



*Groundbreaking by Design.*

# MEETING MINUTES

Project: US 231/US 68/US 68X Intersection Improvement Study  
Warren County

Purpose: Project Team Meeting No. 1

Place: Virtual Meeting

Meeting Date: October 22, 2021

Prepared By: Qk4

Participants:

Joe Plunk	KYTC D3
Ben Hunt	KYTC D3
Andrew Stewart	KYTC D3
Stewart Lich	KYTC D3
Matt Holder	KYTC D3
Steve De Witte	KYTC CO Planning
Steve Ross	KYTC CO Planning
Rebecca Thompson	Qk4
Deanna Miller	Qk4
Cody Humble	Qk4
Steven Trevino	Qk4

Rebecca Thompson opened the meeting, welcoming attendees. The purpose of the meeting is to review the existing conditions information for the study, which focuses on the US 231/US 68/US 68X intersection—locally, Campbell Lane, Russellville Road, and Veterans Memorial Lane.

Deanna Miller and Steve Trevino provided an overview of existing conditions.

- Previous studies in the vicinity were reviewed; there are no planned transportation improvements in the immediate vicinity. While there have been high level discussions about someday widening US 68X to five lanes, the costs and impacts are likely prohibitive.
- CHAF IP20190110 (study intersection) was the fourth highest district priority after boosting in the 2022 SHIFT process. D3 hopes it will receive design funding in the upcoming highway plan and can advance for further development immediately following this planning study.
- The city's 2017 *BG Moves* plan identifies future greenways along US 231 and Village Creek Drive. Both are rated as low priorities.

- Traffic counts were collected in September 2021 at eight intersections. A Vissim microsimulation was built around these volumes, speeds, queue lengths, and other factors to mimic existing conditions. Analysis shows the study intersection operates at Level of Service (LOS) D in both peak hours. Left turns and the US 68 (Russellville Road) thru move operate at LOS E/F in one or more peak hours.
- Bowling Green’s regional travel demand model forms the basis for 2045 forecasts. Background growth assumptions will be adjusted to reflect the nearby Keystone Commons development. An industrial development off Russellville Road beyond the parkway could impact traffic flows; Qk4 will compare this area against growth assumptions in the statewide model.
- Four years of crash data (2017-2020) show 207 crashes at the intersection: no fatalities and 41 injury collisions. There were two collisions with cyclists. By type, most crashes are rear ends (43%) or angle crashes (23%). All four approaches and the intersection itself demonstrate more crashes than expected, resulting in Level of Service of Safety ratings of 3 or 4.

Rebecca Thompson and Cody Humble presented the preliminary improvement concepts, seeking KYTC input prior to detailed traffic modeling and developing cost estimates. FHWA’s high-level capacity planning tool provided volume-to-capacity ratios (v/c) for a variety of intersection configurations based on existing peak hour traffic volumes (**Table 1**).

**Table 1: 2021 Peak Hour Volume-to-Capacity Approximations from FHWA Capacity Tool**

Configuration	AM V/C	PM V/C
Conventional Signalized Intersection (as is)	0.7	0.7-0.8
Signalized Intersection (dual NB left lanes)	0.6	0.7
Quadrant Roadway	0.5-0.6	0.5-0.7
Partial Displaced Left (along bypass)	0.5	0.6
2-Lane Roundabout	1.0	0.9

Qk4 presented four preliminary concepts, followed by group discussion.

**Dual Lefts:** This scenario adds dual left turn lanes on US 68 (Russellville Road) into town. Depending on detailed traffic modeling, dual lefts for the US 231 approach could be added as well. Lane configurations/widths and sidewalk connections are assumed to match the existing layout.

- The team agreed to advance this concept for further analysis.

**Partial Displaced Lefts:** Displaced left turn lanes along the bypass approaches route left-turning traffic to the opposite side of the highway so thru and left turn movements can share the same signal phasing. Displaced left turn lanes along Russellville Road were not considered as they would have substantial impacts to adjacent access points.

