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KENTUCKY TRANSPORTATION CABINET

ASSET MANAGEMENT IMPLEMENTATION PLAN

Asset Management Gap Analysis

Implementation Plan

June 30, 2016

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1.0 Introduction

Description of the Project

This document summarizes the asset management practices of the Kentucky Transportation Cabinet (KYTC) within the Kentucky Department of Transportation and documents steps identified by the cabinet to strengthen them.

Federal statute defines transportation asset management as

> "The term 'asset management' means a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost."[i]

In short, asset management is a systematic approach to sustaining the physical condition of transportation infrastructure at the desired condition with available resources. Documents such as safety, freight or congestion plans address how well the highway network moves people and goods safely. An asset management plan addresses the physical condition and related performance of infrastructure, which is the most fundamental consideration of a transportation network. If it deteriorates far enough, it will be neither safe nor efficient and will cost more to repair or rehabilitate. Hence, asset management addresses the fundamental issue of how an agency measures, manages, invests in, treats and maintains the physical condition of its assets.

Asset management becomes complex for several reasons. First, an agency has thousands of assets all of different age and condition, each requiring different treatments. Second, over their lifecycle it is most economical to treat assets when their deterioration is minor instead of waiting until they require expensive rehabilitation or replacement. However, anticipating the proper treatment at the proper time for thousands of assets requires sophisticated processes that track each asset's condition and needs. Third, because it can take several years to develop a highway project, it requires extensive advance planning to have projects ready to bid and to anticipate when an asset will need treatment. In short, asset management requires inventories of large numbers of complex assets, capabilities to analyze and forecast future condition, sound engineering to anticipate treatment needs, and reliable processes to deliver capital projects and in-house maintenance treatments at the right time for thousands of assets each year.

Adding further complexity is a shortage of money. Even, if an agency knows when and how to optimally treat an asset, it may lack sufficient resources to do so. It may have to settle to do lesser treatments or none at all. This requires the agency to also make constant financial tradeoffs to determine how to allocate scarce funds and in-house resources to cost-effectively achieve the best infrastructure conditions.

This document summarizes KYTC self-assessment of its asset management practices against an idealized set of best practices. It identifies gaps in organizational structure, processes, policies and information needs, to further improve its management of critical highway assets.

DESCRIPTION OF THE KENTUCKY SYSTEM

In 1912, the Kentucky Department of Public Roads was established with 14 employees, a $25,000 annual budget. It became the Kentucky Transportation Cabinet (KYTC) in 1982 with over 5000 employees. Currently, the cabinet has a budget of approximately $ 2.4 billion and 4,674 employees.

The KYTC vision for the state's transportation system is

"***Striving to be national leaders in transportation who provide transportation infrastructure and services for the 21st century that deliver new economic opportunities for all***."

The Mission is

"Provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky."

Kentucky is a geographically diverse state with about 40,000 square miles of land and water spread across 120 counties. It has proportionally a large population of about 4.33 million people. The KYTC is responsible for maintaining all the roadways except those in the city. The KYTC has 12 highway districts that are responsible day-to-day operations and managing projects in the districts. The central office provides guidance on policy and prioritization and administrative support.

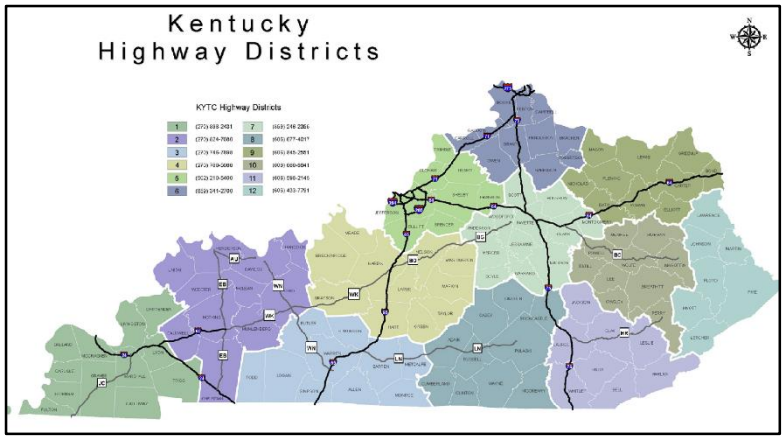

Figure 1: KYTC Districts

The cabinet develops a Long-range Statewide Transportation Plan (LRTP) and a six-year shorter range transportation plan. The cabinet previously included both policy direction and specific projects addressing the short-range six-year time frame and a long-range plan addressing six to twenty years. Since 2006, the LRSTP shifted from a policy/project oriented format to a process-based format. The 2014 LRSTP is a statewide policy plan that by reference incorporates the long-range Metropolitan Transportation Plans (MTP) of the nine Metropolitan Planning Organizations (MPOs).

ROADWAY SYSTEM

The state of Kentucky has approximately 79,598 miles of public roads and streets with varying number of lanes. KYTC has four main categories of pavements that they manage. These are (i) Interstate, (ii) Parkways, (iii) MP System, and (iv) Rural Secondary. The MP system consists of the state primary routes, the state secondary routes and the supplemental routes. The network includes:

The KYTC is responsible for the maintenance and preservation of 27,638 centerline miles of pavement. This includes

- 800 miles of Interstate Highways
- 520 miles of Parkways
- 11,674 Primary and secondary routes
- 12,742 Rural routes
- 1,749 Supplemental routes

Included in the above miles is 3,294 miles of the National Highway System routes.

Kentucky also has over 14,000 bridges. Of these 9,000 are state-maintained bridges. The KYTC also manages 3, 200 traffic signals and 550,000 signs. The KYTC is also responsible for keeping the network clear of snow and ice in the winter and mowing the rights of way in the spring and summer.

Kentucky Administrative Regulations designate state-maintained roadways by the type of service and function they provide. The systems in KYTC are designated as follows:

- **State Primary System**: Interstate, Parkways and other long distance, high volume intrastate routes of statewide significance that generally link major urban areas within the state.
- **State Secondary System**: Regionally significant routes of shorter distance which provide mobility and access to land use activity, generally serving smaller cities and county seats within a region.
- **Rural Secondary System**: Routes of sub-regional significance which might include urban arterial streets and other collectors, often with access to land use activity such as farm-to-market routes as their main function.
- **Supplemental Roads**: All other state-maintained routes such as frontage roads, cross roads and local access roads such as farm-to-market routes as their main function.

Local agencies within the state are also responsible for maintenance of some public roadways within their jurisdiction. Within Kentucky, there are 39,922 miles of county maintained roads, 10, 657 miles of city maintained roads, and 555 miles that are maintained by other entities.

PAVEMENT CONDITIONS

The KYTC pavement condition[ii] rating is based on a comprehensive analysis of smoothness, traffic levels, cracking, and other pavement distresses identified by engineers within the Transportation Cabinet's Division of Maintenance.

The KYTC's notes that the proposed reporting requirements of the Moving Ahead for Progress in the 21st Century (MAP-21) do not reflect the current KYTC business practice. Standard KYTC business practices categorize the pavement system into four: Interstate, Parkway, MP system, Rural Secondary. These four categories are used for reporting, project selection, performance projections and investment analysis. KYTC's pavement ratings of good, fair and poor thresholds are more stringent than those defined in proposed MAP-21 rules. All condition graphs and projections contained in this report are used by KYTC in its business practice and are not for MAP-21 reporting.

KYTC notes that it has a vested interest in accurate data and has made significant investment into data collection vehicles equipped with laser crack measurement systems (LCMS). KYTC is currently streamlining the data processing required to fully utilize the data from LCMS and analyzing valid data extracts from the system for determination of cracking percentages.

In the absence of processed cracking percentage data KYTC estimated the International Roughness Index (IRI) and Rutting and the current condition of the Interstate and non-Interstate National Highway System using the proposed MAP-21 metrics for 2014. Figure 2 below shows the performance condition for 2014 for IS and Non-IS NHS based on MAP-21 thresholds. The percent of poor is less than 2 percent on the IS and less than 4 percent on the NHS (Non-IS). Though the KYTC pavement condition rating system is different from what is required by MAP-21, the KYTC has the capability to use the existing information and report performance according to the proposed MAP-21 standards. Initial data analysis indicates that KYTC will be able to successfully meet the minimum condition requirements. The following table shows the 2014 condition for the IS and the NHS (Non-IS) based on the MAP-21 requirements.

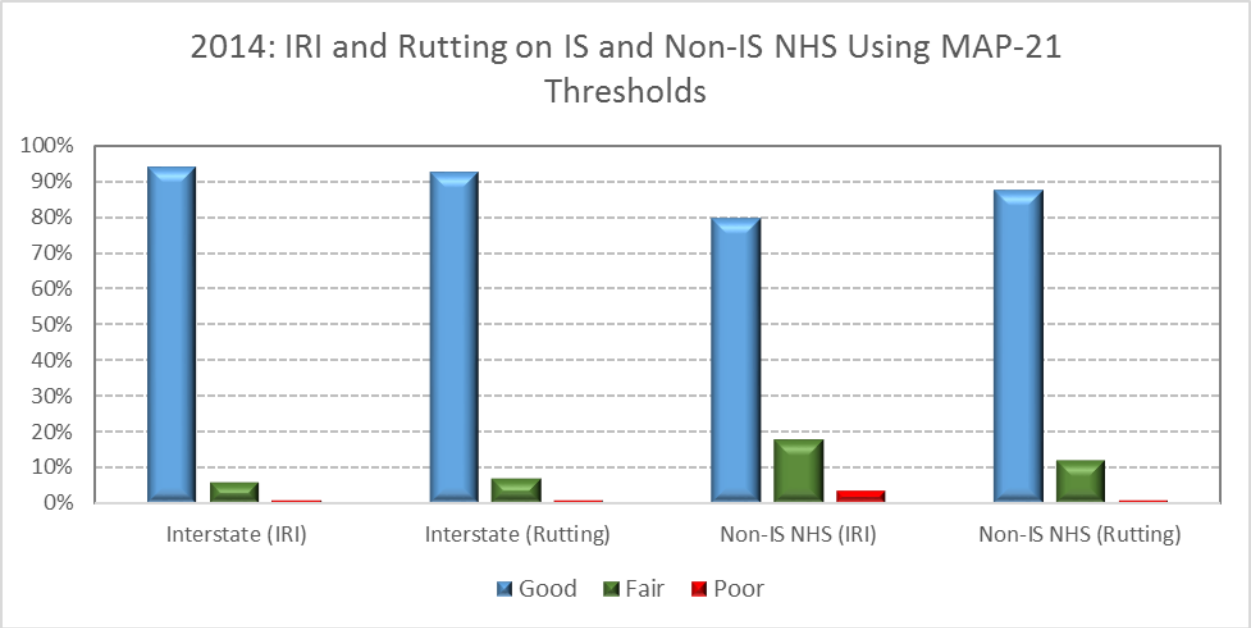

Figure 2: Interstate and NHS condition based on rutting and IRI

The following sections in this report uses the KYTC's more stringent pavement ratings.

KYTC had an informal target of not more than 8 to 10 percent of pavements to be in poor condition. However, it has not been able to allocate sufficient funds to reach that target. This resulted in pavements in poor condition significantly increasing over the last 10 years.

