

Appendix M: Needs – Maintenance



**Kentucky's Long-Range
Transportation Vision**



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INTRODUCTION

This technical memo summarizes the Kentucky Transportation Cabinet's (KYTC) spending needs between 2022-2045 for highway maintenance. Highway maintenance includes activities associated with FE01 (maintenance), FE02 (bridge maintenance), FE04 (traffic), FE06 (capital improvement maintenance), and FE07 (rest area maintenance).

There are three sections in this memo in addition to this Introduction. The Methodology section describes the data used in the needs assessment, assumptions, and data processing steps. The Results section presents the needs amounts. Unless otherwise specified, all dollar amounts are in 2022 United States Dollars (USDs).

METHODOLOGY

Data Sources

Historical spending for highway maintenance is the foundational data for this analysis since it is the basis for establishing trends and baseline needs. The U.S. Bureau of Labor Statistics' Consumer Price Index (CPI) was used to convert historical spending to constant 2022 U.S. dollars. Maintenance needs are also compared with other needs areas calculated for the 2045 Long-Range Statewide Transportation Plan (LRSTP), and overlapping needs related to traffic signals, signs, lighting, operations, and ITS devices are removed from this analysis. KYTC's analysis of the declining purchasing power of its maintenance budgets allows for adjustments to be made to baseline extrapolations to account for losses in purchasing power. Needs are also adjusted based on KYTC's estimates of maintenance needs beyond what historical funding has been able to meet allow for final adjustments to baseline needs. Table 1 lists each data source and briefly summarizes its purpose.

Table 1: Primary Data Sources

Description	Source	Purpose in Methodology
Historical spending for FE01, FE02, FE04, FE06, and FE07 for fiscal years (FY) 2012-2021.	KYTC Office of Budget and Fiscal Management (OBFM).	Establish trends in historical maintenance spending as basis for extrapolating future baseline maintenance spending.
Multiplier to convert historical amounts to 2021 USDs based on Consumer Price Index (CPI).	U.S. Bureau of Labor Statistics ¹ .	Convert historical spending to 2021 USDs.
Needs associated with maintenance of traffic signals, signs, lighting, operations, and ITS devices that are derive from historical FE01 and FE04 spending.	Technical memos on needs for transportation system management and operations (TSMO) and signs.	Remove FE01 and FE04 spending that is accounted for in other needs categories.
Decline in KYTC maintenance budget's purchasing power between 2012 and 2017.	One-Pager on the Allocation of KYTC Maintenance Budget ^{2,3}	Adjust for loses in purchasing power.
Estimate of historically unfunded needs.	KYTC ⁴	Estimate maintenance need that is not met by historical funding.

Assumptions

The following primary assumptions ground the analysis.

- Needs will not decrease in constant dollars for any maintenance category (i.e., FE01, FE02, FE04, FE06, FE07).
- Inflation will average 3.0%⁵ annually from calendar years 2022 to 2024, and 2.0% subsequently. The first rate (3%) is provided by the 1-year and 3-year inflation expectations reported by the Federal Reserve Bank of New York.⁶

¹ U.S. Bureau of Labor Statistics (n.d.). CPI Inflation Calculator. Retrieved from https://www.bls.gov/data/inflation_calculator.htm.

² Kentucky Transportation Cabinet (2021). Allocation of KYTC Maintenance Budget. One-Pager. Provided by Assistant State Highway Engineer (Tracy Nowaczyk) on November 29, 2021.

³ Conversation with Tracy Nowaczyk via MS Teams on May 9, 2022.

⁴ Conversation with Tracy Nowaczyk via MS Teams on May 9, 2022.

⁵ As of December 20, 2021, the 3-year inflation expectations reported by the Federal Reserve Bank of New York are 4.0%, while the 1-year inflation expectations are 6.0%. 3.0% is the inflation rate used for 2023-2024 and 2024-2025 because the average of two years of 3.0% inflation with one year of 6.0% inflation equals 4.0%, which is the 3-year inflation expectation.

⁶ Federal Reserve Bank of New York (2021). Inflation Expectations. Accessed December 20, 2021. Retrieved from <https://www.newyorkfed.org/microeconomics/sce#/inflexp-1>.

Processing

In the preprocessing step, historical spending data is converted from fiscal year to calendar year and is also converted from year-of-expenditure dollars to constant 2022 USDs based on the CPI. Next, historical spending is extrapolated through 2045 to derive baseline needs. Linear extrapolation is used when trends are positive. When historical spending is trending downward in constant dollars, average spending is substituted for the extrapolated value. Finally, refinements are made that adjust the baseline needs, including removing spending associated with other needs categories, adjusting for lost purchasing power, and accounting for needs that historical funding has been unable to meet. The following subsections provide details on these steps.

