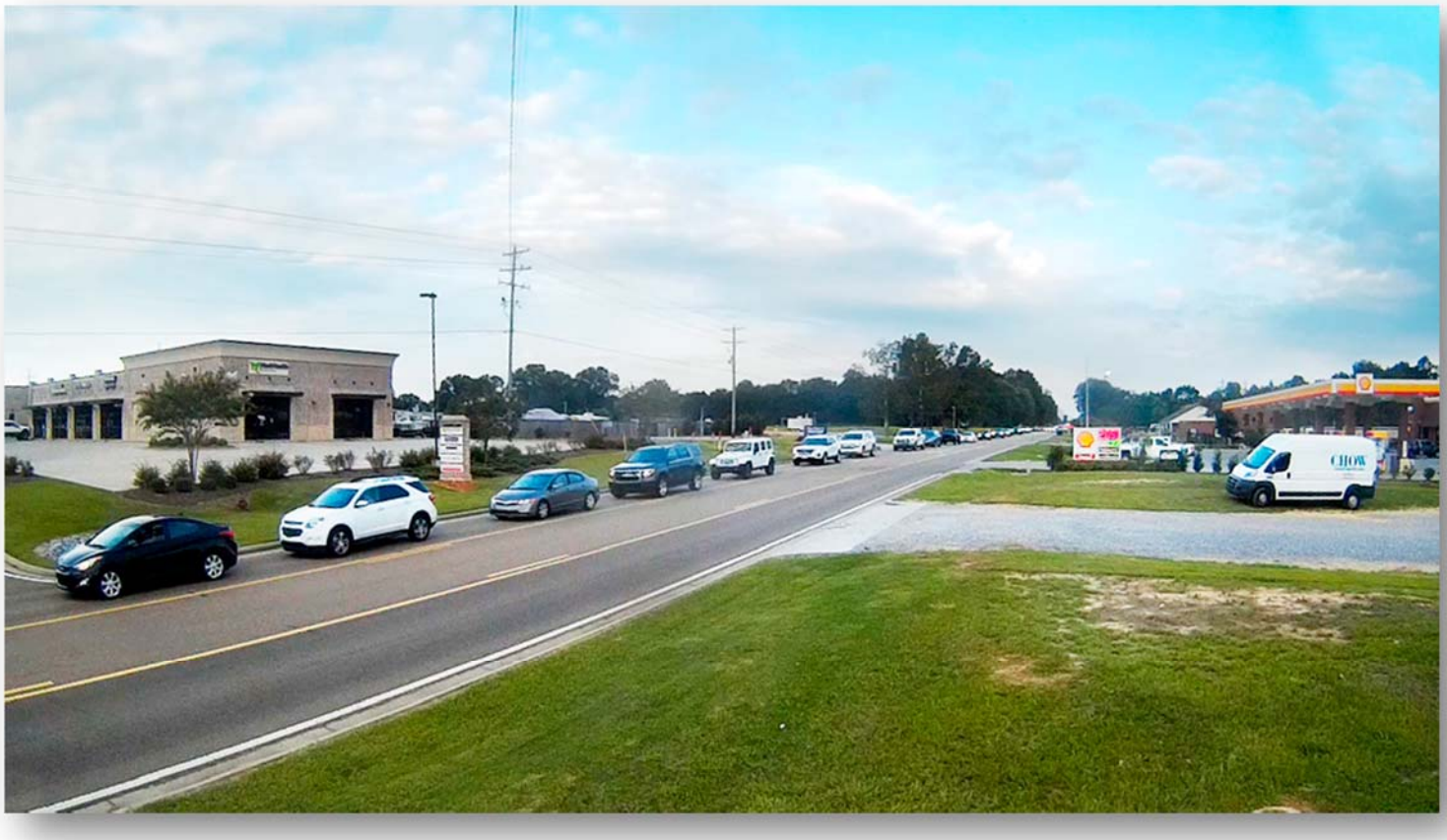
Madison County

Gluckstadt Road Corridor Study

Madison County, Mississippi



October 2017

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Arrington Drive	4-6	Shell Gas Station	19-21	Offices #1078	34-36
Planters Row	7-9	Madison Storage	22-24	Medical Clinic	37-39
JD Johnson Realty	10-12	Chow Drive Thru	25-27	Gluckstadt Place #1085	40-42
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1.0 Introduction

The Madison County Board of Supervisors contracted with Neel-Schaffer to provide a planning level study of traffic circulation on Gluckstadt Road between Bozeman Road and Calhoun Station Parkway to identify short term capacity improvements, particularly to evaluate the opportunity for providing dual eastbound travel lanes. Existing peak hour traffic volumes and existing lane geometrics were used to evaluate the current conditions. The location of the project study area is within Madison County, north of the city limits of the city of Madison, south of Canton, west of I-55. The project study area is shown in **Figure 1**.

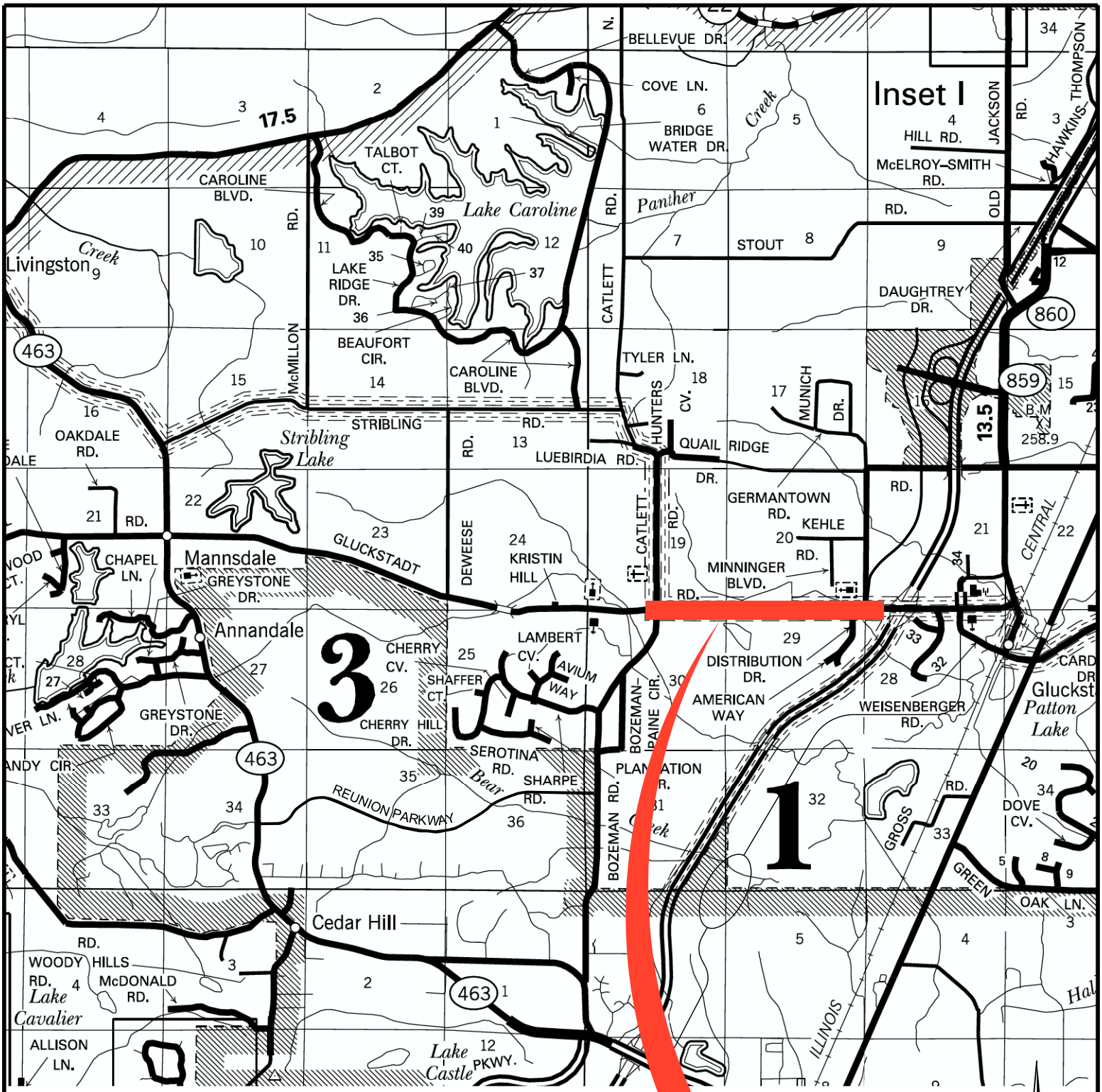
Morning congestion is affected by the limited east/west routes connecting west Madison County with I-55. The existing principal arterial routes in unincorporated Madison County west of I-55 include MS Highway 22, Gluckstadt Road, MS Highway 463, and US Highway 49.

1.1 Project Background

Madison County has experienced significant growth in the past 20 years as urban sprawl has increased the demand for residential development. With the construction of the Germantown High School and Middle School north of Gluckstadt Road and the pending incorporation of the City of Gluckstadt, the population of the area has increased to an estimated population of 2,500 in the Gluckstadt community.

The City of Madison population has increased from 8,027 in 1990 to 24,262 in 2010, while the County population increased from 54,271 to 95,595 during this same time period, representing a compound annual growth of 5.7% for the city and 2.9% for the County.

This growth has included the development of more industry, particularly related to the Nissan manufacturing plant and its suppliers within the I-55 corridor between Gluckstadt and Canton. Retail growth along Calhoun Station Parkway and Gluckstadt Road has been significant. This growth within the County has put a major strain on the existing roadways and intersections and has resulted in traffic congestion on many of the major routes.



