Appendix B: Design Documentation Report

Phase A Design Documentation

US 11 Widening

Forrest and Lamar County

Mississippi Department of Transportation

MDOT PROJECT # 109496 / 304000

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Suite 325

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September 15th, 2026

Garver Project No.: T18-2500293

General Scope of Work

The segment of US 11 from just north of Old Okahola Road to Forrest County Line is to be evaluated for potentially widening. We were unable to find any as-built plans to aid in the development of an existing centerline so we used an aerial imagery. Once survey information was provided, the horizontal alignment was adjusted to match topographic survey. Per the MDOT Functional Classification map for Lamar County, US 11 is a Major Collector. A small portion of US 11 falls into the Hattiesburg Urban Area as a minor arterial, but we consider the entire project a Major Collector.

FCS Classifications\FORREST_FCS.pdf

FCS Classifications\HATTIESBURG_URB_FCS.pdf

FCS Classifications\LAMAR_FCS.pdf

Geometric Design

Typical Sections

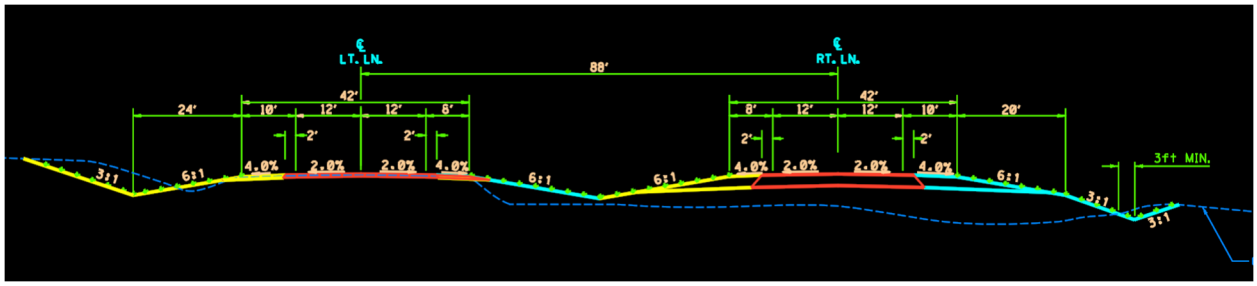
Per the scope of work, Garver is to analyze four-lane alternatives for this project. Alternative A will be the no-build option. Alternative B will be to widen US 11 to the West by adding two additional lanes for future US 11 SB and utilizing existing US 11 as future US 11 NB lanes. Alternative C will be to widen US 11 to the East by adding two additional lanes for future US 11 NB and utilizing existing US 11 as future US 11 SB lanes. If desired Alternative D will use a combination of both Alternative B and C to minimize impacts. This alternative will be required if the findings of the environmental study and cultural resources among other factors. *Nothing in the environmental study or cultural resources indicated that Alternative D would be required.*

Multiple divided typical sections were evaluated for Alternative B and C. An 88’ centerline to centerline with depressed median typical section with unrestricted median openings, an 88’ centerline to centerline with depressed median typical section with restricted crossing u-turn (RCUT) median openings, and a 64’ centerline to centerline with raised median were all evaluated as potential options for proposed US 11 widening. It was decided through discussion with MDOT that the typical section to move forward in evaluation was an 88’ centerline to centerline with depressed median and RCUT median openings.

Due to potential impacts to existing residential area south of the Eagle One Mega Site, it was decided through discussion with MDOT that the widening of US 11 would end north of the existing residential area. A two-lane undivided typical section would be utilized through this area based on 3R criteria.

Table 2-9-E
GEOMETRIC DESIGN CRITERIA FOR RURAL COLLECTORS (MULTILANE)
(New Construction/Reconstruction)

