APPENDIX G:
TRAFFIC FORECAST SUMMARY

Future Traffic Scenarios

Traffic forecasts were developed to evaluate the six alternatives that advanced beyond the Level 1 screening process. The alternatives are grouped into three traffic forecast scenarios as shown below in Table 1, because a number of them have similar alignments and functional characteristics (such as travel time and length). Even though they were grouped for forecasting purposes, the traffic operations characteristics (e.g. level of service) for each alternative were evaluated separately when applicable.

Table 1: Alternative Traffic Forecast Group

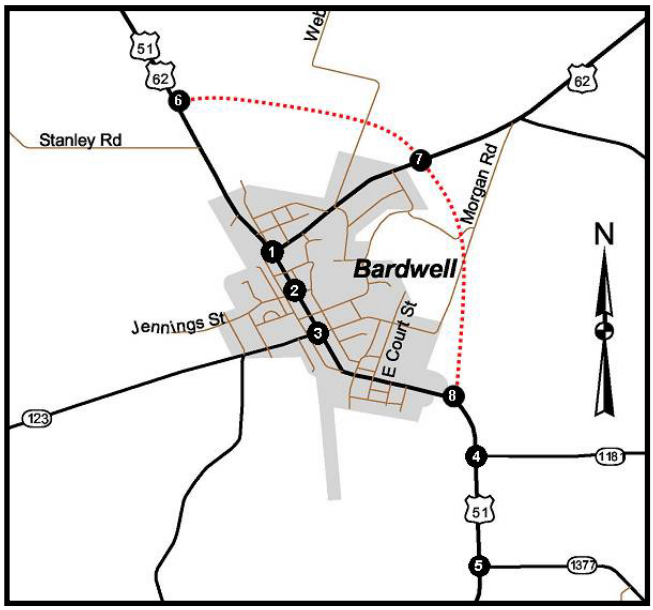
Traffic Forecast Scenario	Alternatives
Group 1	Alternative 1 – No-Build Alternative 2 – Spot Improvements Alternative 3 – Reconstruct US 51 as 2-Lane Roadway with Turn Lanes
Group 2	Alternative 4A – US 51 Realignment West of the Methodist Church Alternative 4B – US 51 Realignment East of the Methodist Church
Group 3	Alternative 5A – US 51 Eastern Bypass

For each scenario, average daily traffic (ADT) and design hourly volume (DHV) forecasts were developed for US 51 for the following years: 2002 (the base year), 2010, 2020, and 2030 (the design year). For 2002, the "forecast" is an estimation of traffic volumes assuming the conceptual alternatives were already constructed.

In addition to mainline estimates for US 51, ADT and DHV turning movement forecasts were developed for the intersections listed below and shown on Figure 1.

1. US 51 and US 62
2. US 51 and Jennings St.
3. US 51 and KY 123
4. US 51 and KY 1181
5. US 51 and KY 1377
6. US 51 North and Bypass *(Alt. 5A only)*
7. US 62 and Bypass *(Alt. 5A only)*
8. US 51 South and Bypass *(Alt. 5A only)*

Figure 1: Intersection LOS Locations



Traffic Forecast Methodology

The traffic forecasts were developed manually, based on historic traffic volumes, growth projections, estimated origin / destination patterns, and travel times. For Alternatives 1, 2, and 3 this meant applying a growth factor to the current 2002 volumes to estimate the future volumes. For the realignment and bypass alternatives, a manual gravity diversion analysis was used to estimate the percentage of diverted traffic. Existing turning movements were estimated at major intersections to approximate origins and destinations of vehicles in the study area. For Alternatives 4A and 4B the major movement was shifted to the realigned US 51 and only local access traffic was retained on the old US 51.

For the bypass alternative (Alternative 5A), traffic volumes were diverted based on manual gravity distribution calculations, employing the California diversion curves to determine the percentage of diverted traffic. The bypass forecasts were developed based on the assumption that land use will remain constant. Redevelopment of land within the bypass corridor would serve to attract more traffic on the bypass. However, economic development projections as a result of land use changes along the bypass were not part of the forecasting scope of work.

As discussed for the No-Build traffic forecasts in Section 3.7, historic count data for the study area was analyzed to project a future traffic growth rate. Between 1985 and 2002, the average growth rate of traffic volumes on US 51 was 0.6 percent per year. (Traffic on US 51 has actually declined by about 20 to 25 percent since 1976 due in part to traffic shifting to Interstate 55 in Missouri.) The population growth rate for Carlisle County is less than the statewide average, with the town of Bardwell showing a slight decline in the 2000 Census. Overall, a growth rate of 1.5 percent per year was used to forecast future traffic volumes.

Future Traffic Volumes

Traffic forecasts are expected to be similar for Alternatives 1, 2, and 3 since the alignment of US 51 does not change. Therefore, the traffic forecasts for Alternative 1 shown in Figure 11 in Appendix B also apply for Alternatives 2 and 3. The traffic projections show a peak volume of 8,500 vehicles per day on US 51 just south of US 62. Truck traffic percentages for the year 2030 for Alternatives 1, 2, and 3 are shown on Figure 2. Truck traffic in town is estimated at approximately 700 to 750 vehicles per day. The volume of truck traffic just north of town however reaches nearly 1,000 vehicles per day because of the added truck traffic from US 62.

For Alternatives 4A / 4B and Alternative 5A, the forecasts are presented in Figures 3 and 5 respectively with truck percentages for the year 2030 shown in Figures 4 and 6, respectively. The Alternative 4A / 4B forecasts show 4,900 vehicles per day and nearly all of the trucks shifting to the realigned US 51 in 2030. Approximately 600 – 1,800 vehicles per day remain on the old US 51 for local access in 2030.