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STUDY AREA

FIGURE 1

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2.0 Existing Conditions

2.1 Cross Section

Gluckstadt Road is an arterial roadway that extends approximately 5.8 miles from MS 463 to Weisenberger Road. The cross section of Gluckstadt Road is a two lane rural arterial roadway from MS 463 to approximately 1/3 mile west of Bozeman Road where the cross section widens to a three lane rural cross section. In 2008/9, Gluckstadt Road was realigned and widened just west of Bozeman Road, and widened to a 3 lane urban cross section east to Distribution Drive. The widening included 36 ft of asphalt with curb and gutter.

A 2012 project extended the widening of Gluckstadt Road east and included the extension of Calhoun Station Parkway to Gluckstadt Road from Church Road. In 2015, the new Gluckstadt Road/I-55 interchange project was completed, widening Gluckstadt Road to a four lane divided roadway from Calhoun Station Parkway east to I-55 and to a six lane roadway east to Weisenberger Road. In 2017, Gluckstadt Road was widened between Distribution Drive and Calhoun Station Parkway to provide a second eastbound lane, along with a new traffic signal and north/south left turn lane construction at the Distribution Drive/Gluckstadt Road intersection.

Gluckstadt Road is stop controlled at MS 463, and has traffic signals at Bozeman Road, Distribution Drive, Calhoun Station Parkway, I-55 SB Ramps, I-55 NB Ramps, Industrial Drive South, and Weisenberger Road. The posted speed limit is 35 mph east of Bozeman Road and 45 mph west of Bozeman Road.

Gluckstadt Road intersections with Bozeman Road/Catlett Road, Ridgefield Drive, Arrington Drive, Planters Row and Distribution Drive have right turn lanes and acceleration lanes along Gluckstadt Road that are approximately 70 ft in length. The Distribution Drive acceleration lane was recently extended east to Calhoun Station Parkway to serve as a second eastbound thru lane between these two intersections.

The existing conditions of Gluckstadt Road are shown in **Figures 2A-C**.

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GLUCKSTADT ROAD - EXISTING CONDITIONS

FIGURE
2A

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GLUCKSTADT ROAD - EXISTING CONDITIONS

FIGURE
2B

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GLUCKSTADT ROAD - EXISTING CONDITIONS

FIGURE
2C

Above – Looking east on Gluckstadt Road at Ridgefield Drive

Below – Looking east on Gluckstadt Road at Planters Row

Looking east on Gluckstadt Road at Distribution Drive

The center two-way left-turn lane (TWLTL) serves turning traffic at the intersections with the residential subdivisions and at the commercial driveways along Gluckstadt Road. Vehicles were observed traveling extended distances in the TWLTL, passing stopped/slower traffic. Many of these vehicles were accessing adjacent commercial businesses. The center TWLTL was also being used by local emergency service vehicles to pass slower traffic.

2.2 Adjacent Development

Residential subdivisions exist along the study corridor at Ridgefield (212 lots), Arrington (22 lots), and Red Oak Plantation (195 lots). Additionally, there are 164 lots in Wellington subdivision north of Ridgefield that have access to Gluckstadt Road via the Ridgefield subdivision. These three subdivisions have direct access to Gluckstadt Road via Ridgefield Drive, Arrington Drive and Planters Row. There are also 16 single family residences with direct driveways onto Gluckstadt Road within the study corridor.

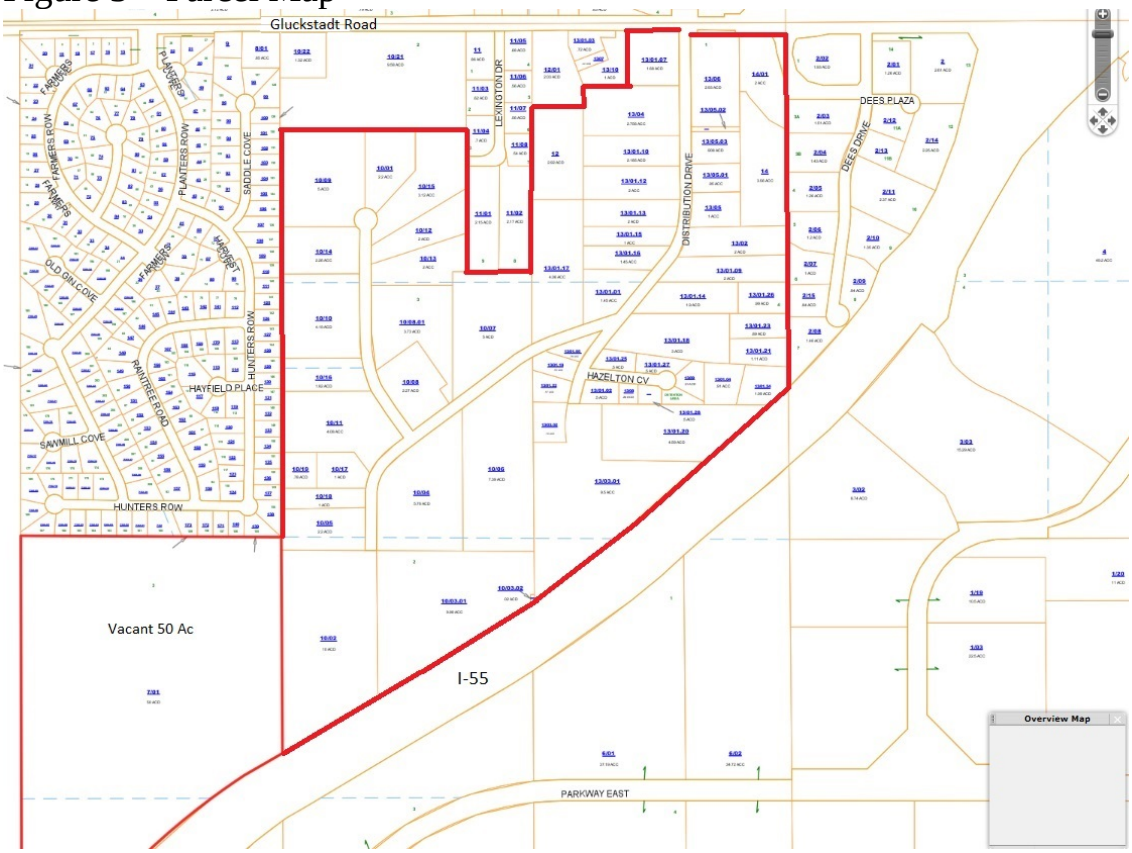
Commercial/office developments exist along the corridor east of Red Oak Plantation subdivision. The commercial/office developments include:

South of Gluckstadt Road
JD Johnson Realty #1019
Mobile businesses/Snow Critters #1049
Madison Storage
Lexington Place
Gluckstadt Place #1085

North of Gluckstadt Road
Hallmark Cleaners - #1042 Plaza
Allstate/Storage Depot #1048
Shell Gas Station #1054
Chow Drive Thru #1064
Animal Hospital #1070
Offices #1078
Medical Clinic #1082

Two roadways on the south side of Gluckstadt Road provide direct access to multiple retail/commercial/ industrial land uses. These roadways include Distribution Drive and Lexington Drive. Distribution Drive has recently been signalized at the intersection with Gluckstadt Road due to the significant peak hour traffic demands at this intersection. Two day care facilities exist on Distribution Drive: Little Footprint Learning Center and Children's Academy of Madison. Additionally, Distribution Drive serves approximately 150 acres of commercial/retail/industrial land uses currently. There is another 50 acre undeveloped parcel at the south end of American Way. The lack of access into this 150/200 acre area puts significant pressure on Distribution Drive. The parcel map for the area is shown in **Figure 3**.

Figure 3 – Parcel Map



Source: Madison County Tax Assessor, 2017.

Lexington Drive extends south of Gluckstadt Road east of the Shell gas station. Lexington Drive provides access to Commercial/Retail development located south of Gluckstadt Road within 10 acres that are subdivided into 9 parcels. While Lexington Drive terminates just south of Gluckstadt Road, the property owner (M&M Operators, Inc.) has contiguous property between Lexington Drive and Enterprise Drive, and appears to use both routes for access to his business, although there is no public access between Enterprise Drive and Lexington Drive.

