

## V. DEVELOPMENT OF CONCEPTS

Throughout the study process several alternative alignments were developed and eliminated. Initial discussion amongst Steering Committee Members suggested six (6) corridor alternatives:

- 1A – Martin Luther King, Jr. Drive Extension to Northwest Boulevard
- 1B – Martin Luther King, Jr. Drive Extension to Northwest Boulevard with closure on Reynolda Road (southeast leg of intersection)
- 2 – Martin Luther King, Jr. Drive Extension to West End Boulevard
- 3A – Martin Luther King, Jr. Drive Extension / Broad Street roundabout w/ one-way pair roads
- 3B – Martin Luther King, Jr. Drive Extension / Broad Street roundabout w/ two-way pair roads
- 4 – Martin Luther King, Jr. Drive Extension / Broad Street t-intersection w/ intersection improvements at key intersections

Traffic analysis was performed for each of the six (6) preliminary alternative alignments. After evaluation and discussion by the Steering Committee Members, it was determined that three (3) alternatives would be further examined and presented to the public for review and comment:

- **Alternative A (1A)** – Martin Luther King, Jr. Drive Extension to Northwest Boulevard
- **Alternative B (3B)** – Martin Luther King, Jr. Drive Extension / Broad Street roundabout w/ two-way pair roads
- **Alternative C (4)** – Martin Luther King, Jr. Drive Extension / Broad Street T-intersection w/ intersection improvements at key intersections.

## VI. PROJECTED TRAFFIC VOLUMES / LEVELS OF SERVICE

### A. Traffic Projections

Morning (7-9 am) and afternoon (4-6 pm) peak hour traffic counts were counted by WSA at the following locations:

- Martin Luther King, Jr. Drive / W. 8<sup>th</sup> Street / Trade Street (02/18/08)
- W. 8<sup>th</sup> Street / N. Cherry Street (02/13/08)
- W. 8<sup>th</sup> Street / N. Marshall Street (02/13/08)
- W. 8<sup>th</sup> Street / Buxton Street (02/12/08)
- N. Broad Street / 7<sup>th</sup> Street (02/29/08)
- W. Northwest Boulevard / Thurmond Street / N. Broad Street (02/21/08)
- W. Northwest Boulevard / Reynolda Road (02/20/08)
- Reynolda Road / West End Boulevard (06/12/08)

Existing AM and PM peak hour traffic volumes are shown on Figure 4.

Based on historic traffic trends in the area and feedback from the City of Winston-Salem, a 1.5% growth rate was used to estimate future 2015 and 2035 background traffic volumes. The following is a list of the study scenarios:

- ❖ 2008 Existing
- ❖ 2015 Opening Year No Build
- ❖ 2015 Opening Year Build Out (Alternatives A, B, & C)
- ❖ 2035 No Build
- ❖ 2035 Build Out (Alternatives A, B, & C)

The corridor alternatives, which were eliminated early in the study process (Alternatives 1B, 2, and 3A), were also evaluated for the 2035 Build Out conditions. The traffic volumes and capacity analysis results are included in Appendix B.

Below are the intersections that were included in the study area for each alternative:

#### Alternative A

- Martin Luther King, Jr. Drive / W. 8<sup>th</sup> Street / Trade Street
- Martin Luther King, Jr. Drive / N. Cherry Street
- Martin Luther King, Jr. Drive / N. Marshall Street
- Martin Luther King, Jr. Drive Extension / Buxton Street
- Martin Luther King, Jr. Drive Extension / Thurmond Street / N. Broad Street
- N. Broad Street / 7<sup>th</sup> Street
- W. Northwest Boulevard / Reynolda Road
- Reynolda Road / West End Boulevard

