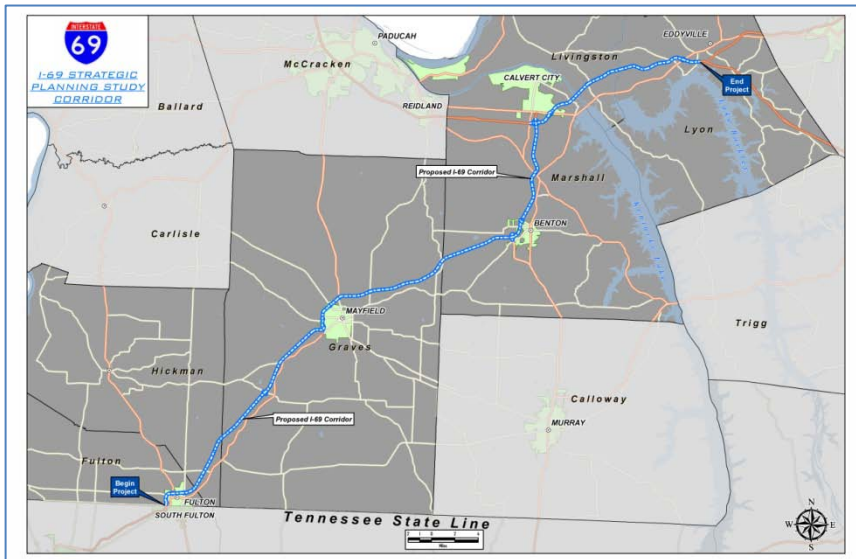


I-69: FULTON TO EDDYVILLE STRATEGIC CORRIDOR PLANNING STUDY EXECUTIVE SUMMARY

Kentucky Transportation Cabinet – Division of Planning
July 2011

The Kentucky Transportation Cabinet (KYTC) has undertaken a strategic corridor planning study for a portion of a proposed interstate route, Interstate 69 (I-69), which is proposed to travel from Tennessee through Kentucky and into Indiana. The project corridor extends along the Julian M. Carroll Purchase Parkway north from the Tennessee state border to the I-24 interchange, and then travel east along I-24 to west of the Wendell H. Ford (Western Kentucky) Parkway. The corridor passes through Fulton, Hickman, Graves, Marshall, Livingston and Lyon Counties.



STUDY PURPOSE

The primary purposes of the strategic corridor study is to review the existing conditions along the Purchase Parkway and I-24 to identify locations that do not meet current AASHTO and Federal Highway Administration (FHWA) highway design guidelines and related criteria. Evaluations include the degree to which these criteria are not met, their impact on safety and capacity, identification of options for making improvements to address identified deficiencies, and make recommendations regarding suitability of routing I-69 along the Purchase Parkway and I-24.

PROJECT BACKGROUND

The federal Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 identified the I-69 (Corridor 18) as a Priority Corridor. The results from a 1995 FHWA *Corridor 18 Feasibility Study* concluded that the future construction of I-69 from Canada to Mexico was economically feasible. The *Corridor 18 Special Issues Study* completed in 1997 identified a Representative Corridor which best served the purposes of Corridor 18 and yielded the most benefits relative to facility costs. The initial national goals of I-69 included the enhanced movement of goods, creating greater employment opportunities and improved system linkage. In Kentucky these national goals are consistent with the regional and local goals of providing improved mobility and serving local connectivity needs. Utilizing the existing Parkway system for I-69 also is consistent with the national and local goals.

STUDY ACTIVITIES

The study activities for the I-69 Strategic Corridor Planning Study included the following:

- Identify criteria and standards per AASHTO and the FHWA for designation as an interstate route;
- Collect data from the KYTC's Highway Information System, as-built plans, crash data, field observation and measurement, and other information provided by local Highway District office;
- Compare and analyze data collected with criteria and identify conditions and locations on the Purchase Parkway that do not meet interstate criteria and standards;

- Develop potential alternatives and costs associated with improving these areas with identified deficiencies to meet criteria and standards for designation as an interstate highway.

KEY FINDINGS

The Purchase Parkway operates similar to an interstate. With exception of one location on the Mayfield Bypass, it possess two travel lanes in each direction, a design speed of 70 mile-per-hour for rural conditions and 50 mile-per hour for urban conditions, and is a fully controlled access facility. However, some of the physical features do not meet the criteria of an interstate facility. Attached to the end of this summary are figures identifying deficiencies.

The following findings are based on available data and limited field reviews.