2.3 Traffic Counts

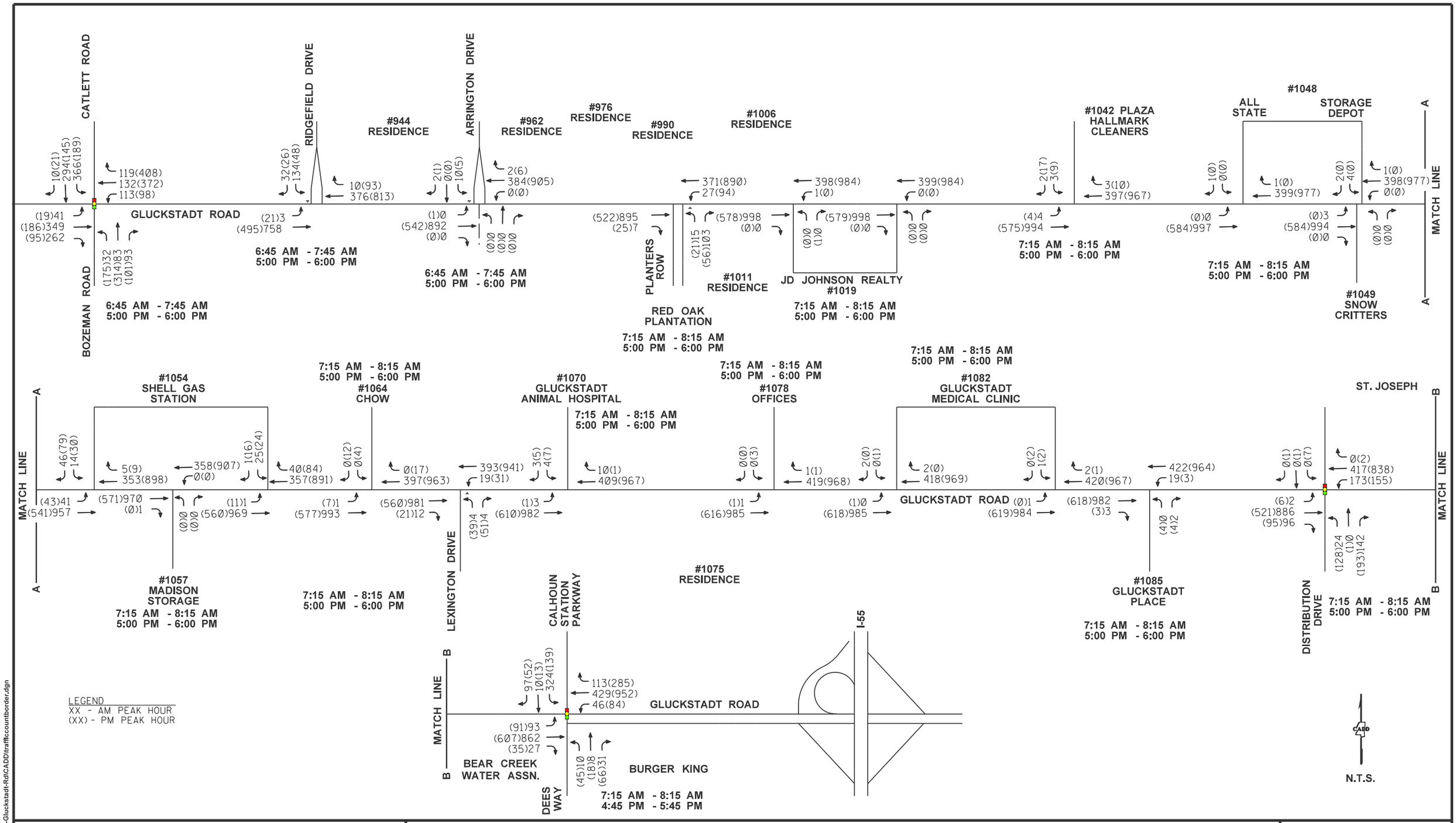
Twelve hour turning movement counts were conducted at the signalized intersections at Catlett-Bozeman Road/Gluckstadt Road and at Distribution Drive/Gluckstadt Road. Peak hour turning movement counts were collected at 15 commercial/retail/office driveways from 6:30-8:30 AM, 11:00 AM – 1:00 PM and from 4:00-6:30 PM. Peak hour counts were also conducted at the intersecting streets of Ridgefield Drive, Arrington Drive, Planters Row, Lexington Drive and Calhoun Station Parkway along Gluckstadt Road. Traffic volumes were collected on typical weekdays in good weather.

The two-way volume on Gluckstadt Road east of Bozeman Road is 1,172 vph in the AM peak hour (6:45-7:45 AM) and 1,354 vph in the PM peak hour (5:00-6:00 PM). The directional distribution of this traffic includes 808 vph EB/364vph WB, which equates to 69% EB/31% WB in the AM peak and 476 vph EB/ 878 vph WB, or 35% EB/65% WB in the PM peak.

The two-way volume on Gluckstadt Road east of Distribution Drive was recorded to include 1,618 vph with 1,028 EB (64%) and 590 WB (36%) in the AM peak from 7:15-8:15 AM, and 1,716 vph in the PM peak hour (5:00-6:00 PM) with 721 EB (42%) and 995 WB (58%).

Eastbound congestion was observed to be the most concentrated, with traffic queues extending from Distribution Drive to beyond the intersection with Bozeman Road in the AM peak hour. Queues at Ridgefield/Arrington were observed for approximately 40 minutes, at Planters Row for 45 minutes, Chow for an hour and at Distribution Drive for 1.5 hours. Signalization of the intersection of Distribution Drive at Gluckstadt Road has reduced these traffic queues.

The southbound left turning traffic from Calhoun Station Parkway to Gluckstadt Road has increased in the AM peak hour from 185 vph to 324 vph in one year, an increase of 75%. The 2017 existing traffic is shown in **Figure 4.**



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2017 EXISTING TRAFFIC GLUCKSTADT ROAD

FIGURE 4

2.4 Driveways

The private driveways on Gluckstadt Road include 16 single family residences with direct driveways onto Gluckstadt Road within the study corridor. The majority of these residential driveways are located within the western 1 mile of the 1.5 mile study corridor and are (very) low volume driveways. The eastern ½ mile of the corridor is primarily commercial development, including industrial/office/retail land uses. The driveways in this eastern section are listed in **Table 1**.

Table 1
Existing Commercial Driveways

	South of Gluckstadt Rd		# Driveways		North of Gluckstadt Rd		# Driveways
1	JD Johnson Realty	#1019	2	1	Hallmark Cleaners	#1042	1
2	Snow Critters	#1049	1	2	Allstate/Storage Depot	#1048	2
3	Madison Storage		1	3	Shell Gas Station	#1054	2
4	Gluckstadt Place	#1085	1	4	Chow Drive Thru	#1064	1
				5	Animal Hospital	#1070	1
				6	Offices	#1078	1
				7	Medical Clinic	#1082	2
		Subtotal	5				10

Source: Neel-Schaffer, 2017.

The majority of the commercial driveways and the intersection of Lexington Drive at Gluckstadt Road have substandard turning radii at the intersections. The two businesses with good driveway turning radii are the Medical Clinic #1082 and Hallmark Cleaners plaza #1042. The short turning radii on the driveway connections to Gluckstadt Road cause drivers to come to a near stop to turn from Gluckstadt Road into the driveway or street.

When auxiliary lanes at driveways are not provided, and insufficient turning radii are provided, avoidance behaviors become necessary as vehicles slow to exit the roadway or enter the motorist's travel path. With increased space between driveways through shared access, use of auxiliary lanes for vehicles slowing down or accelerating, or improved turning radii, these techniques can achieve the fundamental principle of reducing the frequency of conflicts for drivers – resulting in fewer crashes, smoother traffic flow, less delay, reduced congestion and more capacity on the roadway. (ITE Traffic Engineering Handbook, 6th Edition)

3.0 Capacity Analysis

3.1 Methodology

The capacity and level-of-service (LOS) of an intersection is evaluated based on the average vehicular delay during the peak hour periods. The vehicular delays are directly related to the turning movement volumes, traffic composition, traffic control and roadway geometrics at the intersection. The methodology used in this analysis is based on the *Highway Capacity Manual*, 2010 Edition (HCM 2010). The level-of-service, as outlined in the HCM, is reported as a letter designation of LOS A through LOS F (A is least delay, E is capacity, and F is over capacity and experiences the most delay). The traffic volumes recorded at the study intersections during the AM and PM peak hours were analyzed using the information provided in the HCM

The Florida Department of Transportation (FDOT) Quality and Level-of-Service Manual provides planning level capacity for bidirectional hourly traffic volumes for roadways. Table 4-8 from the planning manual identifies that for State two-way arterials, a two lane highway in an area transitioning into an urbanized area with 0-1.99 signalized intersections per mile would have a peak hour capacity of approximately 860 vph in the peak direction. As density of traffic signals increases, the capacity decreases. While intersections are typically the controlling factors on capacity on a roadway, the link volumes are indicative of capacity limitations as well. The FDOT LOS tables are provided in the Appendix.

3.2 Arterial Link Capacity Level-of-Service

The intersection turning movement counts were used to develop link volumes on the east and west sides of the intersections. These 2017 arterial roadway link volumes were compared to the planning level capacity volumes to identify the (planning level) link levels of service for the peak hour traffic volumes.

The results of the arterial roadway link analysis are provided in **Table 2** for Gluckstadt Road.

Table 2 – 2017 Existing Traffic
Link Capacity/Level-of-Service

Segment	Link Volume AM		Link Volume PM		Link LOS	
	WB	EB	WB	EB	AM	PM
Gluckstadt Road @ Distribution Dr	441	984	967	622	**F**	**F**

Source: Neel-Schaffer, 2017, FDOT Quality/Level-of-Service Manual Table 4-8.

The evaluation of the arterial link volumes (from a planning level capacity analysis of link volumes) reveals that existing traffic volumes exceed link capacity during both the AM and PM peak hours.

3.3 Intersection Level-of-Service

The 2017 existing traffic volumes were analyzed using the existing intersection geometrics and peak hour traffic volumes based on the information provided in the Highway Capacity Manual (HCM 2010). The results of the capacity analysis are shown in **Table 3**.