Figure 2: Year 2030 No-Build and Alternatives 2 and 3
Truck Traffic Percentages

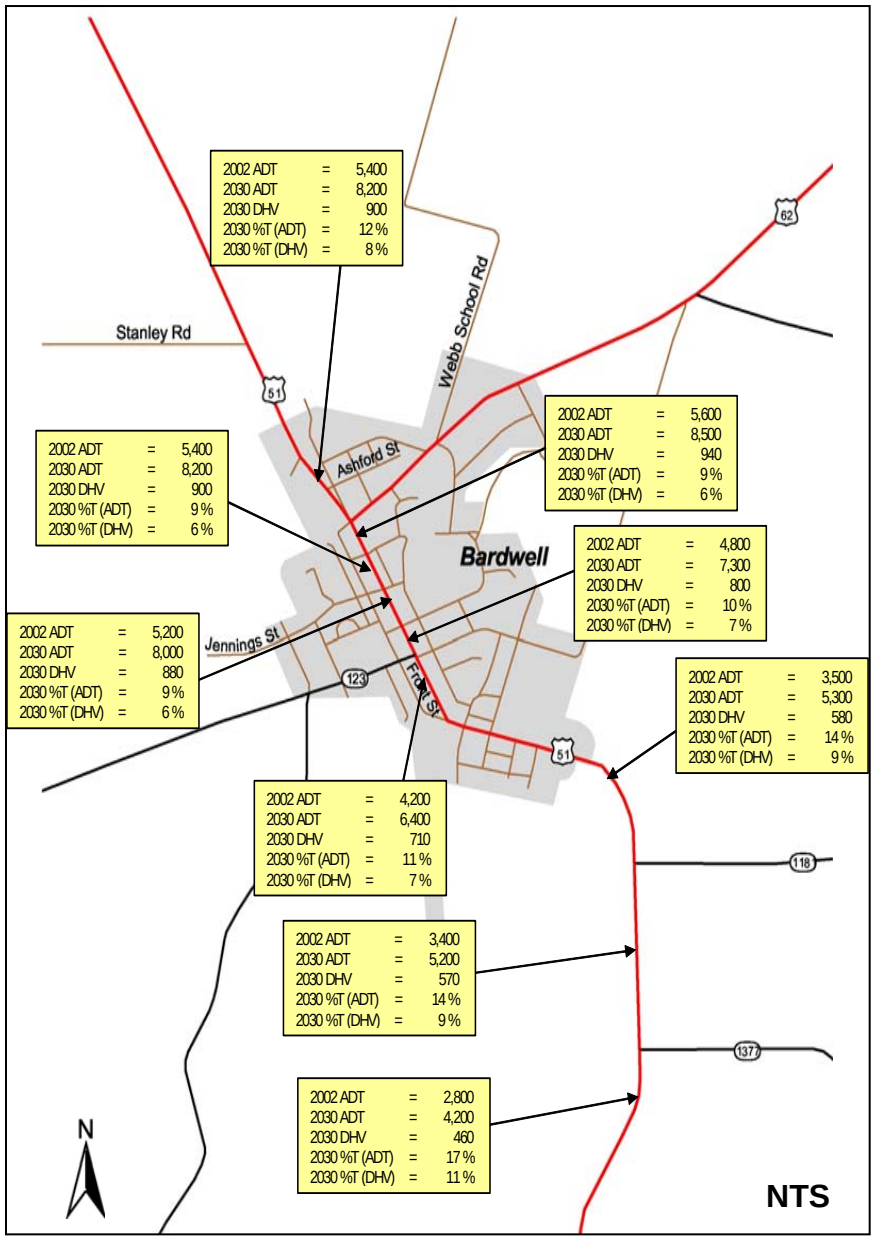


Figure 3: Alternatives 4A and 4B Traffic Forecasts

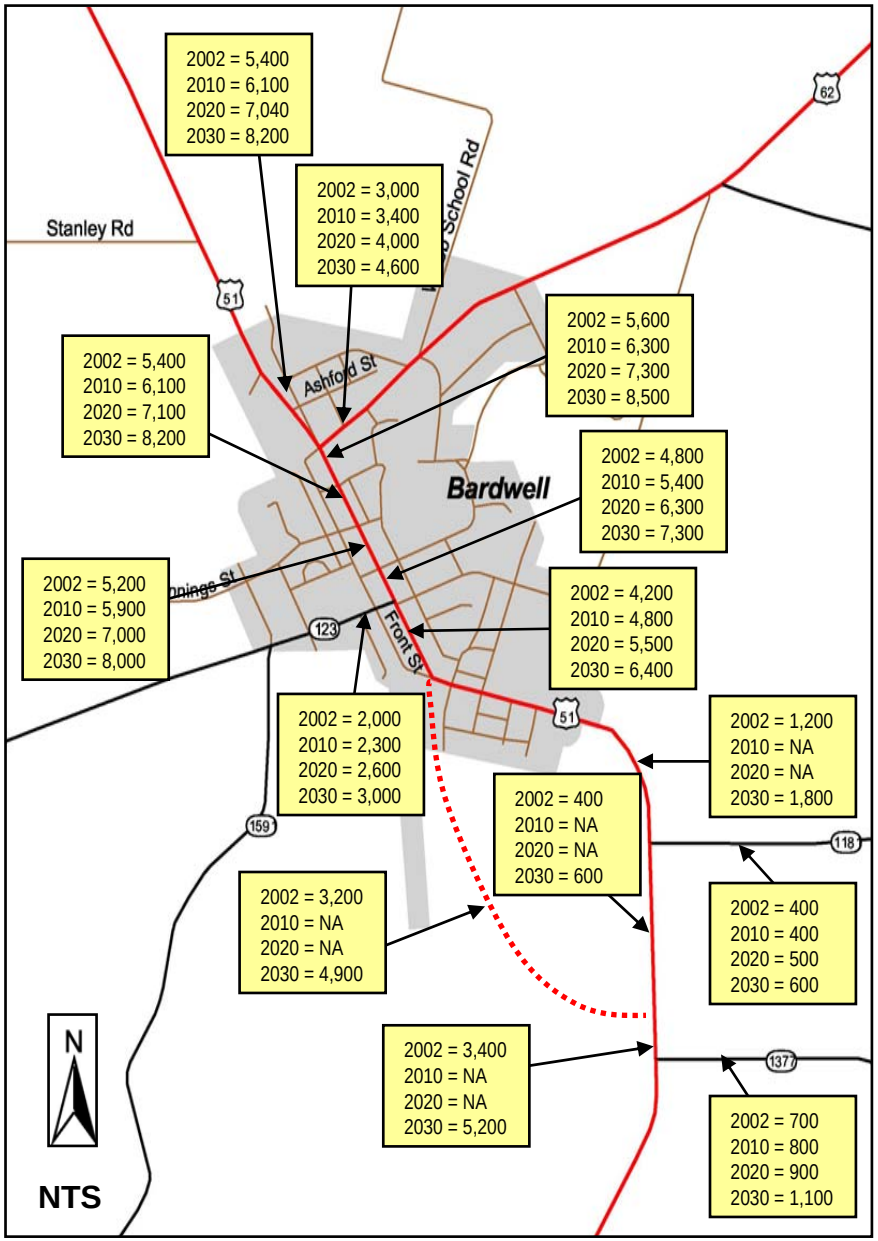


Figure 4: Year 2030 Alternatives 4A and 4B Truck Traffic Percentages

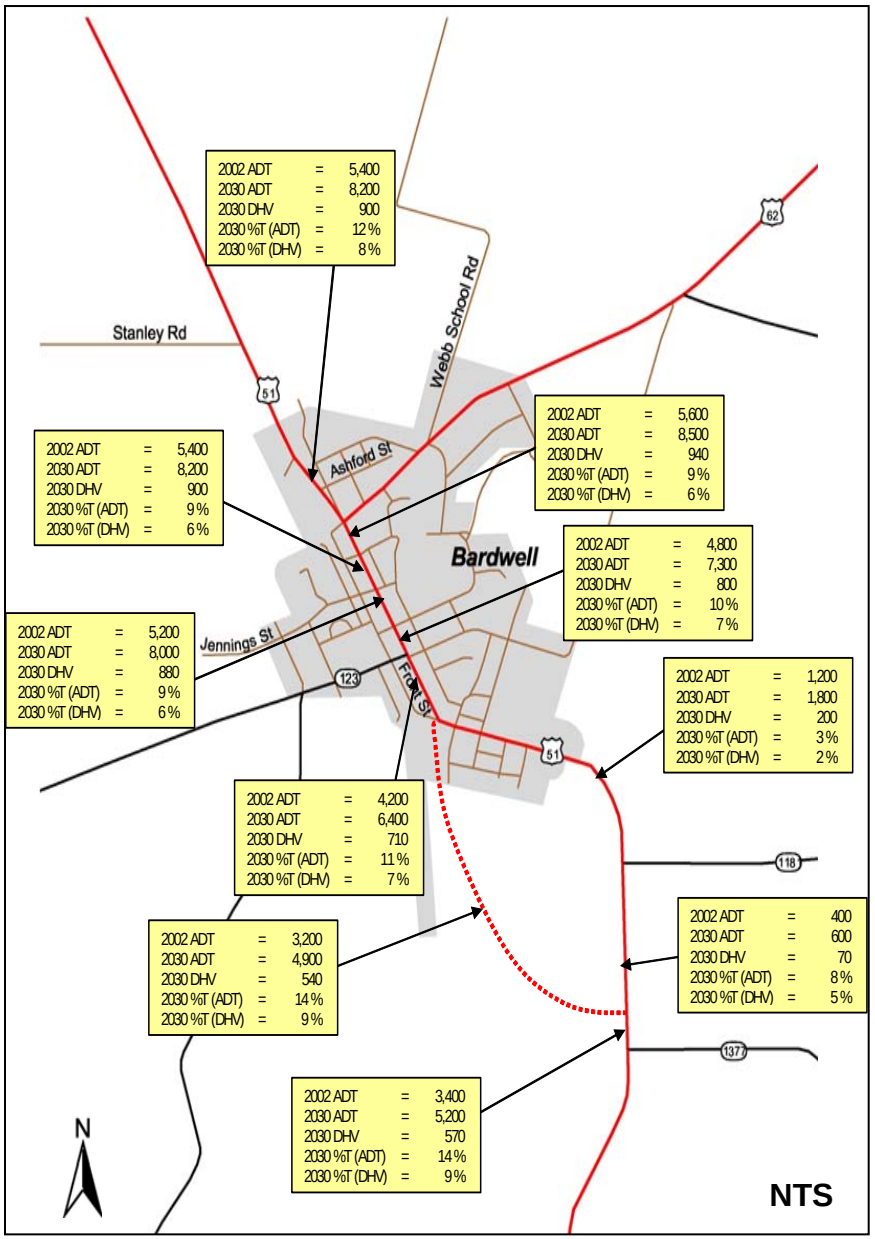