- Queue lengths coupled with sight distance limitations from the railroad overpass is a concern. The steep grade is an issue during winter weather events.
- Dual displaced lefts may be warranted to address US 231 queues, but any improvement should avoid impacting the overpass. It carries five lanes today.
- A dynamic queue warning system may be appropriate to consider.
- FHWA recommends crossovers be placed at least 300-500 feet from the main intersection to accommodate queues.
- The team agreed to advance this concept for further analysis.

**Roundabout:** As discussed at the scoping meeting, the signalized intersection is replaced by a dual lane roundabout in this scenario.

- The layout could be refined to minimize impacts to the recent sewer work in the west quadrant. Joe Plunk will provide plan sheets.
- The layout shown would relocate the Cash Express building and impacts the front Hardees driveway/parking lot.
- The team agreed to advance this concept for further analysis.

**Grade-Separated Option:** In this scenario, a new overpass carries the bypass over Russellville Road, with two-way connectors in the north and south quadrants. All movements to/from Russellville Road become right turns. Both new intersections along the bypass are assumed to be signalized.

- Based on the volume, queue lengths for the Russellville-to-Veterans left turns could be an issue.
- Maintenance of traffic would be complex.
- This concept is likely cost prohibitive. The team agreed not to advance this concept.

A quadrant roadway was also discussed but dismissed as cost prohibitive based on property impacts. A hybrid combination of the grade-separated and quadrant concepts faces the same challenges: high costs and sizeable property impacts. Neither was advanced for further study.

The potential reduction in crashes could show substantial benefits.

Qk4 will continue to refine the three concepts noted above, including traffic microsimulation, cost estimates, and benefit-cost calculations. The next project team meeting should occur in November, followed by a briefing for local officials and stakeholders.

End of Minutes



## MEETING MINUTES

*Groundbreaking by Design.*

Project: US 231/US 68/US 68X Intersection Improvement Study  
Warren County

Purpose: Project Team Meeting No. 2  
Build Recommendations

Place: Virtual Meeting

Meeting Date: December 17, 2021

Prepared By: Qk4

Participants:

Joe Plunk	KYTC D3
Ben Hunt	KYTC D3
Andrew Stewart	KYTC D3
Stewart Lich	KYTC D3
Matt Holder	KYTC D3
Steve De Witte	KYTC CO Planning
Steve Ross	KYTC CO Planning
Jay Balaji	KYTC CO Planning
Karissa Lemon	Bowling Green-Warren County MPO
Rebecca Thompson	Qk4
Deanna Miller	Qk4
Cody Humble	Qk4
Steven Trevino	Qk4

Rebecca Thompson opened the meeting, welcoming attendees. The purpose of the meeting is to discuss potential improvement concepts focusing on the US 231/US 68/US 68X intersection—locally, Campbell Lane, Russellville Road, and Veterans Memorial Lane.

Deanna Miller provided a summary of the study background, schedule, study area and crash history presented at the first project team meeting held October 22, 2021. Highlights included:

- CHAF IP20190110 (covering the study intersection) was the fourth highest district priority after boosting in the 2022 SHIFT process. D3 hopes it will receive design funding in the upcoming highway plan and can advance for further development immediately following this planning study.
- Four years of crash data (2017-2020) show 207 crashes at the intersection: no fatalities and 41 injury collisions. There were two collisions with cyclists. By type, most crashes are rear ends (43%) or angle crashes (23%). All four approaches and the intersection itself demonstrate more crashes than expected, resulting in Level of Service of Safety ratings of 3 or 4.

- Analysis shows the study intersection currently operates at Level of Service (LOS) D in both peak hours. Left turns and the US 68 (Russellville Road) thru move operate at LOS E/F in one or both peak hours. Adjacent signals currently operate at LOS B/C in peak hours.