Table 3
Year 2017 Existing Traffic Levels-of-Service

Signalized Intersection	Time Period	Approach LOS				Intersection LOS
		EB	WB	NB	SB	
Bozeman Rd/	AM Peak	C	B	D	C	C
Gluckstadt Rd	PM Peak	C	C	D	C	C
Distribution Dr/	AM Peak	B	A	B	A	B
Gluckstadt Rd	PM Peak	B	C	C	C	C
Calhoun Stn Pkwy/	AM Peak	B	B	B	C	B
Gluckstadt Rd	PM Peak	B	D	C	C	C

Unsignalized Intersection	Time Period	Critical Movement Level of Service											
		Eastbound			Westbound			Northbound			Southbound		
		Lt	Th	Rt	Lt	Th	Rt	Lt	Th	Rt	Lt	Th	Rt
Ridgefield Drive/	AM Peak	A	-	-	-	-	-	-	-	-	D	-	D
Gluckstadt Road	PM Peak	A	-	-	-	-	-	-	-	-	C	-	C
Arrington Drive/	AM Peak	A	-	-	-	-	-	-	-	-	C	-	C
Gluckstadt Road	PM Peak	B	-	-	-	-	-	-	-	-	C	-	C
Planters Row/	AM Peak	-	-	-	B	-	-	D	-	D	-	-	-
Gluckstadt Road	PM Peak	-	-	-	A	-	-	C	-	C	-	-	-
Shell West Drive /	AM Peak	A	-	-	-	-	-	-	-	-	C	-	B
Gluckstadt Road	PM Peak	B	-	-	-	-	-	-	-	-	C	-	C
Shell East Drive /	AM Peak	A	-	-	-	-	-	-	-	-	C	-	C
Gluckstadt Road	PM Peak	B	-	-	-	-	-	-	-	-	C	-	C
Lexington Drive /	AM Peak	-	-	-	B	-	-	C	-	C	-	-	-
Gluckstadt Road	PM Peak	-	-	-	A	-	-	C	-	C	-	-	-

Source: Neel-Schaffer, 2017. HCM 2010

Signalized intersections were shown to be under capacity within the study area, as the recent signalization and geometric improvements have reduced delays within the corridor. However, the capacity analysis does not completely identify the delays that are occurring along Gluckstadt Road.

3.4 High Volume Intersections

The signalized intersections in the study corridor include 1) Catlett Road/Bozeman Road, 2) Distribution Drive and Calhoun Station Parkway. The hourly approach volumes at the signalized intersections on Gluckstadt Road within the study corridor are listed in **Table 4**.

Table 4
Gluckstadt Road Signalized Intersection Approach Volumes

Intersection w/ Gluckstadt Road	Approach Total				Intersection Total
	NB	SB	EB	WB	
AM Peak Hour					
Catlett Rd-Bozeman Road	208	670	652	364	1,894
Distribution Drive/St. Joseph	166	0	984	590	1,740
Calhoun Stn Pkwy/Dees Way	49	431	982	588	2,050
PM Peak Hour					
Catlett Rd-Bozeman Road	590	355	300	878	2,123
Distribution Drive/St. Joseph	322	9	622	995	1,948
Calhoun Stn Pkwy/Dees Way	129	204	733	1,321	2,387

Source: Neel-Schaffer, 2017.

The intersecting streets and driveways were evaluated to quantify the turning traffic at the major unsignalized driveways and intersections in the study corridor. The intersections with more than 20 vph turning to or from an unsignalized intersection or driveway along the study corridor are listed in **Table 5**.

Table 5
Gluckstadt Road Unsignalized Intersection Turning Volumes

Intersection w/ Gluckstadt Road	NB Lt+ NB Rt	SB Lt+ SB Rt	EB Lt+ WB Rt	EB Rt+ WB Lt	Subtotal Turning (vph)
AM Peak					
Ridgefield Drive	0	166	13	0	179
Planters Row	118	0	0	34	152
Shell Gas Station #1054 west drive	0	60	46	0	106
Shell Gas Station #1054 east drive	0	26	41	0	67
Lexington Drive	8	0	0	31	39
Gluckstadt Place #1085	2	0	0	22	24
PM Peak					
Planters Row	77	0	0	119	196
Ridgefield Drive	0	74	114	0	188
Shell Gas Station #1054 west drive	0	109	52	0	161
Lexington Drive	90	0	0	52	142
Shell Gas Station #1054 east drive	0	40	95	0	135
Chow Drive Thru #1064	0	16	24	0	40
Hallmark Cleaners/#1042 Plaza	0	26	14	0	40

Source: Neel-Schaffer, 2017.

The information provided in Table 4 identifies that Ridgefield Drive and Planters Row have the most turning traffic in both the AM and PM peaks in the corridor (at unsignalized intersections), and that the two Shell gas station driveways have the most turning traffic of all the driveways. The Shell gas station turning volumes are more than double all of the other driveway volumes combined (AM – Shell 173 vph, all other commercial driveways 81 vph, PM – Shell 296 vph, all other commercial driveways 121 vph).

A detail of the traffic entering/exiting the Shell was summarized for the two Shell driveways during the AM, Mid-day and PM peak hours. A summary of the Shell driveway traffic volumes is provided in **Table 6**.

Table 6
Shell Gas Station Driveway Volumes

Start Time	In	Out	Total	Hour Total
6:30 AM	25	18	43	
6:45 AM	20	18	38	
7:00 AM	**30**	**28**	**58**	
7:15 AM	**17**	**21**	**38**	177
7:30 AM	**20**	**19**	**39**	
7:45 AM	**24**	**19**	**43**	
8:00 AM	26	27	53	
8:15 AM	15	22	37	172
Total	**177**	**172**	**349**	

Start Time	In	Out	Total	Hour Total
11:00 AM	23	22	45	
11:15 AM	21	18	39	
11:30 AM	29	16	45	
11:45 AM	29	28	57	186
12:00 PM	**35**	**36**	**71**	
12:15 PM	**27**	**43**	**70**	
12:30 PM	**26**	**27**	**53**	
12:45 PM	**32**	**32**	**64**	**258**
Total	**222**	**222**	**444**	

Start Time	In	Out	Total	Hour Total
4:00 PM	40	42	82	
4:15 PM	41	42	83	
4:30 PM	43	39	82	
4:45 PM	29	43	72	319
5:00 PM	34	30	64	
5:15 PM	44	45	89	
5:30 PM	**33**	**42**	**75**	
5:45 PM	**36**	**32**	**68**	296
6:00 PM	**45**	**42**	**87**	
6:15 PM	**43**	**47**	**90**	**320**
Total	**388**	**404**	**792**	

Source: Neel-Schaffer, 2017.

Many jurisdictions require developments to provide auxiliary right turn ingress lanes when turning traffic is forecast to exceed 40 vph during a peak hour. The Shell station on Gluckstadt Road meets this threshold for at least 5 hours of the day, and is double this threshold for approximately 3 hours of the day. The site is generating 170 vph during the AM peak hours, 186 vph and 258 vph during the mid-day peak hours and in excess of 300 vph during the PM peak hours.

The deficient turning radii at the site driveways exacerbates the impacts of right-turning traffic on Gluckstadt Road, reducing travel speeds and reducing adjacent street capacity. These deficient turning radii are recommended to be replaced with an auxiliary right turn ingress lane and driveway tapers.

Above: Looking north at East Shell driveway from Gluckstadt Road – deficient turning radius.

Below: Looking east at West Shell driveway from Gluckstadt Road – deficient turning radius.

The Chow restaurant site is operating as a drive-thru restaurant, with no indoor seating or on-site parking. Vehicles pull up to the building and place/pick-up food orders. During the count on August 24, 2017, six vehicles pulled up to property and traffic queued into Gluckstadt Road, blocking the westbound thru lane at approximately 6:00 PM. Changes to the circulation patterns and traffic queuing on this site are recommended to reduce the potential for traffic to block Gluckstadt Road.

Above: Looking north from Gluckstadt Road at Chow site

Below: Looking west across Chow driveway along Gluckstadt Road at traffic queues blocking Gluckstadt

Vehicles can be seen in the photo above using the center turn lane to pass a SUV that is stopped in Gluckstadt Road waiting to enter the Chow site.

Much of the congestion along Gluckstadt Road had been focused around the courtesy gaps provided at the Distribution Drive/Gluckstadt Road unsignalized intersection and at the other major unsignalized intersections along the corridor. With the construction of the traffic signal on Gluckstadt Road at Distribution Drive and the second eastbound lane construction between Distribution Drive and Calhoun Station Parkway, much of this delay has been alleviated in the morning peak hours.

The other major unsignalized intersections can be improved with providing/maintaining auxiliary lane construction and improved turning radii improvements as short term improvements. These major intersections on Gluckstadt Road include: Ridgefield Drive, Planters Row, Lexington Drive, Shell Gas Station driveways, Chow Drive Thru, Gluckstadt Place #1085, and Hallmark Cleaners-#1042 Plaza.

Ultimately, with the amount of undeveloped land adjacent to Gluckstadt Road and in western Madison County, Gluckstadt Road must be widened to provide (a minimum) of two thru travel lanes eastbound and two thru lanes westbound, with either a raised center median or a two-way left turn lane.

4.0 Crash Data Summary

4.1 Historical Crash Data

Crash records were provided by MDOT from the Safety Analysis Management System (SAMS) database. Crash records for a five year - 8 month history were provided on Gluckstadt Road from 1/1/2012-8/31/17. The crash records were summarized based on crash type, by location and by injury type. The crash records for Gluckstadt Road were evaluated using the intersection description and the coordinates of the crash. Crash records were filtered by location and isolated to adjacent intersections. A summary of the crash records by location is provided in **Table 7**.

Table 7
Crash Location Sorted by Year

	Year						Total
Gluckstadt Road Location	2012	2013	2014	2015	2016	2017*	Crashes
Church/Calhoun Pkwy/Dees	2	2	4	6	8	8	30
Distribution Drive		1		2	2	5	10
Lexington Drive		1		1	1		3
Shell Gas Station			1	1	2	3	7
Allstate/Storage Depot				2			2
Planters Row				1	2		3
Arrington Drive				1	2		3
Ridgefield Drive	1		1	2	2	2	8
Catlett Rd/Bozeman Rd	4	4	13	6	12	13	52
Crash Total	**7**	**8**	**19**	**22**	**31**	**31**	**118**

*-Partial year for 2017 from 1/1/17-8/31/17. Source: MDOT , Neel-Schaffer, 2017.

