



Kimley-Horn
and Associates, Inc.

September 15, 2004

Mr. Mitch Barron
Newland Communities
31 Hillsboro Street
Pittsboro, NC 27312

■
P.O. Box 33068
Raleigh, North Carolina
27636-3068

Re: BRIAR CHAPEL TIA
PEER REVIEW RESPONSE

Dear Mr. Barron,

Kimley-Horn and Associates has reviewed the Peer Review of our Briar Chapel Development Transportation Impact Assessment and offer the following comments in response. We also anticipate issuing a formal addendum to the report once NCDOT has issued their review of the study. The addendum will incorporate changes and clarifications engendered by both sets of comments and any changes or comments arising out of the on-going public discussion.

The Peer Review Report is composed of two sections – The report itself and an Appendix detailing technical comments. We will divide our responses correspondingly.

PEER REVIEW REPORT

Sections I, II, and III summarize the basic information contained in the Transportation Impact Assessment (TIA) report and appear to be reasonable summaries of the information.

Section IV details the peer review comments and we offer the following sub-section by sub-section comments:

IV. Peer Review Comments and Recommendations

As stated the TIA used a traditional approach in preparing the study. We conferred with County Staff and NCDOT prior to, and during the preparation of the study to discuss format and assumptions. Chatham County does not



have adopted procedures or guidelines on how to conduct Transportation Impact Assessments and County staff directed us to follow NCDOT procedures and guidelines, which we did. The standard approach is to analyze critical intersections in the roadway network since the intersections basically control the capacity of the roadway sections. Roadway segments are not typically analyzed since this seldom provides significant additional information. In general, roadway segments operate at a better level of service than the intersections they connect. There will be further discussion of this later.

All classes of users were considered in developing the plans for Briar Chapel. The project is planned to have an extensive system of pedestrian and bicycle ways to provide access internally. Current levels of pedestrian activity do not indicate the need for off-site facilities. Briar Chapel is committed to providing for transit access when transit service is extended to the area.

IV.A Trip Generation and Distribution

The trip reductions taken in the report are consistent with nationally used methodology recommended by the Institute of Transportation Engineers. There is no readily available local data to further refine the ITE methodology. The internal capture assumed is entirely consistent with the patterns in a mixed-use development designed to encourage internal trip-making and use of alternate modes. *While the non-residential uses appear on the plan to occupy a relatively low percentage of the land area they represent nearly half (48%) of the project's trip-making potential.* Since the non-residential components are sized to serve local demand rather than serving as a regional draw, and the Briar Chapel development will contain a sizable proportion of the area's residences at build-out, the internal capture should be high. The study assumes only 400 (10.6%) of the 3,756 gross trips generated in the PM peak hour will be internal to Briar Chapel.

Likewise, the pass-by trips are trips that are already on US 15-501 and stop at the commercial development. ITE methodology indicates 32% of the commercial trips should be pass-by. The study assumes 20% will be pass-by. The study therefore assumes that 84 of the approximately 2500 non-project cars on US 15-501 in the peak hour will stop at the Briar Chapel commercial area.



All of the assumptions and basis of trip generation, internal capture, and pass-by calculations were discussed with and approved by County and NCDOT staff prior to report finalization.

The Triangle Regional Model was considered in developing the distribution along with current development patterns and travel patterns. The distribution used in the TIA is based principally on current travel patterns and was approved by both NCDOT and Chatham County staffs.

IV. B Intersection Analysis

The Highway Capacity Manual (HCM) methodology was developed primarily to analyze isolated signalized intersections. While it incorporates some methodology for analyzing signals in an interconnected coordinated system, it is not as sophisticated as the Synchro analysis which accounts for interaction between adjacent signals, the effects of coordination and other components of control delay not fully accounted for in the HCM methodology. Synchro is therefore preferred to analyze coordinated systems such as the closed-loop system being installed on US 15-501 as a part of the on-going NCDOT widening project.

The use of Synchro LOS was supported by NCDOT staff specifically for use in this TIA. Chatham County staff deferred to NCDOT on the issue. NCDOT Congestion Management has requested use of Synchro software and Synchro output reports for projects sent to them for review. In addition, many municipalities in North Carolina including the City of Raleigh, the Town of Apex, the Town of Wake Forest, and Wake County accept Synchro reports for traffic impact studies.

The pedestrian phases were included at intersections expected to have high volumes of pedestrian traffic, specifically U.S. 15-501 & East Access Road, U.S. 15-501 & Jack Bennett Road, U.S. 15-501 & Taylor Road, and U.S. 15-501 & Andrews Store Road. Signal phases and timings at other intersections were set to accommodate pedestrians though specific pedestrian phases were not used.



IV. C Roadways

As discussed earlier, we followed standard methodology in analyzing the key intersections in the road network since the intersections generally control the capacity of a roadway. In our experience, the roadway segments, when analyzed in conjunction with intersection analyses, nearly always operate at a better level of service than the intersections themselves. We therefore did not analyze road segments as a part of the initial report. The intersection analyses showed that, with the exception of U.S. 15-501, none of the roadways in the study area indicated the need for more than one through lane; therefore, wholesale roadway widening was deemed unnecessary. Turn lanes are proposed at all new driveways on Andrews Store Road. The addition of a third lane between driveways adds little capacity and increases impervious surfaces.

However, in response to the peer review comments we have run segment analyses using both Synchro and HCM methodology for Andrews Store Road and Mann's Chapel Road. These are the existing roads that Briar Chapel directly accesses and will most significantly impact. These analyses (attached) show that both Andrews Store Road and Mann's Chapel Road operate at acceptable levels of service in the AM and PM peak hours. The arterial levels of service are summarized in the table below:

Arterial Level-of-Service		
Condition	AM Peak-Hour LOS (Avg. Speed)	PM Peak-Hour LOS (Avg. Speed)
Eastbound Andrews Store Road		
Synchro	A (42.5)	A (44.2)
HCS	A (41.0)	A (43.7)
Eastbound Mann's Chapel Road		
Synchro	A (41.5)	B (41.2)
HCS	A (35.9)	A (35.4)

The analysis does not indicate the need for widening of Andrews Store Road or Manns Chapel Road. Manns Chapel Road is designated a thoroughfare on the DCHC Thoroughfare Plan and as such may warrant additional right-of-



way in the future. Additional right-of-way is not needed to implement the improvements recommended in the TIA.

In regard to additional limited-movement driveways on US 15-501, the TIA assumes that all of the traffic is assigned to the full-movement driveways. Secondary driveways are shown and will likely have to be right-in/right-out only to meet NCDOT access standards. This has been discussed with NCDOT. Any secondary driveways will tend to reduce the traffic volumes, and therefore improve the level of service, at the main driveways. The final number, location, and function of secondary driveways will be discussed with, and approved by, NCDOT when applying for driveway permits. Since the secondary driveways are likely to change as site planning is refined and as right-in/right-out driveways will have minimal impact on capacity, it was felt that analysis and discussion of these driveways in detail would do little to inform the review process.