**Traffic Analysis** – Rebecca presented 2021 and 2045 traffic operations and volumes, summarized in **Table 1**. Count data was collected during September 2021. Bowling Green’s regional travel demand model forms the basis for 2045 forecasts. Background growth assumptions were adjusted to 2.1% to reflect the nearby Keystone Commons—a 39-acre, 600-unit residential and commercial mixed-use development predicted to generate nearly 9,000 additional trips per day. This degrades operations, with LOS E or F at the study intersection and adjacent Industrial Drive signal.

Table 1: Existing and Future Traffic Volumes

Approach	“Existing”			2045
	Pre-2020 Historic Trend	2020 Count	Factored 2021 Counts	
US 68X Russellville Rd	17,400	-	16,900	25,500
US 68 Russellville Rd	23,400	20,700	24,500	37,000
US 231 Campbell Ln	23,800	20,000	22,100	33,400
US 68 Veterans Memorial Ln	19,600	16,300	17,500	26,400

The team discussed whether the assumed growth rate was too aggressive. If capacity at the intersection is constrained, likely trips would divert elsewhere in the larger network.

**Improvement Concepts** – Qk4 presented three improvement concepts:

- Dual left turn lanes on US 68X, US 231, and US 68 (Russellville Road). Lane configurations/widths and sidewalk connections are assumed to match the existing layout.
- Displaced left turn lanes on US 231 and US 68 (Veterans Memorial Lane) to route left-turning traffic to the opposite side of the highway, enabling thru and left turn movements to share signal phasing. Coordinated signals are required at both crossovers to shift traffic into displaced left lanes.
- Roundabout to replace the signalized four-leg intersection.

**Table 2** on the following page summarizes each concept with planning level cost estimates, intersection level of service, and preliminary benefit-cost analysis. D3 provided right-of-way and utility estimates. Avoiding the telephone conduit on US 231 near Hardee’s entrance could decrease total utility costs in each scenario by \$1.5 million.

Table 2: Cost Estimates, 2045 Intersection LOS, and Benefit-Cost Ratio

	Phase Costs (\$Millions)					2045 LOS AM (PM)	BCA Disc. 3%
	D	R	U	C	Total		
Dual Lefts	\$0.22	\$1.00	\$3.77	\$2.15	<b>\$7.14</b>	D (D)	7.96
Displaced Lefts	\$0.37	\$3.00	\$3.97	\$3.69	<b>\$11.03</b>	E (D)	1.18
Roundabout	\$0.24	\$1.50	\$3.32	\$2.37	<b>\$7.43</b>	F (F)	*

\*Benefit-cost analysis using only safety benefits resulted in a positive benefit-cost ratio; however, 2045 traffic volumes are predicted to result in gridlock.

Group discussion followed.

- Existing queues often block left turns to/from Whispering Hills Boulevard. Bollards/barrier could be considered to restrict turns. There are other access points for the neighborhood.
- In the displaced left turn scenario, signals would be coordinated but nothing prevents motorists from blocking oncoming traffic lanes.
- Team discussion centered on the 2.1% growth rate used to forecast 2045 traffic volumes. Qk4 will conduct a sensitivity analysis to explore how much growth capacity exists with the roundabout layout before operations fail.
- It is important to balance safety and traffic operational needs. With the frequent crash trends and connections to greenways/sidewalks in the vicinity, safety is a critical consideration.

**Post-meeting update on Sensitivity Analysis**

A sensitivity analysis was run in Vissim to determine how much growth the roundabout can handle before operations break down. Starting with the 2021 volumes, traffic was added following the current turning movement distribution to determine at what point the roundabout configuration would reach LOS D, E, and F. That is, the same growth factor was applied to each movement.

As shown in **Table 3**, the proposed roundabout reaches LOS E once PM peak volumes grow 6% over existing; the proposed roundabout fails (LOS F) before reaching 9% growth. The US 68 (Russellville Road) approach demonstrates the worst delay in the AM peak while US 68X approach fails first in the PM peak. Summary tables describing volume, queue lengths, and delay by movement are attached for reference.