Figure 5: Alternative 5A Traffic Forecast

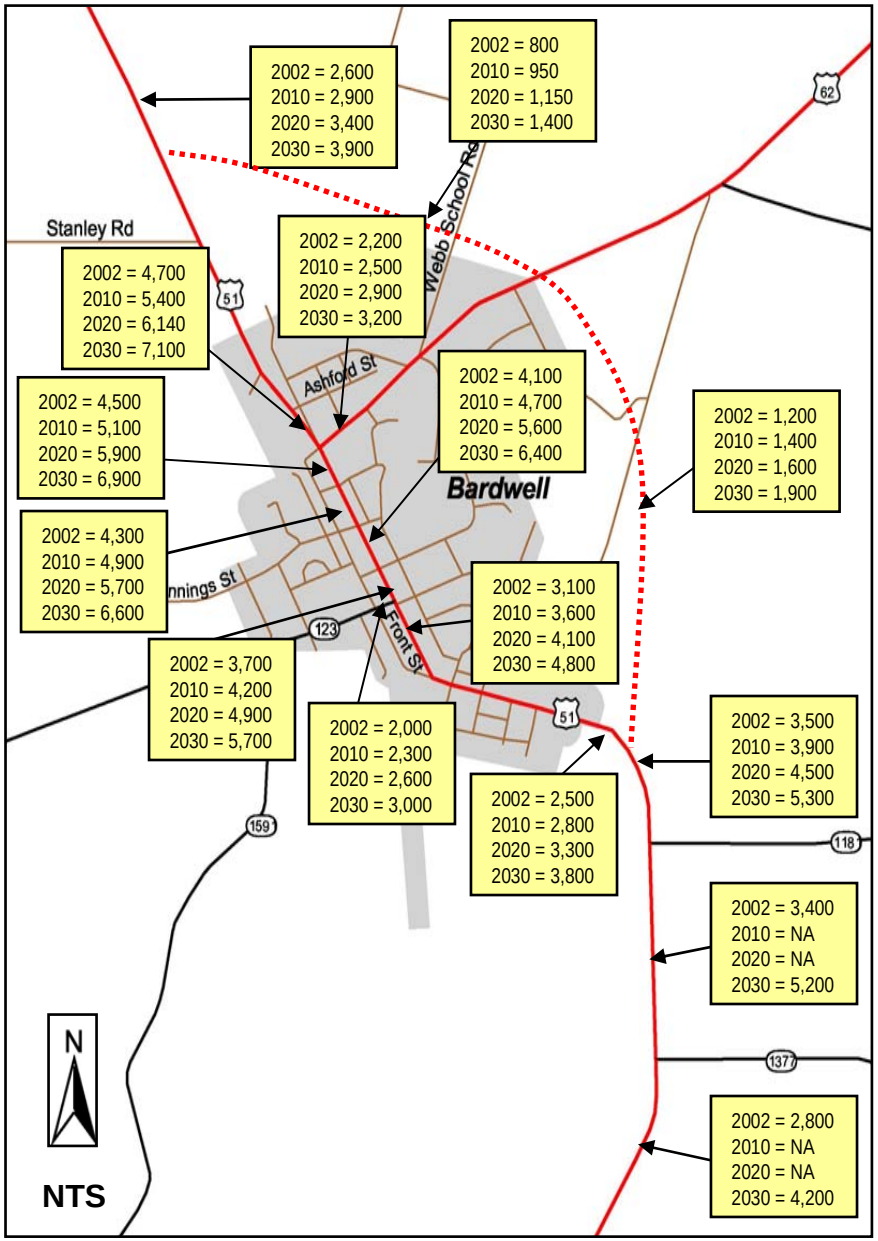
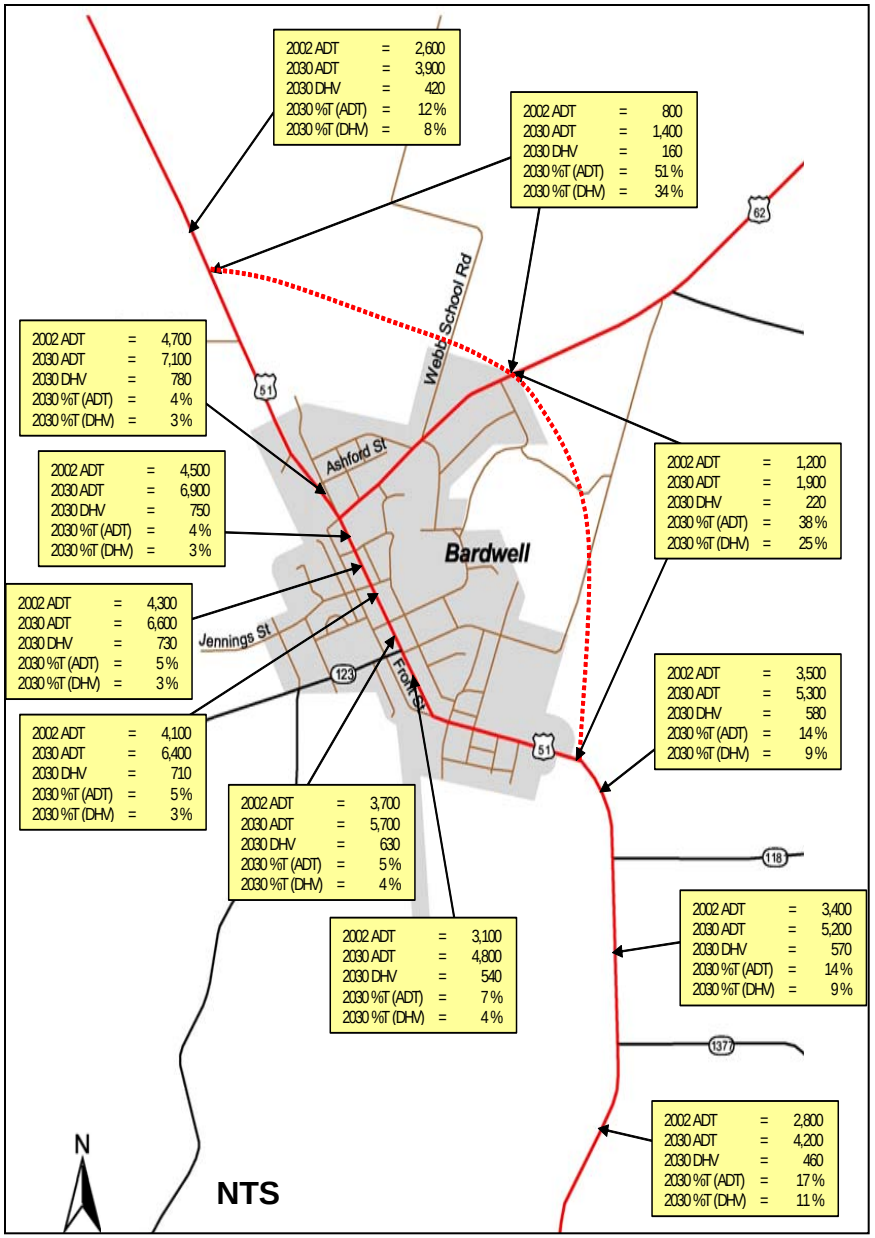


Figure 6: Year 2030 Alternative 5A Truck Traffic Percentages



The Alternative 5A eastern bypass is estimated to carry approximately 1,400 to 1,900 vehicles per day in 2030 depending on the location. It diverts a large portion of the truck traffic, with mainly local access truck traffic remaining in town. The 2030 traffic volumes in town range from 5,000 to about 7,000 depending on location. The reason for the relatively low volume of traffic on the 5A bypass is due in part to a low through volume on US 51 in general.