IV. D Street Connections

The developer has been in discussions with the surrounding neighborhoods on this issue. The plan reflects the desires of these neighborhoods. Analysis indicated that such connections are not needed from a capacity standpoint to serve the development. They may be deemed appropriate by the county to meet county policy.

IV. E-G Pedestrian and Bicycle Facilities, Traffic Calming, & Transit

The TIA notes that pedestrian and bike facilities, traffic calming, and transit will be taken into consideration later in the planning process. The greenway plan includes much of the pedestrian/bike circulation, but plans are not sufficiently detailed to provide final locations for most of these items and they will need to be developed with more specificity as the site construction plans are developed. The appropriate location for traffic calming features will be driven by final roadway configuration and development patterns. Transit service locations will need to be coordinated with transit service providers when the service is initiated. To attempt to be too specific at this point in the development process would be overly restrictive and based on very incomplete information. The commitment is that these items will be properly incorporated into the development. There is little hard analysis required in incorporating these features; it is more a matter of properly locating them



geometrically. The plan provides ample opportunity to incorporate these features.

IV. H Traffic Signal Upgrades

The TIA did not go into detail on the mechanism for revising or installing signals. The purpose was to assess the impacts and recommend the general mitigation measures. At this point in the process, the final details have not been worked out, but NCDOT practice is to have the developer update the timing plans when system revisions are made.

Before signals can be installed there must be a study showing they are truly warranted and design plans will have to be approved by NCDOT. All signals, as they are installed or revised, will have to be incorporated into the closed loop system. Modifications will include the work necessary to incorporate new signals into the closed loop system including new interconnect cable where necessary and updated timing plans.

IV. I Traffic Safety and Circulation near Schools

The design of the schools is not advanced enough to provide meaningful analysis of circulation. NCDOT has a specific group for dealing with traffic safety and circulation around schools. All plans for the traffic network immediately surrounding the school will be subject to detailed design and county and state review. This will occur later in the planning/development process as more detailed plans are prepared.

IV. J Phasing of Improvements

The TIA includes a phasing plan. We believe this plan conforms with this recommendation.

APPENDIX A

The second portion of the report, Appendix A, addresses specific technical comments and for the most part simply reiterates data and findings from the



TIA. We will offer responses only where there are questions or differences between the Peer Review Report and the TIA.

Trip Generation

School Trips

While there are alternative ways to generate school trips, most notably the NCDOT spreadsheet, in discussions with County and NCDOT staff prior to beginning the study it was agreed that ITE trip generation rates would be used. While there are differences, ITE rates are considered to be accurate and appropriate.

An analysis was performed where the MTSA School Traffic Calculator was used instead of ITE rates to estimate the number of trips for the K-8 school and school trips were assigned to the network discretely. Although the Briar Chapel development is anticipated to generate 956 new students, which is approximately 75% of the 1,300 students for the 2 proposed schools, to be conservative, only half of the K-8 School trips were assigned within the Briar Chapel development. The rest were assigned outside of the network. It was determined that while the MTSA calculator results in a larger number of overall school trips, when discretely assigned to the network the number of external school related trips is lower than in the Briar Chapel TIA by 202 in the AM peak hour and 118 in the PM peak hour.

Internal Capture

Briar Chapel is being designed as a community, with the mix of uses normally found in a community. The trip reductions taken in the report are consistent with nationally used methodology recommended by the Institute of Transportation Engineers. There is no readily available local data to further refine the ITE methodology. The internal capture is entirely consistent with the patterns in a mixed-use development designed to encourage internal trip-making and use of alternate modes. While the non-residential uses appear on the plan to occupy a relatively low percentage of the land area, they represent nearly half (48%) of the project's trip-making potential. Since the non-residential components are sized to serve local demand rather than serving as a regional draw, and the Briar Chapel development will contain a sizable proportion of the area's residences at build-out, the internal capture should be high. The study assumes only 400 (10.6%) of the 3,756 gross trips generated



in the PM peak hour will be internal to Briar Chapel consistent with ITE methodology. We believe this to be a low estimate of the probable internal capture.

Pass-by Trips

Likewise the pass-by trips are trips that are already on US 15-501 and stop at the commercial development. ITE methodology indicates 32% of the commercial trips should be pass-by. The study assumes 20% will be pass-by. The study therefore assumes that 84 of the approximately 2500 non-project vehicles on US 15-501 in the peak hour will stop at the Briar Chapel commercial area.

All of the assumptions and basis of trip generation, internal capture, and pass-by calculations were discussed with and approved by County and NCDOT staff prior to report finalization

Traffic Impact Analysis

Appendix A then discusses individual intersection analyses. Most are recitation of the TIA findings. We offer the following responses to individual intersection comments:

US Highway 15-501/SR 1532 (Mann's Chapel Road)

The comments note that the widening proposed should provide adequate length and continuity to truly function as a through lane and be adequately utilized. This is inherent in the recommendation. The exact extent of the widening will need to be evaluated at the time it is designed and the design will have to be reviewed and approved by NCDOT. Driveway interactions will be one of several considerations, and are very important. However, since there is a median being constructed now, the driveways are likely to interact with the new outside lane essentially as they will interact with the outside lane currently being built. Due to the traffic volumes on US 15-501, we expect a properly designed additional through lane to be fully utilized.



US 15-501 / SR 1529 (Taylor Road) & US 15-501/SR 1528 (Andrews Store Road)

The Peer Review recommends northbound exclusive right turn lanes at both of these intersections. The capacity analyses do not indicate the need for these lanes to provide adequate capacity. The right turn volumes at both locations are marginal relative to criteria used by NCDOT to determine when turn lanes are needed. The provision of turn lanes to allow turning traffic to get out of the through traffic stream may have some safety benefits. These may be offset where there is significant pedestrian traffic by the additional crossing distance for pedestrians and additional potential conflicts with pedestrians. The developer has agreed to construct these two right turn lanes.

US 15-501/Mt Gilead Church Road

The Peer Review basically repeats the findings of the TIA. The primary difference is that the TIA indicates that improvements at this intersection are needed primarily due to existing and background traffic, not the impacts of Briar Chapel. We reviewed the traffic volumes at this intersection and it does not appear likely that this intersection will warrant a traffic signal at project build-out. The analysis indicates that left turns off of Mt. Gilead Church Road will experience long delays under stop sign control. However, no physical improvements other than a signal will significantly reduce this delay. The installation of a signal will reduce the delay for the 30 vehicles making a left turn from Mt. Gilead Church Road but introduce delay to many of the 1300 vehicles on US 15-501. The total delay experienced by motorists, and the air and noise impacts would be much greater.

Hamletts Chapel Road/SR 1532 (Mann's Chapel Road/River Forest Road)

The projected volumes indicate that the warrants for a four-way stop will be met. Analysis indicates a better level of service will be afforded by a four-way stop and alleviate the safety concerns of long delays. Before a four-way stop is installed the intersection should be monitored to ascertain that the warrants are met and four-way stop control is appropriate.