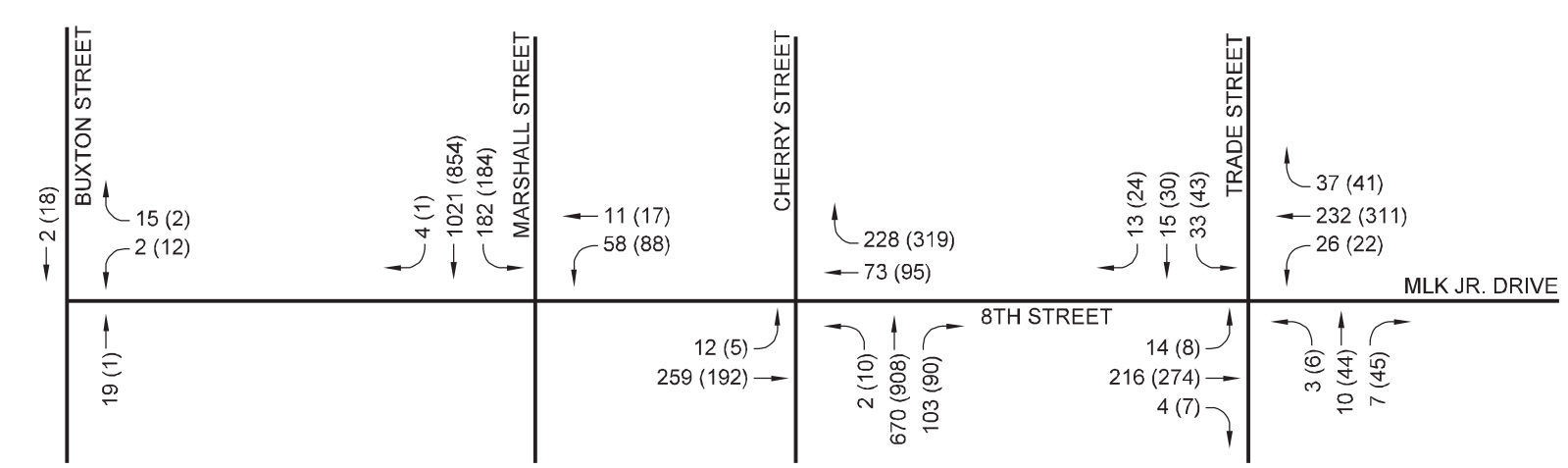
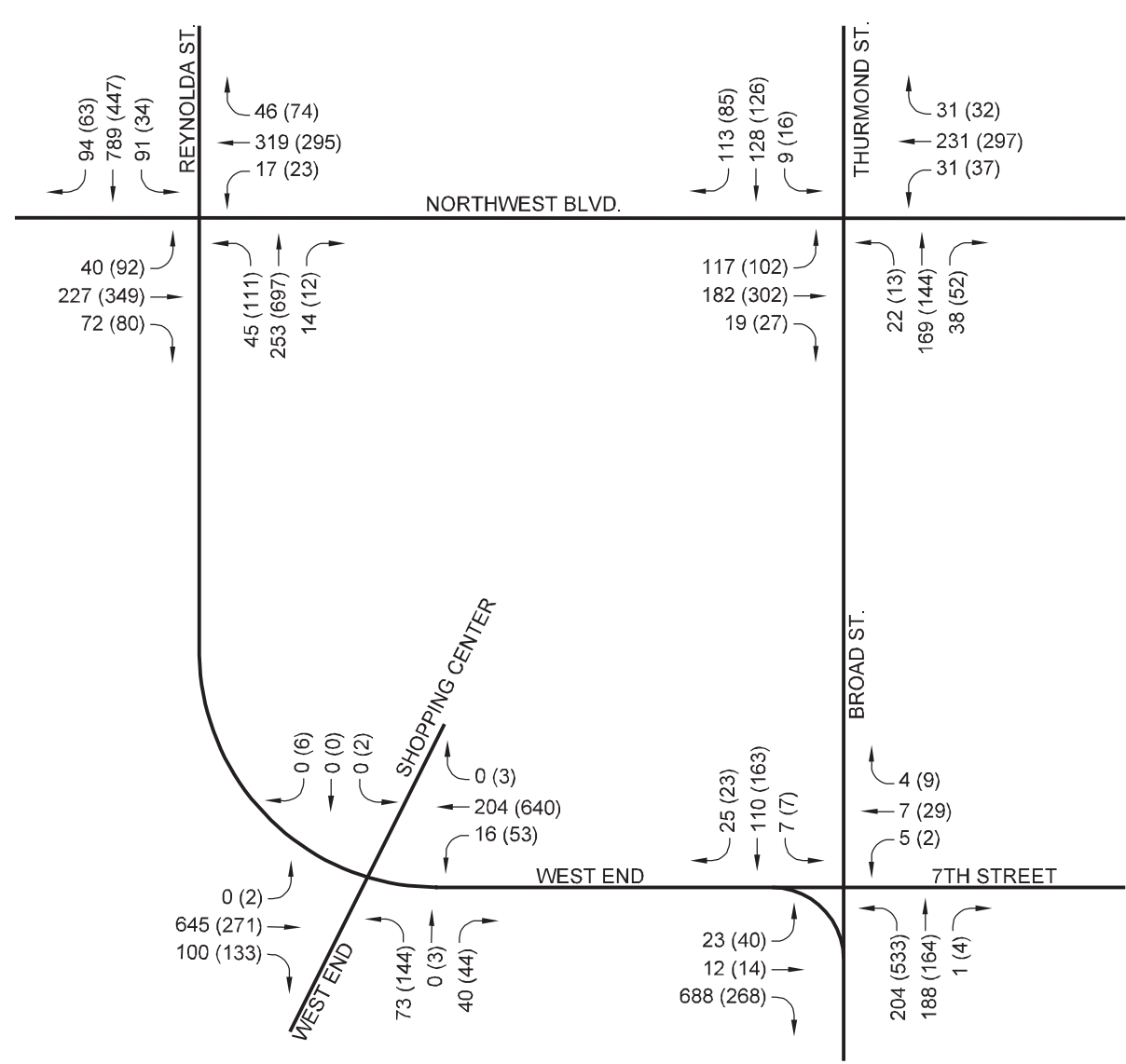
#### Alternative B