INTERSTATE PAVEMENT CONDITION

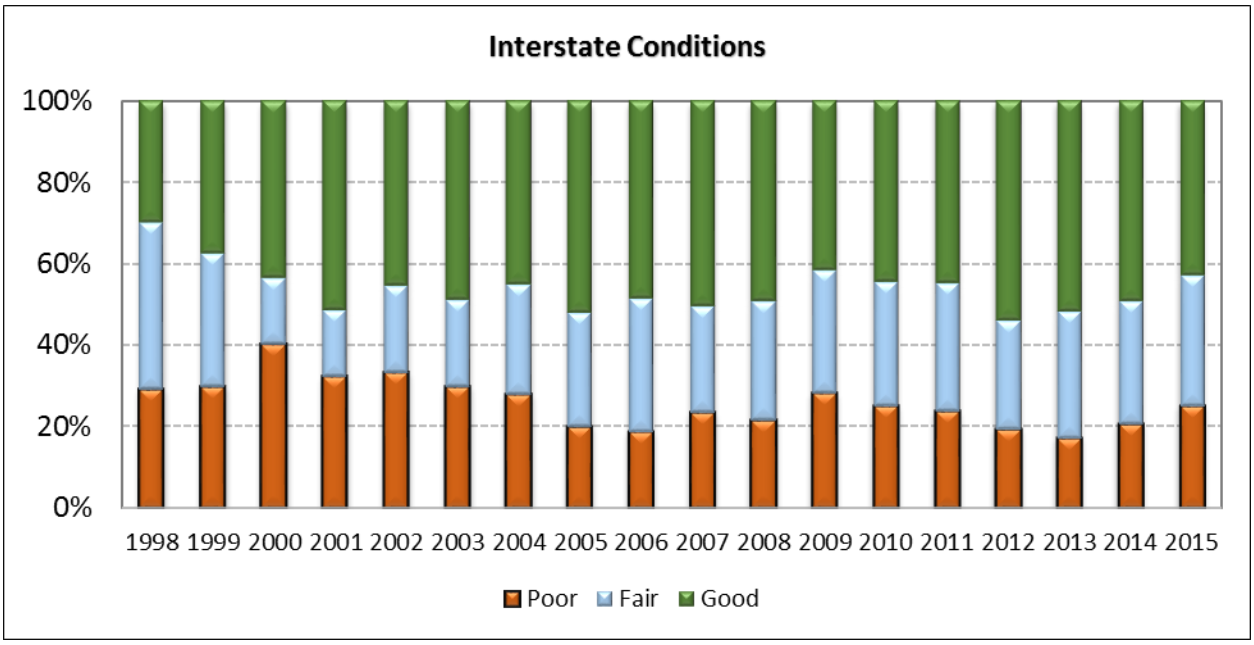

Figure 3: Historic Interstate Condition Trends

Figure 3 show that on an average since 1998 the percent of interstate pavements that are in good condition have improved. Figure 3 also shows that the pavements in poor conditions has increased to approximately 25 percent in 2015.

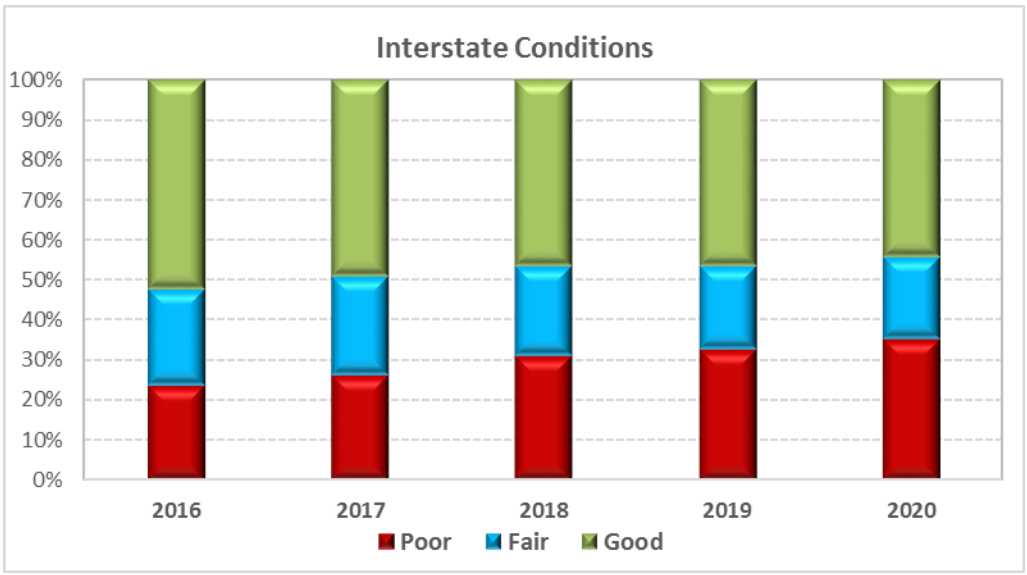

Figure 4: Interstate Condition Projections Based on $80 M Preservation Investment

Figure 4 shows the projection for the interstate system conditions based on the assumption that KYTC will invest $80 million on preservation type projects annually on the interstate system. These projections do not take into consideration any interstate investment being considered widening or other capital projects. The figure shows that even with $80 million annually, the percent of pavements in poor condition will be approximately 35 percent by 2020.

PARKWAY CONDITIONS

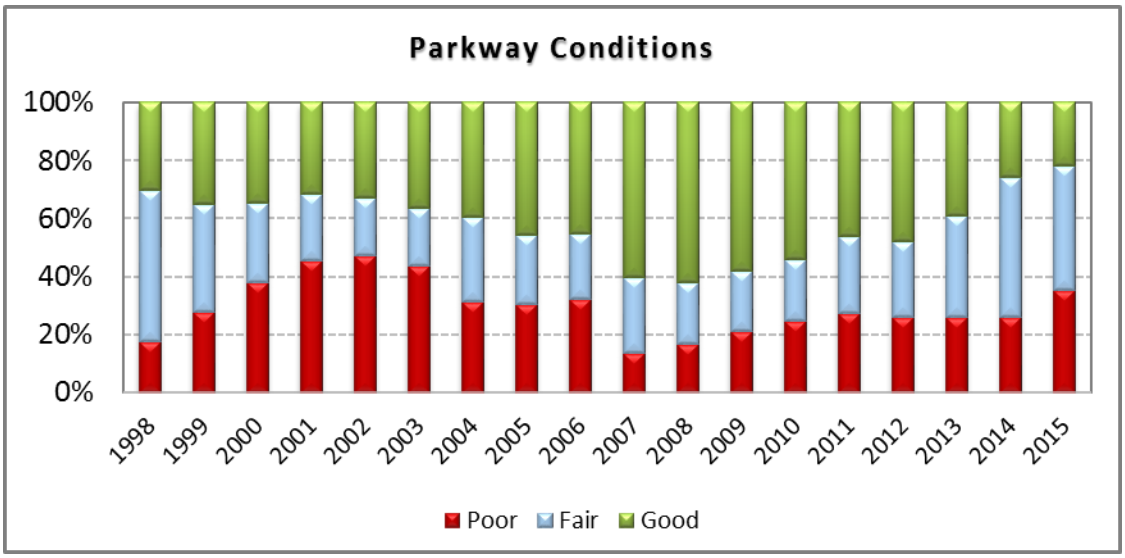

Figure 5: Historic Parkway Condition

Figure 5 shows the past conditions of pavements on the Parkway system. The Parkway system is all National Highway System(NHS), while a small percentage of the MP system is NHS. Figure 5 shows the Parkway pavements in poor condition increasing from 1998 to 2002 and then dropping by approximately 15 percent in 2004. KYTC personnel explained that even with the reduction in the poor pavements by 2006, almost 30 percent of the parkway system was in poor condition. This led the KYTC to service almost 25 percent of the parkway lane miles in 2006. The 2006 investment is reflected in the improvement in the parkway system conditions in 2007 and 2008. Since then, the percent of good pavements have steadily decreased to about 22, while the fair pavements have increased to 43 percent and the poor pavements have increased to approximately 35 percent. KYTC was able to do some maintenance work in 2012 to minimize the degradation of pavements in fair to poor condition.

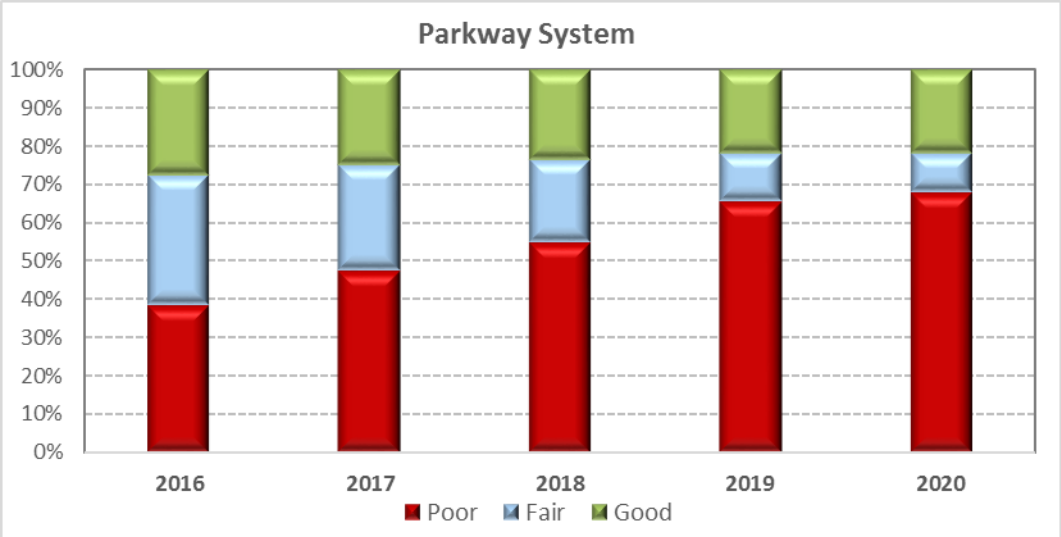

Figure 6: Projected Condition Based on $70 Million Annual Investment in Preservation Activities

Based on past trends there is general concern that not enough monies are being allocated to systematic preservation of the parkway systems. Figure 6 shows the projected conditions of the parkway system assuming that $70 million will be invested annually in system preservation activities. Figure 6 shows this level of investment will result in a drop in good pavements. It will result in 22 percent good, 10 percent fair and an increase to 68 percent poor pavements by 2020.

MP System Conditions

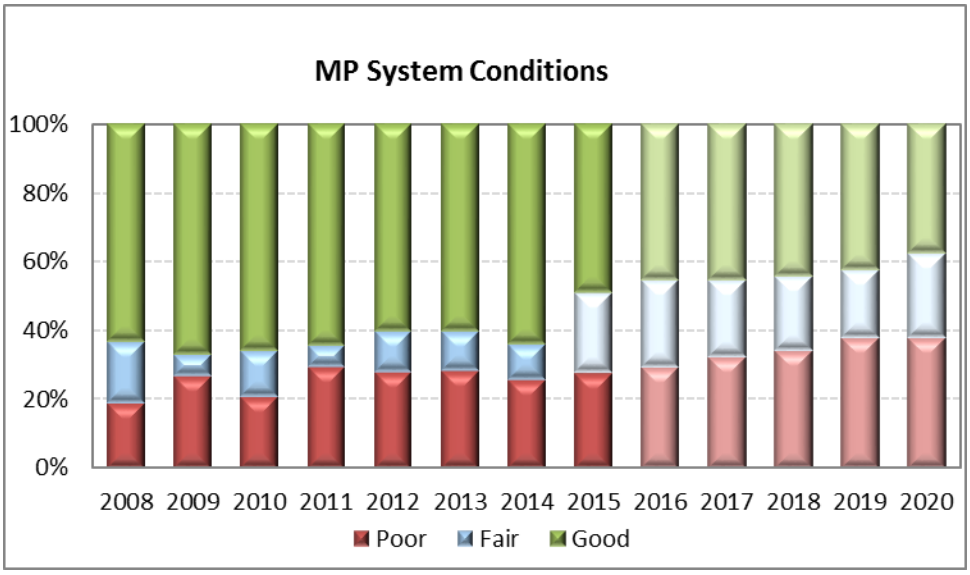

Figure 7: Historic and Projected MP System Conditions

Figure 7 shows the percent of poor condition pavements in the MP system increasing over the years. It also projects the percent of pavements in poor condition continuing to grow to almost 40 percent by 2020. The above projected conditions are based on an estimated annual budget of $93 million in resurfacing and $5 million in preventive maintenance. Calculations show that approximately $130 million in resurfacing and $20 million in preventive maintenance is needed annually to sustain the MP system.

BRIDGES

The KYTC manages 9,000 of the 14,000 bridges in Kentucky. Overall the health of the KYTC bridges appear to be good. The percent of bridges that are structurally deficient on both the NHS and the non-NHS is less than 3 percent.