Operational Considerations and Safety

- Crash Analysis: For the crash analysis, a high crash segment was defined as having a critical crash rate factor greater than or equal to one. Crash segments with a critical crash rate factor between 0.9 and 0.99 are identified in the report.
- Crash Analysis – Purchase Parkway: When compared to other Kentucky parkways, there is one high crash segment in Graves County (MP 25.1 – MP 27.452) where the crash rate exceeds the statewide average for all parkways. There also is one segment in Graves and Marshall Counties (MP 27.452 – MP 41.035) with a critical crash rate factor between 0.9 and 0.99.
- Crash Analysis – I-24: When compared to other interstates within Kentucky, there is one high crash segment located near the Purchase Parkway interchange in Marshall County (MP 24.941- MP 26.558) where the crash rate exceeds the statewide average for all interstates.
- Crash Analysis – Purchase Parkway as an Interstate: When compared to Kentucky interstates, rather than state parkways, two additional high crash segments were identified along the Purchase Parkway located in Graves and Marshall Counties (MP 27.452 – MP 41.035 and MP 42.555 – MP 46.942).
- Crash Segment – Purchase Parkway as an Interstate: There also are three segments with a critical crash rate factor between 0.9 and 0.99. These segments are: MP 24.747 – MP 25.1, MP 41.035 – MP 42.555, and MP 46.942 – MP 51.398.
- Additional Findings Related to Crash Analysis: There were six crashes coded as *median cross-over* or *head-on* collisions for the Purchase Parkway and I-24 during the study period (2005-2009). Two crashes occurred on the Purchase Parkway and the remaining four happened on I-24. There were seven fatal crashes on the Purchase Parkway and six fatal crashes on I-24 during the study period (2005-2009).
- Current Traffic (2010): The current Purchase Parkway traffic volumes range from 7,060 vehicles per day (vpd) in Fulton County to 19,200 vpd near I-24 interchange in Marshall County. The current I-24 traffic volumes range from 21,900 vpd near the Purchase Parkway interchange to 28,200 vpd near Calvert City in Marshall County.
- Truck Percentages (2010): The existing truck percentages on the Purchase Parkway range from 24.9% at Mayfield, Kentucky in Graves County to 34.5% near Benton, Kentucky in Marshall County. On I-24, the truck percentage is 24.9%.
- Future Traffic (2040) without I-69: The projected annual growth rate along the Purchase Parkway and I-24 is 2%. This rate results in traffic volumes ranging from 12,800 vpd to 34,800 vpd on the Purchase Parkway and from 39,700 vpd to 51,100 vpd on I-24.
- Future Traffic (2040) with I-69: Assuming I-69 will travel along the Purchase Parkway and I-24, an annual growth rate of 2.5% was used to forecast 2040 traffic volumes. This rate results in traffic volumes ranging from 14,800 vpd to 40,300 vpd on the Purchase Parkway and from 45,900 vpd to 53,900 vpd on I-24.
- Truck Percentages (2040): Future truck volumes were not forecasted for this project. However, truck traffic is expected to increase if the national goals of I-69 are met.
- Level of Service (2010): All evaluated segments of I-24 and Purchase Parkway operate at LOS C or better in the current year.
- Level of Service (2040): All segments of I-24 and Purchase Parkway in the study area are expected to operate at LOS C or better in the future year 2040.

Mainline Geometry/Typical Section

- Design Speed: The Purchase Parkway meets or exceeds the minimum design speed guidelines for interstate highways in rural and urban areas.
- Lane Width: The lane width on the Purchase Parkway meets the minimum AASHTO guidelines for interstate design.
- Outside Shoulder Width: The Purchase Parkway meets minimum criteria for outside shoulder width based on the current truck DDHV.
- Inside Shoulder Width: The Purchase Parkway does not comply with the minimum design guidelines for inside paved shoulder widths. The section of Purchase Parkway at Mayfield, KY, also referred to as the Mayfield Bypass, has a raised median and no inside shoulder (MP 21.887 – MP 24.901). The remainder of the Purchase Parkway has a 3 foot paved inside shoulder, while the minimum criteria requires a 4 foot paved shoulder.
- Median Width: The Purchase Parkway meets the rural 36 foot AASHTO minimum median width in rural areas and the 10 foot AASHTO minimum median width in urban areas.
- Clear Zones: Based on the available data, it was not possible to fully evaluate the clear zone without detailed field study. The fill and cut slopes provided in the typical sections vary from 1V:2H to 1V:4H, the median ditch slope is 1V:4H, and the outside ditch slope is between 1V:3H and 1V:4H. Inference can be made regarding available clear zone from review of the as-built plans. However, it can be assumed that those sections not already with guardrail installed meet clear zone requirements.
- Sign Installations: A field review of roadside signs showed all signs within the apparent clear zone were crash worthy (break away).
- Guardrail Placement and Condition: As-built plans do not provide sufficient information to evaluate the placement of guardrail (length of need) along the I-69 corridor. However, a field review of the corridor showed that the guardrail end treatments on the Purchase Parkway meet current criteria and standards.
- Superelevation: From the review of as-built plans, horizontal curves along the Purchase Parkway appear to comply with the AASHTO criteria of 10% maximum superelevation.
- Horizontal Alignment: Horizontal curvature for the Purchase Parkway meets the minimum criteria of current design criteria and guidelines.
- Vertical Alignment: The majority of the vertical curves along the Purchase Parkway meet the current criteria and guidelines. Eight vertical curves do not meet the guideline for the minimum length of vertical curves.
- Stopping Sight Distance: The minimum stopping sight distance guideline is not met for three vertical curves: MP 14.965, MP 18.727, and MP 25.320

Bridges and Overpasses

- Lateral Clearance – Purchase Parkway: Of the 46 mainline bridges on the Purchase Parkway, 10 fail to meet the minimum lateral clearance requirement.
- Vertical Clearance – Purchase Parkway and I-24: Of the 35 overpass bridges on the Purchase Parkway, 4 do not meet the minimum 16 foot vertical clearance requirement. The five overpass bridges on I-24 meet the minimum vertical clearance regulation.
- Functional Adequacy: One bridge (MP 21.285) is identified as functionally obsolete.
- Sufficiency Rating: All Purchase Parkway mainline and overpass bridges have a sufficiency rating greater than 60.0.