- Martin Luther King, Jr. Drive / W. 8<sup>th</sup> Street / Trade Street
- Martin Luther King, Jr. Drive / N. Cherry Street
- Martin Luther King, Jr. Drive / N. Marshall Street
- Martin Luther King, Jr. Drive Extension / Buxton Street
- Martin Luther King, Jr. Drive Extension / Broad Street
- W. Northwest Boulevard / Thurmond Street / N. Broad Street
- N. Broad Street / 7<sup>th</sup> Street
- W. Northwest Boulevard / Reynolda Road
- Reynolda Road / West End Boulevard

#### Alternative C

- Martin Luther King, Jr. Drive / W. 8<sup>th</sup> Street / Trade Street
- Martin Luther King, Jr. Drive / N. Cherry Street
- Martin Luther King, Jr. Drive / N. Marshall Street
- Martin Luther King, Jr. Drive Extension / Buxton Street
- Martin Luther King, Jr. Drive Extension / N. Broad Street
- W. Northwest Boulevard / Thurmond Street / N. Broad Street
- N. Broad Street / 7<sup>th</sup> Street
- W. Northwest Boulevard / Reynolda Road
- Reynolda Road / West End Boulevard

Morning and afternoon peak hour traffic volumes for the 2015 and 2035 conditions are shown in Figures 5-8.