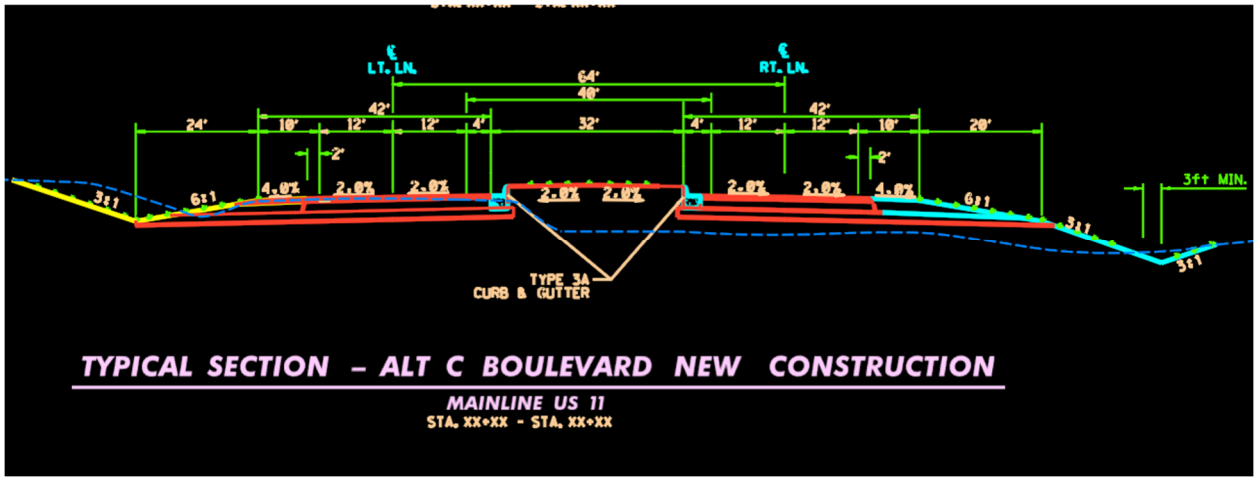
	DESIGN ELEMENT			Manual Section	Multilane
Design Controls	Design Year			2-3.02	20 years
	*Design Speed (1)			2-2.01	65 mph
	Control of Access			11-1.05	Control by Regulation (Type 3)
	Level of Service Threshold			2-3.04	C
Cross-Section Elements	*Travel Lane Width			2-8.03	12 ft
	Outside Shoulder Width	*Usable		2-8.03	10 ft
		Paved (2)			2 ft
	Median Shoulder Width	*Usable		2-8.03	8 ft
		Paved (2)			2 ft
	*Cross Slope	Travel Lane (3)		2-8.03	2%
		Shoulder			See Note (4)
	Auxiliary Lanes	Lane Width		2-8.03	12 ft
		Usable Shoulder Width			Same Usable/Paved Width Adjacent to Travel Lane
	Median Width	Depressed (5)		2-8.03	64 ft Typical
	New and Reconstructed Bridges	*Design Loading Structural Capacity		2-8.03	HL-93
		Minimum Width (6)			Traveled Way + 10 ft (outside shoulder) + 6 ft (median shoulder)
	Existing Bridges to Remain in Place	*Design Loading Structural Capacity		2-8.03 12-2.03	See Note (7)
		Minimum Width			
	Desirable Right of Way Border Width (beyond toe/top of fill/cut slope)			2-8.03 11-1.01	30 ft
	Roadside Clear Zone	Guardrail		2-8.03 9-2.0	Usable Shoulder Width
		Obstruction			See Note (8)
	Slope Schedule (9)	Cut	Foreslope (within clear zone)	2-8.03	6:1
			Depth of Ditch		4 ft
			Backslope		3:1
		Fill	Safety Slope (within clear zone)		6:1
			Fill Slope (outside clear zone)		3:1



The above design criteria shows the dimensions used to develop both open shoulder alternatives B and C.

Table 14-2-G
GEOMETRIC DESIGN CRITERIA URBAN ARTERIALS (MULTILANE)
(New Construction/Reconstruction)

	DESIGN ELEMENT			Manual Section	With Curb	Without Curb
Design Controls	Design Year			14-2.01	20 Years	
	*Design Speed **(1)**			14-2.02	45 mph – 55 mph	45 mph – 60 mph
	Control of Access			11-1.05	Desirable: Partial (Type 2A or 2B) Minimum: Control by Regulation (Type 3)	
	Level of Service Threshold			14-2.01	Desirable: C Minimum: D	
Cross-Section Elements	*Travel Lane Width **(2)**			14-2.06	12 ft	
	Outside Shoulder Width	*Usable **(3)**		14-2.06	Des: 10 ft Min: 6 ft	10 ft
		Paved			Same as Usable	8 ft
	Median Shoulder Width	*Usable **(3)**		14-2.06	Des: 4 ft Min: 2 ft	8 ft
		Paved			Same as Usable	3 ft
	*Cross Slope	Travel Lane **(5)**		14-2.06	2%	
		Shoulder			Shoulder Width > 4 ft: 4% Shoulder ≤ 4 ft: 2%	See Note **(6)**
	Auxiliary Lanes	Lane Width		14-2.07	Same as Travel Lane	
		Usable Shoulder Width			Des: 4 ft Min: 2 ft	Same as Mainline Shoulder
	CTWLTL Width **(7)**			6-4.03	Desirable: 14 ft Minimum: 12 ft	
	Parking Lane Width **(8)**			14-2.06	Desirable: 12 ft Minimum: 10 ft	
	Sidewalk Width			14-2.06	Minimum: 5 ft	
	Median Width	Depressed		6-8.02	64 ft	
		Raised		14-2.06	See Note **(9)**	
	New and Reconstructed Bridges	*Design Loading Structural Capacity		14-2.06	HL-93	
		Minimum Width **(10)**			Approach Roadway Width	Traveled Way + 10 ft (outside shoulder) + 6 ft (median shoulder)
	Existing Bridges to Remain in Place	*Design Loading Structural Capacity		12-3.0 14-2.06	See Note **(11)**	
		Minimum Width				
	Desirable Right of Way Border Width (beyond toe/top of fill/cut slope)			11-1.01 14-2.06	See Note **(12)**	
	Roadside Clear Zone	Guardrail		9-2.0	Usable Shoulder Width	
		Lateral Offset		14-2.06	1.5 ft **(13a)**	See Note **(13b)**
	Slope Schedule **(14)**	Cut	Foreslope	14-2.08	+2%	4:1
			Depth of Ditch		1 ft	4 ft
			Backslope		Des: 3:1 Max: 2:1	3:1
		Fill	Height ≤ 10 ft		Des: 3:1 Max: 2:1	4:1
			Height > 10 ft			4:1 (within clear zone) 3:1 (outside clear zone)



The above dimensions will be used to consider a boulevard option for US 11.