Intersection Levels of Service

Levels of service (LOS) were evaluated for each of the five study intersections as well as the three new Alternative 5A intersections for each of the build alternatives. The analysis years were 2002 (existing conditions only), 2010, 2020, and 2030. The analysis results are shown in Table 2. The table lists the PM peak hour average delay and LOS for each movement at each intersection. Only the PM peak is shown, as it generally represents the highest peak of the day. The levels of service for the No-Build Alternative (Alternative 1) are included in this table for comparison purposes.

Alternatives 2, 3, 4A, and 4B

The Alternative 2 Spot Improvements directly address the poor operating conditions at the key study intersections. Alternative 2A includes installation of a traffic signal and construction of northbound and southbound left turn lanes at the US 51 / US 62 intersection. It is estimated that the intersection will meet one or more signal warrants in 2010. These improvements will provide more than sufficient capacity at the intersection through 2030.

At the US 51 / KY 123 intersection, no capacity enhancements are proposed until between 2020 and 2030, because traffic volumes do not warrant any modifications beyond minor turning radius improvements until that time. The 2020 LOS D applies only to the eastbound approach (140 vehicles) and is not sufficient to require improvements. The intersection is also not expected to meet one or more signal warrants until 2020, based on the current projections. With a traffic signal in place in 2030 the intersection will operate at LOS C. (Without the signal the eastbound side street would fall to LOS F with unacceptable delays.)

In addition to the capacity improvements discussed above, Alternative 2B would remove the signal at US 51 and Jennings Street. This is recommended because the signal is unwarranted and possibly a safety hazard. The side street volumes at this location are low and the change can be made without a significant LOS impact as shown in Table 2.

Table 2: PM Peak Hour Intersection Levels of Service

Int. #	Intersection	Type (Future)	Approach	2002		2010						2020						2030					
				Existing Conditions		ALT 1		ALT 2, 3, 4A,		ALT 5A		ALT 1		ALT 2, 3, 4A,		ALT 5A		ALT 1		ALT 2, 3, 4A,		ALT 5A	
				Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS	Ave. Delay	LOS
1	US 51 / US 62	Varies	Eastbound	13.1	B	26.7	D	15.9	B	18.9	C	29.8	D	15.9	B	22.3	C	41.7	E	15.9	B	27.9	D (1)
			Westbound	12.9	B	45.7	E	17.8	B	18.4	C	100.2	F	18.3	B	24.5	C	774.5	F	18.8	B	42.2	E (1)
			Northbound	7.6	A	8.0	A	18.9	B	7.9	A	8.1	A	22.4	C	7.9	A	8.2	A	29.8	C	8.0	A
			Southbound	8.1	A	9.1	A	13.9	B	8.5	A	9.2	A	14.8	B	8.8	A	9.6	A	16.5	B	9.1	A
			Intersection	-	-	-	-	16.8	B	-	-	-	-	18.8	B	-	-	-	-	22.6	C	-	-
2	US 51 / Jennings St.	2-Way STOP (2)	Eastbound	16.4	B	16.3	B	15.3	C	13.8	B	16.6	B	17.0	C	16.0	C	16.6	B	21.1	C	16.0	C
			Westbound	15.8	B	16.1	B	17.0	C	14.1	B	16.3	B	19.0	C	15.1	C	16.3	B	24.2	C	18.1	C
			Northbound	13.4	B	18.2	B	8.2	A	8.0	A	21.2	C	8.3	A	8.1	A	28.0	C	8.6	A	8.3	A
			Southbound	12.7	A	16.4	B	8.4	A	8.1	A	17.6	B	8.6	A	8.3	A	20.9	C	8.9	A	8.5	A
			Intersection	13.4	B	17.3	B	-	-	-	-	19.2	B	-	-	-	-	24.1	C	-	-	-	-
3	US 51 / KY 123 (Elsey Ave.)	2-Way STOP	Eastbound	10.3	B	21.7	C	21.7	C	14.8	B	31.1	D	31.1	D	18.0	C	61.5	F	19.4	B	23.3	C
			Westbound	12.9	B	17.4	C	17.4	C	11.8	B	21.2	C	21.2	C	15.2	C	23.9	C	16.3	B	16.2	C
			Northbound	7.8	A	8.3	A	8.3	A	8.0	A	8.4	A	8.4	A	8.2	A	8.7	A	28.2	C	8.3	A
			Southbound	7.8	A	8.2	A	8.2	A	7.8	A	8.4	A	8.4	A	7.9	A	8.6	A	19.2	B	8.1	A
			Intersection	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	23.2	C	-	-
4	US 51 / KY 1181	1-Way STOP	Westbound	9.9	A	10.8	B	10.8	B	10.8	B	12.0	B	12.0	B	12.0	B	12.8	B	12.8	B	12.8	B
			Southbound	7.5	A	7.8	A	7.8	A	7.8	A	7.9	A	7.9	A	7.9	A	8.1	A	8.1	A	8.1	A
5	US 51 / KY 1377	1-Way STOP	Westbound	8.8	A	10.1	B	10.1	B	10.1	B	10.1	B	10.1	B	10.1	B	10.4	B	10.4	B	10.4	B
			Southbound	7.6	A	7.9	A	7.9	A	7.9	A	7.9	A	7.9	A	7.9	A	8.1	A	8.1	A	8.1	A
6	US 51N / Bypass	1-Way STOP (4)	Westbound	-	-	-	-	-	-	10.5	B	-	-	-	-	11.0	B	-	-	-	-	11.6	B
			Southbound	-	-	-	-	-	-	8.2	A	-	-	-	-	8.3	A	-	-	-	-	8.4	A
7	US 62 / Bypass	2-Way STOP (4)	Eastbound	-	-	-	-	-	-	11.1	B	-	-	-	-	11.6	B	-	-	-	-	13.0	B
			Westbound	-	-	-	-	-	-	11.6	B	-	-	-	-	12.3	B	-	-	-	-	13.9	B
			Northbound	-	-	-	-	-	-	7.7	A	-	-	-	-	7.7	A	-	-	-	-	7.8	A
			Southbound	-	-	-	-	-	-	7.8	A	-	-	-	-	7.8	A	-	-	-	-	7.8	A
8	US 51S / Bypass	2-Way STOP (4)	Eastbound	-	-	-	-	-	-	8.2	A	-	-	-	-	8.2	A	-	-	-	-	8.4	A
			Southbound	-	-	-	-	-	-	12.4	B	-	-	-	-	13.6	B	-	-	-	-	15.4	C