Interchanges and Ramps (Purchase Parkway)

- Design Speed: Design speed for ramps were not provided on the as-built plans and were not evaluated.
- Lane Width: Ramp lane widths range from 15 feet to 18 feet, which is greater than the 15 foot minimum width per current criteria for lane width.
- Shoulder Width: A majority of the interchange ramps on the Purchase Parkway do not meet the AASHTO guidelines for shoulder width. 10 of the 13 interchanges have ramp shoulder widths that do not meet criteria.
- Horizontal Alignment: With the exception of one loop ramp (Exit 14), all horizontal curvature at interchanges meet minimum criteria and requirements. The loop ramp has a 130 foot radius which does not meet the minimum loop ramp radius of 134 feet for a 25 mph design speed.

- Vertical Alignment-Vertical Grade: The minimum vertical grade is met on all interchange ramps that were provided on the as-built plans.
- Vertical Alignment-Vertical Length of Curve: Three vertical curves on ramps did not meet the requirements for minimum length of curve that were calculated based on the ramp design speed. These ramps are located at the US 51 interchange (Exit 1) and KY 80 interchange (Exit 22).
- Vertical Alignment-Stopping Sight Distance: Two vertical curves on ramps did not meet the minimum stopping sight distance requirement that were calculated based on the ramp design speed. These ramps are located at the US 51 interchange (Exit 1) and KY 80 interchange (Exit 22).
- Superelevation: Based on review of as-built plans, existing ramps appear to satisfy the AASHTO criteria for 10% maximum superelevation.
- Speed-Change Lanes: Many of the existing ramps on the Purchase Parkway do not meet the minimum criteria for acceleration and deceleration lengths.
- Weaving Characteristics: The one location with an existing weaving situation between interchanges will operate at a LOS B with future I-69 traffic projections. The interchanges at Exits 14 and 43 are previous toll plaza interchanges. Exit 52 is a cloverleaf interchange with weaving within the interchanges.
- Interchange Spacing: On the Purchase Parkway, there are two locations where the minimum interchange spacing requirements are not met. Interchange spacing was measured from intersecting routes along the Purchase Parkway. The three interchanges (Exits 0, 1, 2) in Fulton are within three miles of each other. The two interchanges (Exit 41 and Exit 43) in Benton are within three miles of each other.
- Interchange Control of Access: The Purchase Parkway has four interchanges that do not meet the recommended criteria for control of access.
- Interchange Configuration: Currently, the Purchase Parkway has four service interchanges that do not meet the recommended interstate interchange configuration. They are located at Exit 0, Exit 14, Exit 21, and Exit 43. The interchange configuration at I-24 and the Purchase Parkway is not recommended for a systems interchange.

POTENTIAL IMPROVEMENT ALTERNATIVES

For this study, the range of alternatives under consideration is No Build, Necessary Upgrades and Spot Safety Improvements, and Fully Compliant Reconstruction. These alternatives represent incremental levels of infrastructure investment needed to implement I-69 along the Purchase Parkway from Tennessee to I-24.

- **No Build** – This alternate would leave a gap in the nationally proposed I-69 route. However, the Purchase Parkway would provide the connectivity for the I-69 traffic to travel from Tennessee to I-24.
- **Necessary Upgrades and Spot Safety Improvements** - Key safety and operational concerns would be addressed. Design exceptions or variances would be obtained for the existing conditions that do not meet current AASHTO or KYTC guidelines that are deemed appropriate by the KYTC and the FHWA.
- **Fully Compliant Reconstruction** – This alternate would involve improvements within existing right of way or with minimum right of way acquisition necessary for making the existing Purchase Parkway meet minimum AASHTO criteria for interstate routes.

The following table represents preliminary cost estimates for the potential improvement alternatives.

Alternative	Meet Current Standards	Impact on Environment	Cost (million)	Cost per Mile ¹ (million)
1. No Build	No	Least	\$0.00 ²	\$0.00
2. Necessary Upgrades / Spot Safety Improvements	Yes ³	Minimal	\$131.95	\$2.57
3. Fully Compliant Reconstruction	Yes	More Significant	\$218.94 ⁴	\$4.26

Table 8-5 Cost Comparison of Potential Alternatives

¹ Cost per mile based on 51.4 miles of Purchase Parkway.

² Cost for routine maintenance is not depicted in alternatives.

³ This alternative would include upgrading the design features along the Purchase Parkway that potentially represents the most significant safety and operational issues. This alternative requires design exceptions and variances where safety and operational conditions would not create undue risk to the motorist.

⁴ Cost estimate does not include cost associated with connecting to Segments of Independent Utility (SIU) 5 (I-24 at Western Kentucky Parkway) or SIU 7 (Exits 0,1,2 at Fulton, KY).

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.