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR
(XX)	PM PEAK HOUR



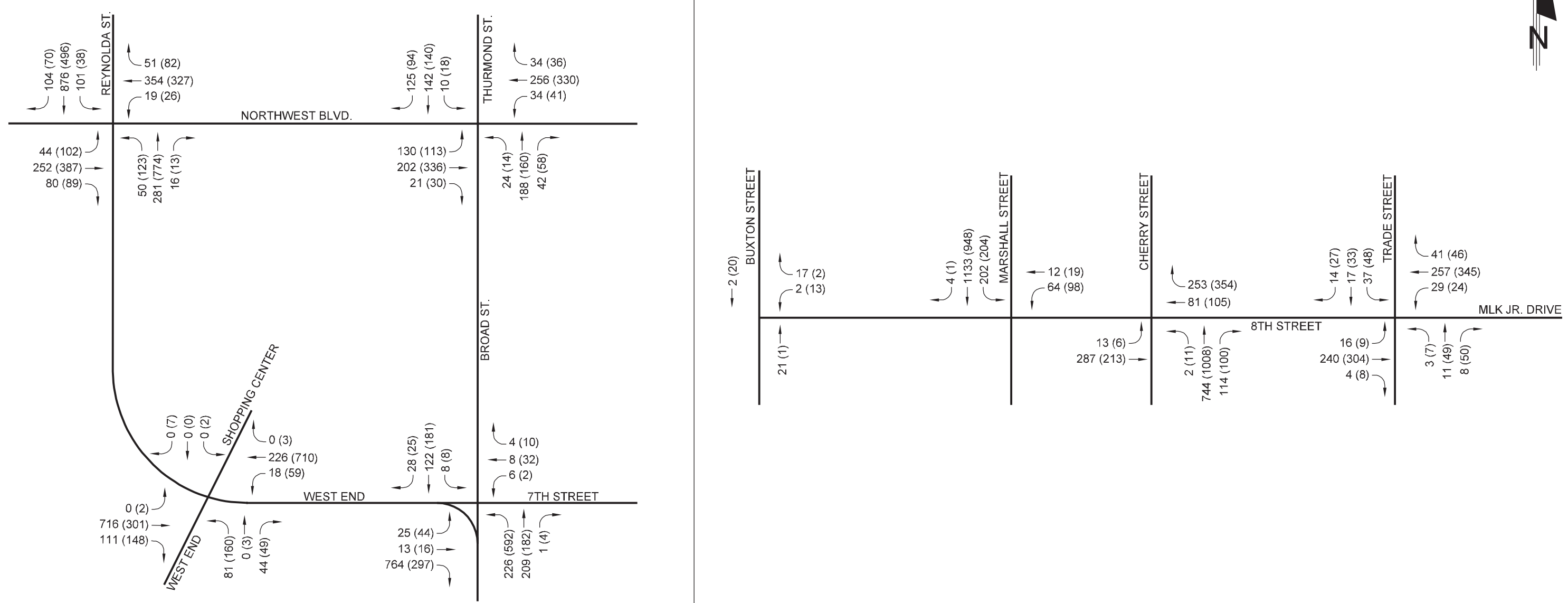
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FEASIBILITY STUDY  
 MARTIN LUTHER KING JR. DRIVE EXTENSION  
 WINSTON SALEM, NORTH CAROLINA