Notes:
(1) Installation of a traffic signal will result in LOS C or better for all movements and LOS B for the intersection overall
(2) Removal of the traffic signal at Jennings is included in all of the build scenarios
(3) The eastbound approach to intersection #3 operates at LOS F without the signal
(4) Signals may be required at major new intersections on the bypass for safety reasons

Alternatives 3, 4A, and 4B all assume the spot improvements will be in place, resulting in similar levels of service at the key intersections. One exception is the US 51 / KY 1181 intersection because the 4A and 4B Alternatives will shift traffic away from that intersection, actually causing it to operate better than shown. For the design year of 2030, the intersection levels of service for Alternatives 2, 3, 4A and 4B are shown on Figure 7.

Alternative 5A

Alternative 5A addresses the LOS deficiencies on US 51 by diverting traffic around the town. The traffic diversion results in acceptable levels of service at all of the study intersections until 2030. In 2030 the eastbound and westbound approaches to the US 51 / US 62 intersection will fall to LOS D and E respectively. Installation of a signal at that time however, would improve the intersection to LOS C, correcting the LOS problem. The 2030 volumes at the intersection are projected to meet one or more signal warrants. For the design year of 2030, intersection levels of service are shown on Figure 8.

Two-Lane Level of Service

The traffic analysis also examined levels of service on US 51 north and south of town and on the proposed 5A bypass. For two-lane highways, level of service is a measure of the average travel speed and the percent time, on average, that a driver will spend following another vehicle. The seven analysis segments were:

1. Ashford Street to Stanley Road
2. Stanley Road to KY 1203
3. KY 1203 to Ballard County Line
4. Bob Brown Road to KY 1377
5. KY 1377 to KY 1181
6. Alternative 5A bypass from old US 51 (north) to US 62 (northern segment)
7. Alternative 5A bypass from old US 51 (south) to US 62 (southern segment)

Similar to the intersection analysis, there are similarities between many of the build alternatives. In fact, Alternatives 1, 2, 3, 4A, and 4B have all been grouped together because they have similar traffic volume and operating characteristics north of Ashford Street and south of KY 1181. The bypass alternative however was examined separately because of the substantially different alignment. The two-lane LOS results are summarized in Table 3 and Figures 7 and 8.