If the intention is to utilize the Purchase Parkway for future I-69 designation, it is recommended to develop a strategy for future improvements based on operational characteristics, safety, routine maintenance and Federal Highway Administration guidance. The strategy of improvements will insure an efficient and coordinated implementation of future projects and designation of I-69. Additional data and analysis are recommended for project development:

- 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.

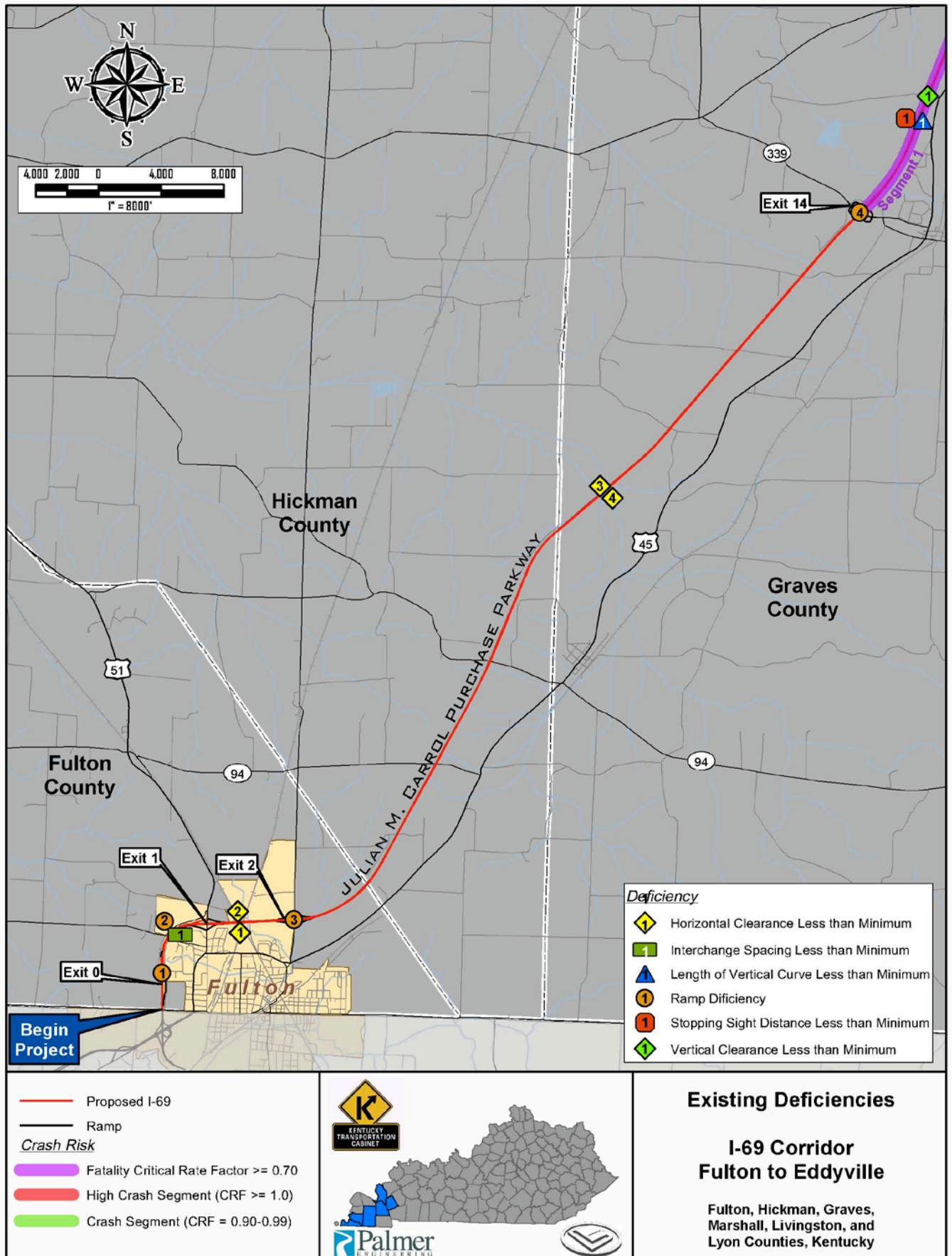
CONCLUSIONS

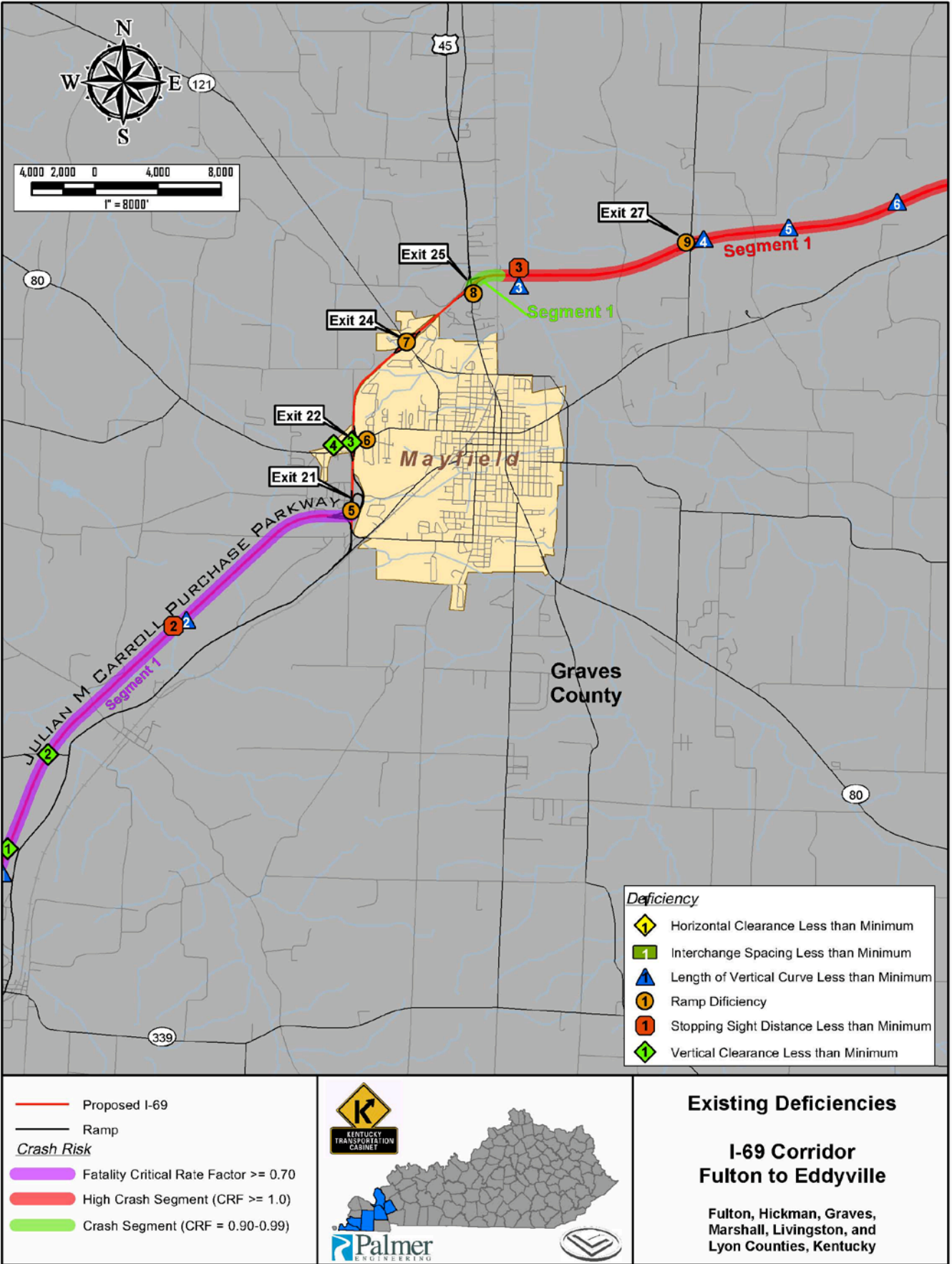
Based on the findings of this study, it can generally be concluded that the Purchase Parkway is currently providing motorists efficient and safe travel from US 51 in Tennessee to I-24 with operating conditions similar to an interstate. There would be minimal to no impact to the operating characteristics 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.