NHS Bridges

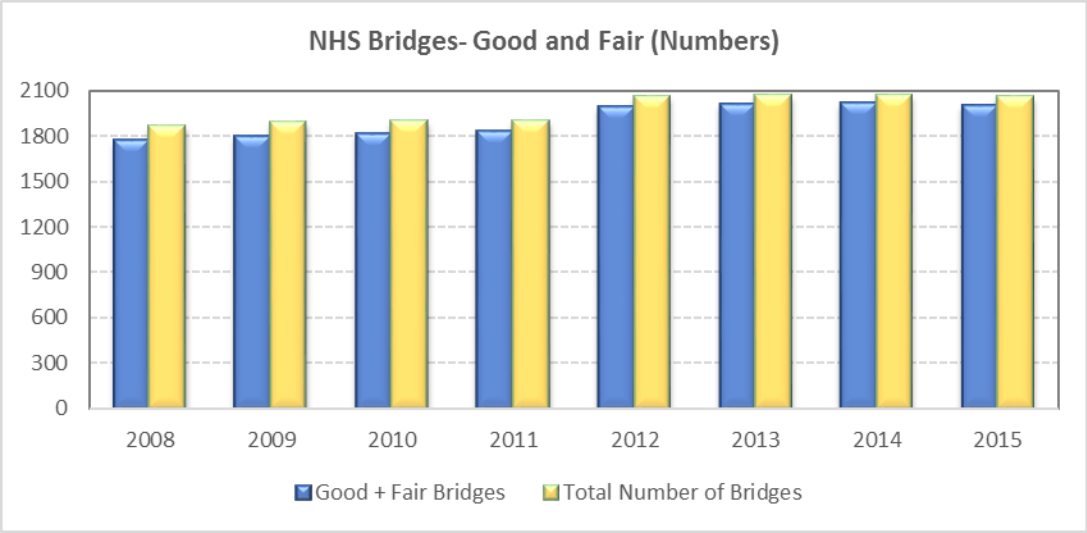

Figure 8: Historic Condition of Number of NHS Bridges in Good and Fair Condition

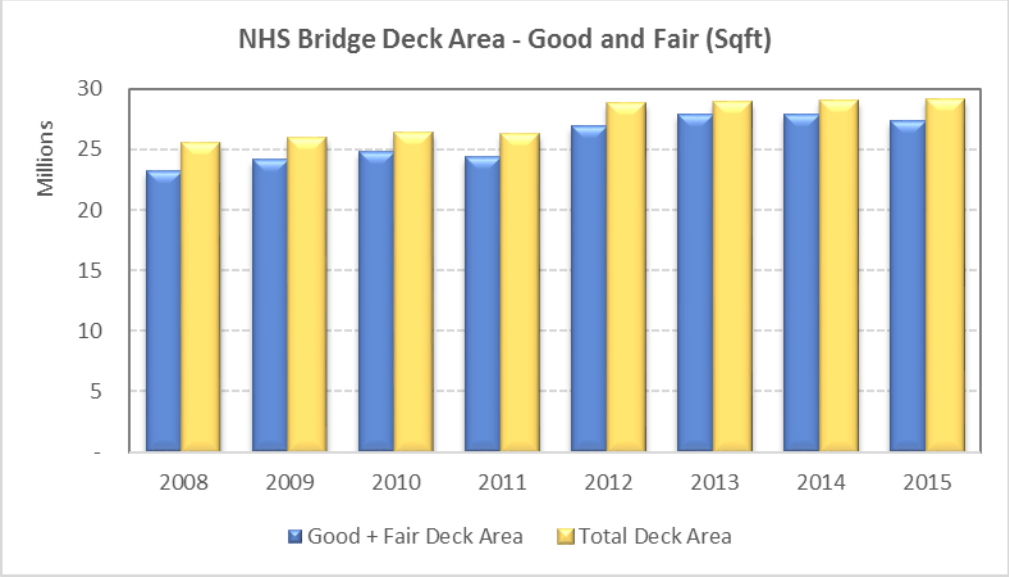

Figure 9: Historic Condition of Deck Area of NHS Bridges in Good and Fair Condition

Figure 8 and 9 shows the total number of bridges and the total bridge deck area on the NHS increasing from 2008 to 2015. It also shows the trend in the number and the total deck area of NHS bridges in Good and Fair condition increasing for that period.

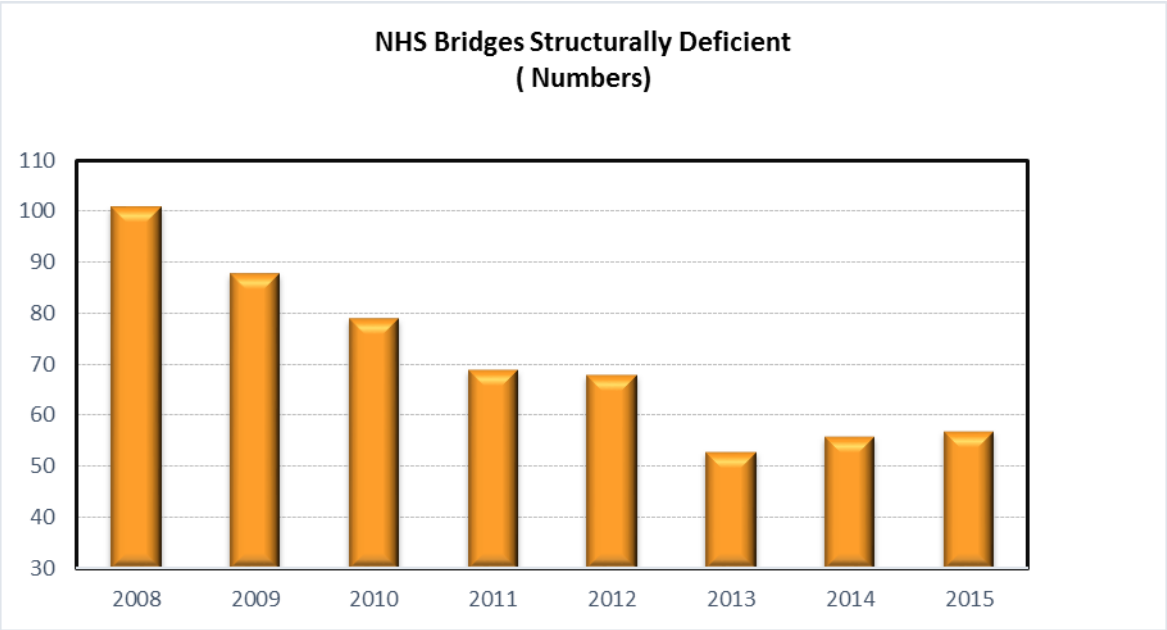

Figure 10: Structurally Deficient NHS Bridges (2007-2012)

Figure 10 shows the number of structurally deficient bridges dropping to approximately 53 in 2013 and then increasing to 57 in 2015. Figure 11 shows the trend in the total deck area of the deficient bridges for the same period. The structurally deficient deck area reduced in 2013 and increased in 2014 and 2015. This increase in 2015 is due to 3 bridges on I-64 in Louisville with about 200,000 square feet each that fell into structurally deficient status.

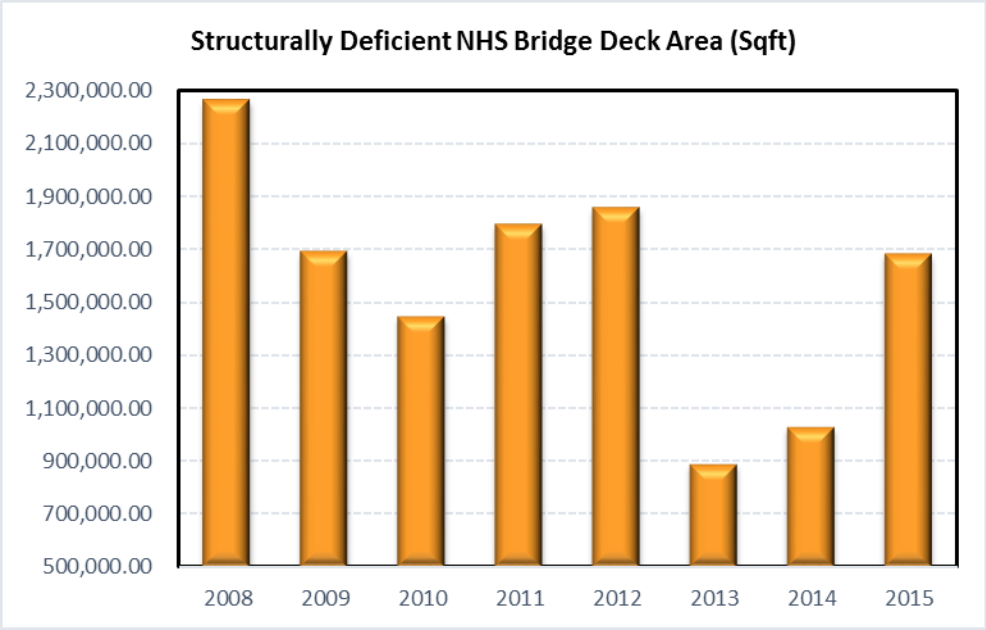

Figure 11: NHS Bridges 2013-2014

Non-NHS Bridges

Figure 12, shows that the number of bridges on the Non-NHS in good and fair condition increasing from 2007 to 2012.

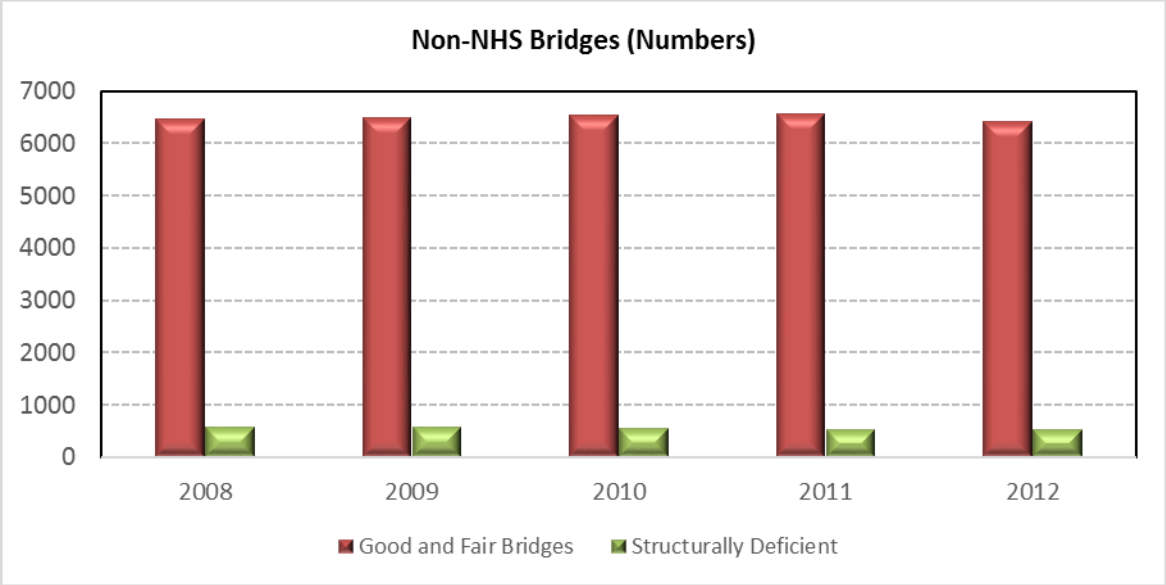

Figure 12: Non-NHS Bridges in Good and Fair Condition

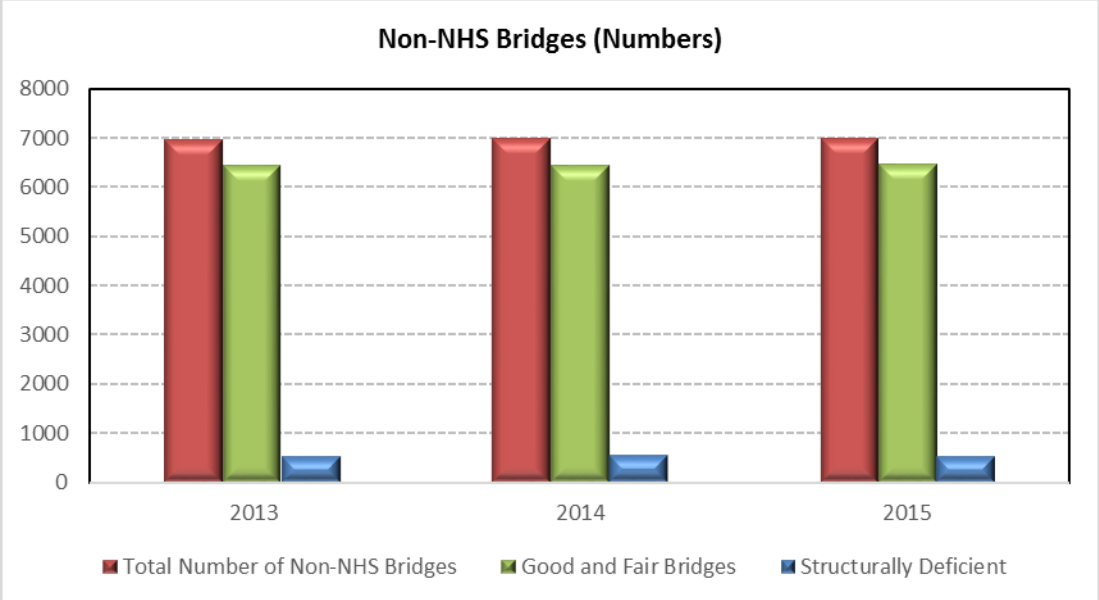

Figure 13: Non-NHS Bridges 2013-2014

Figure 13 shows the total number of structurally deficient Non-NHS bridges increased from 2013 to 2014 by 11 to a total of 530 bridges. This numbers of structurally deficient bridges on the Non-NHS has dropped to 516 in 2015.