Preprocessing

Historical spending was originally reported in fiscal years rather than calendar years. Therefore, annual fiscal year spending is converted to annual calendar year spending by assigning half of the fiscal spending to the same calendar year and half to the prior calendar year. Next, historical spending is converted from year-of-expenditure dollars to constant 2022 USDs by applying multipliers derived from the CPI Inflation Calculator. Figure 1 shows historical spending in year-of-expenditure dollars for each fiscal year, and Figure 2 shows historical spending in 2022 USDs for calendar years.

Figure 1: Historical Maintenance Spending (Year-of-Expenditure Dollars)

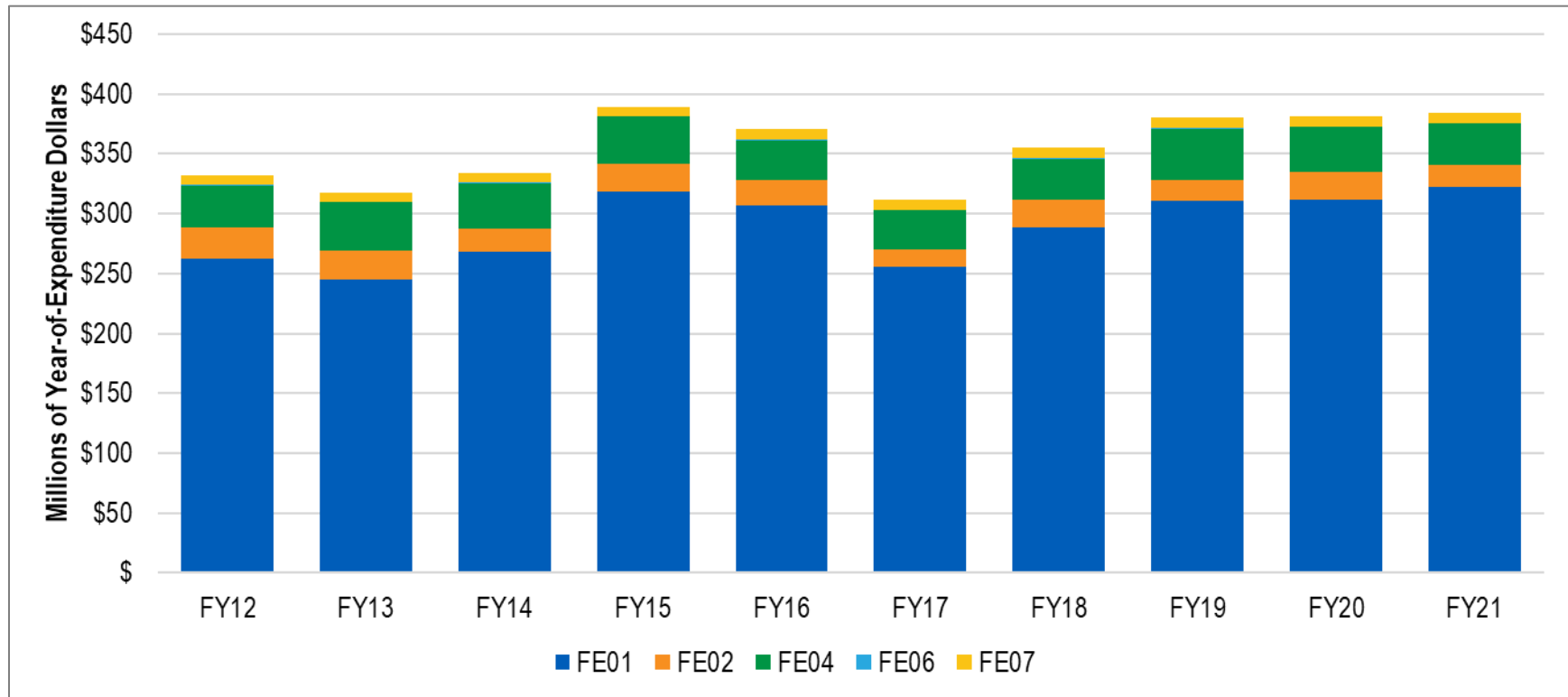
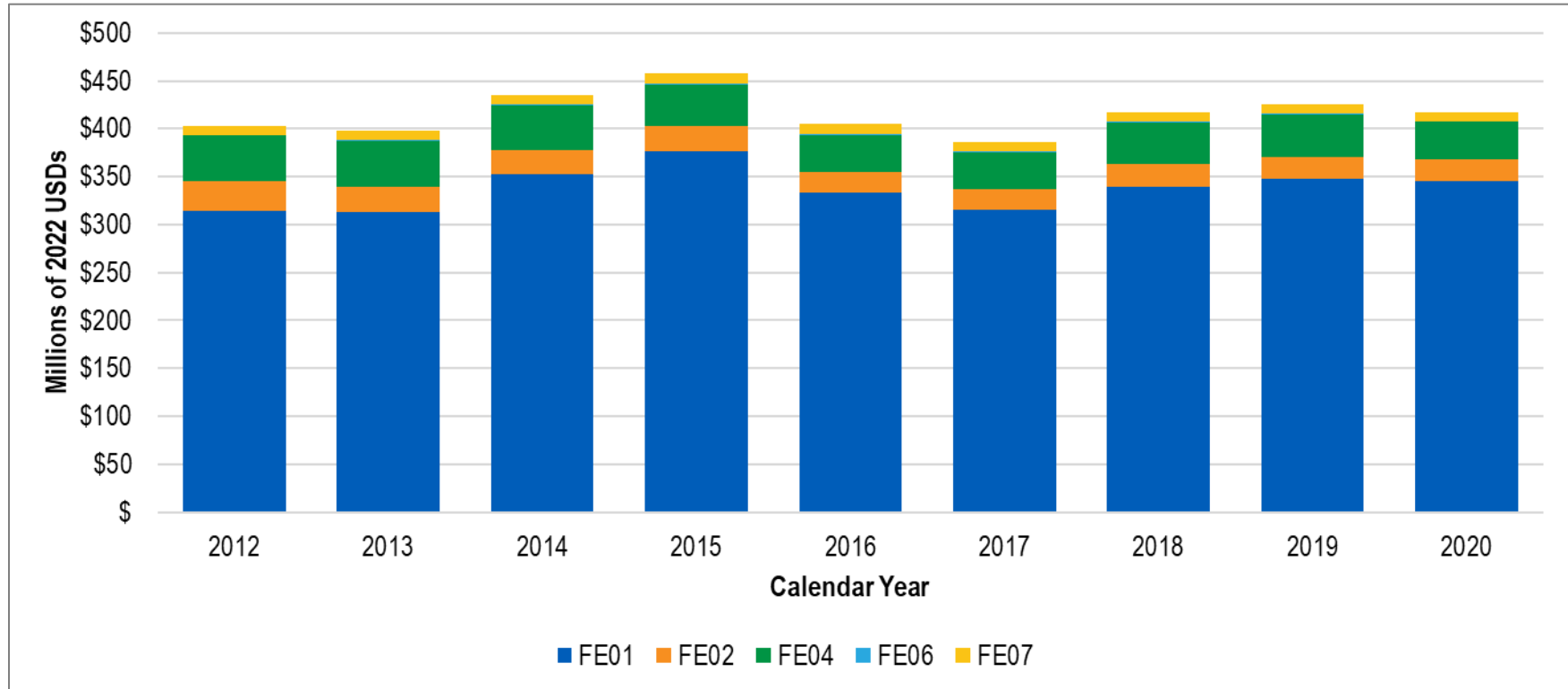