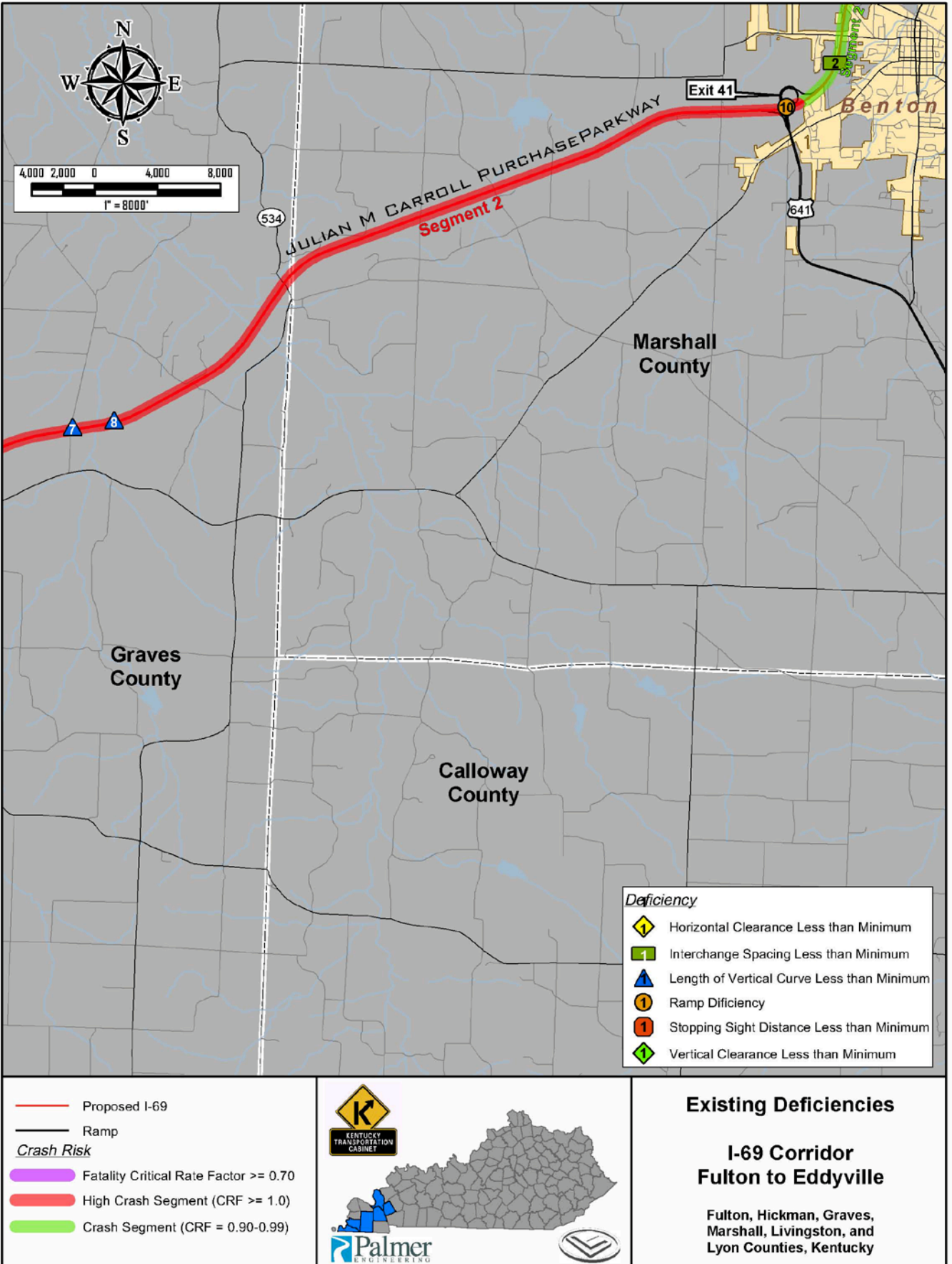
Intuitively, there may be sections of interstate in Kentucky and around the United States that do not meet the current design standards. Some design features on these other interstates may be very similar to the existing design features on the Purchase Parkway. Based on the impact to other sections of 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.

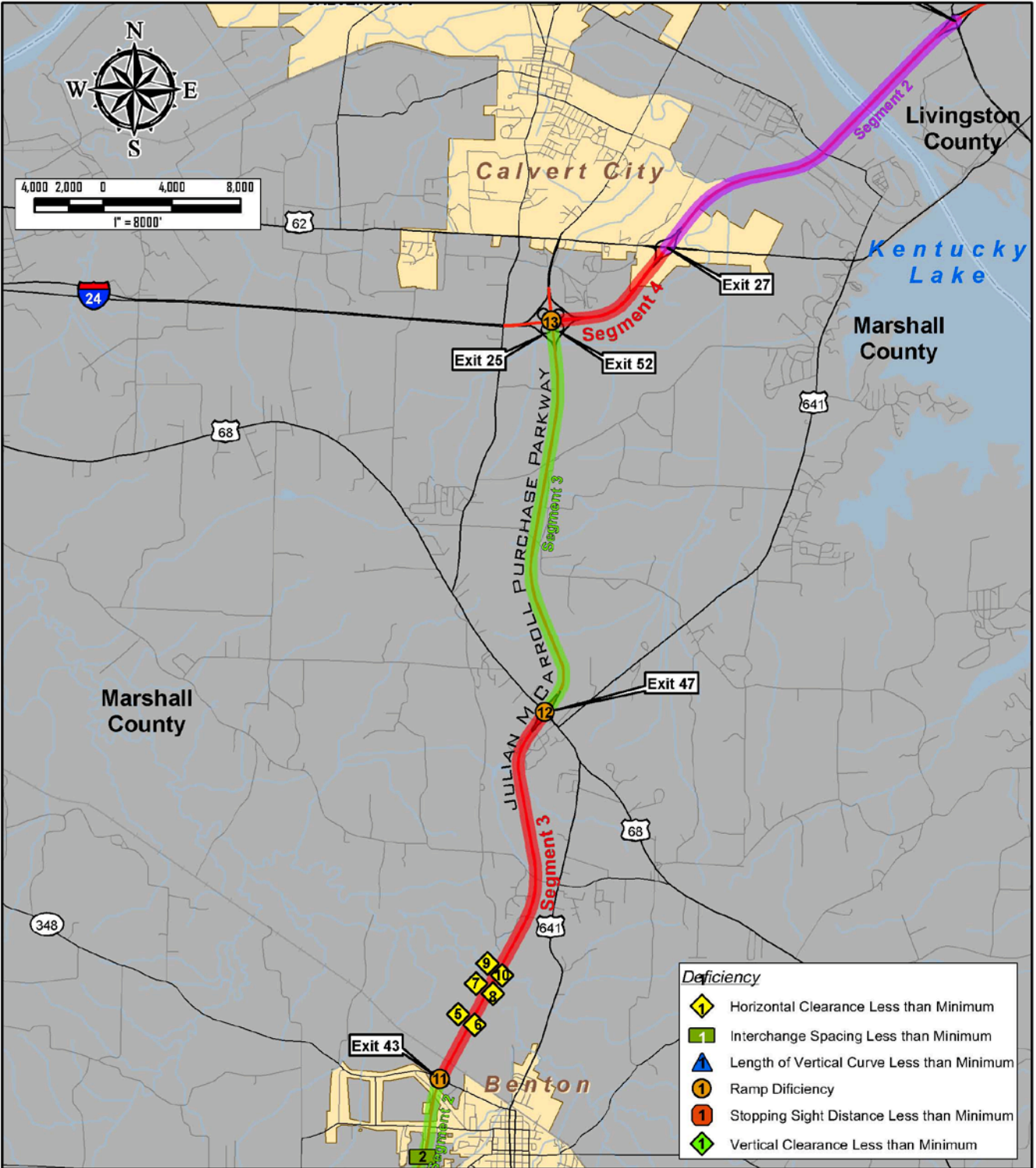
There are two broad based potential improvement alternatives recommended for improving the Purchase Parkway to meet interstate standards. The Necessary Upgrades and Spot Safety Improvement alternative includes upgrading the Purchase Parkway to meet current interstate standards but with design exceptions/variances. 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 previous 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.

