Funding (in million $)	*$869*
$ New Lane Mileage	$169
$ Reconstruction, Widening Existing Lanes and Shoulders	$109
$ Pavement Rehabilitation on Major Highways	$197
$ Safety and Bridges	$154
$ Routine Maintenance	$240

The HERS-ST analysis indicated that, at this current level of investment over twenty years, the following conditions would result by the end of the twenty year period:

- Pavement conditions will deteriorate by eleven percent
- Direct user costs will increase by nearly $18 a week
- Driver delay will increase by nearly two hours a month

Note that this HERS-ST scenario evaluates the conditions for the optimum annual expenditure of $475 million for pavement rehabilitation, major widening, and other reconstruction projects. Were the Cabinet to make investment choices that deviate substantially from the optimum strategy, the likely result would be even further deterioration in one or more of these performance measures.

Full Engineering Needs

HERS-ST possesses the capability to define what annual level of investment is needed for pavement rehabilitation, major widening, and other reconstruction projects to bring all facilities for which the Cabinet is administratively responsible (approximately - excluding the Rural Secondary System) up to full design standards for geometrics and pavement condition and maintain that condition. In addition, the Office of System Preservation and Operations provided an estimate of the investment level necessary to similarly upgrade bridge and safety conditions and to provide full funding of routine maintenance needs.

For purposes of this evaluation, the following funding figures were used for calculating "full engineering needs" (shown in $ millions):

Total Yearly Funding (in million $)	*$4,428*
$ New Lane Mileage	$1,586
$ Reconstruction, Widening Existing Lanes and Shoulders	$ 798
$ Pavement Rehabilitation on Major Highways	$ 424
$ Safety and Bridges	$1,320
$ Routine Maintenance	$ 300

The HERS-ST analysis indicated that, at an investment level required to bring highway facilities to Full Engineering Standards over the next twenty years:

- Over 44,500 crashes will be prevented
- 812 fatalities would be prevented
- Direct user costs will be reduced by $61.2 billion
- Time in traffic will be reduced by 1.2 billion hours

While the resultant performance measures under this investment level are impressive, it is simply not reasonable to expect anything close to a five-fold increase in revenue over what is currently in place for highway transportation purposes. Still, there are some analytical benefits to examining this scenario.

Since HERS-ST uses incremental benefit-cost analyses to optimize highway investments, one can deduce which types of improvement options provide the least relative benefits when compared to costs by scrutinizing the types of improvement options which show up only in an analysis of this level of investment. When compared to the optimum strategy at the current level of investment one notes that, while investment in pavement rehabilitation projects increases by a factor of only two, the investment level for reconstruction projects increases by a factor greater than seven and the investment level for new lane mileage increases by a factor greater than nine.

Derived Investment Level for Maintaining Current User Costs

HERS-ST also possesses the capability to set certain end-result performance measures, define the annual investment level necessary to achieve those results, and also depict other performance measures resulting from that annual level of investment. One scenario was examined with the end-result defined as "minimizing increases in user costs." Further, some constraints were placed on project improvement standards to restrict highway widening in some areas, allow narrower lanes and shoulders in some circumstances, and allow some roads to have more curves and hills. These allowances were defined to provide a more realistic assessment of the type and magnitude of improvement options the KYTC would pursue in a real-world environment. The annual funding required for a twenty-year period to minimize increases in direct user costs using some modified improvement standards are as follows:

Total Yearly Funding (in million $)	*$1.694*
$ New Lane Mileage	$ 597
$ Reconstruction, Widening Existing Lanes and Shoulders	$ 275
$ Pavement Rehabilitation on Major Highways	$ 368
$ Safety and Bridges	$ 194
$ Routine Maintenance	$ 260

The HERS-ST analysis indicated that, at the derived investment level required to maintain current user costs over the twenty-year period, the following would occur over a twenty-year period:

- Over 33,100 crashes will be prevented
- 442 fatalities will be prevented
- Direct user costs will be reduced by $28.6 billion
- Time in traffic will be reduced by 185.1 million hours

As can be seen, the annual investment level needed to minimize future increases in direct user costs is approximately twice the current level of investment. However this overall figure includes only modest increases in investment levels for safety projects, bridge rehabilitation and replacement projects, and routine maintenance activities based on adjustments made by KYTC estimates. Annual investments in pavement rehabilitation are about twice what they are

under the optimum strategy at the current level of investment, while annual investments for reconstruction projects are about two and one-half times the level under the optimum strategy at the current level of investment. Annual investments in new lane mileage would be between three and four times the level under the optimum strategy at the current level of investment. In this scenario, the increased cost of the investments is more than offset by the direct cost savings to the users. Again, despite these positive performance indicators, there is no realistic expectation that current revenues available for investment in highway projects will increase by this order of magnitude.

Alternative Scenario (Additional $100 million investment)

A quick overview of the three scenarios above leads to some stark conclusions:

- The current level of investment is insufficient to make significant improvements in the Commonwealth's highway network;
- The level of investment necessary to upgrade all facilities to full geometric standards and maintain that condition is not going to be made;
- A level of investment necessary to just minimize the potential increases in costs for the highway user is not really an attainable policy.

HERS-ST may be used, however, to evaluate the impact of any investment level using the performance measures cited in the scenarios above. One such scenario might involve the impact of an additional $100 million in annual investment.

For purposes of this analysis, the investment levels for safety projects, bridge rehabilitation and replacement projects, and routine maintenance activities were assumed to be unchanged from current allocation. HERS-ST thus assigned the additional $100 million in annual additional investment among new lane mileage ($56 million); reconstruction, widening existing lanes and shoulders ($16 million), and pavement rehabilitation of major highways ($28 million).

Total Yearly Funding (in million $)	*$ 969*
$ New Lane Mileage	$ 225
$ Reconstruction, Widening Existing Lanes and Shoulders	$ 125
$ Pavement Rehabilitation on Major Highways	$ 225
$ Safety and Bridges	$ 154
$ Routine Maintenance	$ 240

The HERS-ST analysis indicated that, at an investment level of $100 million per year more than current funding over the twenty-year period, a total additional investment of $2.0 billion, the following would occur over twenty years:

- Over 9,500 crashes will be prevented
- 118 fatalities will be prevented
- Direct user costs will be reduced by $8.9 billion
- Time in traffic will be reduced by 29.6 million hours

Nearly 500 additional new lane miles would be enabled at this enhanced investment level. Reconstruction and widening of existing lanes and shoulders could be increased by nearly twenty percent annually. Pavement rehabilitation projects on major highways could be increased by more than 100 miles annually. More importantly, projections for reduced travel times and direct costs to users while improving the safety performance of the highway network show compelling evidence of the value of this increased level of investment. Approximately $8.9 billion in incremental direct benefits are projected to accrue over twenty years as a result of this incremental $2.0 billion investment.

Summary

Existing investment levels underfund Kentucky's highway network and result in our inability to perform as a key link in growing the Commonwealth's economy. Investment levels necessary to achieve and maintain a flaw-free highway system are a pipe dream. Even the investment levels needed to minimize user cost increases are likely beyond the realm of possibility. However, modest increases in the aggregate level of investment could produce demonstrable direct and indirect benefits for highway users and those market segments positively impacted by a safer, smoother, less congested transportation system throughout the Commonwealth.