2.0 Transportation Asset Management: State-of-the-Practice

This section provides an overview of Transportation Asset Management (TAM) and provides a brief discussion of key good practices. This section sets the context for recommendations made later in this plan.

A Systematic Way of Doing Business

In agencies, where mature asset management has been implemented, asset management is not viewed as yet another new program. Rather asset management is a "way of doing business." It brings a systematic and comprehensive approach to how an agency manages its infrastructure, and the data that supports it. Asset Management is distinguished by being:

Strategic - Asset management seeks to achieve and sustain assets in good repair now and in the future through comprehensive and strategic approaches.

Policy-driven - Resource allocation decisions are based on a well-defined set of policy goals and objectives.

Performance-based - Policy objectives are translated into system performance measures that are used for both day-to-day and long-term decision making about assets.

Forward looking - Achieving long-term performance targets and objectives is emphasized. By focusing upon the long-term, asset management naturally encourages sound preservation, which generally provides the lowest-lifecycle costs and highest long-term performance. While some performance management frameworks emphasize lagging indicators, asset management focuses on leading indicators of how today's decisions will affect long-term asset performance.

Formally documented - Asset Management usually is rooted in official policies, ingrained into agency standards, manifested in agency manuals and articulated in agency publications.

System Based - Although the management structures of asset management agencies vary widely, they appear to have evolved similar management strategies including the primary strategy of adopting a systems approach to managing their assets.

Analyzing Options and Tradeoffs - Decisions on how to allocate funds within and across different types of investments, such as preventive maintenance versus rehabilitation, pavements versus bridges, are based on an analysis of how different allocations will affect achievement of relevant policy objectives.

Data driven - Decisions about programming, project selection and maintenance treatments are driven by good data and not by rules-of-thumb, past practice or individual opinion.

Focused on long-term, lifecycle costs – Investments and decisions are based to the extent possible upon the lowest, long-term lifecycle costs for maintaining assets. This requires good data and analytics to identify the best lifecycle treatments. It also requires comprehensive preservation and preventive maintenance efforts as opposed to only worst-first treatments.

Cross-Cutting and Collaborative – The functions of planning, design, construction, maintenance and information technology tend to be in less rigid "silos" in an asset management environment. The need for timely treatment of assets at critical points tends to create more coordination between the capital and maintenance decision makers, both of whom rely on good planning information and accurate data.

Continuously Evaluated - Performance results are monitored and evaluated for both efficiency and effectiveness. A "plan, do, check, implement" approach is used to evaluate results and seek continuous improvement.

The antithesis of asset management is to build assets and then neglect them until they deteriorate and require expensive treatments or replacement. Instead, asset management is about anticipating when to preserve, maintain or rehabilitate assets at key points in their lifecycle to sustain them for the longest reasonable period for the lowest overall cost. Managing one asset or even one class of assets could be relatively simple. However, in a transportation agency with millions of individual assets, all of a different age and condition, asset management becomes a complex and sophisticated process to maximize resources.

Key Components of Asset Management

An effective asset management approach includes components relating to sound policy, good planning, reliable asset condition data, investment strategies and effective management of risks. This section summarizes the key components of an asset management approach. More detail is provided in Appendix 2.

Policy and Framework

Asset management is based on clear policy and supported by a framework that allows decision makers to understand if the policy objectives are being achieved. Generally, an agency with mature asset management will have a clear policy that facilitates adoption of asset management and directs all employees to coordinate their efforts to achieve. The policy basis provides legitimacy to the asset management effort and can serve as a "pivot point" or demarcation that tells agency staff that a change in direction, or at least emphasis, is required. The policy serves an important change management function by demarking that old approaches are being changed and new ones adopted.

A key component of the policy and framework are explicit condition targets. The agency expresses what it means to provide "good roads and bridges" by stating the technical criteria for adequacy. This can be specific to the condition of pavements, bridges and maintenance appurtenances. These targets provide definition to staff as to the condition they are to attempt to achieve with their efforts. When funds are

inadequate, the agency may identify intermediate targets or "aspirational" targets, which would be the ones they would like to achieve if greater resources existed. Documenting the resource gap between intermediate and aspirational targets can be a key outcome for communication and decision making.

Planning and Programming

These targets are built into the framework of existing processes such as development of the Statewide Transportation Improvement Plans, annual programming decisions, project-selection processes and maintenance programs. Generally, in an asset management approach, these decisions are documented to illustrate how they contribute to achieving the asset-condition targets. One of the most important pieces of the framework is the allocation of funds at the program level. The formal documentation of how much is being allocated for bridges, pavements, signs, guardrail, signals and other assets is important. Allocations are justified by what they can achieve and then measurement occurs to see if the expenditures achieved the desired targets. Iteratively over several years, the agency can calibrate expenditures to achieve its targets, or at least more precisely measure how many additional resources are needed to achieve them.

Documents such as the long-range plan, STIPs and budget submittals to the Legislature focus on how resource allocation and project selection are based upon the asset condition targets. If the asset conditions fall far below target, the planning and programming documents can emphasize the unmet need. This information can be used to advocate for resources or to re-direct existing resources to a critical asset need. The targets become the benchmark by which programming and project-selection decisions are measured.

Program Delivery

To achieve and sustain condition targets over a number of years requires the steady, predictable delivery of capital projects and maintenance activities. An agency with mature asset management would have reliable project development processes that scope projects to achieve asset condition targets and then deliver them reliability at appropriate point in the asset's lifecycle. Similarly, maintenance activities such as sealing cracks and maintaining drainage would occur to support the long-term performance of the assets. In the program-delivery process, the areas of information management, planning, programming, design, construction and maintenance are linked to deliver the right treatments at the right time.

Information and Analysis

Mature asset management agencies are strong in data and analysis. They have comprehensive asset inventories that include the location, condition and performance of all key assets. They also have management systems that allow them to track asset condition changes over time and to predict how assets will perform in the future based upon differing expenditure and treatment scenarios. The management systems interface with financial systems. This allows the agency to measure the effects of expenditures of capital and operational funds upon asset conditions.

Risk Management

Risk management is the most recent and least-understood element of a mature asset management approach. Risk is the positive or negative effect of uncertainty or variability on agency objectives. Managing risks is about predicting and then managing the uncertainties and threats that surround agency objectives. Because protecting public health and safety is always an objective, risk management addresses managing threats to safety. But it is broader and also includes managing threats to objectives, including achieving sound asset conditions. A robust risk management approach would identify the risks to achieving asset management objectives and have strategies in place to measure, monitor and mitigate those risks. Risks could be as broad as increased hurricanes, decreases in Federal aid, higher construction prices or the uncertainty inherent in long-term condition forecasts. An agency with clear asset management objectives will need to understand and manage the risks to those objectives.

3.0 TAM in KYTC

This section summarizes the current KYTC asset management practices and compares and contrasts them to the best practices in the asset management guide. The summary is based on review of KYTC material, self-assessment survey results, interviews, meetings, many follow-up discussions with KYTC subject matter experts and workshops with personnel identified by the KYTC point of contacts and meetings with the senior leadership team.

3.1 Asset Management Strengths

At the strategic level the agency plans indicate support for asset management. This is reflected in the KYTC 2014-2035, Long Range Statewide Transportation Plan[iii] that has identified the following agency and process level goals. Several of the goals support asset management. The measure of success with asset management will be the agency's ability to allocate funds and implement these goals.

Agency Goals

- Providing a safe and secure system
- ***Maintaining and improving existing infrastructure on a continual basis***
- Ensuring dependable, effective and efficient facilities
- Improving local, regional and global connectivity and access
- Including all appropriate modes of transportation within a fully-integrated system

Process Goals

- Set **performance standards for methods and practices**
- To **deliver improvements and to maintain the system**. These process goals include consideration of:
    - Dependable access to markets, jobs and resources
    - Human and natural resources
    - **Efficient and flexible use of available resources**
    - **Transparent decision-making processes**

KYTC Future System Goals

- Include a greater **emphasis upon investments that cost less per year to** operate.
- Include emerging technologies that ***continue to improve operations and state of good repair***
- Be responsive to the needs of a growing population that will be older, more urban, and more diverse than ever before in the state's history.
- Strive to be increasingly safer as is reflected in the past trend of the decreasing number of traffic fatalities along the state's roadway network.

3.1.1 Self-Assessment Survey Results

A self-assessment survey was circulated to the KYTC subject matter experts and other select personnel. The survey respondents provided feedback on 63 different aspects of asset management. Fifty-five of the survey questions are from the AASHTO Asset Management Guide Volume I and represent a maturity model of asset management. In additional to the four areas covered in the guide, eight questions covering risk-based decision making was added to the survey. The survey questions present a comprehensive summary of the elements of an effective asset management approach.

Twenty KYTC personnel responded to the asset management self-assessment survey that covered five areas. These were, Policy Guidance, Planning and Programming, Program Delivery, Information and Analysis and Risk-Management in Transportation Asset Management Decision Making. The self-assessment is on a scale of 1 to 5 with 1 indicating "strongly disagree" and 5 indicating "strongly agree." Like a maturity model it allows respondents to self-assess their agency's processes, policies, data, and practices against an idealized asset management standard.

Survey Results	
Major Areas	Scoring
Program Delivery	3.4
Policy Guidance	3.1
Planning and Programming	3.0
Information and Analysis	3.0
Risk-based Decision Making	2.3

The average responses showed the rating to be 3 or more in four categories. Overall the area of Program Delivery scored the highest. The highest scores of 4.3 was received for the question, "*Agency executives and program managers are regularly kept informed of program delivery status*." The lowest score in Program Delivery of 1.6 was received for, "*Our agency maintains and uses information on the full unit costs of maintenance activities*."

In the area of Policy Guidance, the question, "Our agency works with political leaders and other stakeholders to present funding options and consequences as part of our budget proposal." scored the highest with 3.7. The question, "Our agency regularly communicates to customers and other stakeholders our accomplishments in meeting policy objectives" scored 2.3, the lowest in Policy Guidance.

In Planning and Programming, the question, "The preservation program budget is based upon analyses of least life-cycle cost rather than exclusive reliance on worst-first strategies" received the lowest score of 2.2. The question, "Our agency's programs are based on realistic estimates of costs, benefits, and impacts on system performance", received the highest score of 3.5.

In the area of Information and Technology, the highest score of 3.9 was received for, "Our agency regularly collects information on the performance of our assets (e.g., serviceability, ride quality, capacity, operations, and safety improvements)." The lowest score of 1.8 was received for, "Our agency

monitors actual system performance and compares these values to targets projected for its capital improvement program.

In the area of Risk-based Decision Making, the highest score of 2.6 was received for, “Is there a good understanding of risk management in the agency?” While the lowest score of 1.6 was received for, “Does financial planning for investments incorporate risk management?

3.1.2 Pavements Strengths

The KYTC has very good subject matter expertise in the preservation and maintenance of pavement. The experts analyze the data and present the information to the leadership and to legislature and other stakeholders. This is evidenced in the discussions and in the computation and presentation of asset sustainability measures, deferred liabilities and the impact of investment on the remaining service life of pavements.

3.1.3 Pavement Management Systems and Data Collection

The KYTC has a statewide pavement data collection process that is managed centrally. It has three asset data collection vehicles that collect rutting, faulting, laser crack measurement system (LCMS) distress, IRI and images of the system. Hundred percent of the data for the NHS is collected in both directions for the outside travel lane on an annual basis. The data collection for the rest of the system follows a two-year cycle. Additionally, a team of five engineers also perform visual inspection of pavement distresses annually for the Interstates and Parkways and on a three-year cycle for the rest of the systems. Engineering judgment based on the visual inspection data is combined with the measured distresses (IRI, rutting, faulting) to create a priority score for each pavement section.