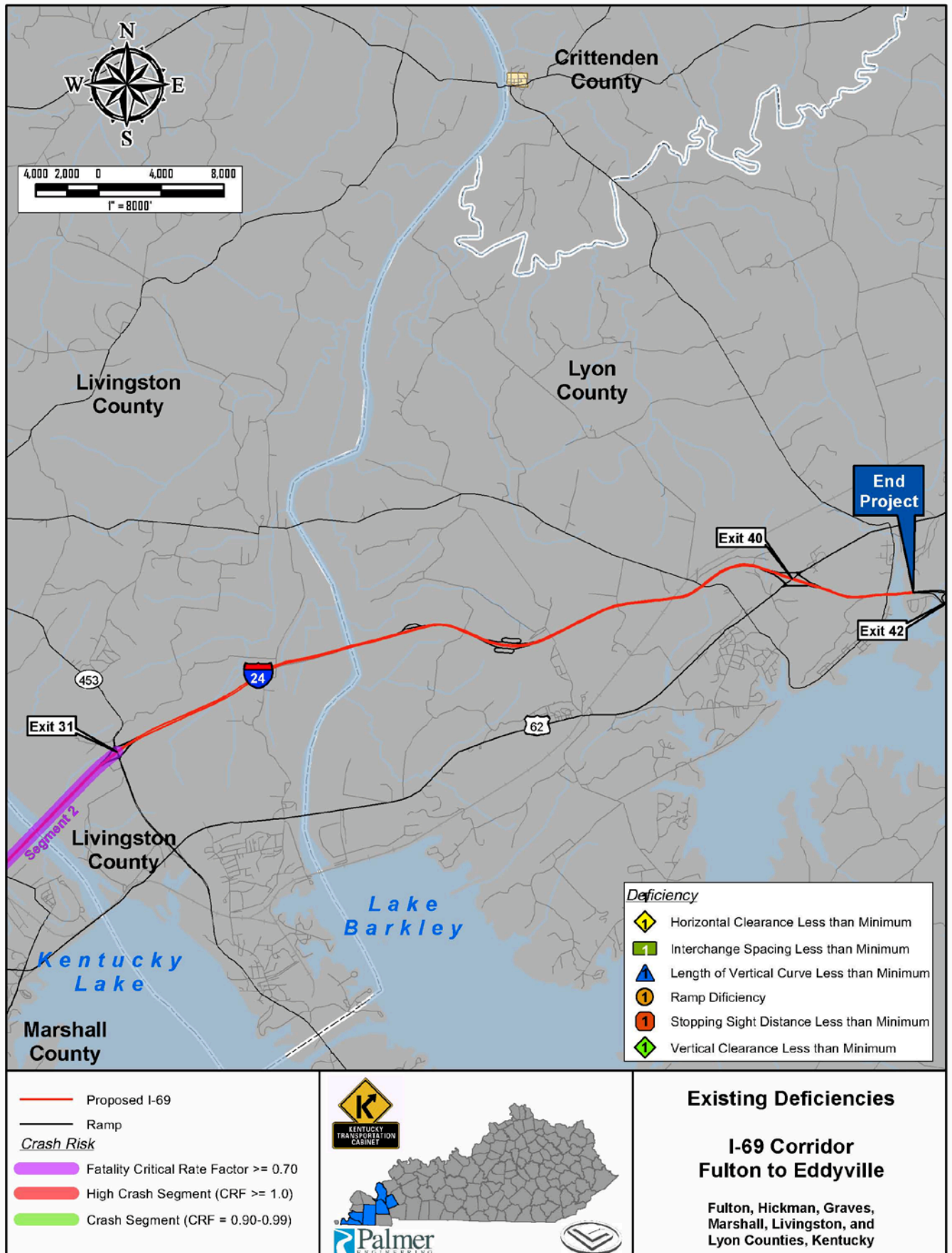























































<p>— Proposed I-69</p> <p>— Ramp</p> <p>Crash Risk</p> <p>— Fatality Critical Rate Factor ≥ 0.70</p> <p>— High Crash Segment (CRF ≥ 1.0)</p> <p>— Crash Segment (CRF = 0.90-0.99)</p>	<p>Kentucky Transportation Cabinet</p> <p>Palmer ENGINEERING</p>	<p>Existing Deficiencies</p> <p>I-69 Corridor</p> <p>Fulton to Eddyville</p> <p>Fulton, Hickman, Graves, Marshall, Livingston, and Lyon Counties, Kentucky</p>
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Deficiency Type	Milepoint	Deficiency Description
Purchase Parkway - Fulton/Hickman County		
	Exit 0	Taper Length < Min; Rolled Curb
	MP 1.0	Interchange Spacing less than 3 mile minimum
	Exit 1	Taper Length < Min; Rolled Curb
	Exit 2	Taper Length < Min; Divergence Angle > Max; Rolled Curb
	1.781	Horizontal Clearance = 30' (Note bridge is over 200' long)
	1.781	Horizontal Clearance = 30' (Note bridge is over 200' long)
Purchase Parkway - Graves County		
	9.082	Horizontal Clearance = 30' (Note bridge is over 200' long)
	9.082	Horizontal Clearance = 30' (Note bridge is over 200' long)
	13.645 - 21.305	Fatality CRF = 0.75 (CRF >=0.70)
	Exit 14 MP 13.653	Taper Length < Min; Degree of Curve > Max; Ramp Entrance/Exit Deficient; Rolled Curb; Interchange control of access less than 300' minimum
	14.965	Length of Vertical Curve = 500' (696' calculated minimum)
	14.965	Stopping Sight Distance = 554' (730' minimum)
	15.302	Vertical clearance = 15.88' (16' minimum)
	16.526	Vertical clearance = 15.94' (16' minimum)
	18.727	Length of Vertical = 600' (624' calculated minimum)
	18.727	Stopping Sight Distance = 727' (730' minimum)
	Exit 21 MP 21.285	Taper Length < Min;; Divergence Angle > Max; Rolled Curb
	Exit 22 MP 22.267	Taper Length < Min; Interchange control of access less than 100' minimum
	22.267	Vertical clearance = 15.30' (16' minimum)
	22.267	Vertical clearance = 15.12' (16' minimum)
	Exit 24 MP 23.701	Taper Length < Min
	Exit 25 MP 24.726	Taper Length < Min; Rolled Curb

Deficiency Type	Milepoint	Deficiency Description
	24.747 - 25.100	Crash Segment CRF = 0.9 (CRF 0.90-0.99)