The crash types were summarized based on the year of the crash and by injury severity. The results of the crash type summary and injury severity are listed in **Tables 8** and **9**, respectively.

Table 8
Crash Type by Year

SAMS Crash Type Description	Year						Total Crashes
	2012	2013	2014	2015	2016	2017*	
Angle	1	1	3	5	4	4	18
Deer	1	2		1	2	1	7
Head on			1				1
Left turn same roadway	1		1	3	1		6
Other in road					1		1
Rear end slow or stop	3	5	12	11	21	21	73
Rear end turn			1	1		1	3
Right turn cross traffic					1		1
Run off Road - Right			1				1
Sideswipe	1			1		4	6
Unknown					1		1
Crash Total	7	8	19	22	31	31	118

*-Partial year for 2017 from 1/1/17-8/31/17. Source: MDOT , Neel-Schaffer, 2017.

Table 9
Crash Type by Reported Injury

SAMS Crash Type Description	SAMS Injury Severity			Total Crashes
	Moderate Injury	Complaint of Pain	Property Damage Only	
Angle	2	6	10	18
Deer			7	7
Head on			1	1
Left turn same roadway		3	3	6
Other in road			1	1
Rear end slow or stop	3	11	59	73
Rear end turn		1	2	3
Right turn cross traffic			1	1
Run off Road - Right			1	1
Sideswipe			6	6
Unknown			1	1
Crash Total	5	21	92	118

*-Partial year for 2017 from 1/1/17-8/31/17. Source: MDOT , Neel-Schaffer, 2017.

The crash history shows a trend in increased crash frequency with 2017 crashes on track to be 560% higher than the crash total in 2012. The highest crash locations are at the signalized intersections on each end of the corridor at Bozeman/Catlett Road (44%) and Calhoun Station Parkway/Dees (25%) intersections. Most of the crashes are property damage only (78%) and rear-end crashes (64%).

5.0 Future Year Traffic

5.1 Historical Area Growth

The census data for Madison the City and Madison County were researched to compare the population changes since 1990. The historical population changes are listed in **Table 10**.

Table 10
Historical Population Changes

Location	Population by Year			Compound Annual Percent Change		
	1990	2000	2010	'90-'00	'00-'10	'90-'10
Madison County	54,271	75,063	95,595	3.30%	2.45%	2.87%
City of Madison, MS	8,027	18,978	24,262	8.99%	2.49%	5.69%

Source: US Census.gov.

The population changes are significant, as Madison County has seen a 20 year compound annual growth rate at 2.87%, with the City of Madison at 5.69% (annually) since 1990, although some of the city growth has been through annexation. These growth rates have put significant pressure on the existing roadway network.

Traffic volume trends were researched on Gluckstadt Road through MDOT daily traffic volume records. The MDOT historical count information is summarized in **Table 11**.

Table 11 – Historical Daily Traffic Volumes by Year

Roadway	Count Year											
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Gluckstadt Rd	3400	3400	3400	5400	5400	5400	8600	8700	8800	8800	8900	9100

Source: MDOT 2017.

The traffic volumes show an increase in traffic on Gluckstadt Road equivalent to a 9.36% compound annual growth rate over the last 11 years on Gluckstadt Road. However, a comparison of volumes was conducted by identifying the traffic on Gluckstadt Road east of Bozeman Road from the 12 hour count. That count, while not adjusted for seasonal traffic variations, recorded 10,224 vehicles on Gluckstadt Road east of Bozeman Road between 6:30 AM and 6:30 PM. Typically, the 12 hour count would yield approximately 70% of the daily traffic, resulting in a daily volume of approximately 14,600 vpd. This corresponds to a 9.3% K value (peak hour to daily ratio) with the peak hour volume of 1,354 vph. The east end of the corridor had a 12-hour count of 13,825 vehicles on Gluckstadt Road east of Distribution Drive. Using this same 70% value, a typical daily volume on Gluckstadt Road east of Distribution Drive is estimated at 19,750 vpd.

Level of service is typically calculated based on the peak hour volume, and is dictated by how that traffic arrives within the peak hour given the traffic composition and lane geometry. The most limitations on capacity are typically encountered at intersections. While the intersections are shown to be operating near capacity, the daily volumes are indicative of a roadway that is over capacity. The rapid development of residential property to the north and west, along with the new Germantown High School and Middle School has put intense pressure on Gluckstadt Road from a capacity standpoint. As commercial and office developments continue to locate along Gluckstadt Road, the friction from these unsignalized driveways will further reduce the capacity of the roadway, as evidenced by the high volume of traffic at the Shell gas station and the corresponding delays and slower travel speeds/reduced capacity associated with these two driveways. Gluckstadt Road has an estimated capacity of approximately 15,000 vehicles per day, and cannot process much more (if any) traffic during the peak hours. The annual growth on Gluckstadt Road is estimated to have increased from 8,800 vpd in 2013 to 17,000 vpd (average of 19,750 and 14,600 vpd) in 2017 resulting in a compound annual growth of approximately 18%. The planning level of capacity for a two lane roadway with turn lanes is approximately 14,000 vpd. Existing traffic volumes on Gluckstadt Road between Calhoun Station Parkway and Bozeman Road exceed this value.

With Gluckstadt Road at (or over) capacity, the traffic bypassing Gluckstadt Road has increased. The southbound left turn from Calhoun Station Parkway to Gluckstadt Road was recorded to increase in the AM peak hour from 185 vph to 324 vph in one year, an increase of 75%.

The traffic volumes in the area are increasing at an accelerated rate. Additional capacity on Gluckstadt Road is needed.

5.2 Traffic Forecast

Future year volumes were forecast to year 2027 to evaluate a 10 year horizon using an average of the historical City, County and Gluckstadt Road growth rates (2.87%, 5.69% & 9.36%) which yield a compound annual growth of 6%. Applying this 6% growth rate to the 2017 daily traffic volume on Gluckstadt Road of 17,000 vpd, the volume on Gluckstadt Road is forecast to increase to approximately 30,000 vpd by 2027, if the roadway is not constrained by capacity and no other access to I-55 is developed between Gluckstadt Road and MS Highway 463.

6.0 Corridor Improvement Alternatives

Policy improvements can make a significant impact on future transportation demands and help to prevent some of the current traffic issues facing Madison County on Gluckstadt Road from developing in other areas of the County. The adoption of policies requiring traffic studies for proposed developments, requiring construction of auxiliary left turn and right turn lanes for new developments, adoption of minimum right-of-way widths and building setbacks for Principal and Minor Arterials can help to avoid traffic issues in the future similar to what Madison County is currently facing. In the absence of those requirements, the short term corrective measures identified in this analysis are needed more urgently as there are few options for navigating the existing roadway network that is overly congested and in desperate need of auxiliary turn lanes and additional thru lanes to help move traffic during peak hours.

6.1 Auxiliary Turn Lanes

The major intersection turning movements were quantified and the unsignalized intersections with the most traffic within the study corridor were identified to include:

Ridgefield Drive,	Planters Row,	Lexington Drive,
Shell Gas Station,	Gluckstadt Place#1085,	Chow Drive Thru, and
Hallmark Cleaners #1042 Plaza		

Ridgefield Drive and Planters Row have existing left turn and right turn ingress lanes. Each of the other roadways/businesses have left turn ingress lanes from the two-way left turn lane, but no right turn ingress lanes. With a closer look at the right turn ingress traffic, the Shell East Drive was recorded to have 40 westbound right turns in the AM peak hour and 84 westbound right turns in the PM peak hour. An auxiliary right turn ingress lane is recommended between the Chow driveway and Shell East Drive, along with a 50 ft taper on the east approach to the Chow driveway. Additional review of the Chow site is recommended by Madison County to modify the on-site circulation of the Chow property to minimize the potential for traffic to queue into Gluckstadt Road and block thru traffic.

The benefits from having right turn lanes include increased capacity, reduced speed differentials and brake applications, and reduced rear-end collisions. (*Guide for the Geometric Design of Driveways*, NCHRP 659)