**Table 3: Roundabout Sensitivity Analysis**

Roundabout LOS	AM Peak Hour		PM Peak Hour	
	VPH Increase	Entering VPH	VPH Increase	Entering VPH
Existing Volumes	--	2,914	--	3,382
LOS D	14.5%	3,337	5.5%	3,569
LOS E	23.8%	3,608	6.1%	3,588
LOS F	27.0%	3,702	8.7%	3,675

**Next Steps**

Following additional traffic analyses discussed above, the project team will host a stakeholder briefing in early 2022, followed by draft and final report submittals. KYTC’s geotechnical overview is needed for the document.

End of Minutes



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## MEETING MINUTES

Project: US 231/US 68/US 68X Intersection Improvement Study  
Warren County

Purpose: Local Officials and Stakeholders Briefing  
Study Overview and Improvement Concepts

Place: Virtual Meeting

Meeting Date: March 14, 2022

Prepared By: Qk4

Participants:

Karissa Lemon	Bowling Green-Warren County MPO
Todd Alcott	Mayor, City of Bowling Green
Miranda Hunt	
Sherry Murphy	Bowling Green Convention and Visitors Bureau
Brent Childers	City of Bowling Green - Neighborhood & Community Services
R. Sullivan	
Ben Peterson	City-County Planning Commission
Greg Meredith	City of Bowling Green - Public Works
Melissa Cansler	City of Bowling Green - Public Works
Mark Young	Warren County Fiscal Court
Ron Bunch	Bowling Green Area Chamber of Commerce
Jeff Michael	
Carlos Jenkins	Warren County Public Schools
Joe Plunk	KYTC D3
Ben Hunt	KYTC D3
Matt Holder	KYTC D3
Steve De Witte	KYTC CO Planning
Dave Heil	KYTC CO Planning
Rebecca Thompson	Qk4
Deanna Miller	Qk4

Ben Hunt opened the meeting, welcoming attendees. The purpose of the meeting is to present a study overview and identified improvement concepts focusing on the US 231/US 68/US 68X intersection—locally, Campbell Lane, Russellville Road, and Veterans Memorial Lane.

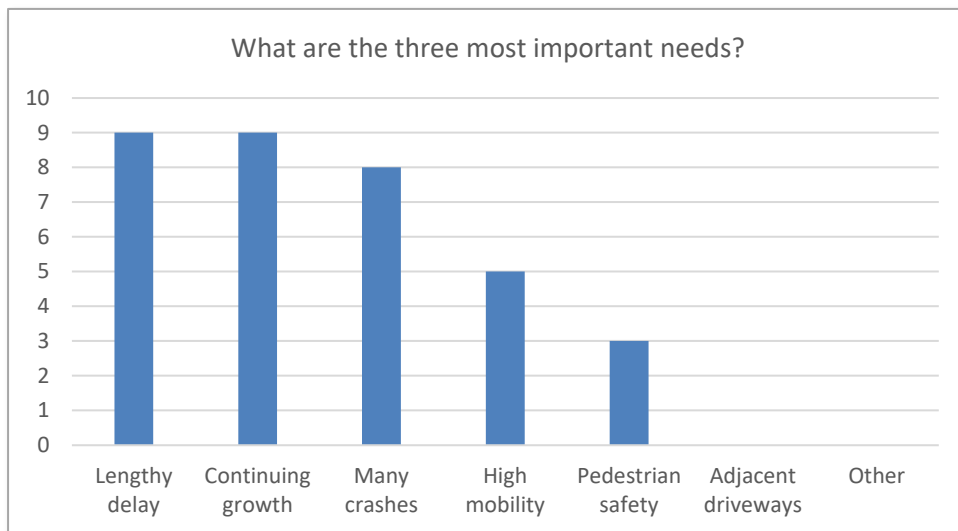
Deanna Miller provided a summary of existing conditions including highway systems, pedestrian facilities, 2021 traffic operations, and crash history. Highlights included:

