IX. RECOMMENDATIONS

The following chapter includes recommendations for improvements to the Purchase Parkway and related work for future designation as I-69.

As previously discussed in **Chapter I,** the FHWA has identified thirteen design features that are important to the operational and safety performance a highway. These controlling design features compiled are commonly known as the *13 controlling criteria*. A formal written design exception is required when any of the 13 criteria are not met on the National Highway System (NHS). The Interstate System is part of the NHS. The *13 controlling criteria* is listed below. Design features that deviate from common practice but are not included in the *13 controlling criteria* will be termed design variance. There are two categories for design variances. A design variance is a design feature that (1) varies from the current AASHTO criteria but not part of the *13 controlling criteria* or (2) a design feature that varies from common practice but not part of the *13 controlling criteria*. A summary of recommended design exceptions and design variances is provided at the end of this chapter.

1. Design speed
2. Lane width
3. Shoulder width
4. Bridge width
5. Horizontal alignment
6. Superelevation
7. Vertical alignment
8. Grade
9. Stopping sight distance
10. Cross slope
11. Vertical clearance
12. Lateral offset to obstruction
13. Structural capacity

A. Recommendations

It is recommended that the Necessary Upgrades and Spot Safety Improvements alternative be chosen for initial advancement based on the following:

- The Purchase Parkway adequately meets AASHTO guidelines for most design elements of an interstate. Of the design element deficiencies, others may be accepted as design exception/variance with agreement by the KYTC and the FHWA.
- Based on the operational and crash analysis included in this study, addressing those repairs identified for Needed Upgrades and Spot Safety Improvements will appropriately address any crash history concerns identified. The entire length of the Purchase Parkway meets the level of service required and only a few locations exhibit potential safety problems.

The following summarizes a strategy for implementing the Necessary Upgrades and Spot Safety Improvement alternative.

1. Geometry/Typical Section

a. Inside paved shoulder (Four foot paved minimum) – It is recommended that a design exception be requested for the minimum inside paved shoulder on the Purchase Parkway that currently has three foot paved inside shoulders with the intention to correct the existing deficient inside shoulder during future pavement rehabilitation or resurfacing projects.

It is recommended to construct a 4 foot paved shoulder for the Mayfield Bypass section of the Purchase Parkway. Currently, there is not a paved inside shoulder on this section.

b. Vertical Curve / Stopping Sight Distance – It is recommended to seek a design exception for the locations mentioned in **Chapter IV** that do not meet the minimum vertical length of curve and minimum stopping sight distance except one location at MP 25.32. Based on crash history data, **Table 7-4**, only this location (MP 25.32) has a significant crash history (CRF>1.0). Correction of this vertical curve is recommended. Since there is not a crash history associated with the other locations, it is not considered cost effective to improve. Correction of vertical curvature/stopping sight distance concerns may be addressed for other locations during future pavement rehabilitation or resurfacing projects.

c. Superelevation – Referencing the Federal Highway Administration *Mitigation Strategies for Design Exceptions*, "A formal design exception is required if the State's superelevation policy cannot be met in design of any curve on the NHS." This document advises, "A design exception is also required if a superelevation rate is proposed that is different from the published rate per the State's policy for that curve, regardless of whether the curve is a controlling one (minimum radius for a design speed) or not." The current KYTC geometric policy references the AASHTO Policy on Geometric Design of Highway and Streets, current edition, which provides maximum superelevation rate tables for 4%, 6%, 8%, 10%, and 12%. From review of as-built plans and field inspections, it appears that the Purchase Parkway was constructed on the basis of 10% maximum superelevation.

   A crash analysis on horizontal curves with a superelevation greater than 8% is provided in **Chapter VII**. There is one horizontal curve with a superelevation of 8.3% that has a critical crash rate factor greater than one. Based on the analysis, it is not apparent that the crash history is directly related to the superelevation.