6.2 Driveway Tapers

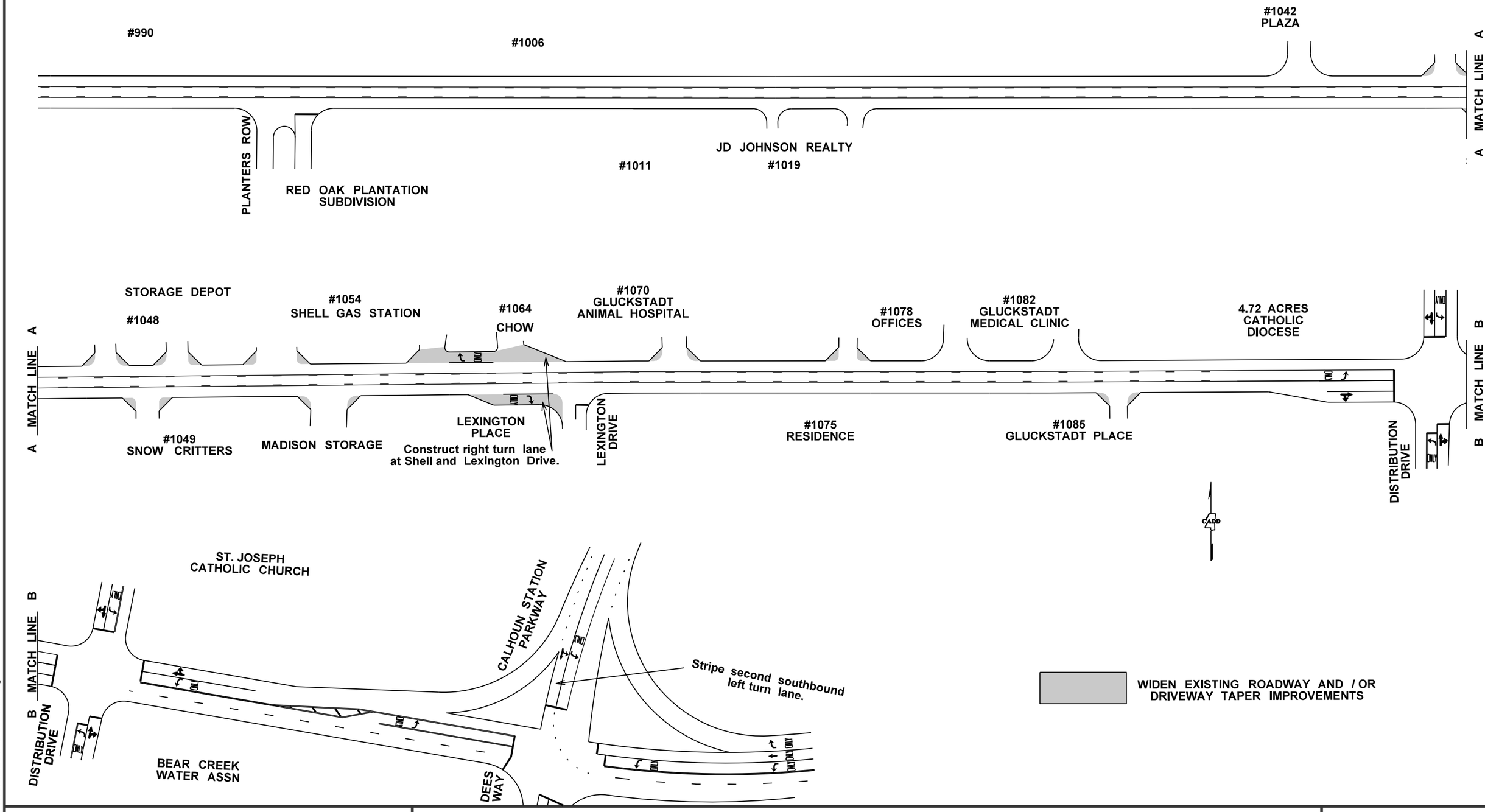
Two of the commercial developments on Gluckstadt Road provide adequate turning radii for traffic to exit Gluckstadt Road and enter the adjacent property without either coming to a complete stop, or encroaching on another lane of traffic. These two developments are 1) Gluckstadt Medical Clinic#1082 and 2) Hallmark Cleaners #1042 Plaza. The adjacent private driveways and the southwest corner of Lexington Drive at Gluckstadt Road are recommended to provide either improved turning radii or tapers to allow vehicles to enter/exit Gluckstadt Road within a normal turning path and maintain one lane of traffic without having to come to a complete stop in the roadway or enter the roadway with a significant speed differential. The construction of improved driveway tapers is anticipated to also help to improve mainline capacity, and reduce the speed differential between thru traffic and right-turning traffic.

The construction of auxiliary turn lanes and improved turning radii or tapers is anticipated to reduce the rear-end collision crash rate on Gluckstadt Road as the minimal turning radii are likely contributing to this crash type. The auxiliary lane and taper concepts are shown in **Figure 5**.

6.3 Dual Eastbound Lane Concept

Conversion of the existing two-way left turn lane into a second eastbound thru lane was evaluated. The western mile of the corridor between Red Oak Plantation subdivision and Catlett/Bozeman Road has two residential driveways on the south side of the roadway. The two-way left turn lane is mostly unused by traffic on the south side of the road in this area. The primary use of the center lane is from merging traffic from Ridgefield and Arrington subdivisions and left turning traffic into Ridgefield, Arrington and Red Oak Plantation subdivisions. Each of these developments has public street intersections, along with right turn lanes and acceleration lanes. Maintaining a center turn lane at these subdivisions is recommended, to allow left turn traffic out of the subdivisions to make turns in two stages, by only requiring a gap in major street traffic from one direction at a time. To maintain a turn lane between east/west traffic lanes, a fourth lane would be needed between Ridgefield and Arrington Drive to provide two eastbound thru lanes. Thru traffic would be shifted over a 250 ft shifting taper ($L_T=WS^2/60$, W=12 ft, S=35 mph) and a fourth lane constructed for a distance along Gluckstadt Road of approximately 1,000 lf.

In the east 0.5 miles of the corridor in the commercial area of Gluckstadt Road, maintaining a center turn lane is needed to allow the high volume of left turning to keep from blocking thru lanes and to merge into Gluckstadt Road in a two-stage merge with gaps in traffic from one direction at a time. This concept includes constructing a second eastbound lane on the south side of Gluckstadt Road between the east limits of Red Oak Plantation subdivision and Distribution Drive, extending the 2 eastbound lanes between Bozeman Road and I-55. This dual eastbound lane concept is shown in **Figures 6A & 6B**.



S:\Projects\14044-Gluckstadt-Rd\CADD\FIGURE5.dgn

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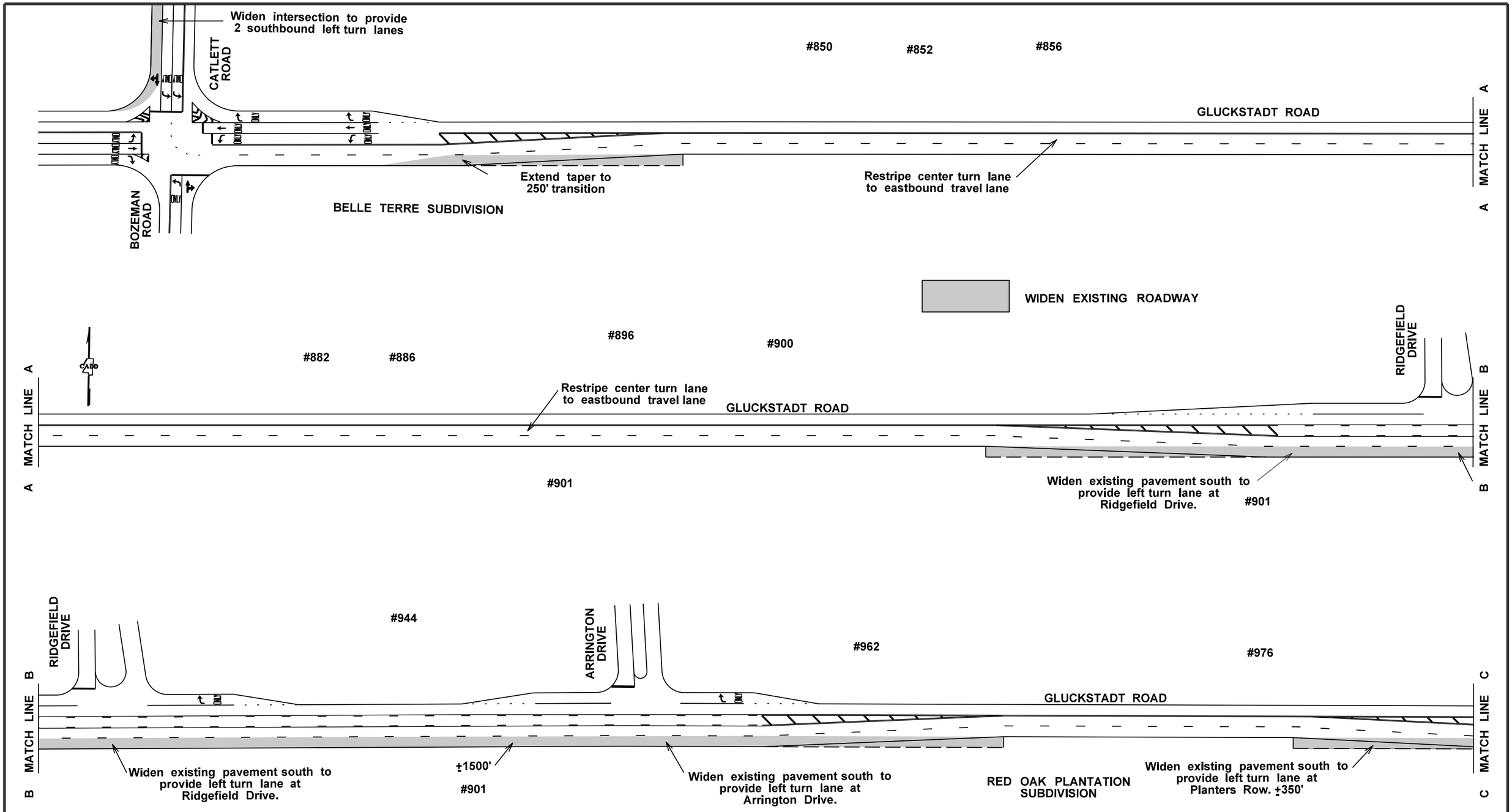
GLUCKSTADT ROAD - AUXILIARY LANE AND DRIVEWAY TAPER IMPROVEMENTS