Figure 7: Alternatives 2, 3, 4A and 4B 2030 Intersection and Segment LOS

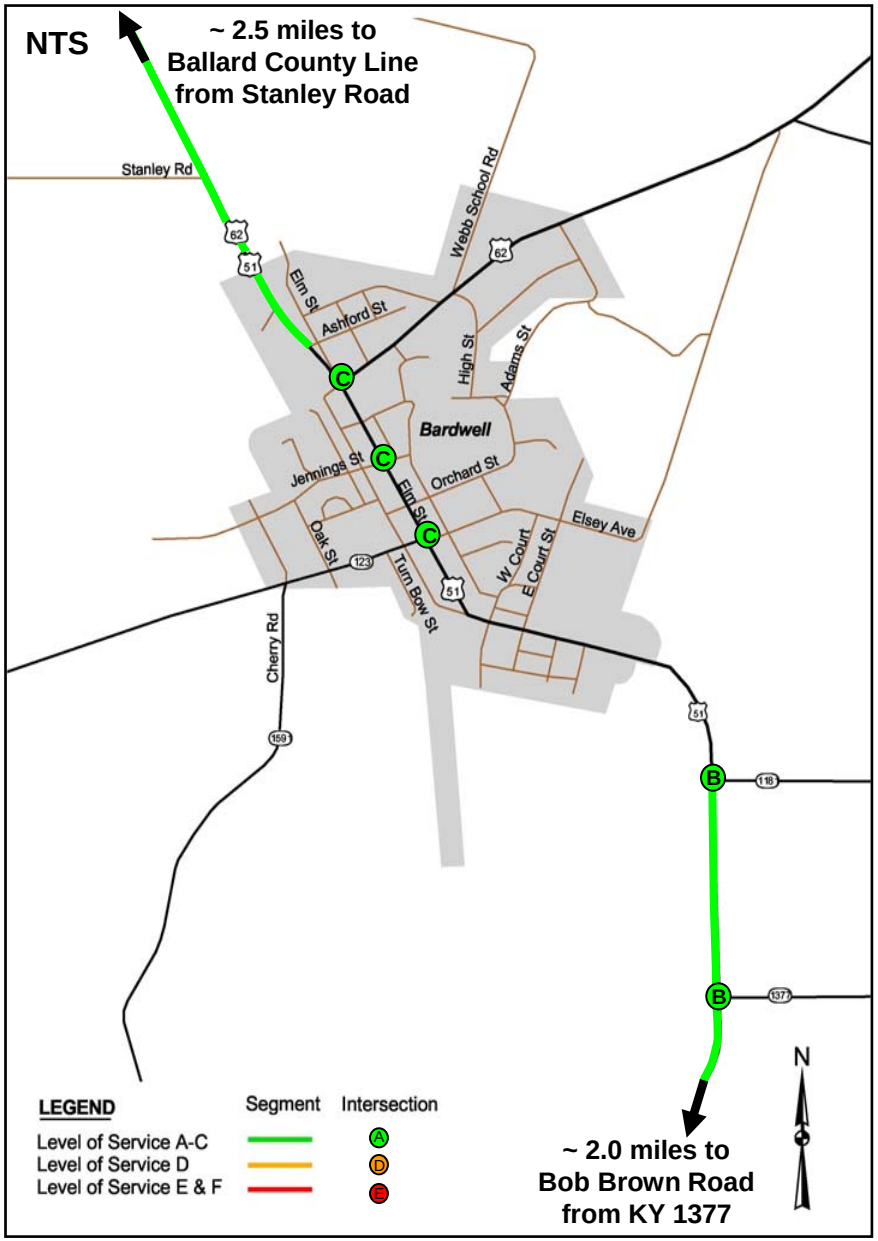


Figure 8: Alternative 5 2030 Intersection and Segment LOS

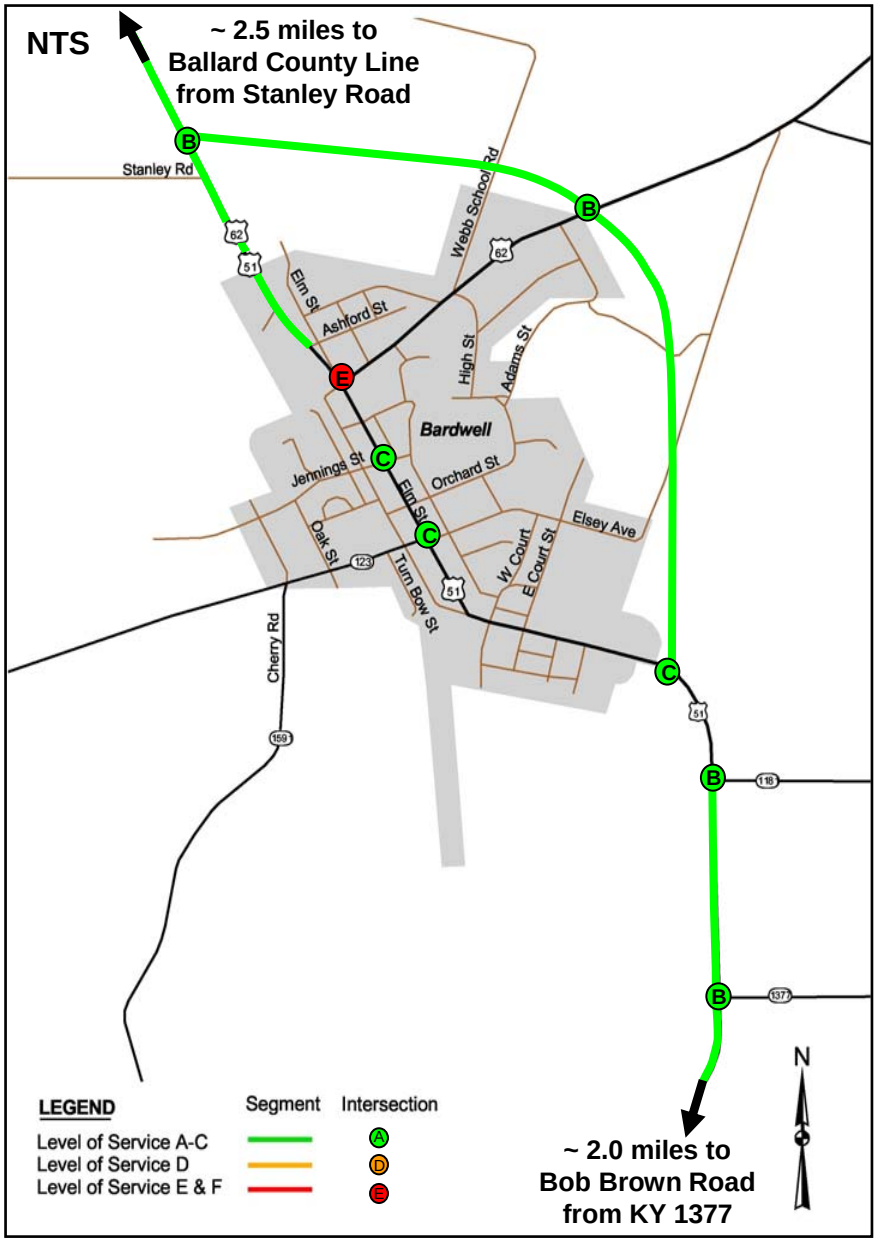


Table 3: Two-Lane Level of Service Analysis

Segment	2002		2010		2020		2030	
	Alts. 1 to 4B	Alt. 5	Alts. 1 to 4B	Alt. 5	Alts. 1 to 4B	Alt. 5	Alts. 1 to 4B	Alt. 5
Stanley Road to KY 1203	C	C	C	C	C	C	C	C
KY 1203 to Ballard County Line	C	C	C	C	C	C	C	C
Bob Brown Road to KY 1181	C	C	C	C	C	C	C	C
US 51 N to US 62 (northern segment)	-	B	-	B	-	B	-	C
US 51 S to US 62 (southern segment)	-	B	-	B	-	B	-	B

The two-lane analysis showed that nearly all of the existing segments operate at LOS C and will continue to operate at LOS C through 2030 without improvements. The only exception is Ashford Street to Stanley Road, which is projected to drop to LOS D in 2020. This segment is on the LOS C/D threshold for speed and drops to LOS D because of the percent time spent following (73% compared to a 65% threshold for LOS C/D). However, improvements are not deemed to be warranted for this segment because 1) it is close to the LOS C threshold; 2) the segment is short (less than half a mile); and 3) it is not projected to be an issue until 2020. The two-lane analysis showed that the bypass segments will also operate at LOS C or better through 2030.