3.1.4 Pavement Data

The KYTC has over 20 years of pavement data that can be used for analysis. It uses the Agile Assets, Pavement Management System (PMS) as a database to store the pavement data. The system is also used to generate some reports. Currently, the analysis and GIS based forecasting is done outside of the PMS using data extracted from the PMS. The KYTC has two efforts pertaining to pavements with the University of Louisville, Kentucky:

1. To create pavement deterioration models based on historic Kentucky data for Interstate and Parkway asphalt pavements. The goal is to complete the models for asphalt pavements on the MP system by December 2016. The University will also work with Agile Assets to implement the modeling in the upgraded pavement management system.
2. The University is studying the LCMS data and working to correlate it with the KYTC historic visual pavement survey data. This step will allow the switch to LCMS as the major source of pavement distress data and fully integrate this source with the upgraded PMS.

KYTC is in the process of upgrading the PMS. By 2017, the KYTC intends to use these models to do pavement deterioration projections.

3.1.5 Remaining Service Interval

Pavements are the one of the highest valued assets in most transportation agencies. KYTC started the use of various measures to track and analyze the effectiveness of investment and forecast needs. One

such measure is the Remaining Service Interval (RSI) that has been used by KYTC since 2013. This measures the number of remaining years of life of a pavement, and reflects the year before another treatment is required.

Remaining Service Interval

Measures the number of years before treatment is required for any given pavement section.

It also provides information on how much restoration has been done to keep the pavements in good condition. The KYTC assumes that a standard resurfacing job will give asphalt pavements 12 to 15 years of useful life, while diamond grinding and repairing concrete will give the pavement approximately 10 years. RSI can be used to ensure that timely inexpensive preservation treatments can be done to extend pavement life while it is still in good or fair condition. Once the pavement drops to poor condition with an RSI of less than 4 years then more expensive rehabilitation treatment is required. The KYTC data shows that it cost eight times more to do rehabilitation that to do timely preservation[iv].

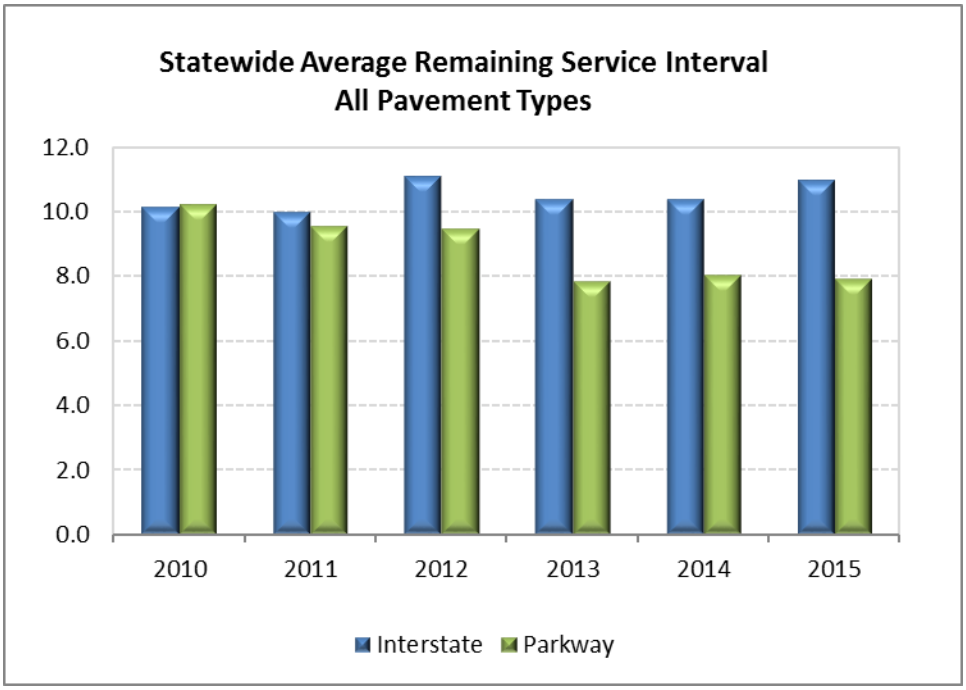

Figure 14: Remaining Service Interval Trends

Figure 14 shows the RSI for five years. It provides an overview of the system conditions and the need for investments in parkways. It shows the RSI of parkways to be on the decline. Between 2012 and 2013 the average RSI for parkway pavements dropped by more than one year because no work was done on the parkways that year. This is the result of limited preservation on parkway pavements.

3.1.6 Asset Sustainability Ratio

Asset Sustainability Ratio (KYTC definition)

The ratio of the lane miles restored to the lane miles consumed each year.

In the last few years, the KYTC pavement group also started computing the Asset Sustainability Ratio (ASR). This is another measure that support asset management. ASR shows how pavement restoration compares to the consumption and pavement wear. The assumption is that each year, each lane mile of pavement that is not treated loses one year of life. Based on the number of lane miles of work done and the type of work done, KYTC calculates the number of lane miles restored each year and compares it to the total lane miles consumed, to compute the ASR. An ASR greater than one indicates that more lane miles have been restored than consumed. The goal is to make sure that at the minimum the number of lane miles consumed is restored and the ASR is not less than one.

Figure 15 shows the ASR for the interstate steadily improving from 2011 to 2014 but dropping in 2015 to 0.7 in 2015. The ASR for the parkways has been increasing and decreasing over the five-year period and dropped to 0.5 in 2015. This reflects the sporadic nature of investments in the parkway system. The ASR trend highlights the need for systematic preservation over the long-term to cost effectively sustain the condition of pavements.

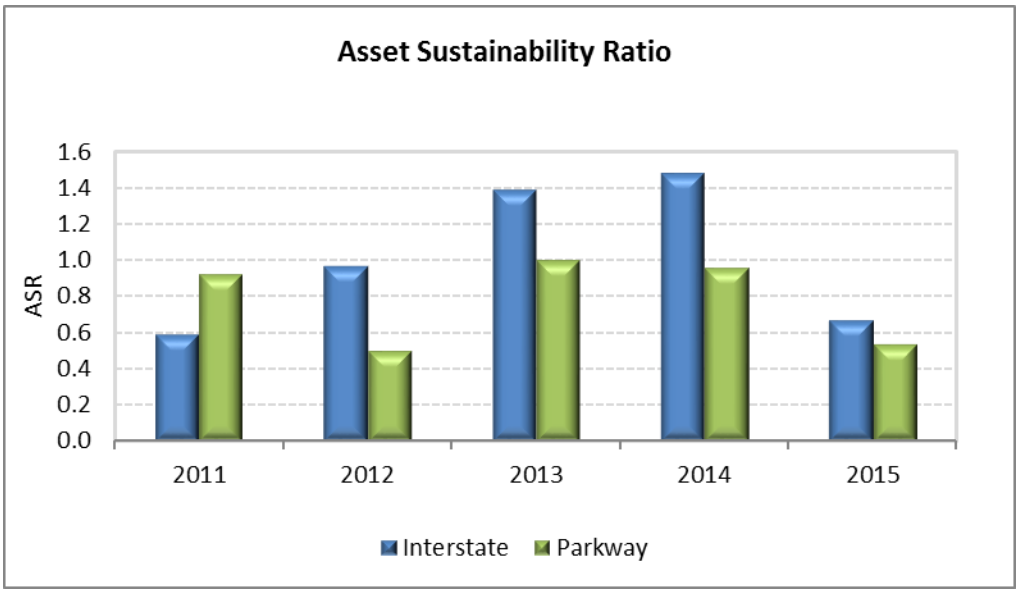

Figure 15: Historic Trends in Asset Sustainability Ratio

3.1.7 Overall MP Needs

Another asset management strength is that KYTC tracks and analyzes the needs and the investment made in the pavements. This analysis can help decision makers quickly understand the state of the system and the investment needs.

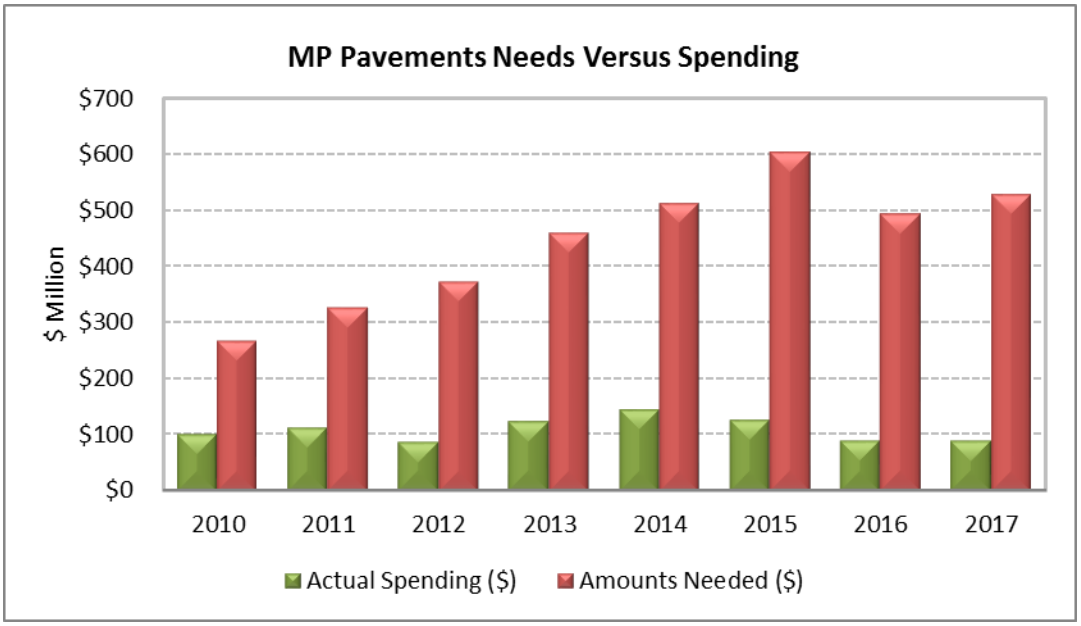

Figure 16: Trends in Needs versus Spending on the NHS Pavements

Figure 16 shows the actual spending versus the budget needs for the MP pavements. It highlights the gap between the needs and the funding projected to be available for the MP pavements in the future. Such analysis provides decision-makers information for budget allocations and investment needs. Subsequent charts show the impact of the financial gap for the different tiers of the KYTC roadway systems.

3.1.8 Interstate Pavements-Past Investments

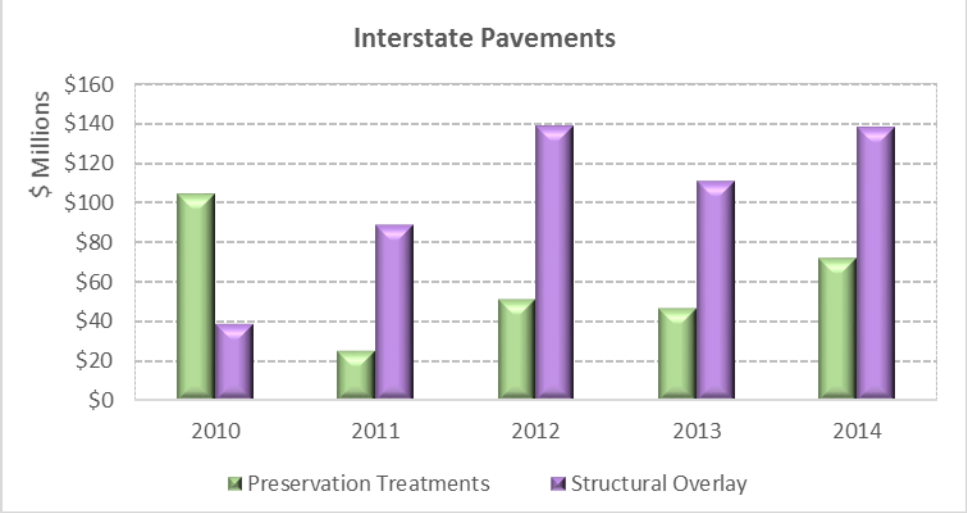

Figure 17: Historic Trends in Pavement Investments

Figure 17 shows the investments in preservation and rehabilitation made in the interstates. It shows over $100 million investments in preservation in 2010 and subsequent decrease in preservation while investment in rehabilitation increased since 2010 and continued to be over $100 million and close to $150 million in 2014. The KYTC attributed the increase in preservation in 2010 to approximately $104 million being invested in Diamond Grinding and Repair that resulted in the average IRI of the Interstate

System in Kentucky changing from 102.6 in 2009 to 79 in 2011. The figure reflects some of the impact of this investment. However, since 2010 the investment has shifted from preservation treatments to rehabilitation. The KYTC estimates that it needs at least $80 million every year in preservation to keep the interstate in reasonably good condition and prevent the good pavements from deteriorating into the fair category and those in fair deteriorating to poor.