9. *Median Width (Raised) – The minimum raised median width on urban roadways should be 18 feet. This width should only be used where the majority of the intersections along the roadway are signalized. If many of the intersections are not signalized, then the recommended width is 22 feet, assuming no right of way restrictions. The 22-foot median width allows passenger vehicles to store within the median crossover. For medians with dual left-turn lanes, the raised median should desirably be 36 feet, but the minimum should be 30 feet.*

The median width shown on these cross-section options will be able to comfortably accommodate dual left-turn lanes.

Once Alternative B was selected to proceed to NEPA study, RWD-600 was provided to provide typical section information for the three sections of the project. The first section runs from the BOP to the start of the four lane section. This section will be a 3R improvements as only improvements through this section will be to improve current highways shoulder width and foreslopes as a proposed four lane section would be too impactful as this section has developed sections on either side of the existing highway. MDOT wanted to limit impacts through this section. Per section 12-2.08.01 of the MDOT Roadway Design Manual, the clearzone desirably will meet clearzone noted in Section 9-2.0; however, if not feasible the recommended clearzones listed in Table 12-2-B should be used. Based on design speed of 55 mph and ADT over 6000 the clearzone should be 16'. Based on the RWD-600, a 3' minimum cut ditch is recommended. The bottom of the ditch would be 17' from the edge of travel lane. In order to maintain a consistent roadway template from fill section to cut section a clear zone of 17' was utilized.

Two typical sections for the US 11 four lane section will be needed as the existing US 11 lanes will be overlaid in some areas where the proposed US 11 NB profile matches existing; however, there are some sections of existing US 11 that requires a revised profile to meet minimum K values. In these sections the existing US 11 lanes will be reconstructed to meeting the revised profile.

Per the RWD-600, the typical that will be used from Sta. 32985 – Sta. 409+75 will be based on the Rural Collector Criteria, while the typical that is used from Sta. 409+75 – EOP will be the Urban Arterial Criteria. The RWD-600 can be found here: L:\2025\T14-2500972 - MDOT Highway 11 EA\Design\Reports\Approved RWD-600 109496_104000-2026-5-8.pdf

On 9/4/2026, MDOT requested that our typical at the EOP match the beginning typical of Michael Baker's project. This typical consisted of a 4-lane undivided road. Our drawings were updated to match. They also request that our EOP move to Sta. 450+00.

Horizontal Alignment

The initial transition from two-lane to four-lane uses a reverse curve transition with 9890’ Radii to maintain normal crown. Alternative B and Alternative C are the same dimensions here but reversed. Centerline to centerline width is 88’. Reverse curve was subsequently change to use a 7330’ radius to utilize reverse crown superelevation.

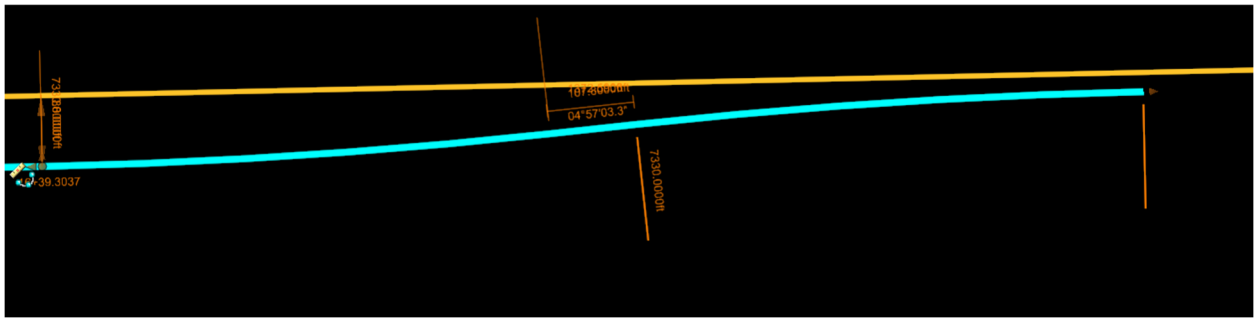


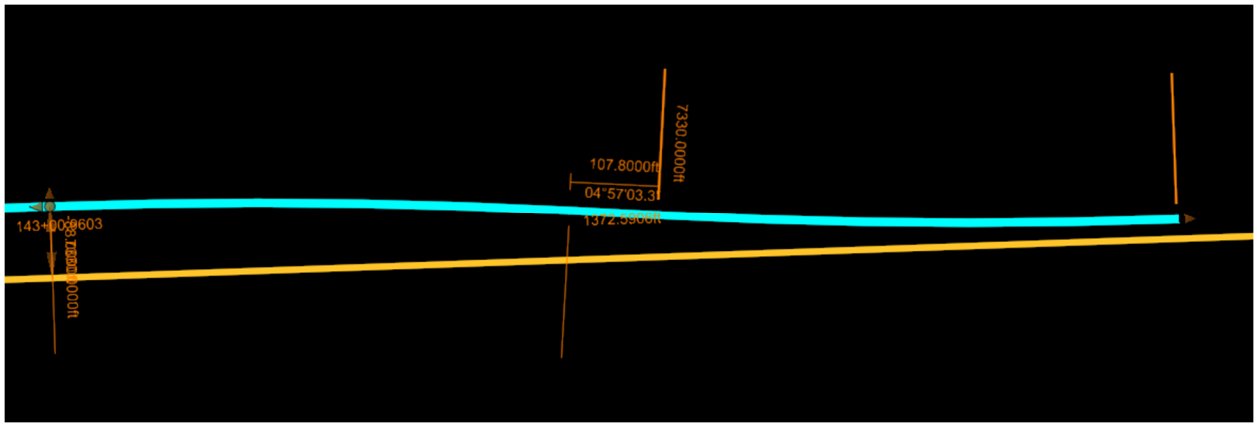
The end transition for Alt B and Alt C use 7330’ Radii on the reverse curve transition for e = RC. RC was chosen as we will be transitioning from 4 lane undivided (RC) to 4 lane divided. The tangent length ahead of this transition curve should be at long enough to transition from RC from divided section to RC for transition.