	25.100 - 27.452	High Crash Segment - CRF= 1.33 (CRF >=1.0)
	27.452 - 34.487	High Crash Segment - CRF = 1.05 (CRF >=1.0)
	25.32	Length of Vertical Curve = 536' (584' calculated minimum)
	25.32	Stopping Sight Distance = 721' (730' minimum)
	Exit 27 MP 27.461	Taper Length < Min; Ramp Entrance/Exit Deficient; Divergence Angle > Max; Rolled Curb; Interchange control of access less than 300' minimum
	27.517	Length of Vertical Curve = 536' (584' calculated minimum)
	28.625	Length of Vertical Curve = 400' (438' calculated minimum)
	29.970	Length of Vertical Curve = 400' (416' calculated minimum)
	31.144	Length of Vertical Curve = 400' (467' calculated minimum)
	31.646	Length of Vertical Curve = 600' (608' calculated minimum)
Purchase Parkway - Marshall County		
	34.487 - 41.035	High Crash Segment - CRF = 1.05 (CRF >=1.0)
	Exit 41 MP 40.809	Taper Length < Min; Divergence Angle > Max
	MP 41.682	Interchange spacing less than 3 mile minimum
	41.035 - 42.555	Crash Segment - CRF = 0.99 (CRF 0.90-0.99)
	42.555 - 46.942	High Crash Segment CRF =1.0 (CRF >=1.0)
	Exit 43 MP 42.555	Taper Length < Min; Degree of Curve > Max; Ramp Entrance/Exit Deficient; Rolled Curb
	43.277	Horizontal Clearance = 30' (Note bridge is over 200' long)
	43.277	Horizontal Clearance = 30' (Note bridge is over 200' long)
	43.614	Horizontal Clearance =30' (Note bridge is over 200' long)
	43.614	Horizontal Clearance =30' (Note bridge is over 200' long)
	43.872	Horizontal Clearance =30' (Note bridge is over 200' long)
	43.872	Horizontal Clearance = 30' (Note bridge is over 200' long)
	Exit 47 MP 46.942	Taper Length < Min; Rolled Curb; Interchange control of access less than 300' minimum
	46.942 - 51.398	Crash Segment - CRF = 0.91 (CRF 0.90-0.99)
	Exit 52 MP 51.398	Taper Length < Min; Degree of Curve > Max

Deficiency Type	Milpoint	Deficiency Description
Interstate 24 - Marshall County		
<u>4</u>	24.941 - 26.558	High Crash Segment - CRF =1.10 (CRF >=1.0)
<u>2</u>	26.558 - 29.352	Fatality CRF = 0.71 (CRF >=0.70)
Interstate 24 - Livingston/Lyon County		
<u>2</u>	29.352 - 30.742	Fatality CRF = 0.71 (CRF >=0.70)