Figure 2: Historical Maintenance Spending (2022 USDs)



Extrapolation

Historical spending in 2022 USDs is linearly extrapolated for the categories where the trend is positive (i.e., FE01 and FE07). For the remaining categories where historical spending is negative, the average of historical spending is carried into the future instead.

Refinement

The following adjustments are made to the baseline maintenance needs.

- Removing needs captured in other needs categories:** An average of \$17 million per year is removed because it is included in needs categories for signs, intelligent transportation systems (ITS), lighting, operations, or traffic signals. These amounts were derived from historical spending from FE01 and FE04.

- **Adjust for lost purchasing power:** The baseline need derived from historical spending is adjusted for lost purchasing power. As measured by the Kentucky Construction Cost Index, KYTC's maintenance budget's purchasing power has declined by \$87 million between 2012 and 2017, equating to a loss of 25.0% of purchasing power out of the 2017 budget of \$347.46 million.⁷ Maintenance spending would need to increase by 33.4% to make up for this loss in purchasing power. Based on the newest analysis, this adjustment was increased to 37%.⁸ Therefore, all historically derived maintenance needs are increased by 37% to adjust for the loss in purchasing power.
- **Add needs that historical funding has not been adequate to support:** KYTC estimates that true maintenance needs surpass what historical funding has been able to cover by 10-20%. Therefore, baseline needs are multiplied 14% after removing needs captured in other categories and adjusting for lost purchasing power to account for this need that exists above and beyond historical spending.