SR 1532 (Mann's Chapel Road)/ North Access Road & SR 1532(Mann's Chapel Road)/ South Access Road

The laneage has been evaluated and that recommended in the TIA is the configuration that provides the best level of service. These intersections do not project to meet the warrants for a traffic signal but are recommended to be monitored to make sure. If there are other, specific, improvements identified that we have not evaluated, we will evaluate them.

Technical Comments

1. Dallas phasing has not been proposed or analyzed for US 15-501 intersections. The traffic signal plans that are a part of the current NCDOT 15-501 widening project use protected-permitted phasing, and the phasing was therefore used in the TIA. Pedestrian timing was considered in setting up the timing plans for all signals. There are some inconsistencies in phasing between AM and PM scenarios. These have been corrected (listed below with analyses attached) and do not change any of the levels-of-service at the affected intersections.
 - o U.S. 15-501 & Old Lystra Road
 - Converted phasing to include right-turn overlaps for the westbound approach in the No-Build AM and PM scenarios
 - Converted phasing to include right-turn overlaps for the northbound approach in the No-Build AM scenario
 - o U.S. 15-501 & Mann's Chapel Road
 - Converted phasing to include right-turn overlaps for the northbound approach in the No-Build AM and PM scenarios
 - Converted the phasing for the east-west direction to split phase

Protected-only phasing may be required at the intersection of U.S. 15-501 & Mann's Chapel Road due to the addition of the recommended north- and southbound through lanes. Changing the phasing for the north- and southbound lefts to protected-only will result in the delay increase as shown:



Level-of-Service Change U.S. 15-501 & Mann's Chapel Road		
Condition	AM Peak-Hour LOS (Delay)	PM Peak-Hour LOS (Delay)
Buildout w/ Permitted + Protected Phasing	C (31.1)	C (23.7)
Buildout w/ Protected Only Phasing	C (32.5)	C (27.6)

2. There are some inconsistencies in storage lengths between the No-Build and Build-Out scenarios. Storage lengths are correct in the build-out scenario. Correcting the No-Build analysis to match the build-out does not change either the LOS or delay at any intersection. At no point were recommendations made due to queue lengths in the No-Build scenario.

Incorrect lane widths were used at the following locations with the noted corrections:


- U.S. 15-501 & Old Lystra Road
 - Changed westbound lane widths from 9 to 12 feet for the No-Build AM and PM scenarios
 - U.S. 15-501 & Andrews Store Road
 - Changed eastbound lane widths from 10 to 12 feet for the buildout AM scenario
 - Lystra Road & Farrington Road –
 - Changed northbound, southbound, and eastbound lane widths from 12 to 11 feet for the buildout PM scenario
 - Changed westbound lane widths from 11 to 12 feet for the buildout PM scenario
3. Lane geometry was incorrect in the Synchro files at the following locations with the noted corrections:
- U.S. 15-501 & Taylor Road
 - Removed northbound right-turn lane in the buildout AM scenario
 - U.S. 15-501 & Andrews Store Road



- Removed northbound right-turn lane in the buildout AM and PM scenarios
- Removed westbound right-turn lane in the buildout PM scenario
- Hamletts Chapel Road & Mann's Chapel Road
 - Removed southbound right-turn lane in the buildout AM scenario
- Andrews Store Road & South Access Road
 - Changed geometry to a left-turn lane and a shared through-right lane for both buildout AM and PM scenarios

Please feel free to call me with any questions or comments at (919) 677-2113.

Sincerely,



Allen L. Williford, P.E.
Senior Vice President

ALW:jtf

Attachments: LOS Table, Revised Synchro Reports, Arterial Analyses

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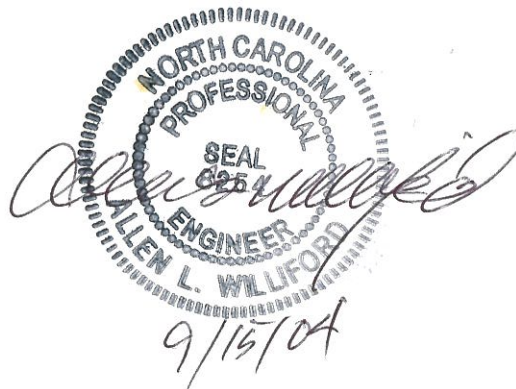


Table 1 Level-of-Service Changes from Technical Comments		
Condition	AM Peak-Hour LOS (Delay)	PM Peak-Hour LOS (Delay)
U.S. 15-501 & Old Lystra Road		
No-Build Reported	A (7.7)	B (11.1)
No-Build Corrected	A (7.9)	B (10.7)
U.S. 15-501 & Mann's Chapel Road		
No-Build Reported	C (26.3)	C (28.9)
No-Build Corrected	C (26.0)	C (28.6)
U.S. 15-501 & Taylor Road		
Buildout Reported	A (7.7)	NA
Buildout Corrected	A (8.5)	NA
U.S. 15-501 & Andrews Store Road		
Buildout Reported	C (23.9)	C (20.1)
Buildout Corrected	C (25.8)	C (21.2)
Hamletts Chapel Road & Mann's Chapel Road		
Buildout Reported	B (13.4)	NA
Buildout Corrected	B (14.9)	NA
Lystra Road & Farrington Road		
Buildout Reported	NA	B (16.3)
Buildout Corrected	NA	B (18.6)
Andrews Store Road & South Access Road		
Buildout Reported	F (76.1)	C (20.2)
Buildout Corrected	F (62.3)	C (20.2)



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		250	325	
Storage Lanes	1	1		1	1	
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	300	50	50	300
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1770	1583	3539	1583	1770	3539
Flt Permitted	0.950				0.053	
Satd. Flow (perm)	1770	1583	3539	1583	99	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		24		118		
Link Speed (mph)	45		55			55
Link Distance (ft)	997		1757			1434
Travel Time (s)	15.2		21.6			17.8
Volume (vph)	39	22	1898	106	58	692
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	43	24	2109	118	64	769
Turn Type	pm+ov		pm+ov		pm+pt	
Protected Phases	8	1	2	8	1	6
Permitted Phases		8		2	6	
Detector Phases	8	1	2	8	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	13.0	24.0	24.0	13.0	24.0
Total Split (s)	16.0	13.0	121.0	16.0	13.0	134.0
Total Split (%)	11%	9%	81%	11%	9%	89%
Maximum Green (s)	9.3	7.0	114.3	9.3	7.0	127.3
Yellow Time (s)	4.7	4.0	4.7	4.7	4.0	4.7
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag		Lead	Lag		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Coord	None	None	Coord
Act Effct Green (s)	11.9	23.9	122.5	137.9	132.1	132.1
Actuated g/C Ratio	0.08	0.16	0.82	0.92	0.88	0.88
v/c Ratio	0.31	0.09	0.73	0.08	0.34	0.25
Uniform Delay, d1	65.1	0.0	6.8	0.0	1.1	1.4
Delay	65.1	18.1	9.8	0.4	8.3	0.4
LOS	E	B	A	A	A	A
Approach Delay	48.3		9.3			1.0
Approach LOS	D		A			A
Queue Length 50th (ft)	40	0	470	0	2	13
Queue Length 95th (ft)	82	28	672	m9	17	16
Internal Link Dist (ft)	917		1677			1354
50th Up Block Time (%)						
95th Up Block Time (%)						
Turn Bay Length (ft)				250	325	
50th Bay Block Time %			8%			







Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
95th Bay Block Time %			21%			
Queuing Penalty (veh)			17			

Intersection Summary

Area Type: Other
 Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.73
 Intersection Signal Delay: 7.9 Intersection LOS: A
 Intersection Capacity Utilization 75.2% ICU Level of Service C
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Old Lystra Road & U.S. 15-501

 ø1	 ø2	
13 s	121 s	
 ø6		 ø8
134 s		16 s



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0		250	325	
Storage Lanes	1	1		1	1	
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	300	50	50	300
Trailing Detector (ft)	0	0	0	0	0	0
Turning Speed (mph)	15	9		9	15	
Satd. Flow (prot)	1770	1583	3539	1583	1770	3539
Flt Permitted	0.950				0.138	
Satd. Flow (perm)	1770	1583	3539	1583	257	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		42		70		
Link Speed (mph)	45		55			55
Link Distance (ft)	997		1757			1434
Travel Time (s)	15.2		21.6			17.8
Volume (vph)	116	38	1148	63	17	1950
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	129	42	1276	70	19	2167
Turn Type	pm+ov		pm+ov		pm+pt	
Protected Phases	8	1	2	8	1	6
Permitted Phases		8		2	6	
Detector Phases	8	1	2	8	1	6
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	16.0	13.0	16.0	16.0	13.0	16.0
Total Split (s)	23.0	17.0	70.0	23.0	17.0	87.0
Total Split (%)	21%	15%	64%	21%	15%	79%
Maximum Green (s)	16.3	10.3	63.3	16.3	10.3	80.3
Yellow Time (s)	4.7	4.7	4.7	4.7	4.7	4.7
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lead/Lag		Lead	Lag		Lead	
Lead-Lag Optimize?		Yes	Yes		Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	Min	Coord	None	Min	Coord
Walk Time (s)		5.0			5.0	
Flash Dont Walk (s)		11.0			11.0	
Pedestrian Calls (#/hr)		0			0	
Act Effct Green (s)	16.4	29.0	75.0	94.4	87.6	87.6
Actuated g/C Ratio	0.15	0.26	0.68	0.86	0.80	0.80
v/c Ratio	0.49	0.09	0.53	0.05	0.06	0.77
Uniform Delay, d1	42.9	0.0	8.7	0.0	2.3	5.9
Delay	42.4	8.6	2.4	0.0	4.2	14.2
LOS	D	A	A	A	A	B
Approach Delay	34.1		2.2			14.1
Approach LOS	C		A			B
Queue Length 50th (ft)	84	0	31	0	4	677
Queue Length 95th (ft)	141	26	36	m0	m5	798
Internal Link Dist (ft)	917		1677			1354
50th Up Block Time (%)						



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
95th Up Block Time (%)						
Turn Bay Length (ft)				250	325	
50th Bay Block Time %						20%
95th Bay Block Time %			2%			21%
Queuing Penalty (veh)						4

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 100 (91%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 10.7
Intersection LOS: B
Intersection Capacity Utilization 73.7%
ICU Level of Service C
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Old Lystra Road & U.S. 15-501

ø1	ø2	
17 s	70 s	
ø6		ø8
87 s		23 s



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	↑	→	←	↑	→	←	↑	→	←	↑	→
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	11	12	10	10	11	12	11	11	12	11
Storage Length (ft)	300		100	150		0	450		300	450		300
Storage Lanes	2		1	2		0	1		1	1		1
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	50	50	50		50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	1801	1531	3433	1533	0	1711	3539	1531	1711	3539	1531
Flt Permitted	0.950			0.950			0.277			0.062		
Satd. Flow (perm)	3433	1801	1531	3433	1533	0	499	3539	1531	112	3539	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			106		62				61			57
Link Speed (mph)		45			45			55			55	
Link Distance (ft)		4538			1000			2585			795	
Travel Time (s)		68.8			27.3			74.3			12.1	
Volume (vph)	403	67	95	46	15	56	40	1580	70	50	618	51
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	448	74	106	51	79	0	44	1756	78	56	687	57
Turn Type	Split		pm+ov	Split			pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	4	4	5	8	8		5	2	8	1	6	4
Permitted Phases			4				2		2	6		6
Detector Phases	4	4	5	8	8		5	2	8	1	6	4
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	24.0	24.0	13.0	24.0	24.0		13.0	24.0	24.0	13.0	24.0	24.0
Total Split (s)	46.0	46.0	13.0	24.0	24.0	0.0	13.0	67.0	24.0	13.0	67.0	46.0
Total Split (%)	31%	31%	9%	16%	16%	0%	9%	45%	16%	9%	45%	31%
Maximum Green (s)	38.8	38.8	5.8	16.8	16.8		5.8	59.8	16.8	5.8	59.8	38.8
Yellow Time (s)	4.7	4.7	4.7	4.7	4.7		4.7	4.7	4.7	4.7	4.7	4.7
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5
Lead/Lag			Lead				Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes				Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		None	Coord	None	None	Coord	None
Act Effct Green (s)	27.2	27.2	37.1	12.5	12.5		98.8	90.8	104.0	98.3	88.3	118.5
Actuated g/C Ratio	0.18	0.18	0.25	0.08	0.08		0.66	0.61	0.69	0.66	0.59	0.79
v/c Ratio	0.72	0.23	0.23	0.18	0.43		0.11	0.82	0.07	0.31	0.33	0.05
Uniform Delay, d1	57.8	52.4	0.0	63.9	13.7		8.1	24.2	1.0	8.3	15.7	0.0
Delay	57.3	51.1	4.6	63.0	20.8		7.0	24.9	1.2	13.2	14.2	1.6
LOS	E	D	A	E	C		A	C	A	B	B	A
Approach Delay		47.7			37.3			23.5			13.2	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	216	63	0	24	16		13	461	4	12	182	0
Queue Length 95th (ft)	262	106	36	45	69		m24	#1050	m9	43	262	24
Internal Link Dist (ft)		4458			920			2505			715	
50th Up Block Time (%)												
95th Up Block Time (%)												
Turn Bay Length (ft)	300		100	150			450		300	450		300



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th Bay Block Time %												
95th Bay Block Time %								32%				
Queuing Penalty (veh)								7				

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 54 (36%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 26.0 Intersection LOS: C
Intersection Capacity Utilization 74.6% ICU Level of Service C
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Mann's Chapel Road & U.S. 15-501