2008 EXISTING  
 PEAK HOUR TRAFFIC

FIGURE: 4

SCALE: NONE



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR
(XX)	PM PEAK HOUR



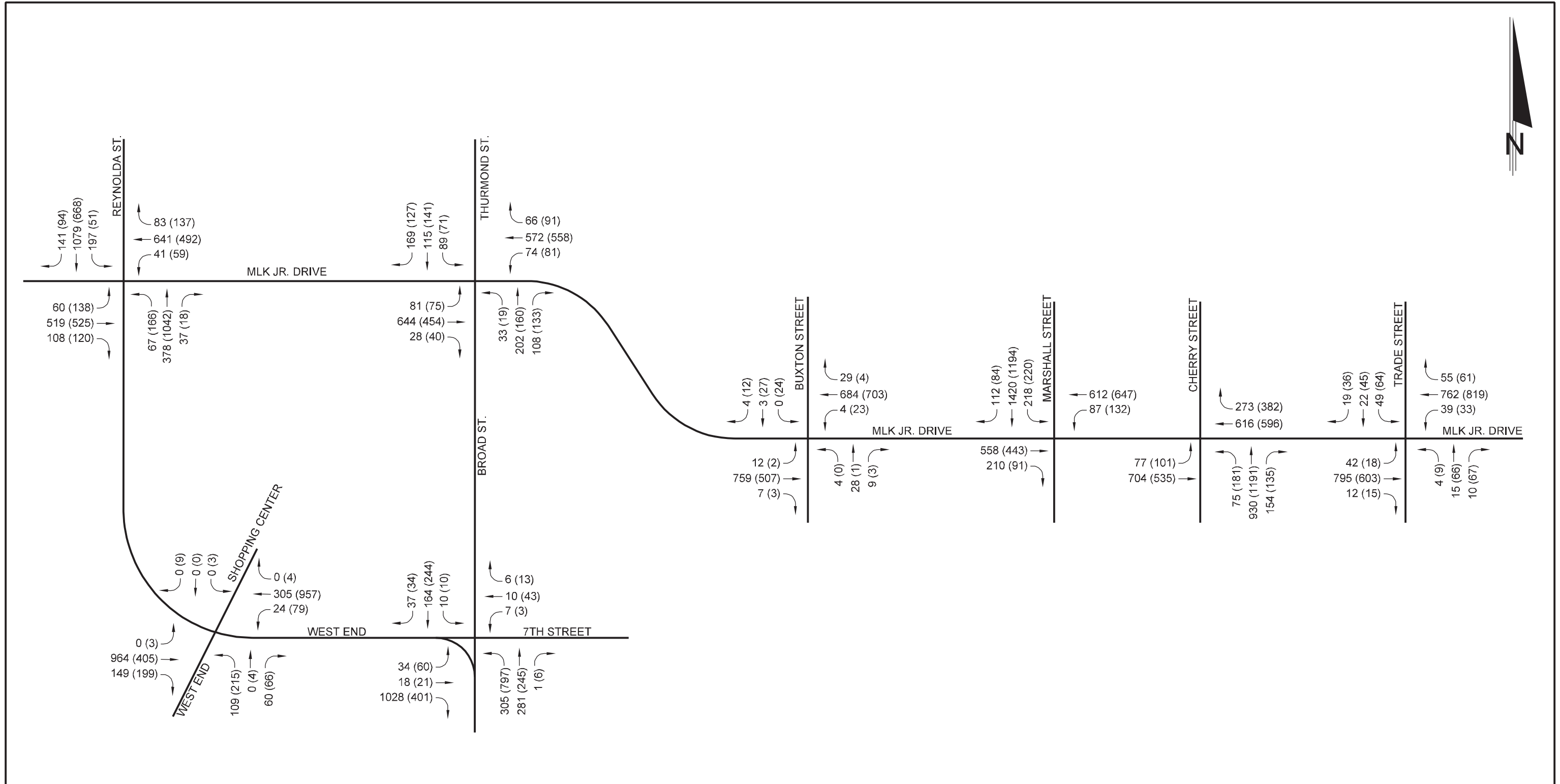
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FEASIBILITY STUDY  
 MARTIN LUTHER KING JR. DRIVE EXTENSION  
 WINSTON SALEM, NORTH CAROLINA