FIGURE 5



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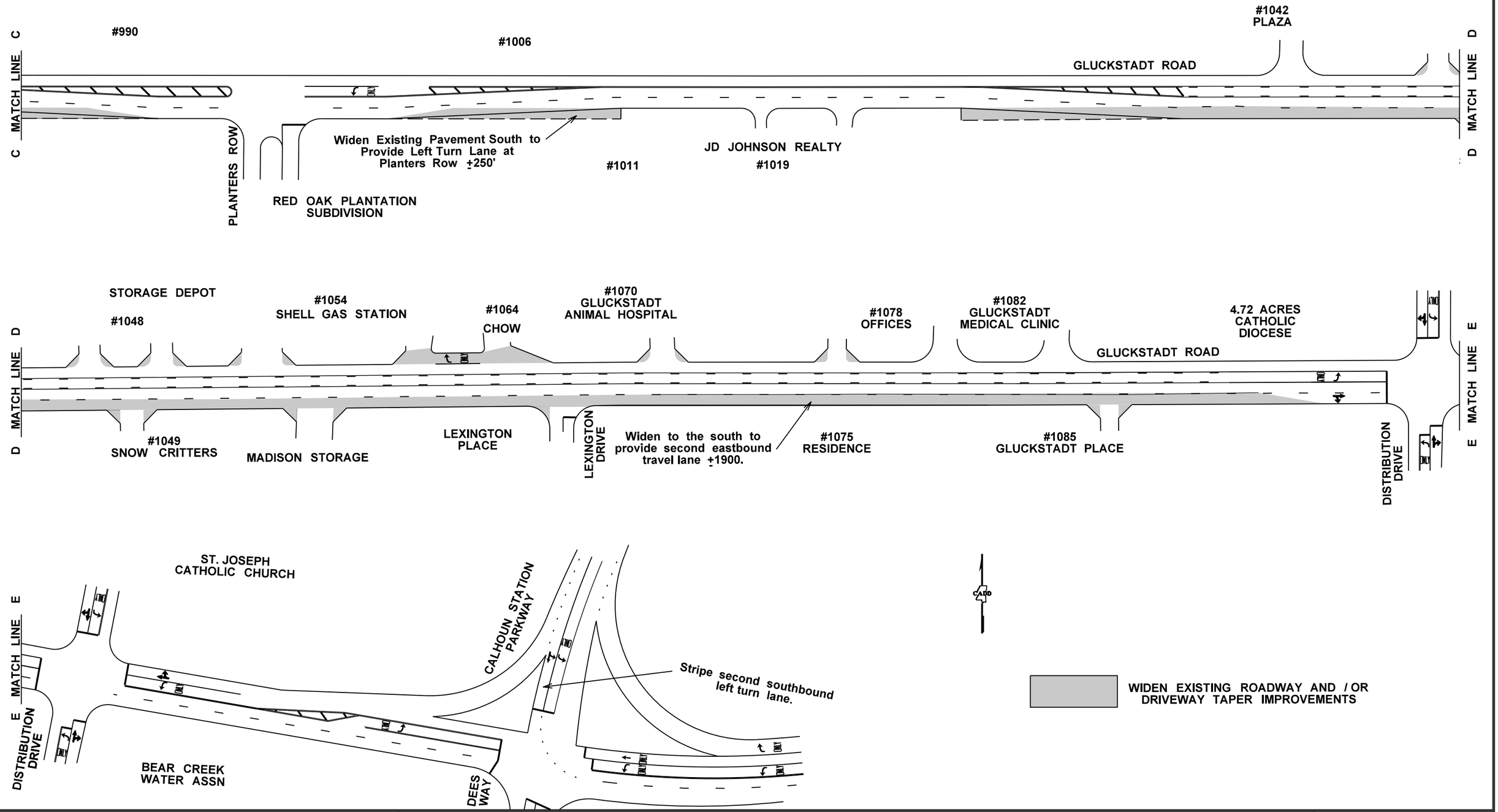
GLUCKSTADT ROAD - DUAL EASTBOUND LANE CONCEPT

FIGURE
6A



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GLUCKSTADT ROAD - DUAL EASTBOUND LANE CONCEPT

FIGURE 6B

6.4 Reversible Lane Concept

Conversion of the existing two-way left turn lane into a reversible lane was evaluated. The concept of a reversible lane is when one or more lanes are designated for movement in one direction during part of the day and in the opposite direction during another part of the day. For the three lane section of Gluckstadt Road, the center turn lane would operate as an eastbound lane in the AM peak, westbound lane in the PM peak and as a center turn lane in the off peak hours. Some jurisdictions restrict left turns from the reversible lane during peak periods to maintain more thru capacity. Reversible lane systems require proper signing or control techniques for safe and efficient operation. Techniques can include: curb and overhead signs, lane-use control signals, and movable pedestals, tubes or traffic cones. (*Traffic Engineering Handbook*)

The *Traffic Engineering Handbook* outlines the advantages and disadvantage of a reversible lane operation. They include:

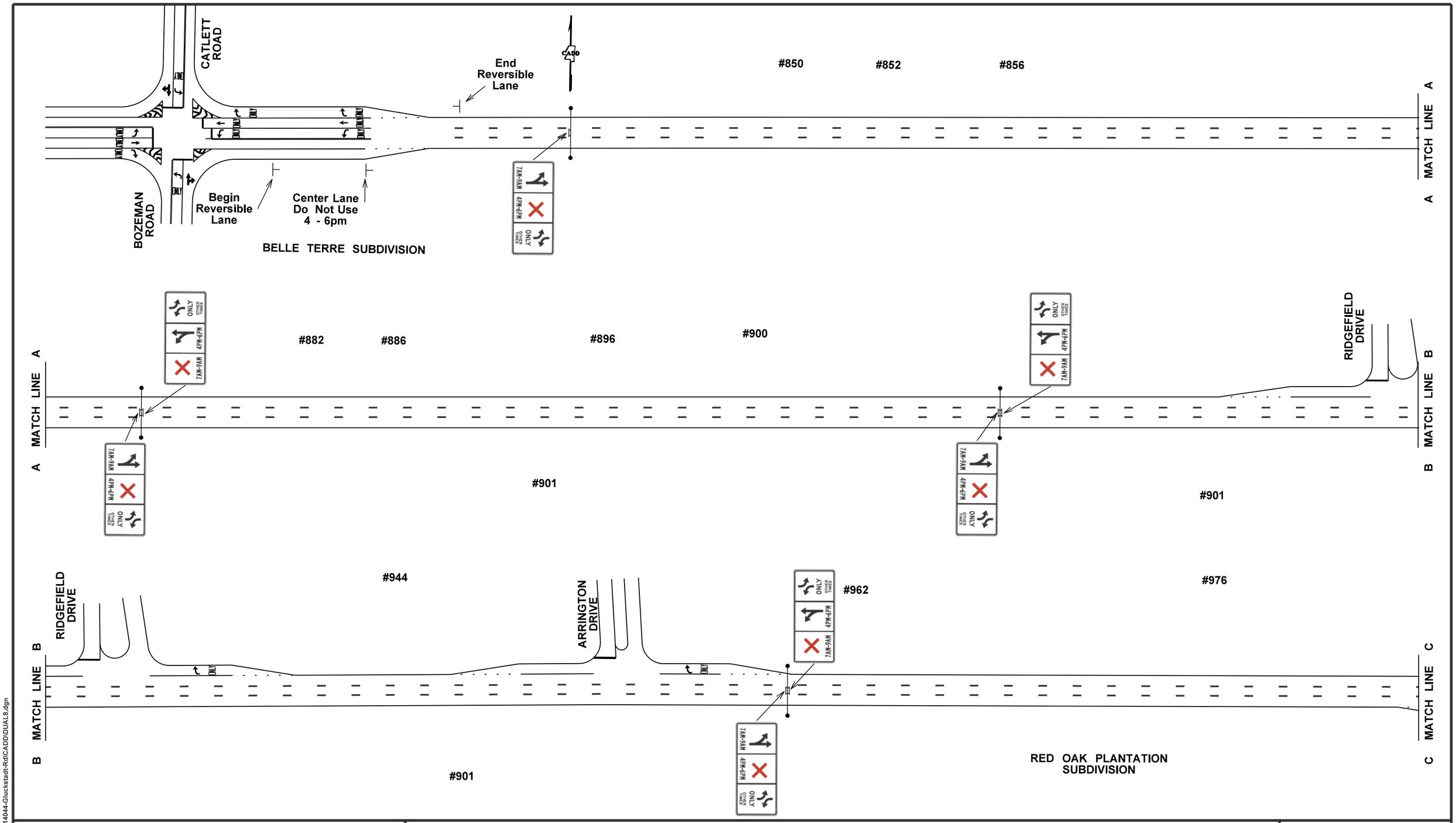
Advantages

- Extra capacity is provided in the direction and at the time needed.
- Minor direction traffic does not have to shift to another street.
- Among the most efficient methods of increasing the peak-period capacity of existing streets.

Disadvantages

- Potentially high cost for installation or operation of control devices.
- Potentially more crashes if control methods are not clear and positive.
- Possible need for concentrated enforcement efforts to prevent violations of the lane use regulations.
- Potential difficulty of solving changeover problems before and after peak periods.
- Difficulties experienced by drivers turning from a cross-street or driveway onto the reversible lane street.

The potential reversible lane section includes approximately 1.5 miles between Bozeman Road and Distribution Drive. The concept is shown graphically in **Figures 7A-B**.



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GLUCKSTADT ROAD - REVERSIBLE LANE CONCEPT

FIGURE 7A

S:\Projects\14044-Gluckstadt-Rd\CADD\DUAL8.dgn

#990

#1006

#1042
PLAZA

C MATCH LINE C

D MATCH LINE D

PLANTERS ROW

RED OAK PLANTATION SUBDIVISION

JD JOHNSON REALTY

#1011

#1019

SNOW

STORAGE DEPOT

#1048

#1054
SHELL GAS STATION

#1064
CHOW

#1070
GLUCKSTADT ANIMAL HOSPITAL

#1078
OFFICES

#1082
GLUCKSTADT MEDICAL CLINIC

Center Lane
Do Not Use
7 - 9 am

Begin
Reversible
Lane

D MATCH LINE D

E MATCH LINE E

#1049
SNOW CRITTERS

MADISON STORAGE

LEXINGTON PLACE

LEXINGTON DRIVE

#1075
RESIDENCE

End
Reversible
Lane

#1085
GLUCKSTADT PLACE

DISTRIBUTION DRIVE

ST. JOSEPH
CATHOLIC CHURCH

CALHOUN STATION PARKWAY

Begin
Reversible
Lane

E MATCH LINE E

DISTRIBUTION DRIVE

Stripe second southbound
left turn lane.