3.1.9 Parkway Pavements-Past Investments

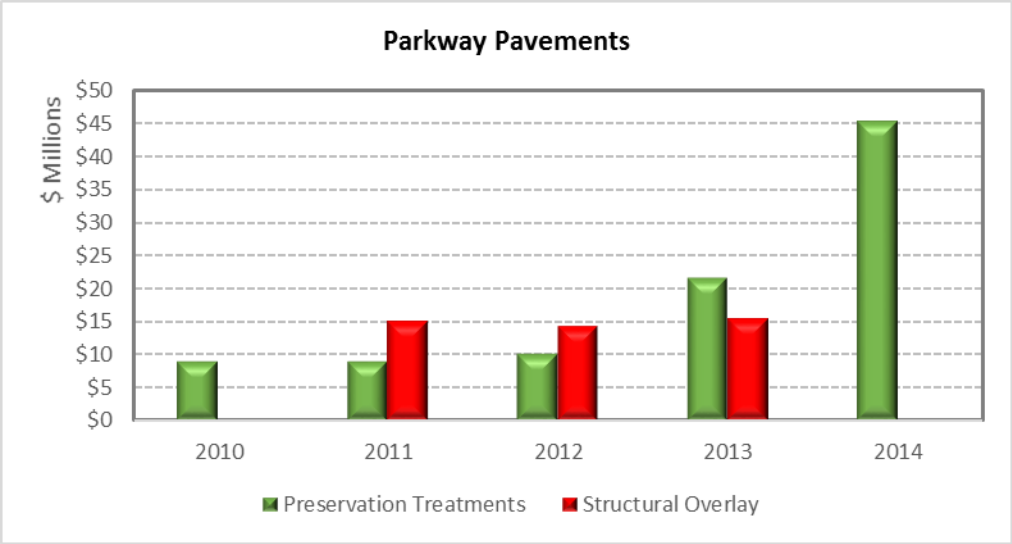

Figure 18: Historic Parkway Pavement Investments

KYTC has projected a need for at least $50 million in preservation in parkways to systematically preserve the parkway. Figure 18 shows that historically the investment in preservation in the parkway system has not been consistent and has been less than the amounts needed. It shows that the investments in preservation treatments have consistently been below $50 million. The increase in funding for preservation in 2014 reflects the KYTC's effort to successfully increase the funding of parkway preservation that year.

3.1.10 MP System-Past Investments

The overall investment in the MP system as reflected by the conditions shown in Figure 16 has been inadequate. It shows that based on the budget allocations there does not appear to be any plans to increase funding to improve these pavements.

3.1.11 Deferred Liabilities

Another important measure that KYTC computes is the deferred liabilities. This is the cost of all the projects that need to be done but are being delayed because of lack of funding.

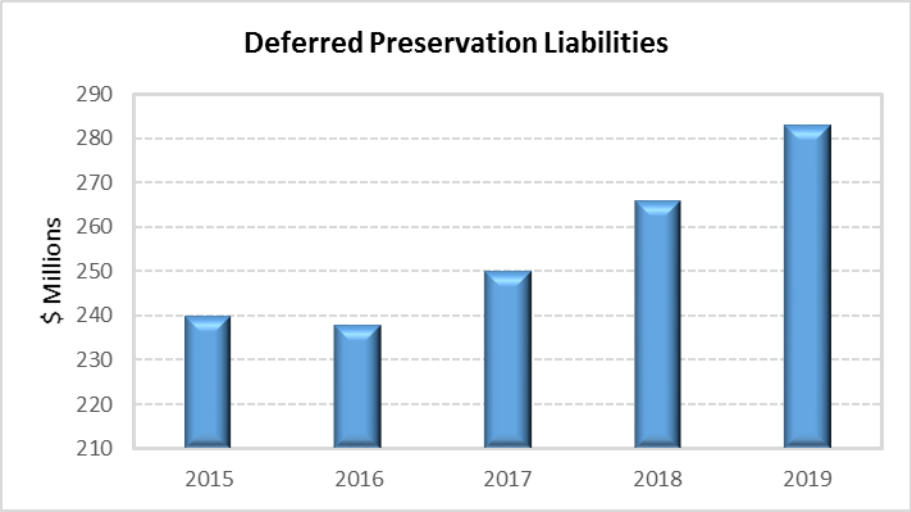

Figure 19: Interstate and Parkway Deferred Preservation Liabilities

Based on the pavement needs, each year the KYTC creates a list of projects required to address the pavement needs. Based on the availability of funds only a fraction of these projects get done. Each year more projects are added to the list to reflect the additional pavements that require treatment. This list of pending projects has been growing over the years. The agency revises the cost of the pending projects to adjust for inflation. Figure 19 shows the dollar amounts needed to address these deferred projects. Deferred preservation liability reflects the impact of the lack of investment in preservation.

Deferred Preservation Liability

The cost of completing all the preservation projects that have been deferred. It also represents the accumulated preservation liability.

All of the measures discussed above can help KYTC communicate to internal and external stakeholders the state of health of the pavements, the cost of repairs, and the cost of deferred action.

3.1.12 Preservation and Maintenance of Bridges

Overall the percent of number of bridges and the related total deck area on the NHS that is structurally deficient is less than 4 percent. Figure 20 shows the total deck area for the structurally deficient NHS bridges have increased while that on the Non-NHS has decreased. There is a 60 percent increase in the structurally deficient NHS deck area in 2015 as compared to 2014. This is due to 3 large bridges that have been added to the list of structurally deficient bridges. The KYTC thinks that the overall number of bridges and percent of total deck area that are structurally deficient is manageable.

Each year, the KYTC spends approximately $25 million on bridge maintenance and preservation and an additional $6 million on bridge painting. Additional monies are spent on large painting projects and on replacement of between 60 to 80 bridges annually.

The 2016-2022 six-year plan shows approximately $388 million for On-System Bridge Replacement, $115 million Bridge Replacement On/Off and $87 million for Bridge Replacement Off System.

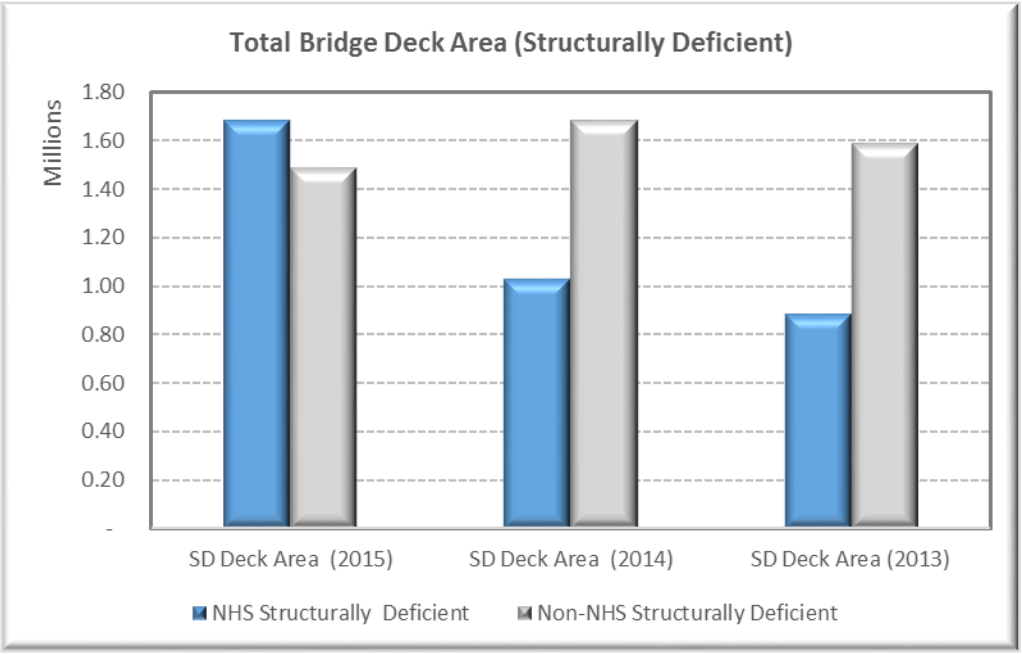

Figure 20: Total Structurally Deficient Deck Area

The KYTC has good subject matter expertise in bridge preservation and maintenance. The central office oversees the bridge inspections. The bridge preservation branch within the maintenance division is responsible for coordinating bridge inspection and being current on bridge maintenance and inspection technologies, advising on bridge maintenance problems, preparing bridge repair contracts and determining bridge weight restrictions, including the extended weight coal haul system.

The KYTC uses the bridge inspection data, while relying more on the advice and feedback from the bridge inspectors to determine which bridges to work on. District have bridge maintenance crews with the expertise to do some bridge washing, sealing and greasing of bearing and other bridge preservation activities.

The KYTC uses the AASHTOWare Bridge Management System that is managed by the bridge preservation branch under the Maintenance Division.

3.1.13 Maintenance Activities

The KYTC rates the various maintenance features. This performance and condition of these maintenance items can be useful to make asset management decisions. The KYTC conducts annual surveys of over 23 maintenance items for the entire system annually. The data from the Van collections discussed earlier in this report is combined to get a final score of the condition and performance of the system.

This includes shoulder and pavement drop offs, ditching, curbing, guardrail, signage, drainage structures, and other assets managed by the Division of Maintenance. The agency has a detailed manual on how to rate the maintenance items. The KYTC Maintenance Rating Score is a composite measure of the roadway feature performance. Random sections of roadway are also evaluated annually for effectiveness of guardrail, signage, ditching, drainage structures, and other assets managed by the Division of Maintenance. Individual feature scores are weighted by importance to establish the overall composite score. The information is captured and tracked electronically.

DISTRICT MAINTENANCE FEATURE SCORES
All State Roads - Fiscal Year 2015

District:	1	2	3	4	5	6	7	8	9	10	11	12
Rideability Index	71.6	72.6	75.6	73.5	69.6	67.8	70.9	75.9	71.1	67.6	72.2	70.4
Appearance	93.2	94.7	94.3	73.3	98.0	85.1	87.0	97.7	81.0	88.3	88.8	96.0
Vertical Clearance	73.9	86.0	71.8	74.4	69.4	67.0	71.8	77.5	54.0	43.3	70.1	42.3
Visual Obstructions	100.0	94.2	69.0	94.2	76.6	89.4	87.9	93.1	69.5	90.7	84.8	93.0
Fencing	92.8	95.8	99.2	95.6	99.4	96.1	92.4	84.6	77.5	NA	96.9	NA
Guardrail Out of Specifications	92.2	73.9	91.9	95.8	89.0	86.8	75.6	73.3	51.2	49.5	56.1	64.7
Guardrail Damaged	100.0	88.2	91.9	93.2	93.6	75.3	84.7	95.9	75.4	92.5	96.4	68.8
Attenuators/Rail Ends Damaged	100.0	81.6	100.0	94.9	71.8	77.5	73.6	91.7	79.8	77.2	100.0	79.3
Pavement Potholes	89.4	85.5	96.3	72.1	69.7	72.2	83.8	95.7	68.1	91.4	69.0	64.1
Rutting	77.4	91.7	96.0	94.8	88.2	76.6	95.9	99.6	74.6	72.1	66.0	81.2
Pavement Dropoff	83.2	94.3	83.7	77.9	95.3	73.0	94.0	96.6	69.2	88.3	88.0	61.0
Shoulder Dropoff	75.3	86.2	63.2	55.9	61.0	75.0	59.1	83.4	74.0	72.9	61.2	70.8
High Shoulder	96.2	95.8	94.5	96.0	76.4	88.9	86.6	98.6	66.5	90.8	83.0	84.9
Shoulder Potholes	94.4	92.3	92.4	51.4	71.6	91.6	91.7	97.6	88.9	90.4	67.6	80.2
Drains	96.6	86.1	86.0	83.6	84.9	76.4	84.9	93.0	82.1	74.6	84.3	77.6
Ditches	96.1	78.5	76.8	93.7	80.7	83.9	83.0	95.0	74.9	74.1	77.1	67.4
Curbs and Gutters	100.0	100.0	NA	NA	77.4	90.2	96.9	NA	74.6	NA	NA	100.0
White Striping	96.7	88.7	96.9	98.4	92.0	96.3	94.5	96.3	89.3	82.8	92.4	75.8
Yellow Striping	98.4	91.2	92.6	92.8	86.4	89.6	89.2	96.0	72.5	67.2	85.9	52.2
Guide Sign Faces	96.1	97.4	73.7	97.9	73.5	94.2	93.5	99.4	80.9	92.3	97.1	86.4
Guide Sign Assemblies	98.4	100.0	78.6	96.9	64.4	88.2	90.3	97.4	100.0	61.3	95.8	90.2
Warning/Reg Sign Faces	89.0	78.2	78.5	95.9	82.0	80.7	73.2	94.2	59.0	99.8	95.0	82.5
W/R Sign Assemblies	100.0	100.0	87.2	100.0	72.3	92.2	85.0	91.8	88.1	87.5	95.7	89.4

Strength - A feature scored at 90 or higher across the district.
Within Acceptable Limits - A feature scored between 70 and 90 points across the district.
Failing - A feature scored below 70 across the district.
Features did not have a sample size large enough to produce statistically valid data
*Some values may appear to be shaded incorrectly due to rounding

Figure 21:District Rating of Maintenance Features

Figure 21 shows the 2015 rating for the 23 maintenance features for the twelve districts. The red color indicates the areas where the district has received a “failed” rating.