$$0.7L_1 + 0.7L_2 = 0.7(84) + 0.7(77) = 112.7$$

The tangent length between the transition curves also allow to transition from RC to RC in the other direction.

$$0.7L_1 + 0.7L_2 = 0.7(77) + 0.7(77) = 107.8$$





A 9’ radius was used to end the median on both transitions:



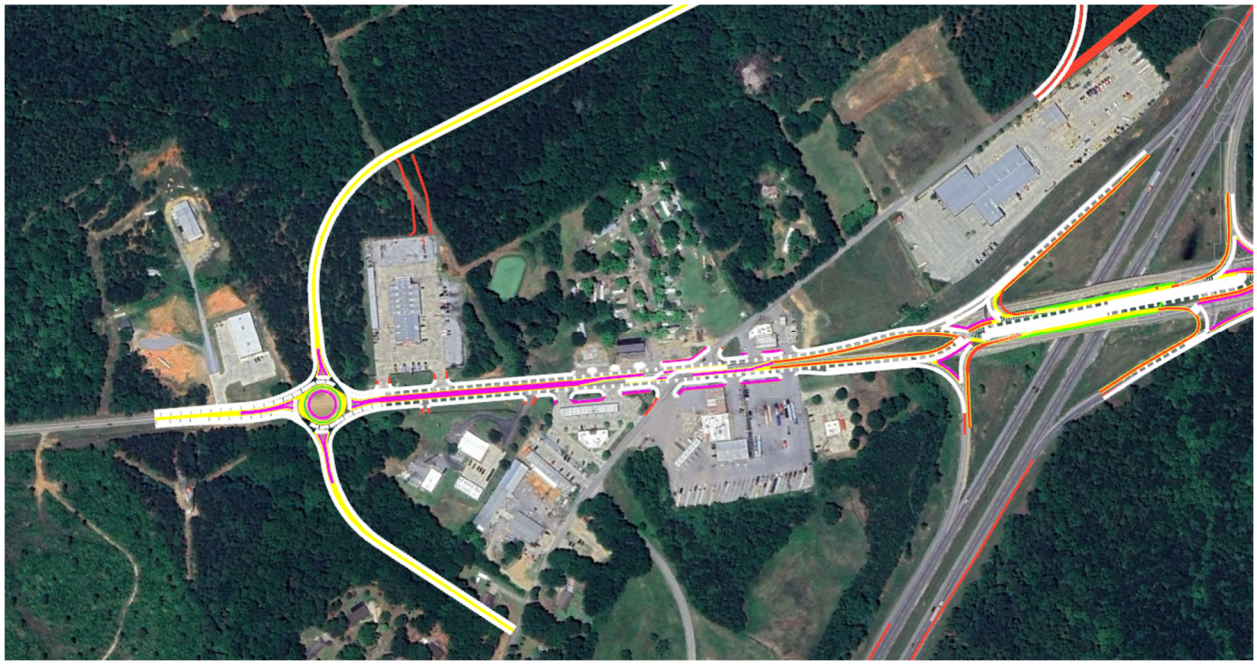
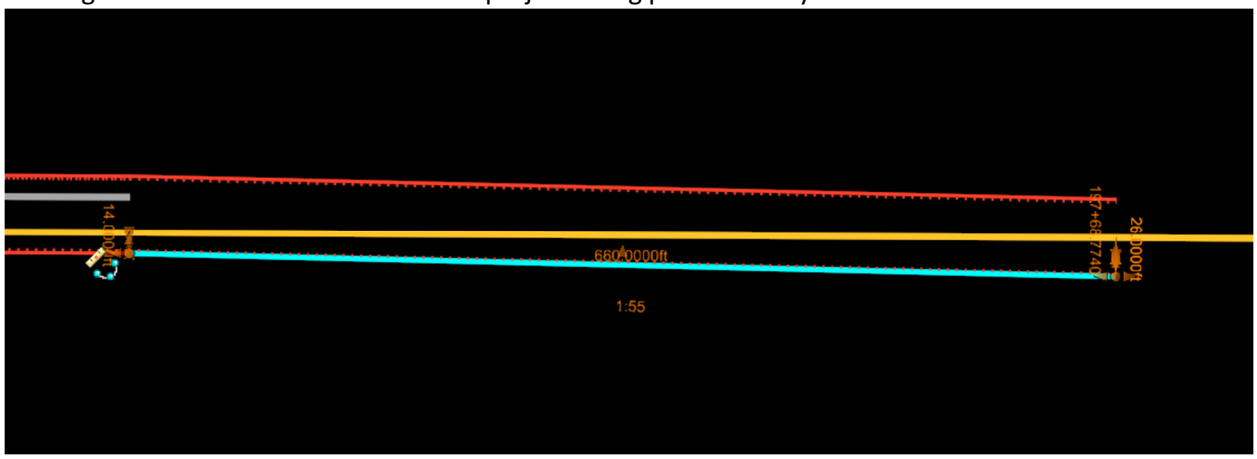