Impact of I-66 and I-69 on US 51 Traffic Volumes

Due to the proximity to the study area of the proposed Interstate 66 and Interstate 69 highways, the project team investigated the possible impact of these highways on future US 51 traffic volumes. Regarding I-69 in the vicinity of the study area, the Kentucky Transportation Cabinet is considering the possibility of designating the Purchase Parkway as I-69 from the Tennessee State Line to Interstate 24. From there, I-69 will run concurrent with I-24 to the Western Kentucky Parkway.

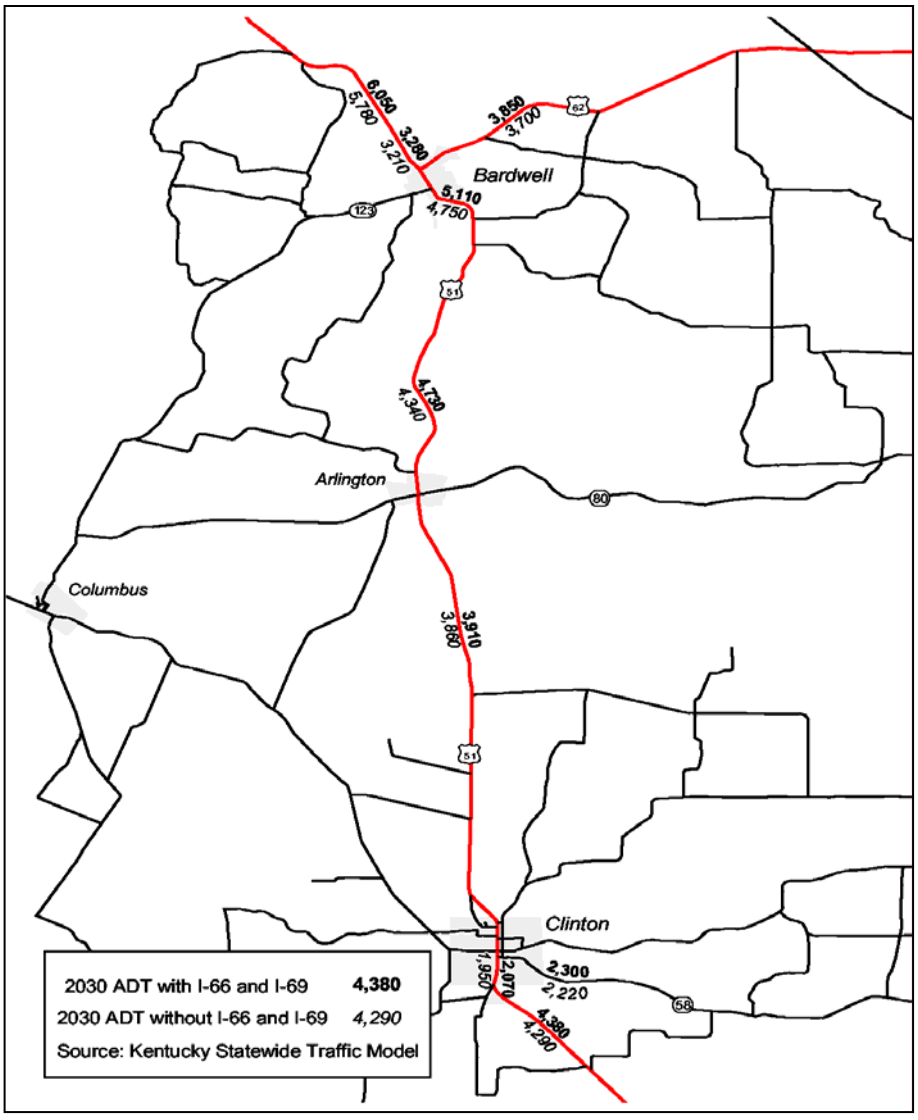
The final recommendation for I-66 in Western Kentucky is currently a no-build approach. However, the Kentucky Statewide Traffic Model (KYSTM) was reviewed to determine whether or not a proposed I-66 and I-69 highways would significantly increase traffic volumes on US 51. Year 2030 KYSTM assignments were examined both with and without the proposed new interstates in place. The results of these two runs are illustrated in Figure 9. As shown, the increase in traffic is not significant in the study area when I-66 and I-69 are added to the model. This is likely due to two factors:

1. The US 51 corridor is in a rural, sparsely populated area of the state. There are not a lot of trips in the corridor to begin with and even the addition of I-66 and I-69 will not generate enough growth in the corridor to cause a significant increase in traffic. The KYSTM version that contains I-66 and I-69 also includes

projections for population and employment growth in these corridors as a result of their construction.

2. On a system-wide level, I-55/I-57 to the west and US 45 to the east are parallel north-south alternatives to US 51, which connect population centers of considerably larger size. US 51 connects Fulton at its south end to Wickliffe and Cairo, Illinois at its northern terminus.

Figure 9: Traffic Impacts of I-66 and I-69



Traffic Forecast Summary

Traffic volumes on US 51 in Bardwell are not expected to increase significantly by the year 2030. However, even with modest traffic growth, the future level of service for some intersection approaches may begin to decline. These intersection LOS issues can be addressed through implementation of spot improvements and/or more extensive highway improvements. No major segment LOS issues are expected in the study area through 2030, with or without the proposed 5A bypass. The proposed 4A and 4B realignments will divert most of the traffic from the current US 51 just south of town, but will not affect traffic volumes through town. The proposed 5A bypass will divert approximately 1,400 to 1,900 vehicles per day in 2030 from US 51 (including most heavy trucks). One reason these volumes are relatively low is that overall through volumes on US 51 are projected to be low. The potential addition of I-66 and I-69 in Western Kentucky is not expected to have a significant impact on future US 51 traffic in the area.