- All four segments are classified as arterials and are in the Kentucky Freight Network with AAA ratings. US 68 X is the only approach not on the National Highway System and both segments of Russellville Road are part of the US 68 Heritage Scenic Byway.
- Analysis shows the study intersection currently operates at Level of Service (LOS) D in both peak hours. Left turns and the US 68 (Russellville Road) thru move operate at LOS E in one or both peak hours. Adjacent signals currently operate at LOS B/C during peak hours.
- Four years of crash data (2017-2020) show 207 crashes near the intersection with no fatalities and 41 injury collisions. There were two collisions with cyclists. By type, most crashes are rear ends (43%) or angle crashes (23%). All four approaches and the intersection itself demonstrate more crashes than expected, resulting in Level of Service of Safety ratings of 3 and 4.

**Traffic Analysis** – Rebecca Thompson presented an overview of future traffic, noting Bowling Green’s regional travel demand model forms the basis for 2045 forecasts. Background growth assumptions were adjusted to reflect the addition of a new school and nearby Keystone Commons—a 39-acre, 600-unit residential and commercial mixed-use development predicted to generate nearly 9,000 additional trips per day. The model predicts annual growth rates around 2% (verses 1.5% on other recent studies). Peak hour spreading or traffic detouring to other routes will likely occur as congestion grows. The 2045 No-Build traffic through the existing intersection geometry results in LOS E/F during peak hours.

**Study Objectives** – The objective of this study is to develop conceptual improvement options to address traffic flow, safety, and access at the US 231/US68/US68X intersection. Each improvement concept identified should address one or more study area needs: congestion, mobility, travel delay, crash trends, continued growth, and pedestrian safety.

Participants were polled to identify the top three of the cited study area needs. Shown below, lengthy delays, continuing development, and high crash rates were the top rated.





**Improvement Concepts** –In addition to the No-Build option, three improvement concepts were studied:

- Dual left turn lanes on US 68X, US 231, and US 68 (Russellville Road). Lane configurations/widths and sidewalk connections are assumed to match the existing layout.
- Displaced left turn lanes on US 231 and US 68 (Veterans Memorial Lane) to route left-turning traffic to the opposite side of the highway, enabling thru and left turn movements to share signal phasing. Coordinated signals are required at both crossovers to shift traffic into displaced left lanes.
- A dual-lane roundabout to minimize stops.

A comparison of improvement concepts was presented to the group. The dual lefts and roundabout result in similar costs and right-of-way needs. Build 1 (dual lefts) provides the best traffic throughput while the roundabout provides the most safety benefits.

Metric	Build 1: Dual Lefts	Build 2: Partial DLT	Build 3: Roundabout
2045 Traffic Operations	Best	Medium Less familiar and adds new signals	Least Future enhancement options
Crash Reductions	Medium \$600,000 annual crash savings	Least Up to \$500,000 annual crash savings	Best \$1,700,000 annual crash savings
Pedestrian Connections	Medium	Least	Best Shorter crossings, steady traffic flow
Cost	\$7.2M	\$11.1M	\$7.4M
Approx. ROW	1.3 ac Fewest building impacts	2.6 ac	1.5 ac

Twelve of 14 poll respondents agreed the roundabout concept is preferred. Nine of 14 agreed the displaced lefts are least preferred.

Group discussion followed.

- Constructing a “Super U-turn” was suggested as a fourth improvement concept to explore.
- Existing queues often block left turns to/from Whispering Hills Boulevard. Joe Plunk explained that lefts will be restricted at this intersection in all improvement scenarios.
- It is important to balance safety and traffic operational needs. With the frequent crash trends and connections to greenways/sidewalks in the vicinity, safety is a critical consideration.
- The roundabout concept shown can accommodate large semi-truck traffic. It was noted that this planning study provides general information for concepts; specific design details are determined in later phases.

**Next Steps**

A draft and final report detailing the planning process and improvement options will be submitted in the next few weeks. Attendees were encouraged to submit any further questions or comments to the project team via email.

End of Minutes