RESULTS

Highway maintenance needs for the 24-year period from 2022 to 2045 total \$16.52 billion. Figure 3 shows annual highway maintenance needs in 2022 USDs. They range from a low of \$650.34 million in 2022 to a high of \$725.43 million in 2045. In year-of-expenditure dollars, maintenance needs are expected to total \$21.04 billion between 2022 and 2045, ranging from \$650.34 million in 2022 to \$1.14 billion in 2045. Figure 4 shows annual maintenance needs in year-of-expenditure dollars.

⁷ KYTC (n.d.). Allocation of KYTC Maintenance Budget. Provided by KYTC Assistant State Highway Engineer on November 29, 2021.

⁸ Conversation with Tracy Nowaczyk via MS Teams on May 9, 2022.

Figure 3: Annual Maintenance Needs (2022 USDs)

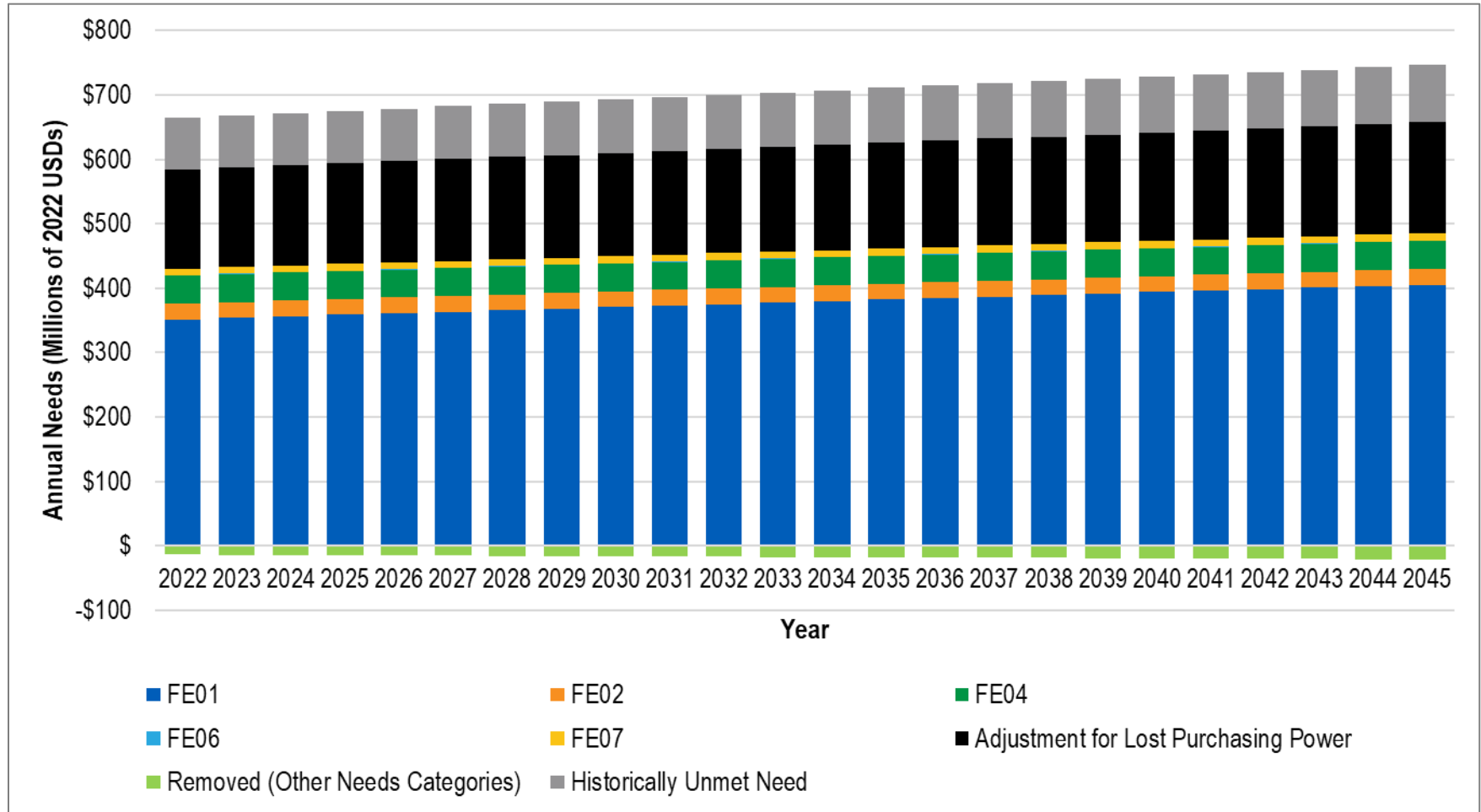


Figure 4: Annual Maintenance Needs (Year-of-Expenditure USDs)