ø1	ø2	ø4	ø8
13 s	67 s	46 s	24 s
ø5	ø6		
13 s	67 s		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	←	↑	↑	←	↑	↑	←	↑	↑	←	↑	↑
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	11	11	12	10	10	11	12	11	11	12	11
Storage Length (ft)	300		100	150		0	450		300	450		300
Storage Lanes	2		1	2		0	1		1	1		1
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50	50	50	50		50	50	50	50	50	50
Trailing Detector (ft)	0	0	0	0	0		0	0	0	0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	1801	1531	3433	1634	0	1711	3539	1531	1711	3539	1531
Flt Permitted	0.950			0.950			0.067			0.175		
Satd. Flow (perm)	3433	1801	1531	3433	1634	0	121	3539	1531	315	3539	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			42		25				38			274
Link Speed (mph)		45			45			55			55	
Link Distance (ft)		4538			1000			2585			795	
Travel Time (s)		68.8			27.3			74.3			12.1	
Volume (vph)	155	75	69	159	110	73	145	975	34	140	1629	247
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	172	83	77	177	203	0	161	1083	38	156	1810	274
Turn Type	Split		pm+ov	Split			pm+pt		pm+ov	pm+pt		pm+ov
Protected Phases	4	4	5	8	8		5	2	8	1	6	4
Permitted Phases			4				2		2	6		6
Detector Phases	4	4	5	8	8		5	2	8	1	6	4
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	16.0	16.0	13.0	16.0	16.0		13.0	16.0	16.0	13.0	16.0	16.0
Total Split (s)	16.0	16.0	13.0	18.0	18.0	0.0	13.0	63.0	18.0	13.0	63.0	16.0
Total Split (%)	15%	15%	12%	16%	16%	0%	12%	57%	16%	12%	57%	15%
Maximum Green (s)	8.8	8.8	5.8	10.8	10.8		5.8	55.8	10.8	5.8	55.8	8.8
Yellow Time (s)	4.7	4.7	4.7	4.7	4.7		4.7	4.7	4.7	4.7	4.7	4.7
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5
Lead/Lag			Lead				Lead	Lag		Lead	Lag	
Lead-Lag Optimize?			Yes				Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None		None	Coord	None	None	Coord	None
Act Effct Green (s)	12.8	12.8	22.8	15.0	15.0		70.2	60.2	75.2	70.2	60.2	76.0
Actuated g/C Ratio	0.12	0.12	0.21	0.14	0.14		0.64	0.55	0.68	0.64	0.55	0.69
v/c Ratio	0.43	0.40	0.22	0.38	0.83		0.73	0.56	0.04	0.48	0.93	0.24
Uniform Delay, d1	45.2	45.0	10.2	43.2	40.4		19.3	16.2	0.0	6.8	23.1	0.0
Delay	45.5	45.5	12.1	43.6	54.4		37.8	12.7	0.9	10.9	37.3	2.9
LOS	D	D	B	D	D		D	B	A	B	D	A
Approach Delay		37.8			49.4			15.5			31.2	
Approach LOS		D			D			B			C	
Queue Length 50th (ft)	59	55	15	59	125		36	308	4	60	648	29
Queue Length 95th (ft)	93	105	46	94	#251		#165	167	m0	m70	#785	m46
Internal Link Dist (ft)		4458			920			2505			715	
50th Up Block Time (%)												
95th Up Block Time (%)											19%	
Turn Bay Length (ft)	300		100	150			450		300	450		300









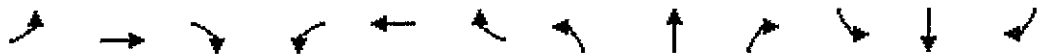
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
50th Bay Block Time %												37%
95th Bay Block Time %					42%							36%
Queuing Penalty (veh)					36							228

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 61 (55%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 28.6
Intersection LOS: C
Intersection Capacity Utilization 88.6%
ICU Level of Service D
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Mann's Chapel Road & U.S. 15-501

 ø1	 ø2	 ø4	 ø8
13 s	63 s	16 s	18 s
 ø5	 ø6		
13 s	63 s		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	200		0	0		0	400		0	325		325
Storage Lanes	2		0	1		0	1		0	1		1
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	300		50	300	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	3433	1583	0	1770	1583	0	1770	3525	0	1770	3539	1583
Flt Permitted	0.950			0.950			0.175			0.044		
Satd. Flow (perm)	3433	1583	0	1770	1583	0	326	3525	0	82	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		284			134			3				121
Link Speed (mph)		35			25			45			45	
Link Distance (ft)		1000			292			488			1197	
Travel Time (s)		19.5			8.0			20.1			14.0	
Volume (vph)	87	0	105	8	0	17	71	1946	58	124	1024	109
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	97	117	0	9	19	0	79	2226	0	138	1138	121
Turn Type	Split			Split			pm+pt			pm+pt		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases							2			6		6
Detector Phases	4	4		8	8		5	2		1	6	4
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		13.0	22.0		13.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	22.0	22.0	0.0	13.0	93.0	0.0	13.0	93.0	22.0
Total Split (%)	15%	15%	0%	15%	15%	0%	9%	62%	0%	9%	62%	15%
Maximum Green (s)	16.0	16.0		16.0	16.0		7.0	87.0		7.0	87.0	16.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lead/Lag							Lead	Lag		Lead	Lag	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Coord		None	Coord	None
Walk Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	5.0
Flash Dont Walk (s)	11.0	11.0		11.0	11.0			11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0			0			0	0
Act Effct Green (s)	12.5	12.5		9.3	9.3		120.2	110.8		121.5	111.5	127.0
Actuated g/C Ratio	0.08	0.08		0.06	0.06		0.80	0.74		0.81	0.74	0.85
v/c Ratio	0.34	0.30		0.08	0.08		0.23	0.85		0.78	0.43	0.09
Uniform Delay, d1	64.8	0.0		68.4	0.0		2.9	15.6		31.0	8.2	0.0
Delay	64.5	0.0		66.0	0.0		2.1	8.0		52.9	1.3	0.2
LOS	E	A		E	A		A	A		D	A	A
Approach Delay		29.2			21.2			7.8			6.3	
Approach LOS		C			C			A			A	
Queue Length 50th (ft)	46	0		8	0		9	216		81	48	0
Queue Length 95th (ft)	76	0		28	0		m11	250		#195	21	0
Internal Link Dist (ft)		920			212			408			1117	
50th Up Block Time (%)												



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)												
Turn Bay Length (ft)	200						400			325		325
50th Bay Block Time %												
95th Bay Block Time %												
Queuing Penalty (veh)												

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 4 (3%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.85

Intersection Signal Delay: 8.5

Intersection LOS: A

Intersection Capacity Utilization 88.9%


ICU Level of Service D

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 6: Taylor Road & U.S. 15-501