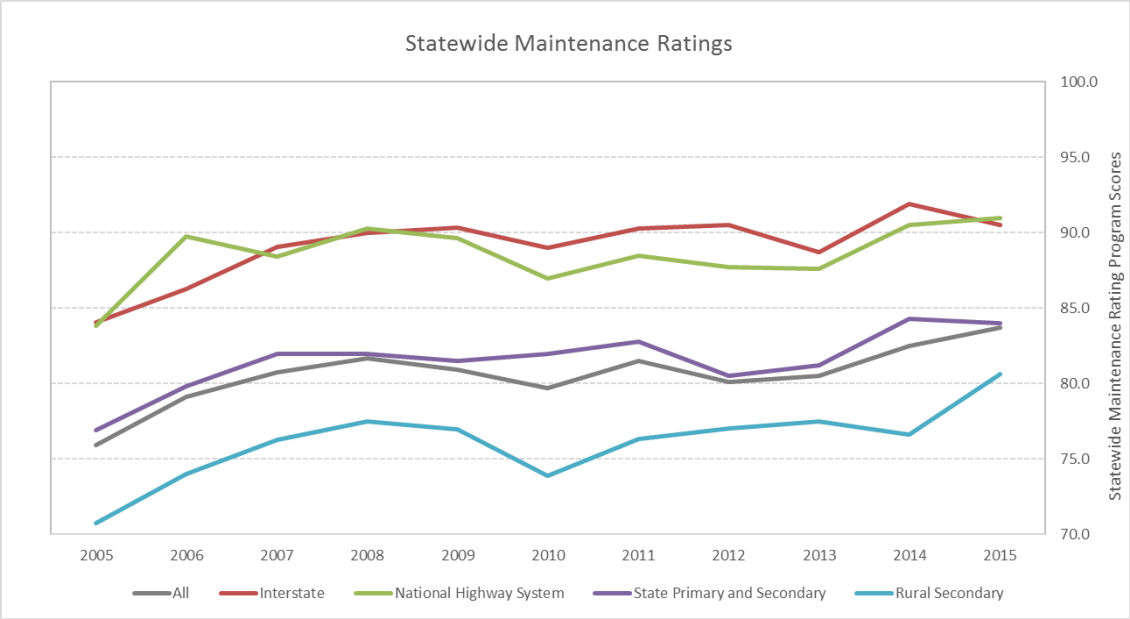

Figure 22: Statewide Maintenance Rating Trends

Figure 22 shows the overall statewide maintenance rating score improving since 2005. The Interstate condition dropped since 2014 but is still above 90 percent. The NHS system rating is trending in the right direction. Overall, in 2015 there has been a slight drop in the score for the interstate, the rating on the NHS and the state primary and secondary system remained close to 2014, while the rural secondary showed substantial improvements. Such analysis helps decision-makers understand the state of the system and investment needs.

3.2 Opportunities for Improvement in TAM Practices in KYTC

Overall the KYTC has developed some mature processes to analyze and present the future condition of pavements and the challenges faced by the resource shortages. It has developed a methodology to track the deferred liabilities, remaining service life and the asset sustainability ratio for pavement assets. In comparing the KYTC practices to the state-of-TAM practices, there are opportunities for improvements. Several of the opportunities discussed in this report were discussed with KYTC personnel at various points in the TAM GAP analysis effort. Some of the challenges faced by the KYTC appear to be due to a shortfall in allocating resources to preservation and maintenance of assets. While others can be addressed by streamlining and formalizing various agency processes. Following are some of the opportunities for improvement.

Kentucky Road Fund is funded through fuel taxes, usage taxes, and registration and licensing fees. Approximately 60 percent comes from state taxes on motor fuels. There is a statutory ceiling on gas tax of $0.31 and a floor of $0.225 per gallon. The annual budget of state fund is approximately $1.3 billion. The KYTC has identified the inadequate investment in preservation and maintenance as a major asset management challenge. This challenge may be further exacerbated by the loss of over $112 million in 2016 due to the declining motor fuel tax revenue.

Figure 23 shows the historic investment trends. It shows how funding for asset management has been impacted by investment in capital projects. The average annual budget for roadway maintenance including for winter maintenance activities, traffic operations, and rest area maintenance excluding

bridge maintenance is approximately $300 million. The annual bridge maintenance budget is approximately $35 million.

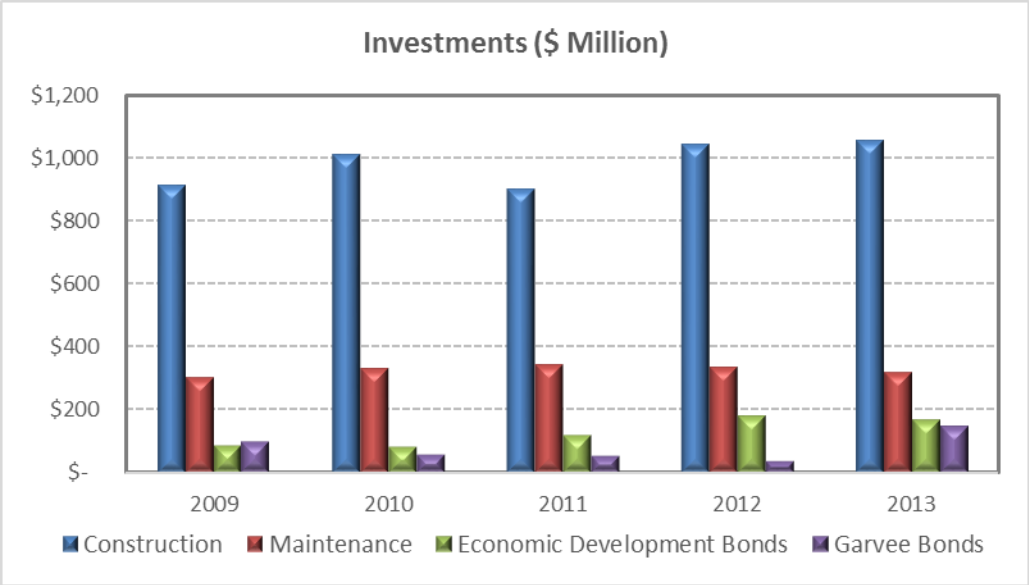

Figure 23:Historic Investment Trends

The impact of revenue decline on future maintenance and preservation activities in KYTC are unknown. The KYTC personnel acknowledged the need to be innovative in using technologies as well as in raising revenues to improve the condition of infrastructure assets and to sustain them in a state of good repair.

3.2.1 Communicating Strategic Direction Agency-wide

An area of opportunity for KYTC is to clearly formalize and communicate the asset management priorities agency-wide. Another is to align work and resources appropriately to meet these priorities.

Leadership level support and communication of asset management across the organization is important to initiating and sustaining asset management in the KYTC. Currently, there is a gap in the understanding by personnel from the districts and the headquarters about asset management and its benefit. Though there is an inherent focus on improving the condition of bridges, keeping roads in good condition and preventing those in fair and good from dropping to worse conditions, there are no formal published performance targets that the different areas strive to achieve.

The following asset management framework elements that could help advance TAM in the agency were missing:

- Formal goals, targets and policies that communicate asset management objectives, and expectations to achieve them.
- Link between preservation and maintenance budget allocations to achieving specific condition targets.
- Outcome-based budgeting, where districts are allocated budgets to achieve specific condition targets.

- Tracking of projects selected and projects completed and comparing them to budget allocations and accomplishment of asset conditions targets.
- Regular reports that summarize progress of performance and gaps and follow-up meetings to discuss plans to address the gaps on an on-going basis.
- Use of management systems for analysis.
- Easy access to current data, historic trends and forecasts pertaining to assets condition and budget allocations.

3.2.2 Asset Management Committee

The KYTC has good subject matter expertise and though agency personnel directly involved in the asset management plan development activities were familiar with TAM, across the agency there was not a clear understanding about the importance of asset management. Educating both the leadership and staff on TAM and its relationship to day-to-day activities could help engender agency-wide engagement in TAM and also catalyze the use of long-term cost effective approaches to sustaining and managing existing assets. Also, there was not an agency-wide understanding of performance targets. Many KYTC personnel questioned if performance targets existed.

The KYTC is short staffed and the staff is busy with routine operations. It does not have any personnel or an office that is championing asset management. The KYTC had an Asset Management Committee in the past. The committee did not have the necessary authority to engage the rest of the cabinet and struggled to get buy-in and was unable to institutionalize or integrate asset management principles into the agency's business operations

A formal Asset Management Committee with active participation and support from the leadership can help facilitate the adoption of asset management in the agency. It can bring the subject matter experts together to create a better understanding of asset management and its practical relevance to day-to-day agency activities. It can also help to "jump start" the activities necessary to develop the Transportation Asset Management Plan (TAMP) that is required by MAP-21 and the subsequent Fixing America's Surface Transportation Act. The KYTC had a group that developed the six-year plan. A similar group or an extension of this group that focuses on asset management priorities instead of new construction projects may be a good start for this effort. External resources to assist the agency teams may help expedite the education and engagement of personnel across the agency in the adoption of asset management practices.

3.2.3 Pavement Targets

Overall the KYTC has several ways by which it measures the investments made. However, formal condition targets were missing. There is a need to establish and communicate across KYTC the pavement condition targets for the different tiers of the roadway system that are required to achieve the KYTC's desired asset management goals. A financial plan that links the budget allocations to achieving these targets will highlight the gap between needs and budget allocations. This will allow the KYTC to highlight the funding gaps and present scenarios for tradeoffs in investments. These can be shared with the legislature and other stakeholders as appropriate to highlight the issues and the impact

of deferring good asset management practices. This can also help further the discussion and engagement on project selection relating to preservation and maintenance.

3.2.4 Pavement Management System

On the data front, the KYTC has the Agile System software (PMS) for pavement. This is currently serving as a database for storing data. Most of the pavement analysis is done in Excel, outside of the pavement management system. Though the KYTC is doing good pavement analysis in Excel using the data from the PMS it will benefit from expediting the updates to its pavement management system to provide information to support decision-making on an on-going basis.

3.2.5 Information Dashboard

The KYTC has a dashboard for performance measures. However, the level of details presented in the dashboard is not sufficient for decision-making or for providing information on KYTC's asset condition or performance. It will be useful to periodically publish reports that show trends and performance at the cabinet and district level and have regular follow-up meetings to discuss the performance.

3.2.6 Communicating to External Stakeholders the Benefits of TAM

The KYTC has several years of data and measures such as ASR, RSI and Deferred Liabilities that can be used to communicate to internal and external stakeholders the downward trend in asset conditions and related challenges the state is facing. The ASR is a simple way of communicating the state of the system and shows the assets being consumed and restored. Using the ASR, the KYTC can show that by using rehabilitation it will be spending a lot of money on fixing only few interstate lane miles. The ASR allows the KYTC to show that such investments add life to few lane miles and the same monies invested in preservation could add life to many more miles of pavement. ASR also can be used to show the benefit of TAM and systematic preservation.