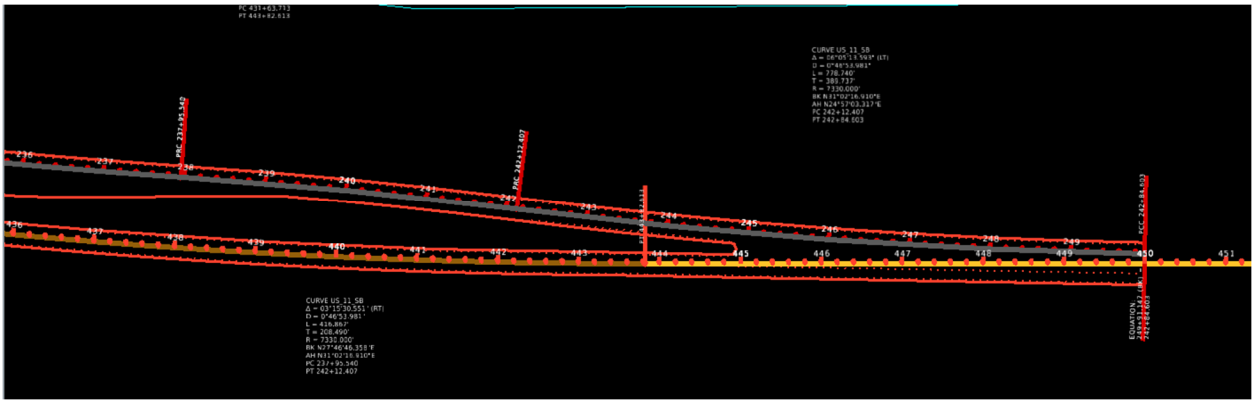
Figure 1KMZ Provided of Project We are Tying into

A KMZ was provided of the DDI project being done by others. The four-lane section of this project that we will be tying into is widening to both sides of the existing roadway aligned by the center of the existing road. Since we are widening to either side of the existing road with a median, a shift to tie in will be necessary.

A lane shift (WS=660') was performed here to align our proposed widening along the centerline of existing US 11 to match the roundabout project being performed by others.



As discussed in the Typical Section segment of this document, MDOT requested we adjust our EOP to match the DDI project to the north. This change pushed our transition back into a curve on the mainline so the geometry needed to be adjusted.



The 660’ taper on the NB lanes remained to center us up on the existing US 11 alignment but the SB lane transitioned needed to use a 7330’ reverse curve that ends tangent at Sta. 450+00 in order to fit.

Vertical Profile

US 11 4-Lane Divided

The proposed vertical profile for the future US 11 SB lanes was designed based on the provided RWD-600 as shown below. The existing US 11 profile was evaluated based on the below design criteria as well.

Table 2-9-E: Rural Collectors (Multilane) (New Construction/Reconstruction) with Minimum Criteria

Control of Access:	Control By Regulation (Type 3)	* Design Speed (mph):	55
* Travel Lane Wd:	12 ft	* Stopping Sight Distance:	645 ft
* Outside Shoulder Wd (Usable):	10 ft	* Max Superelevation Rate:	10%
		* Max Grade (Level):	4.5%
Outside Shoulder Wd (Surfaced):	2 ft	Min Grades:	0.4%
		* Vertical Curve (Crest K-Value):	193
* Cross Slope Travel Lane:	2%	Vertical Curve (Sag K-Value):	157
* Cross Slope Shoulder:	See Note 4	* Vertical Clearance (New):	16 ft
Median Wd Depressed:	64 ft Typical	* Vertical Clearance (Existing):	14.5 ft
* New Bridge Structural Capacity:	HL-93	* Vertical Clearance (Sign Truss):	19 ft
		Vertical Clearance (Over):	25 ft
New Bridge Min Wd:	Traveled Way + 10 ft (outside shoulder) + 6 ft (median shoulder)		

Based on the evaluation of the existing US 11 profile, the existing profile is going to have to be modified to meet the current design criteria. Given that existing US 11 appears to be concrete pavement overlaid with asphalt, the assumption is that the existing US 11 will be removed or the existing concrete pavement rubbleized and new pavement structure constructed. The proposed 4 lane divided profile was designed based on constructing future US 11 SB lanes first while maintaining traffic on existing US 11. Once traffic is swapped over to the newly built US 11 SB lanes, existing US 11 pavement would be removed or rubbleized; and the proposed US 11 NB would be constructed with a proposed profile that meets current design requirements while staying within the maximum vertical separation from the US 11

SB lanes to ensure propers slopes for median openings. Sight distance for local road intersections were verified for proposed profiles.