 ø1	 ø2	 ø4	 ø8
13 s	93 s	22 s	22 s
 ø5	 ø6		
13 s	93 s		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	500		0	50		0	425		0	350		350
Storage Lanes	1		0	1		0	1		0	1		1
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1595	0	1770	1609	0	1770	3525	0	1770	3539	1583
Fit Permitted	0.604			0.561			0.235			0.053		
Satd. Flow (perm)	1125	1595	0	1045	1609	0	438	3525	0	99	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		208			19			3				298
Link Speed (mph)		45			25			45			45	
Link Distance (ft)		2102			343			696			1096	
Travel Time (s)		31.8			9.4			10.5			20.1	
Volume (vph)	327	13	284	6	2	17	198	1707	46	124	753	268
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	363	330	0	7	21	0	220	1948	0	138	837	298
Turn Type	pm+pt			Perm			pm+pt			pm+pt		pm+ov
Protected Phases	7	4			8		5	2		1	6	7
Permitted Phases	4			8			2			6		6
Detector Phases	7	4		8	8		5	2		1	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		13.0	22.0		13.0	22.0	22.0
Total Split (s)	36.0	52.0	0.0	16.0	16.0	0.0	19.0	85.0	0.0	13.0	79.0	36.0
Total Split (%)	24%	35%	0%	11%	11%	0%	13%	57%	0%	9%	53%	24%
Maximum Green (s)	30.0	46.0		10.0	10.0		13.0	79.0		7.0	73.0	30.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lead
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Coord		None	Coord	None
Walk Time (s)	5.0	5.0						5.0			5.0	5.0
Flash Dont Walk (s)	11.0	11.0						11.0			11.0	11.0
Pedestrian Calls (#/hr)	0	0						0			0	0
Act Effct Green (s)	40.1	40.1		9.8	9.8		103.3	90.9		97.2	87.3	122.3
Actuated g/C Ratio	0.27	0.27		0.07	0.07		0.69	0.61		0.65	0.58	0.82
v/c Ratio	0.83	0.57		0.10	0.17		0.52	0.91		0.78	0.41	0.22
Uniform Delay, d1	48.4	15.6		68.1	6.4		8.9	28.1		30.2	18.5	0.0
Delay	49.9	15.5		65.5	27.1		9.4	28.5		50.7	21.6	1.8
LOS	D	B		E	C		A	C		D	C	A
Approach Delay		33.5			36.7			26.6			20.1	
Approach LOS		C			D			C			C	
Queue Length 50th (ft)	312	94		7	2		62	311		106	217	0
Queue Length 95th (ft)	421	189		24	31		m103	#1158		#203	323	81
Internal Link Dist (ft)		2022			263			616			1016	
50th Up Block Time (%)								2%				



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
95th Up Block Time (%)								12%				
Turn Bay Length (ft)	500			50			425			350		350
50th Bay Block Time %								3%				
95th Bay Block Time %								33%				
Queuing Penalty (veh)								177				

Intersection Summary

Area Type: Other

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 134 (89%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.91

Intersection Signal Delay: 25.8

Intersection LOS: C

Intersection Capacity Utilization 98.5%








ICU Level of Service E






















95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Andrews Store Road & U.S. 15-501

 ø1	 ø2	 ø4	
13 s	85 s	52 s	
 ø5	 ø6	 ø7	 ø8
19 s	79 s	36 s	16 s

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	500		0	50		0	425		0	350		350
Storage Lanes	1		0	1		0	1		0	1		1
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	50		50	50	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1770	1585	0	1770	1609	0	1770	3536	0	1770	3539	1583
Flt Permitted	0.499			0.646			0.080			0.112		
Satd. Flow (perm)	930	1585	0	1203	1609	0	149	3536	0	209	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		176			101							308
Link Speed (mph)		45			25			45			45	
Link Distance (ft)		2102			343			696			1096	
Travel Time (s)		31.8			9.4			10.5			20.1	
Volume (vph)	183	1	158	43	9	91	236	1029	4	12	1717	277
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Lane Group Flow (vph)	203	177	0	48	111	0	262	1147	0	13	1908	308
Turn Type	pm+pt			Perm			pm+pt			pm+pt		pm+ov
Protected Phases	7	4			8		5	2		1	6	7
Permitted Phases	4			8			2			6		6
Detector Phases	7	4		8	8		5	2		1	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	13.0	22.0		22.0	22.0		22.0	22.0		22.0	22.0	13.0
Total Split (s)	13.0	35.0	0.0	22.0	22.0	0.0	22.0	53.0	0.0	22.0	53.0	13.0
Total Split (%)	12%	32%	0%	20%	20%	0%	20%	48%	0%	20%	48%	12%
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	2.0
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	Lead
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None		None	None		None	Coord		None	Coord	None
Act Effct Green (s)	25.7	25.7		12.7	12.7		78.3	73.6		67.7	59.0	72.1
Actuated g/C Ratio	0.23	0.23		0.12	0.12		0.71	0.67		0.62	0.54	0.66
v/c Ratio	0.69	0.35		0.35	0.40		0.76	0.48		0.05	1.00	0.27
Uniform Delay, d1	36.5	0.2		44.8	3.9		22.5	10.8		5.5	25.5	0.0
Delay	36.5	4.9		43.8	10.5		33.3	2.0		4.2	34.5	0.0
LOS	D	A		D	B		C	A		A	C	A
Approach Delay		21.8			20.6			7.9			29.6	
Approach LOS		C			C			A			C	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (ft)	124	0		32	6		78	18		1	~756	0
Queue Length 95th (ft)	m186	m51		67	56		185	37		m2	m#836	m0
Internal Link Dist (ft)		2022			263			616			1016	
50th Up Block Time (%)												
95th Up Block Time (%)												
Turn Bay Length (ft)	500			50			425			350		350
50th Bay Block Time %											9%	
95th Bay Block Time %				26%	14%						20%	
Queuing Penalty (veh)				14	3						2	

Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 35 (32%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.00

Intersection Signal Delay: 21.2

Intersection LOS: C

Intersection Capacity Utilization 95.2%

ICU Level of Service E

~ Volume exceeds capacity, queue is theoretically infinite.








Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 7: Andrews Store Road & U.S. 15-501

 ø1	 ø2	 ø4
22 s	53 s	35 s
 ø5	 ø6	 ø7
22 s	53 s	13 s
		 ø8
		22 s



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑		↰	↑			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (veh/h)	210	195	20	47	173	62	23	97	34	59	76	187
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (veh/h)	233	217	22	52	192	69	26	108	38	66	84	208

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total (vph)	233	239	52	261	171	358
Volume Left (vph)	233	0	52	0	26	66
Volume Right (vph)	0	22	0	69	38	208
Hadj (s)	0.2	0.0	0.2	-0.1	-0.1	-0.3
Departure Headway (s)	6.9	6.6	7.1	6.7	6.7	6.1
Degree Utilization, x	0.45	0.44	0.10	0.49	0.32	0.60
Capacity (veh/h)	502	522	477	498	485	564
Control Delay (s)	14.1	13.5	9.7	14.8	12.8	18.0
Approach Delay (s)	13.8		14.0		12.8	18.0
Approach LOS	B		B		B	C

Intersection Summary					
Delay		14.9			
HCM Level of Service		B			
Intersection Capacity Utilization		70.8%	ICU Level of Service		C