ASR can also be used effectively to shows the impact of investment on the total life restored. By comparing and contrasting the investments in preservation and rehabilitation KYTC can show that by investing in preservation more can be achieved. The related data-driven charts with simple narrative can be used to communicate the health of the system, the risk of delayed investment, and the benefits of asset management. These can also be used to educate and effectively communicate with the legislature and other stakeholders the liabilities that are accumulating for the future generation. These metrics provide an opportunity to discuss the importance of long-term pavement goals and funding needed to cost effectively extend the useful life of the roadway system.

3.2.7 Focus on Bridge Preservation and Maintenance

The KYTC has 57 NHS bridges and 516 Non-NHS bridges that are structurally deficient. The Six-year plan shows about $500 million set aside for rehabilitation of various bridges. Long-term performance objectives that are tracked could focus the bridge program into more cost effective preservation and maintenance mode. It could also benefit from implementing a statewide formal systematic bridge preservation and maintenance plan. It has subject matter expertise in bridges that can be better utilized to formalize and create a more systematic bridge preservation and maintenance program.

3.2.8 Allocation of District Bridge Resources

The KYTC could benefit from formally implementing a district level bridge preservation and maintenance program. Currently, the district personnel have the expertise to do preservation and maintenance activities. However, they are often engaged in other non-structure related emergencies. Dedicating the district crew to planned bridge maintenance for three to four weeks each year will result in proactively addressing long-term needs of bridges and culverts.

3.2.9 Result-oriented Bridge Decisions

Linking decisions on project activities to data-driven analysis will allow the KYTC to make the case for preservation and maintenance and focus resources on these activities. These changes can help it to create a bridge preservation program based on good asset management.

3.2.10 Bridge Management System

On the data front, the KYTC uses the bridge management system from AASHTO. Though inspection data is stored in the software, decisions are more based on the recommendations of the inspectors. Fully utilizing management systems for analysis and decision-making may benefit the KYTC.

3.2.11 Systematic Maintenance

Currently the KYTC spends a lot of time addressing emergencies. It could benefit from establishing a systematic maintenance process so that time spent on fighting fires can be minimized or eliminated.

3.2.12 Focus on Historically Under Performing Areas

Historically district maintenance budgets are allocated based on the past trends, with some incremental additions to address poor performing areas. Few years back the KYTC had implemented a process were additional monies were provided to districts to improve areas that scored poorly in areas identified as the, “Red Box” areas. This provided incentives to districts to focus and improve the performance in the red box areas that are shown in the Figure 21. Restarting the incentives for addressing Red Box areas will focus resources on and improve the condition of these poor performing maintenance areas.

3.2.13 Performance Based Maintenance Budgeting

In the current process there are no performance expectations and there is no allocation of funds to fix performance issues. Once budgets are allocated there is no tracking to review if the monies have been invested to address the performance issues that needed to be fixed. In performance based budgeting the expectation is to allocate funds to address and improve the poor performing areas. This change will result in establishing performance targets and allocating budgets to achieve them and then tracking the performance of the areas that triggered the budget allocation. This process will result in more funds being allocated to poor performing areas but will ensure that the performance of these areas improve and established targets are achieved.

Additionally, process improvements will have to be made to link maintenance areas being rated to maintenance activities completed and to performance expectation based on budget allocations made.

3.2.14 Improve Data Accessibility

The feedback from some of the KYTC personnel indicated that accessing data on maintenance related activities was cumbersome and they preferred not to waste time on fussing with data. An approach to holding areas responsible for their own performance is to provide them access to performance data and user-friendly reports. This will allow the districts and other areas of the KYTC to review their own performance and also compare it to the performance of other areas and adopt successful strategies of better performing peers.

3.2.15 Data Opportunity

Data governance appears to a challenge in KYTC. The first step towards data-driven decision that the KYTC may benefit from will be to focus on making existing data available enterprise-wide. Many across the KYTC expressed the need for easier access to enterprise data in formats that can be customized by users for analysis and decision support. KYTC personnel expressed that often querying of data is time consuming and the agency-wide data is often outdated and has limited use in decision making.

The Information Technology area appeared to have too many projects in its pipeline. There was no clear indication of when user requests for reports and systems would be available. This has resulted in subject matter experts relying on updating data on their own computers resulting in data siloes.

Creating a simple data warehouse where data that is reliable can be made available for users to access will be a good starting point in supporting data-driven decision making. In parallel the KYTC can develop or put in place more sophisticated systems to address the data accesses and analysis needs of users.

3.2.16 Budget Information

Investment decisions can be enhanced by making budget data accessible to users in usable format for investment trends analysis and forecasting.

3.2.17 Better Project Coordination

Another area of opportunity is to synchronize and address the scheduling of the capital projects with activities related to preservation. Better communication and aligning of work will ensure that resources are not wasted on preservation and maintenance projects where capital improvements are planned.

4.0 Draft Implementation Plan

4.1 Recommendations and Next Steps

In Dec 2015, a workshop and a leadership briefing were held to share the findings of this effort and obtain feedback from the agency leadership. Personnel from across the agency attended the morning workshop and provided feedback. The same afternoon, a meeting was held with the KYTC leadership team to brief them on the findings, share the feedback from the morning workshop, and obtain leadership feedback. FHWA Kentucky division personnel also attend the leadership briefing. The findings were well received and the draft report was accepted. The feedback received from KYTC was incorporated into the report for a final meeting. In view of the expected KYTC leadership changes, the final briefing on the summary of findings was postponed to June 2016 to include the new team. On June

15, 2016, the final briefing was held and the summary of the effort and findings were presented to the new KYTC leadership. This meeting was also attended by FHWA Division staff and leadership. The findings and summary of this report were well received by the new KYTC leadership.

The next steps and the Draft Implementation Plan were also discussed at the June meeting. Based on the preferences communicated by the KYTC team, the implementation plan presented in Section 4.2 has been limited to recommendations on three major areas that the agency thinks can help with next steps in the KYTC effort to develop an asset management plan. These include, 1) Draft language for the KYTC TAM, 2) Five goals to address the gaps and enhance the implementation of TAM, and 3) Objectives to achieve each goal.

4.2 Draft Plan

The following implementation plan is being recommended based on the research of the KYTC asset management practices, the self-assessment survey, workshops, interviews, phone meetings, review of material provided by the KYTC and multiple workshops with agency personnel including the KYTC leadership team.

4.2.1 Draft Language for KYTC TAM

KYTC's Mission statement is as follows:

Provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky.

The following suggested language for asset management builds on the KYTC mission, the agency goals, and the processes goals. Specifically, on the following:

- Maintaining and improving existing infrastructure on a continual basis;
- Setting performance standards for methods and practice;
- Deliver improvements to maintain the system; and
- Consider Efficient and flexible use of available resources and Transparent decision-making processes.

It also draws on the following KYTC future system goals:

- Include a greater emphasis upon investments that cost less per year to operate; and
- Include emerging technologies that continue to improve operations and state of good repair.

Draft Language for KYTC TAM

Transportation Asset Management is implementing policies, procedures, using engineering judgement, data, innovative technologies and tools, to strategically and cost effectively operate, maintain, preserve, rehabilitate and replace assets, while proactively addressing risks and extending the useful life of assets to achieve the desired state of good repair.

4.2.2 TAM Implementation Plan (2016-2025)

The KYTC uses asset management principles in its pavement and bridge programs. The recommendations provided in this section will add to KYTC's current asset management approach and

enable the application of an enhanced approach across all programs and assets. The implementation plan suggests five goals along with several objectives under each goal that if implemented, will address the gaps identified and strengthen the existing TAM practices.

4.2.3 TAM Goals and Objectives

The following five goals are suggested for consideration in the TAMP development efforts at the KYTC. The purpose of these goals are to enhance TAM implementation in the agency. They are based on comparing the strengths and opportunities detailed in this report with the best practices in related areas.

Goal 1: Articulate an asset management framework with strategies and objectives to formalize and integrate the adoption of asset management as a way of doing business.

Goal 2: Produce a risk-based asset management plan that establishes clear goals for performance and condition of infrastructure assets, linking treatments to budget allocations that achieve the desired state of good repair.

Goal 3: Use measures such as asset sustainability ratio, deferred liability, and remaining service life to communicate the benefits of TAM and use financial forecasting and funds management to catalyze adequate investment.

Goal 4: Formalize and implement systematic preservation and maintenance processes and update management systems to reflect these changes.

Goal 5: Implement a comprehensive data management framework with data governance policies **and** procedures to support analysis needs and data driven risk-based asset management decisions.

Several objectives associated with each goal are also presented below for consideration. It is recommended that based on the KYTC schedule for delivery of the TAMP, a project plan be created that addresses the goals and objectives. Further, it is recommended that detailed tasks be developed for each objective along with timelines and specific deliverables that can be assigned for delivery to person(s) or group(s) within the KYTC.

Goal 1: Articulate an asset management framework with strategies and objectives to formalize and integrate the adoption of asset management as a way of doing business.

Objective 1A: Create an asset management group or committee supported by the leadership and resource it to develop the asset management framework and the TAMP.

Objective 1B: With leadership support integrate measures such as asset sustainability ratio, remaining service life and deferred liabilities into the asset management framework and use these to communicate and educate internal and external stakeholders on the long-term benefits of implementing the TAMP.

Objective 1C: Document and institutionalize practices that link the success of asset management to implementing long-term and short term projects as-well-as day-to-day activities.

Objective 1D: Document and clearly communicate roles and responsibilities, and hold personnel responsible for delivering the TAMP.

Goal 2: Produce a risk based asset management plan that establishes clear goals for performance and condition of infrastructure assets, linking treatments to budget allocations that achieve the desired state of good repair.

Objective 2A: Set formal long-term goals based on the desired state of good repair for bridges, culverts and pavements.

Objective 2B: Allocate budgets to systematically implement preservation and maintenance treatments to cost-effectively achieve and sustain the state of good repair.

Objective 2C: Monitor and compare the effectiveness of the implemented treatments with the recommended treatments and the budget allocations and make changes as appropriate.

Objective 2D: Develop a risk register to manage the risks to delivering the TAMP.

Goal 3: Use measures such as asset sustainability ratio, deferred liability, and remaining service life to communicate the benefits of TAM and use financial forecasting and funds management to catalyze adequate investment.

Objective 3A: Communicate the benefits of TAM to stakeholders using measures such as asset sustainability ratio, deferred liability, and remaining service life**.**

Objective 3B: Develop financial forecasting and investment analysis that reflects the financial ability to deliver the TAMP.

Objective 3C: Establish processes that ensure that reliable financial forecasting information is easily available and used by asset managers and fund managers to improve investment analysis and long-term planning and management of assets.

Objective 3D: Develop a process that formally identifies financial risks to delivering the TAMP and triggers communication of high priority risks to executives and decision-makers.

Goal 4: Formalize and implement systematic preservation and maintenance processes and update management systems to reflect these changes.

Objective 4A: Formalize and communicate best practices on systematic preservation and maintenance and institutionalize their use in the agency.

Objective 4B: Update or upgrade existing management systems, as appropriate, to reflect preservation and maintenance best practices and strengthen analysis, forecasting and reporting capabilities in the management systems to support asset management decisions.

Goal 5: Implement a comprehensive data management framework with data governance policies and procedures to support analysis needs and data driven, risk-based, asset management decisions.

Objective 5A: Establish and communicate the data management framework across the agency.

Objective 5B: Prioritize, formalize and communicate the data needed for decision making.

Objective 5C: Establish an enterprise data management framework and an enterprise data-warehouse that addresses the data needs of all users.

Objective 5D: Document, institutionalize, educate and enforce data update procedures to ensure that enterprise data is updated and reliable.

Objective 5E: Develop a dashboard that provides users reliable and updated information about condition, performance and financial information for priority assets.

Objective 5E: Provide user-friendly tools that make it easy for users to access and query data for analysis and generate reports to support different levels of decision making and routine activities.

[i] 23 U.S.C Section 101
[ii] http://datamart.business.transportation.ky.gov/kytcmap21_M.asp
[iii] Kentucky's Long Range Statewide Transportation Plan: Planning to Make a Difference in America Tomorrow (2014-2035)
[iv] "Kentucky's Long Range Statewide Transportation Plan: Planning to Make a Difference in America Tomorrow (2014-2035), page 92 Pavement Preservation,