   Since the Purchase Parkway appears to have been constructed with a maximum superelevation of 10% which is compliant with the AASHTO and KYTC policies, and there are no apparent crash histories related to superelevation, a design exception for superelevation does not appear warranted.

d. Mayfield Bypass Median Width/Type – It is recommended to construct a new median on the Mayfield Bypass section of the Purchase Parkway. Currently the median is defined as non mountable because it has a raised curb along edge of driving lane. The crash history for this section does not correlate with the need of a median barrier. According to the AASHTO Roadside Design Guide, a median barrier is optional for the existing median width (16 feet) and existing Average Daily Traffic (14,300 vpd). However, median barrier is recommended for the design year (2040) forecasted traffic as an interstate (30,000 vpd) on the Mayfield Bypass. It is recommended to construct a new median with barrier for this section based on the need to construct inside paved shoulders, forecasted interstate traffic, and drainage needs in the median after constructing inside paved shoulders.

2. Bridges and Overpasses

a. Vertical Clearance – It is recommended to correct the vertical clearance for the four overpasses bridges that do not meet minimum criteria.

b. Mainline Bridge Railing – It is recommended to retrofit the bridge railing for all mainline bridges to meets current criteria. Retrofitting the bridge railing should be completed prior to interstate designation.

c. Mainline Bridge Width – It is recommended to seek a design exception for mainline bridge width. With the exception of the two mainline bridges at Exit 21, there are 10 bridges with an existing width of 30 feet. The mainline bridges identified as deficient are greater than

200 feet in length and would need to be widened from their existing 30 foot width to 31 feet. Based on the crash analysis, there does not appear to be a crash history related to bridge width at these locations.

d. Crash Worthy Pier Protection – It is recommended to improve the crash worthy protection of overpass bridge piers along the Purchase Parkway. There are eight overpasses that have earthen mound pier protection that do not meet current standards.

3. Interchanges and Ramps

a. Interchange Spacing – It is recommended to seek a design variance for interchange spacing for the rural interchange spacing in Fulton, KY (Exit 0, Exit 1, and Exit 3) and in Benton, KY (Exit 41 and Exit 43).

b. Interchange Control of Access – It is recommended to seek a design variance for the interchange control of access deficiencies at Exit 14, Exit 22, Exit 27, and Exit 47. As future improvements and rehabilitation projects are indicated, control of access at these locations can be initialized.

c. Interchange Deficiencies

- Exit 0 Weigh Station Interchange – In the future, coordination between the Tennessee Department of Transportation and Kentucky Transportation Cabinet (KYTC) will more clearly define future I-69 connectivity between Kentucky and Tennessee at this location. Specific deficiencies will be more thoroughly addressed at that time.

- Exit 14 Previous Toll Plaza Interchange – It is the recommended to improve the existing interchange at Exit 14 to meet current interstate criteria.

- Exit 21 Mayfield Bypass Interchange – It is recommended to improve the interchange to meet current interstate criteria.

- Exit 43 Previous Toll Plaza Interchange - It is the recommended to improve the existing interchange at Exit 43 to meet interstate standard. This interchange has been identified by KYTC for improvement and is currently under design.

- I-24 / Purchase Parkway Interchange – It is recommended to improve the eastbound I-24 to southbound I-69 ramp and construct a new southbound I-69 flyover ramp from westbound I-24. The following existing ramps will be eliminated with this recommendation:

    - Westbound I-24 to northbound Purchase Parkway ramp
    - Westbound I-24 to southbound Purchase Parkway loop ramp
    - Eastbound I-24 to northbound Purchase Parkway loop ramp

  The existing northbound Purchase Parkway to westbound I-24 loop ramp also will remain in place and serve as the northbound I-69 to westbound I-24 connector under this scenario.

  This option will require a deferral (design exception) for the I-69 northbound movement. The existing northbound Purchase Parkway to eastbound I-24 ramp will serve as the I-69 north movement. This ramp will accommodate the traffic in the near future. However, it is recommended to improve the ramp to meet current criteria once traffic volumes exceed capacity. It also is recommended to construct a new northbound I-69

to westbound I-24 flyover ramp once the traffic volumes exceed the existing loop ramp capacity.