Briar Chapel
8: Lystra Road & Farrington Road

Build-out PM
8/12/2004



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	11	11	11	12	12	12	11	11	11	11	11	11
Grade (%)		2%			1%			0%			0%	
Storage Length (ft)	150		0	0		0	75		0	125		0
Storage Lanes	1		0	0		0	1		0	1		1
Total Lost Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Leading Detector (ft)	50	50		50	50		50	300		50	300	50
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Satd. Flow (prot)	1694	1533	0	0	1789	0	1711	1801	0	1711	1801	1531
Flt Permitted	0.733				0.979		0.125			0.623		
Satd. Flow (perm)	1307	1533	0	0	1756	0	225	1801	0	1122	1801	1531
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		170			4							662
Link Speed (mph)		55			55			55			55	
Link Distance (ft)		5189			1008			1000			1066	
Travel Time (s)		64.3			22.9			12.4			13.2	
Volume (vph)	430	11	153	1	11	4	153	194	0	44	570	698
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Lane Group Flow (vph)	478	182	0	0	17	0	170	216	0	49	633	776
Turn Type	pm+pt			Perm			pm+pt			Perm		pm+ov
Protected Phases	7	4			8		5	2			6	7
Permitted Phases	4			8			2			6		6
Detector Phases	7	4		8	8		5	2		6	6	7
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	13.0	16.0		16.0	16.0		13.0	16.0		16.0	16.0	13.0
Total Split (s)	19.0	35.0	0.0	16.0	16.0	0.0	13.0	45.0	0.0	32.0	32.0	19.0
Total Split (%)	24%	44%	0%	20%	20%	0%	16%	56%	0%	40%	40%	24%
Maximum Green (s)	12.5	28.4		9.4	9.4		9.0	38.4		25.4	25.4	12.5
Yellow Time (s)	4.0	5.1		5.1	5.1		3.5	5.1		5.1	5.1	4.0
All-Red Time (s)	2.5	1.5		1.5	1.5		0.5	1.5		1.5	1.5	2.5
Lead/Lag	Lead			Lag	Lag		Lead			Lag	Lag	Lead
Lead-Lag Optimize?	Yes			Yes	Yes		Yes			Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		None	Min		Min	Min	None
Act Efect Green (s)	18.6	18.6			9.9		38.0	38.0		28.3	28.3	48.6
Actuated g/C Ratio	0.30	0.30			0.14		0.59	0.60		0.45	0.45	0.77
v/c Ratio	0.98	0.32			0.07		0.49	0.20		0.10	0.78	0.58
Uniform Delay, d1	20.5	1.0			23.0		7.2	7.4		12.6	18.6	0.6
Delay	54.2	4.1			25.5		8.1	6.4		13.1	24.6	1.2
LOS	D	A			C		A	A		B	C	A
Approach Delay		40.4			25.5			7.1			11.7	
Approach LOS		D			C			A			B	
Queue Length 50th (ft)	~222	4			4		21	27		10	197	9
Queue Length 95th (ft)	#369	42			23		87	88		38	#504	72
Internal Link Dist (ft)		5109			928			920			986	
50th Up Block Time (%)												
95th Up Block Time (%)												



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Bay Length (ft)	150						75			125		
50th Bay Block Time %	32%											26%
95th Bay Block Time %	39%						14%	13%				52%
Queuing Penalty (veh)	64						15	11				19

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 62.9

Natural Cycle: 90

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.98

Intersection Signal Delay: 18.6

Intersection LOS: B

Intersection Capacity Utilization 85.9%

ICU Level of Service D

~ Volume exceeds capacity, queue is theoretically infinite.




















Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 8: Lystra Road & Farrington Road

ø2	ø4
45 s	35 s
ø5	ø7
13 s	19 s
ø6	ø8
32 s	16 s

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control	Free				Free			Stop			Stop	
Grade	0%				0%			0%			0%	
Volume (veh/h)	39	370	0	1	284	188	0	0	0	238	0	57
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (veh/h)	43	411	0	1	316	209	0	0	0	264	0	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	524			411			879	1024	411	816	816	316
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	524			411			879	1024	411	816	816	316
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	100	8	100	91
cM capacity (veh/h)	1042			1148			237	225	641	286	298	725
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2					
Volume Total	43	411	317	209	0	264	63					
Volume Left	43	0	1	0	0	264	0					
Volume Right	0	0	0	209	0	0	63					
cSH	1042	1700	1148	1700	1700	286	725					
Volume to Capacity	0.04	0.24	0.00	0.12	0.00	0.92	0.09					
Queue Length (ft)	3	0	0	0	0	217	7					
Control Delay (s)	8.6	0.0	0.0	0.0	0.0	74.7	10.4					
Lane LOS	A		A		A	F	B					
Approach Delay (s)	0.8		0.0		0.0	62.3						
Approach LOS					A	F						
Intersection Summary												
Average Delay	15.9											
Intersection Capacity Utilization	43.0%											
ICU Level of Service	A											



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			↰	↱		↕		↰	↱	
Sign Control	Free			Free			Stop			Stop		
Grade	0%			0%			0%			0%		
Volume (veh/h)	48	203	1	2	316	182	2	0	3	125	0	30
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (veh/h)	53	226	1	2	351	202	2	0	3	139	0	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None						None					
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	553			227			722	891	226	691	689	351
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	553			227			722	891	226	691	689	351
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			100			99	100	100	59	100	95
cM capacity (veh/h)	1017			1342			312	267	813	343	349	692

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	53	227	353	202	6	139	33
Volume Left	53	0	2	0	2	139	0
Volume Right	0	1	0	202	3	0	33
cSH	1017	1700	1342	1700	495	343	692
Volume to Capacity	0.05	0.13	0.00	0.12	0.01	0.41	0.05
Queue Length (ft)	4	0	0	0	1	48	4
Control Delay (s)	8.7	0.0	0.1	0.0	12.3	22.5	10.5
Lane LOS	A		A		B	C	B
Approach Delay (s)	1.7		0.0		12.3	20.2	
Approach LOS					B	C	

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A

URBAN STREET WORKSHEET #1								
General Information				Site Information				
Analyst <i>JTF</i>				Urban Street <i>Andrews Store Road</i>				
Agency/Co. <i>KHA</i>				Direction of Travel <i>East-bound</i>				
Date Performed <i>8/31/2004</i>				Jurisdiction				
Time Period <i>AM</i>				Analysis Year <i>2014</i>				
Project Description: <i>Briar Chapel</i>								
Input Parameters								
Analysis Period(h) T = 0.25	Segments							
	1	2	3	4	5	6	7	8
Cycle length, C (s)	150.0							
Eff. green to cycle ratio, g/C	0.270							
v/c ratio for lane group, X	0.570							
Cap of lane group, c (veh/h)	330							
Pct Veh on Grn., PVG								
Arrival type, AT	4							
Unit Extension, UE (sec)	0.0							
Length of segment, L (mi)	2.00							
Initial Queue, Qb (veh)	0							
Urban street class, SC	2							
Free-flow speed, FSS (mi/h)	45							
Running Time, TR (s)	160.0							
Other delay, (s)	0.0							
Delay Computation								
Uniform delay, d1 (s)	47.2	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Incremental delay adj, k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Upstream filtering adj factor, I	1.000							
Incremental delay, d2 (s)	7.0	3.5	3.4	3.4	3.4	3.4	3.4	3.4
Initial queue delay, d3 (s)	0							
Progression adj factor, PF	1.008	0.256	0.256	0.256	0.256	0.256	0.256	0.256
Control delay, d (s)	15.5							
Segment LOS Determination								
Travel time, ST (s)	175.5							
Travel speed, SA (mi/h)	41.0							
Segment LOS	A							
Urban Street LOS Determination								
Total travel time (s)	175.5							
Total length (mi)	2.00							
Total travel speed, SA (mi/h)	41.0							
Total urban street LOS	A							