US 11 – 2 Lane Undivided

Profile for new construction 2-lane divided was designed based on the following design data from the RWD-600.

Table 2-9-D: Rural Collectors (2-Lane) (New Construction/Reconstruction) with Minimum Criteria

Control of Access:	Control By Regulation (Type 3)	* Design Speed (mph):	55
* Travel Lane Wd:	12 ft	* Stopping Sight Distance:	495 ft
* Outside Shoulder Wd (Usable):	8 ft	* Max Superelevation Rate:	10%
		* Max Grade (Level):	6%
Outside Shoulder Wd (Surfaced):	2 ft	Min Grades:	See Note 11
		* Vertical Curve (Crest K-Value):	114
* Cross Slope Travel Lane:	2%	Vertical Curve (Sag K-Value):	115
* Cross Slope Shoulder:	See Note 4	* Vertical Clearance (New):	16 ft
* New Bridge Structural Capacity:	HL-93	* Vertical Clearance (Existing):	14.5 ft
		* Vertical Clearance (Sign Truss):	19 ft
New Bridge Min Wd:	40 ft	Vertical Clearance (Over):	25 ft
* Existing Bridge Structural Capacity:	See Note 7		

US 11 – 3R

Profile for section of US 11 between Old Okahola Road and the beginning of the profile grade increase for the future rail spur was evaluated based on the 3R criteria provided in the RWD-600 design criteria below.

Table 12-2-E: Rural Collectors (2-Lane) (3R Criteria) with Minimum Criteria

Control of Access:	Control By Regulation (Type 3)	* Design Speed (mph):	55
* Travel Lane Wd:	12 ft	* Stopping Sight Distance:	See Section 12-2.05
* Outside Shoulder Wd (Usable):	5 ft	* Max Superelevation Rate:	10%
		* Max Grade (Level):	Existing
Outside Shoulder Wd (Surfaced):	2 ft	Min Grades:	See Note 12
		* Vertical Curve (Crest K-Value):	114
* Cross Slope Travel Lane:	2%	Vertical Curve (Sag K-Value):	115
* Cross Slope Shoulder:	See Note 5	* Vertical Clearance (New):	16 ft
* New Bridge Structural Capacity:	See Note 6	* Vertical Clearance (Existing):	14.5 ft
		* Vertical Clearance (Sign Truss):	19 ft
New Bridge Min Wd:	34 ft	Vertical Clearance (Over):	23.5 ft
* Existing Bridge Structural Capacity:	See Note 7		

There is one section of existing US 11 vertical profile that needed to be modified as the existing sag curve created inadequate sight distance for the existing White Chapel Road intersection. Through evaluation of multiple alternatives to improve the sight distance at the intersection, it was decided through discussions with MDOT to raise the existing US 11 sag curve just north of the Old Okahola Road intersection. Discussion of White Chapel/Old Okahola intersection improvements and US 11 detour for profile changes is discussed below.

Southern Detour Design

The following tables were used to determine reverse transition geometry and typical sections for the detour:

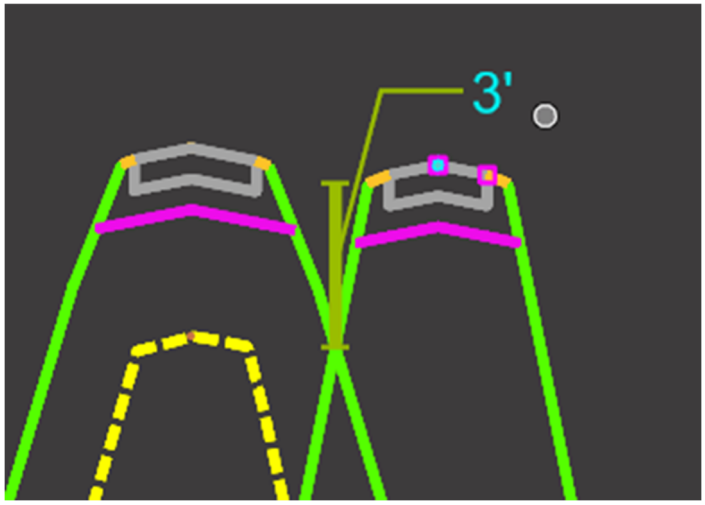
Table 10-5-B
MINIMUM RADII FOR TEMPORARY HORIZONTAL CURVES

Design Speed (mph)	R_{min} (ft)
30	400
35	600
40	800
45	1100
50	1400
55	1900
60	2600
65	3300
70	4500

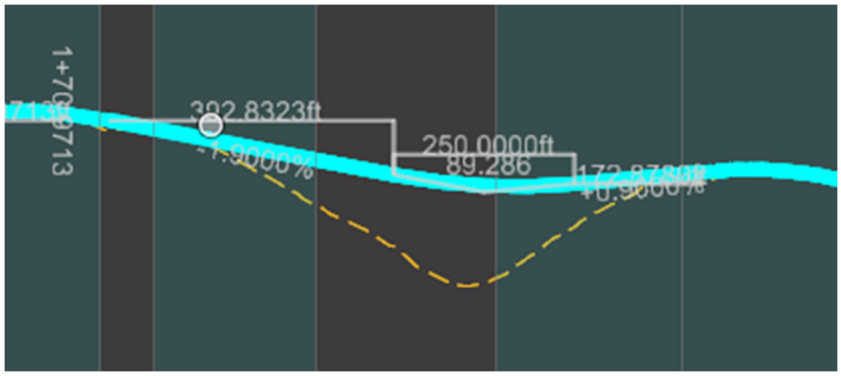
Table 10-5-C
MINIMUM WIDTHS OF ON-SITE DETOURS
(2-Lane, 2-Way Roadways)