BEAR CREEK
WATER ASSN

DEES WAY

CADD

WIDEN EXISTING ROADWAY AND / OR
DRIVEWAY TAPER IMPROVEMENTS

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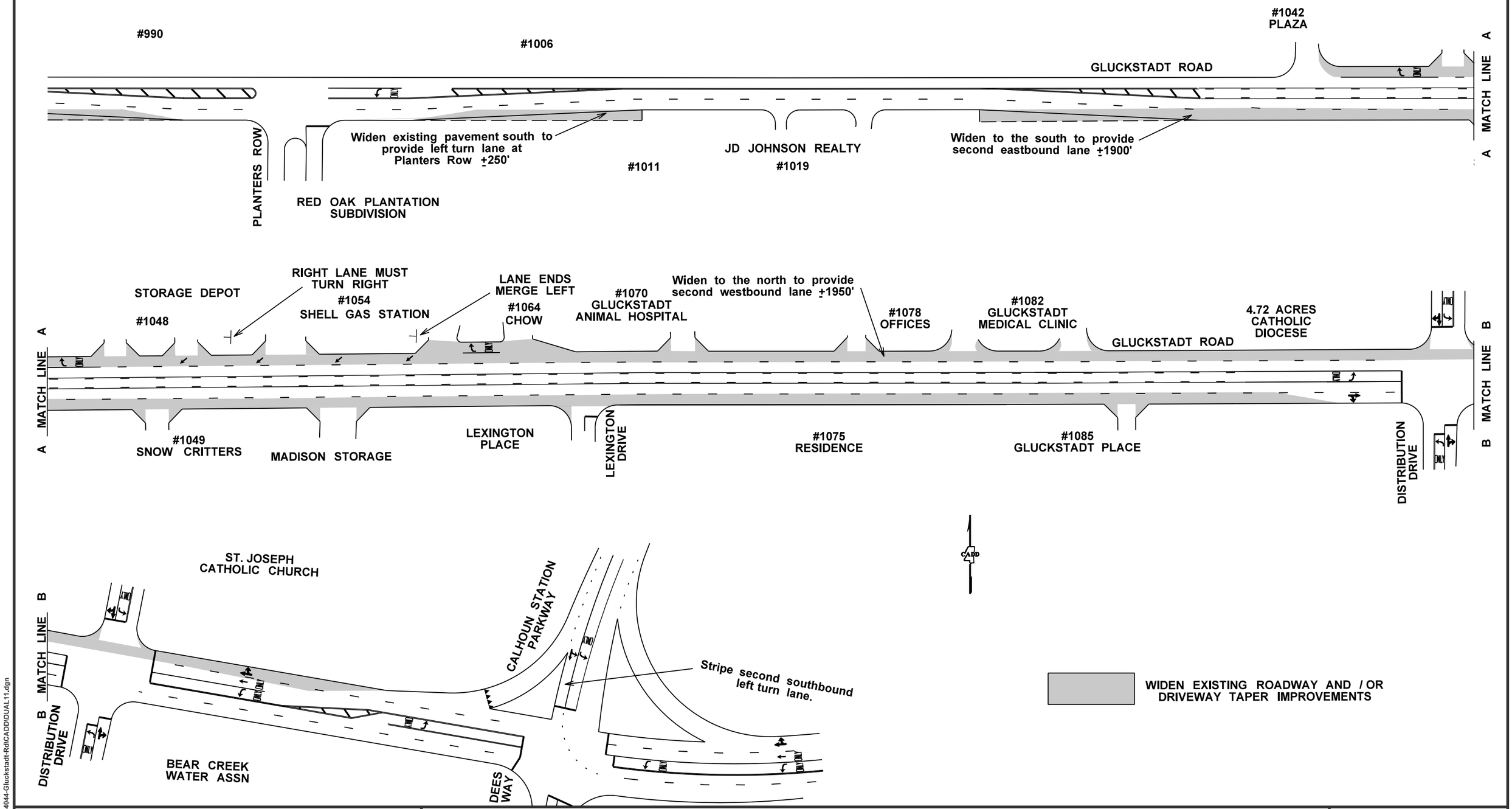
GLUCKSTADT ROAD - REVERSIBLE LANE CONCEPT

FIGURE
7B

6.5 Widening Gluckstadt Road – Five Lanes

The cross section of Gluckstadt Road is currently at (or over) capacity of a 2/3 lane roadway. The classification of the roadway as a principal arterial means that Gluckstadt Road is responsible for conveying traffic regionally. There are only 4 principal arterials designated in Madison County west of I-55: Gluckstadt Road, MS Hwy 463, MS Hwy 22 and US Highway 49. Ultimately, Gluckstadt Road will be channeling traffic to (or across) I-55 from residential and retail developments as the undeveloped land continues to develop at accelerated rates.

Widening Gluckstadt Road to provide two eastbound and two westbound lanes is needed with existing traffic volumes. The bulk of the congestion and delays is occurring in the commercial area of the corridor east of Red Oak Plantation. Widening Gluckstadt Road by constructing a second westbound thru lane on the north side of Gluckstadt Road and a second eastbound thru lane on the south side of Gluckstadt Road would provide a five-lane cross section through the most congested area and help to relieve the majority of the congestion/delays, particularly with the AM peak hour traffic. The conceptual 5 lane section is shown in **Figure 8**.



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GLUCKSTADT ROAD - FIVE LANE CONCEPT

FIGURE 8

7.0 Recommendations and Conclusions

The traffic issues on Gluckstadt Road will continue to increase as commercial and residential development continues at an accelerated pace in Madison County. Driveway improvements and auxiliary lane construction are recommended to help decrease the impacts that turning traffic has on Gluckstadt Road capacity and speed differential and improve safety. The circulation at Chow is recommended to be reviewed and modified to keep internal Chow traffic from blocking Gluckstadt Road.

To further improve capacity on Gluckstadt Road, providing a second eastbound travel lane is recommended. This second eastbound lane will help to reduce congestion and delays that occur primarily during the AM peak. The most immediate, cost effective method of gaining a second eastbound travel lane was shown in Figures 6A-B. This widening concept included:

- Widening the intersection of Catlett Road/Gluckstadt Road to provide dual southbound left turn lanes,
- Maintaining a center turn lane on Gluckstadt Road at the subdivision entrances at Ridgefield, Arrington, and Red Oak Plantation,
- Widening to the south and constructing a fourth lane (2^{nd} eastbound) east of Red Oak Plantation and connecting with the existing dual eastbound lanes at Distribution Drive, and
- Restriping the intersection of Calhoun Station Parkway at Gluckstadt Road to provide dual southbound left turn lanes.

Crash frequency is expected to be reduced with the recommended improvements as congestion and speed differentials are anticipated to be minimized.

In evaluation of the reversible lane concepts, the disadvantages/risks are greater than the advantages, and a reversible lane is not recommended on Gluckstadt Road at this time. Reversible lanes are typically used when you have no other economically feasible option from a right-of-way standpoint. The reversible lane investment is different than each of the other alternates, as the roadway needs to be widened. Each of the other construction alternates identified in this report provides an improvement in the capacity of Gluckstadt Road and any funds invested in those alternates would fit the future five-lane concept. However, funds spent on a reversible lane with signals/ signage would be wasted if the reversible lane project was implemented and then later determined to have safety concerns and removed or discontinued.

In regards to the ultimate buildout and transportation capacity demands in the area, if Reunion Parkway is not extended to I-55/ Parkway East, Gluckstadt Road would not be able to accommodate the 10 year growth as a 5-lane roadway and need to be widened to a 6-lane divided roadway. Widening Gluckstadt Road to 6-lanes would require acquisition of structures (commercial and residential) on one side of Gluckstadt Road and resulting in a project that would cost more than $20 million. Even if Gluckstadt Road was widened to 5 lanes, Reunion Parkway Phase 2 and interstate interchange are still desperately needed construction projects in Madison County to relieve the congestion and growth that are occurring at an accelerated pace.

Appendix

References A1-A4

Table 4-8 FDOT Generalized Peak Hour Directional volumes A1

Table 4-2 FDOT Generalized Daily Two-Way volumes A2

MUTCD Reversible Lane Signage Details A3-4

Traffic Volumes B1-B58

Intersection/Driveway Peak Hour Count Sheet Detail (AM, Mid-Day, PM)

Ridgefield Drive	1-3	Allstate Ins. #1048	16-18	Animal Hospital	31-33
Arrington Drive	4-6	Shell Gas Station	19-21	Offices #1078	34-36
Planters Row	7-9	Madison Storage	22-24	Medical Clinic	37-39
JD Johnson Realty	10-12	Chow Drive Thru	25-27	Gluckstadt Place #1085	40-42
Hallmark Cleaners	13-15	Lexington Drive	28-30		

Calhoun Station Parkway/Gluckstadt Road B43-47

Distribution Drive/Gluckstadt Road B48-53

Bozeman-Catlett/Gluckstadt Road B54-58

2017 Existing Geometry Intersection LOS Summary C1-C18

2017 AM Signalized Intersection Summary C1-C3

2017 PM Signalized Intersection Summary C4-C6

2017 AM Un-signalized Intersection Summary C7-C12

2017 PM Un-signalized Intersection Summary C13-C18