2015 OPENING YEAR (NO BUILD)  
 PEAK HOUR TRAFFIC

FIGURE: 5

SCALE: NONE



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR
(XX)	PM PEAK HOUR



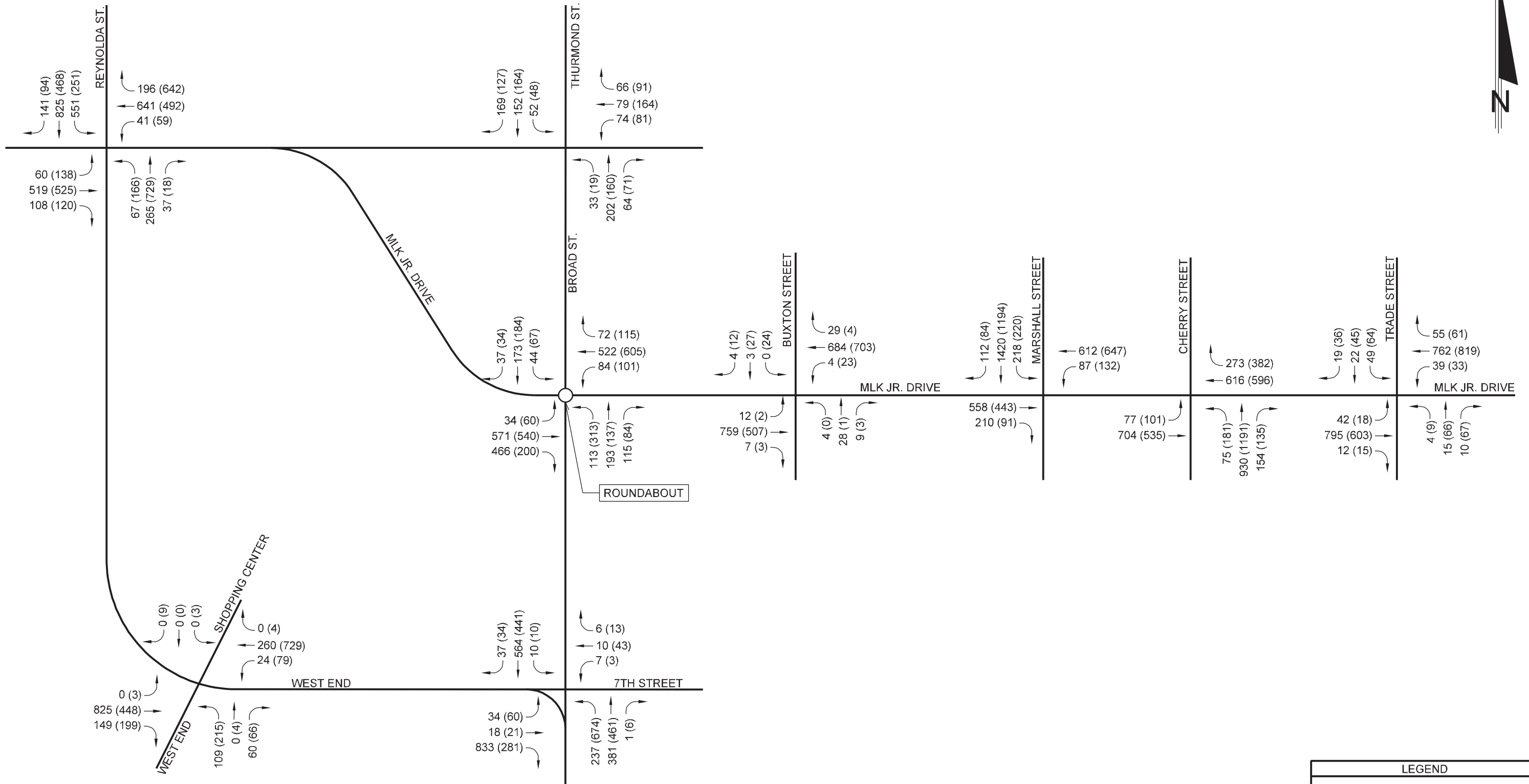
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 WINSTON SALEM, NORTH CAROLINA