DHV	Roadway Width (ft)		Bridge Width (ft)
	Lanes	Shoulders	
≤ 200	12	3	24
> 200	12	5	24

The minimum lateral offset was found by offsetting the US 11 centerline by 75’ and running a model on it. This offset was then gradually brought in to *60’,* which is where the minimum ditch depth between the mainline model and detour model was 3’.



The profile was designed by getting instantaneous grades at both the beginning takeoff and the end takeoff, which were -1.9% and 0.9% respectively. New construction k-values were used here for our sag which was 79 min. I could only fit one curve into the profile which happened to be 250’.

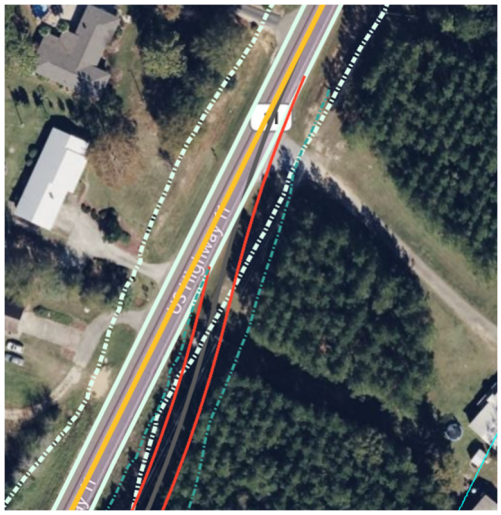


This matched our proposed US 11 grading fairly well. A box extension will be required underneath this sag.

After running a model with 12’ lanes, 5’ shoulders, 2:1 side slopes, and a ditch depth of 3’, the footprint is reduced to only be impacting the property’s two driveways and dirt parking lot, which we are already going to be impacting from the mainline improvements.



The impacts to properties at the end of the detour also appear to have been minimalized:



Local Roads

Old Okahola:
The following table was used to generate typical sections for local roads. We lacked traffic data for some local roads and used the same typical for those in models.

Table 2-9-F
GEOMETRIC DESIGN CRITERIA FOR RURAL LOCAL ROADWAYS
(New Construction/Reconstruction)

	DESIGN ELEMENT		Manual Section	Design ADT				
				Under 400	400 – 2,000			Over 2,000
Design Controls	*Design Speed **(1)**		2-2.01	30 mph	30 – 45 mph			See Table 2-9-D
	Control of Access		11-1.05	Control by Regulation (Type 3)				
	Level of Service Threshold		2-3.04	C				
Cross-Section Elements	*Travel Lane Width		2-8.03	10 ft	11 ft			
	Shoulder Width	*Usable	2-8.03	4 ft	6 ft			
		Paved **(2)**		2 ft	2 ft			
	*Cross Slope	Travel Lane **(3)**	2-8.03	2%				
		Shoulder		See Note **(4)**				
	Auxiliary Lanes	Lane Width	2-8.03	10 ft	11 ft			
		Usable Shoulder Width		4 ft	6 ft			
	New and Reconstructed Bridges	*Design Loading Structural Capacity	2-8.03	HL-93				
		Minimum Width **(5)**		26 ft or Approach Roadway Width (whichever is greater)				
	Existing Bridges to Remain in Place	*Design Loading Structural Capacity	2-8.03 12-2.03	See Note **(6)**				
		Minimum Width						
	Roadside Clear Zone	Guardrail	2-8.03 9-2.0	Usable Shoulder Width				
		Obstruction		See Note **(7)**				
	Slope Schedule **(8)**	Cut Foreslope	2-8.03	3:1	4:1			
		Depth of Ditch		3 ft				
		Backslope		3:1				
		Fill Slope		Desirable: 4:1 Minimum: 3:1				
Alignment Elements	**DESIGN SPEED**			**30 mph**	**35 mph**	**40 mph**	**45 mph**	
	*Stopping Sight Distance		2-8.02	200 ft	250 ft	305 ft	360 ft	
	Intersection Sight Distance **(9)**		6-6.0	335 ft	390 ft	445 ft	500 ft	
	*Superelevation Rate		2-8.02 3-4.01	e_{max} = 6%				
	*Minimum Horizontal Curve Radius (e_{max} = 6%)		2-8.02 3-3.0	231 ft	340 ft	485 ft	643 ft	
	*Maximum Grades	Level	2-8.02 4-3.01	7%				
		Rolling		8%				
	Minimum Grades		4-3.02	See Note **(10)**				
	Vertical Curve (K-values)	*Crest	2-8.02 4-5.0	19	29	44	61	
		Sag		37	49	64	79	
	*Vertical Clearance (local roadway under) **(11)**	New/Reconstructed Bridges	2-8.02	Desirable: 17 ft Minimum: 16 ft				
		Existing Bridges		Desirable: 16 ft Minimum: 14.5 ft				
	Vertical Clearance (local roadway over railroad) **(12)**		2-8.02	25 ft				

*For application of controlling design criteria, see Section 2-9.02.