URBAN STREET WORKSHEET #1								
General Information				Site Information				
Analyst <i>JTF</i>				Urban Street <i>Andrews Store Road</i>				
Agency/Co. <i>KHA</i>				Direction of Travel <i>East-bound</i>				
Date Performed <i>8/31/2004</i>				Jurisdiction				
Time Period <i>PM</i>				Analysis Year <i>2014</i>				
Project Description: <i>Briar Chapel</i>								
Input Parameters								
Analysis Period(h) T = 0.25	Segments							
	1	2	3	4	5	6	7	8
Cycle length, C (s)	110.0							
Eff. green to cycle ratio, g/C	0.210							
v/c ratio for lane group, X	0.370							
Cap of lane group, c (veh/h)	177							
Pct Veh on Grn., PVG								
Arrival type, AT	4							
Unit Extension, UE (sec)	0.0							
Length of segment, L (mi)	2.00							
Initial Queue, Qb (veh)	0							
Urban street class, SC	2							
Free-flow speed, FSS (mi/h)	45							
Running Time, TR (s)	160.0							
Other delay, (s)	0.0							
Delay Computation								
Uniform delay, d1 (s)	37.2	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Incremental delay adj, k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Upstream filtering adj factor, I	1.000							
Incremental delay, d2 (s)	5.9	4.1	3.4	3.4	3.4	3.4	3.4	3.4
Initial queue delay, d3 (s)	0							
Progression adj factor, PF	1.048	0.256	0.256	0.256	0.256	0.256	0.256	0.256
Control delay, d (s)	4.9							
Segment LOS Determination								
Travel time, ST (s)	164.9							
Travel speed, SA (mi/h)	43.7							
Segment LOS	A							
Urban Street LOS Determination								
Total travel time (s)	164.9							
Total length (mi)	2.00							
Total travel speed, SA (mi/h)	43.7							
Total urban street LOS	A							

URBAN STREET WORKSHEET #1								
General Information				Site Information				
Analyst <i>JTF</i>				Urban Street <i>Mann's Chapel Road</i>				
Agency/Co. <i>KHA</i>				Direction of Travel <i>East-bound</i>				
Date Performed <i>8/31/2004</i>				Jurisdiction				
Time Period <i>AM</i>				Analysis Year <i>2014</i>				
Project Description: <i>Briar Chapel</i>								
Input Parameters								
Analysis Period(h) T = 0.25	Segments							
	1	2	3	4	5	6	7	8
Cycle length, C (s)	150.0							
Eff. green to cycle ratio, g/C	0.280							
v/c ratio for lane group, X	0.140							
Cap of lane group, c (veh/h)	74							
Pct Veh on Grn., PVG								
Arrival type, AT	4							
Unit Extension, UE (sec)	0.0							
Length of segment, L (mi)	2.00							
Initial Queue, Qb (veh)	0							
Urban street class, SC	2							
Free-flow speed, FSS (mi/h)	45							
Running Time, TR (s)	160.0							
Other delay, (s)	0.0							
Delay Computation								
Uniform delay, d1 (s)	40.5	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Incremental delay adj, k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Upstream filtering adj factor, I	1.000							
Incremental delay, d2 (s)	3.9	4.4	3.4	3.4	3.4	3.4	3.4	3.4
Initial queue delay, d3 (s)	0							
Progression adj factor, PF	1.001	0.256	0.256	0.256	0.256	0.256	0.256	0.256
Control delay, d (s)	40.3							
Segment LOS Determination								
Travel time, ST (s)	200.3							
Travel speed, SA (mi/h)	35.9							
Segment LOS	A							
Urban Street LOS Determination								
Total travel time (s)	200.3							
Total length (mi)	2.00							
Total travel speed, SA (mi/h)	35.9							
Total urban street LOS	A							

URBAN STREET WORKSHEET #1								
General Information				Site Information				
Analyst <i>JTF</i>				Urban Street <i>Mann's Chapel Road</i>				
Agency/Co. <i>KHA</i>				Direction of Travel <i>East-bound</i>				
Date Performed <i>8/31/2004</i>				Jurisdiction				
Time Period <i>PM</i>				Analysis Year <i>2014</i>				
Project Description: <i>Briar Chapel</i>								
Input Parameters								
Analysis Period(h) T = 0.25	Segments							
	1	2	3	4	5	6	7	8
Cycle length, C (s)	110.0							
Eff. green to cycle ratio, g/C	0.140							
v/c ratio for lane group, X	0.330							
Cap of lane group, c (veh/h)	83							
Pct Veh on Grn., PVG								
Arrival type, AT	4							
Unit Extension, UE (sec)	0.0							
Length of segment, L (mi)	2.00							
Initial Queue, Qb (veh)	0							
Urban street class, SC	2							
Free-flow speed, FSS (mi/h)	45							
Running Time, TR (s)	160.0							
Other delay, (s)	0.0							
Delay Computation								
Uniform delay, d1 (s)	42.6	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Incremental delay adj, k	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Upstream filtering adj factor, I	1.000							
Incremental delay, d2 (s)	10.3	4.2	3.4	3.4	3.4	3.4	3.4	3.4
Initial queue delay, d3 (s)	0							
Progression adj factor, PF	1.088	0.256	0.256	0.256	0.256	0.256	0.256	0.256
Control delay, d (s)	43.6							
Segment LOS Determination								
Travel time, ST (s)	203.6							
Travel speed, SA (mi/h)	35.4							
Segment LOS	A							
Urban Street LOS Determination								
Total travel time (s)	203.6							
Total length (mi)	2.00							
Total travel speed, SA (mi/h)	35.4							
Total urban street LOS	A							

Arterial Level of Service: EB Andrews Store Road

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
U.S. 15-501	II	45	265.7	15.5	281.2	3.3	42.5	A
Total	II		265.7	15.5	281.2	3.3	42.5	A

Arterial Level of Service: EB Mann's Chapel Road

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
U.S. 15-501	I	45	413.5	40.3	453.8	5.2	41.5	B
Total	I		413.5	40.3	453.8	5.2	41.5	B

Arterial Level of Service: EB Andrews Store Road

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
U.S. 15-501	II	45	265.7	4.9	270.6	3.3	44.2	A
Total	II		265.7	4.9	270.6	3.3	44.2	A

Arterial Level of Service: EB Mann's Chapel Road

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
U.S. 15-501	I	45	413.5	43.6	457.1	5.2	41.2	B
Total	I		413.5	43.6	457.1	5.2	41.2	B