The recommended improvements are shown in **Figure 8-1** and the construction cost is provided in **Table 8-1 Unit Costs-Necessary Upgrade and Spot Safety Improvements**. Additional improvements to the interchange include extending acceleration and deceleration tapers.

d. Ramp Typical Section – It is recommended to improve existing ramp cross section geometry that does not meet current interstate criteria. Currently, a majority of the interchange ramps have rolled curb and deficient shoulder widths. It is recommended to remove the rolled curb on the interchange ramps and construct minimum shoulder width in order to meet minimum interstate criteria.

e. Ramp Alignment Geometry

- Divergence Angle – It is recommended to correct the deficient ramps with divergence angles that do not meet current criteria.

f. Speed Change Lanes – It is recommended to improve all ramp tapers and acceleration/deceleration lanes to meet current interstate criteria.

4. Design Exception and Variance Summary

The following table summarizes the essential design elements commonly known as the *13 controlling criteria*. Following the *13 controlling criteria* are design variances which do not meet the AASHTO criteria of an interstate.

13 Design Criteria	Meets Criteria (Yes or No)	Cost to Cure ($)		Design Exception/Variance should be requested	Explanation
Design Speed	Yes*	$33,860,000		Yes	The Purchase Parkway meets the design speed criteria except for the new I-69 through route at the I-69/I-24 interchange. It is recommended to improve the eastbound I-24 to southbound I-69 ramp, construct a new I-69 southbound flyover ramp, and seek a design exception for the northbound I-69 through movement.
Lane Width	Yes	-		-	-
Shoulder Width	No	$3,730,000	2	Yes	The inside paved shoulders need to be widen from 3 feet to 4 feet for the Purchase Parkway. The paved inside shoulder for the Mayfield Bypass should be widened inconjunction with construction of a new median. It is recommended to seek a design exception for inside paved shoulder of the Purchase Parkway, with the exception of the Mayfield Bypass shoulder improvement.
Bridge Width	No	$2,370,000	3	Yes	There are 12 bridges on the Purchase Parkway that do not meet criteria. 10 of these 12 bridges are long bridges (> 200 feet long). The remaining two bridges are part of the Exit 21 interchange that is recommended to be upgraded to meet interstate standards. It is recommended to seek a design exception for bridge width.
Horizontal Alignment	Yes	-		-	-
Superelevation	Yes	-		-	-
Vertical Alignment	No	$250,000		Yes	There are eight deficient vertical curves on the Purchase Parkway. All of these curves are sag curves and six are close to meeting criteria. There is one deficient curve that is recommended to correct due to crash history.
Grade	Yes	-		-	-
Stopping Sight Distance	No	$167,000			There are 3 vertical curves that do not meet the minimum stopping sight distance. All of these curves are a sag and 2 are close to meeting criteria. This cost is also included in the cost to cure vertical alignment deficiencies. It is recommended to improve one vertical curve due to crash history.
Cross Slope	Yes	-		-	-
Vertical Clearance	No	$330,000		No	There are 4 overpasses on the Purchase Parkway that do not meet vertical clearance requirements. It is recommended to improve the overpass bridge clearance to meet current criteria.
Lateral offset to obstruction	-	-		-	-
Structural Capacity	Yes	-		-	-
Design Variances					
Acceleration & Deceleration Lengths / Divergence Angle	No	$768,000	1	No	It is recommended to improve the deficient ramps to meet AASHTO criteria.
Interchange Spacing	No	$4,233,000		Yes	The interchange spacing between Exit 41 and Exit 43 is less than the 3 mile rural recommended criteria. Cost to cure does not include the interchange spacing deficiency at Exit 0, Exit 1, and Exit 2. The connection of I-69 between Kentucky and Tennessee is still in question, which would include these exits at Fulton, KY and Fulton, TN.
Interchange Control of Access	No	$5,000,000		Yes	There are four interchanges that have interchange control of access less than the minimum criteria
Interchange Ramp Shoulder Width / Curb	No	$2,937,000	1	No	Many of the interchange ramps do not meet the minimum shoulder width and/or have an existing curb.
Bridge Side railing/barrier	No	$930,000		No	All of the mainline bridges have brush blocks rather than a barrier slope that meets current standards. It is recommended to retrofit the existing side railing/barrier to meet criteria.
Bridge Pier Protection	No	$240,000		No	Eight overpass bridges have earthen mound bridge pier protection that does not meet current standard. It is recommended to improve the pier protection to meet current standard.
Median Width / Type	Yes	$2,175,000	4	-	Construct a new median with barrier and inside shoulder on the Mayfield Bypass. (Cost includes median barrier and inside paved shoulders.)