Per the design manual, the ADT of Old Okahola Rd mandates channelization. The following paragraphs breaks down the layout of every alternative evaluated:

ALT A



Alternative A, which was presented during the public hearing process, maintains the existing geometry of Old Okahola Road and White Chapel Road at their intersections with US 11. A dedicated left-turn lane is proposed for vehicles turning onto Old Okahola Road to address operational and safety concerns in the area. To accommodate the additional lane, roadway widening would occur on the east side of US 11, avoiding reconstruction of the Old Okahola Road intersection.

Under this alternative, the intersections would continue to function as an offset T-intersection configuration, which is generally less desirable from a safety perspective. In addition, White Chapel Road intersects US 11 at an angle of approximately 25 degrees, which does not meet the preferred criteria outlined in the MDOT Roadway Design Manual.

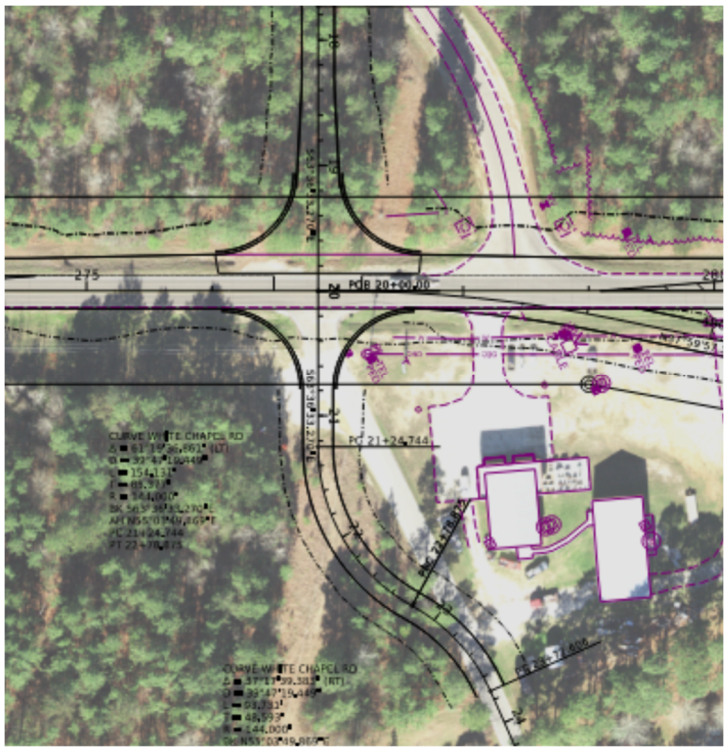
ALT B



Alternative B realigns White Chapel Road to intersect Old Okahola Road, creating a single T-intersection with US 11. Access to both local roads would be provided through a two-way left-turn lane along US 11.

This alternative would improve traffic operations and intersection safety; however, it would result in greater property impacts because the proposed alignment would pass directly through an existing commercial property.

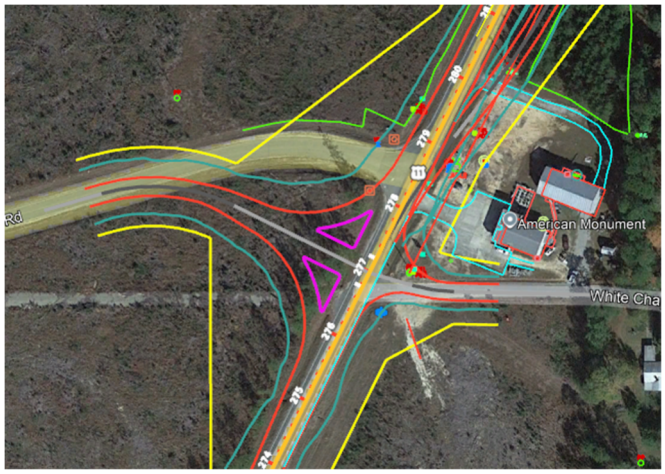
ALT C



Alternative C realigns both Old Okahola School Road and White Chapel Road so that they intersect US 11 at a common location south of the existing business. Because the Old Okahola School Road intersection would be reconstructed, the widening required for the proposed left-turn lanes would occur on the west side of US 11.

To achieve an intersection angle near 90 degrees while avoiding impacts to the residence located west of the roadway, White Chapel Road would require a sharp S-curve. This roadway geometry introduces concerns related to superelevation transition and overall operational performance.

ALT D (Preferred Alternative)



Alternative D is the Preferred Alternative. Similar to Alternative C, this design consolidates the two local road intersections into a T-intersection configuration, improving safety and reducing conflict points along US 11.

Rather than incorporating the sharp S-curve required under Alternative C, Alternative D shifts the intersection slightly north and introduces a minor intersection skew of less than 10 degrees. This configuration allows the roadway to tie back into the existing alignment more quickly, minimizing roadway curvature, reducing the overall project footprint, and avoiding the geometric concerns associated with Alternative C.