Table 9-1 Summary of Design Exceptions and Variances

[1] Does not include improvements associated with Exit 14 (Toll Plaza), Exit 21 (Modified Trumpet), and Exit 43 (Toll Plaza)

[2] Does not include widening Mayfield Bypass inside paved shoulder.

[3] Cost is associated with widening the deficient mainline bridges to 31 feet curb to curb.

[4] The median width meets AASHTO criteria. The median type meets AASHTO criteria with current traffic volumes ,but not future traffic projections.

Designation of the Purchase Parkway as I-69 may be accomplished by implementing the recommended improvement strategies in coordination with the Federal Highway Administration. Information presented herein is a *first look* to identify deficiencies and impediments for designation as I-69 and to identify a range of improvement strategies needed to upgrade the Purchase Parkway to satisfy applicable interstate criteria with applicable design exceptions/variances by the Federal Highway Administration. Thus, as projects for implementation of recommended improvement strategies are initiated, additional engineering analysis and studies may be needed to further refine the specifics for improvements. For example, the following may be areas for further analysis.

- Operational Considerations – There may be roadway conditions not shown in crash data contributing to crash history. Additional analyses during preliminary engineering may provide additional insight which could refine the scope of needed improvements at a given location.
- Mainline Geometry and Typical Section – Analyses for mainline geometry and typical section were evaluated using as-built plans supplemented with field reviews of existing conditions. Actual design features may require further verification with non-detailed field reviews of the roadway cross-section during preliminary engineering for implementing improvement strategies.
- Interchanges and Ramps – Most of the interchange ramps are deficient and some design features were illegible on the as-built plans. Therefore, as interchanges are identified for improvement, geometric features (i.e. superelevation rate, horizontal and vertical alignments, design speed, etc.) should be further analyzed.

B. Summary and Conclusion

Based on the findings of this study, it can generally be concluded that the Purchase Parkway is currently providing motorists efficient and safe travel from US 51 in Tennessee to I-24 with operating conditions similar to an interstate. There would be minimal to no impact to the operating characteristics of the Purchase Parkway in the near future if it was designated as I-69 under the current conditions. The operation characteristics of the I-69 corridor would not be expected to be altered until more sections of I-69 are completed across the country especially in Tennessee and Indiana. As sections of I-69 are completed and thus provide continuity at a regional and national level, additional truck traffic volume will likely grow on the Purchase Parkway to the point that estimated truck traffic and congestion along the existing Purchase Parkway may eventually alter the operational characteristics.

Intuitively, there may be sections of interstate in Kentucky and around the United States that do not meet the current design standards. Some design features on these other interstates may be very similar to the existing design features on the Purchase Parkway. Based on the impact to other sections of Parkways that are designated as future interstate corridors and existing interstates with similar design feature deficiencies, designation of the Purchase Parkway as I-69 under the Parkway's existing conditions appears realistic.

There are two broad based potential improvement alternatives recommended for improving the Purchase Parkway to meet interstate standards. The Necessary Upgrades and Spot Safety Improvement alternative includes upgrading the Purchase Parkway to meet all current interstate standards but with design exceptions/variances. The Fully Compliant Reconstruction alternative would upgrade the Purchase Parkway to meet interstate standards with no design exceptions or variances. Right of way acquisitions will be needed for interchange improvements.

In general, improvements related to bridge deficiencies, Mayfield Bypass median, interchange acceleration and deceleration lanes, and toll plaza interchange improvements are recommended. It is also recommended that initially, minimal improvements should be made to the Purchase

Parkway and I-24 interchange and US 45 interchange in Mayfield. The minimal improvements should be designed to provide continuity and capacity for the forecasted traffic, while maintaining consideration for crash history and safety for the traveling public. Ultimately, as traffic operations change and traffic volumes increase, additional improvements to these interchanges may be needed to improve safety and meet current interstate criteria.