2035 BUILDOUT AM & PM  
 PEAK HOUR TRAFFIC  
 ALTERNATIVE A

FIGURE: 6

SCALE: NONE



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR
(XX)	PM PEAK HOUR



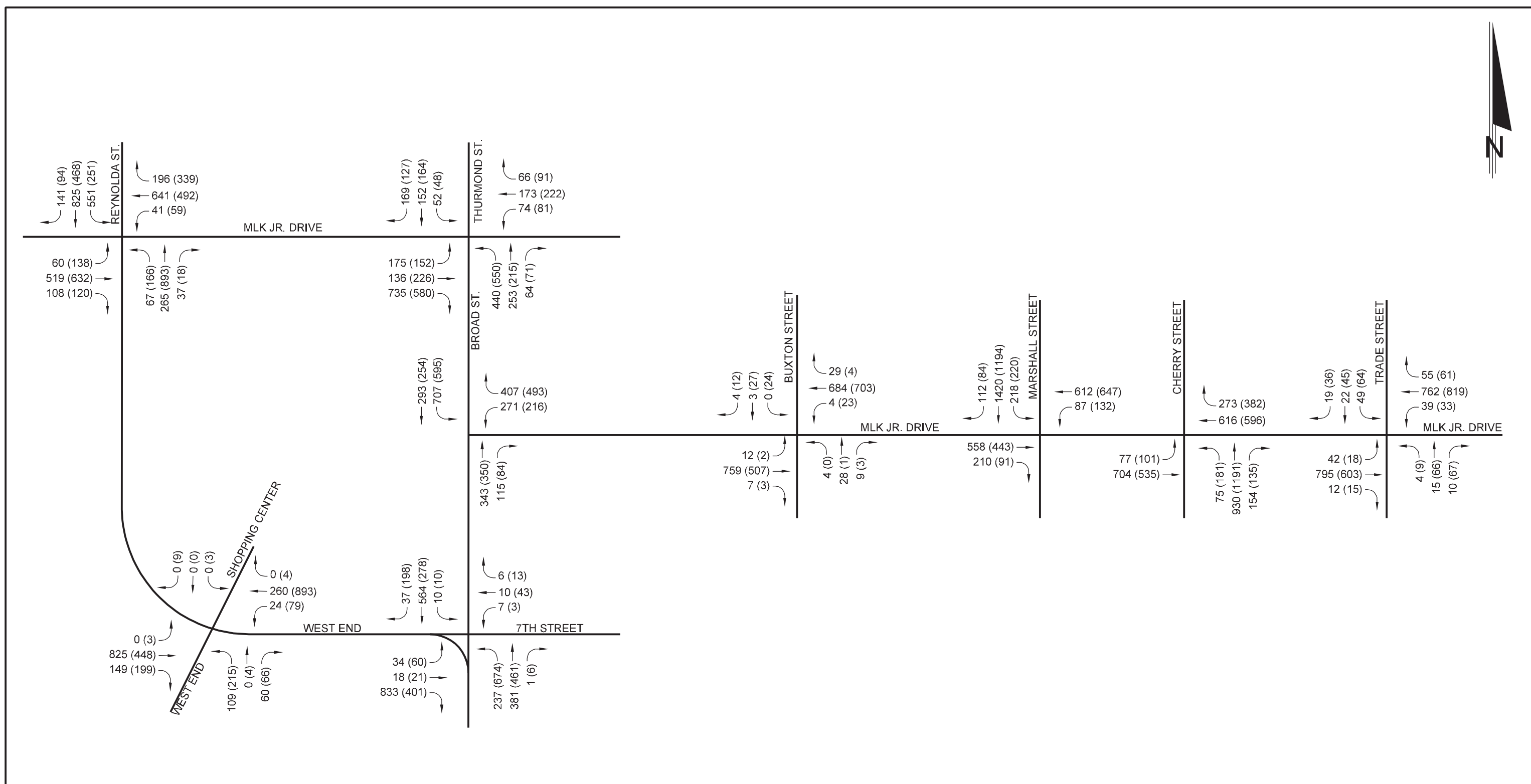
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2035 BUILDOUT AM & PM  
 PEAK HOUR TRAFFIC  
 ALTERNATIVE B

FIGURE: 7

SCALE: NONE



LEGEND	
←	DIRECTIONAL MOVEMENT
XX	AM PEAK HOUR
(XX)	PM PEAK HOUR


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2035 BUILDOUT AM & PM  
 PEAK HOUR TRAFFIC  
 ALTERNATIVE C

FIGURE: 8

SCALE: NONE

## **B. Level of Service Calculations**

The study area intersections were analyzed using the methods outlined in the **Highway Capacity Manual**<sup>3</sup> and Synchro Version 7.0 Software. The **Highway Capacity Manual**<sup>3</sup> defines capacity as “the maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform section of a lane or roadway during a specified time period under prevailing roadway, traffic, and control conditions, usually expressed as vehicles per hour or persons per hour”.

Level of service (LOS) is a term used to represent different traffic conditions, and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorist/or passengers”. Level of Service varies from Level A, representing free flow, to Level F where traffic breakdown conditions are evident. Level B represents good progression with minimal congestion. At Level C, the number of vehicles stopping is significant, although many still pass through the intersection without stopping. Level D represents more congestion, but the overall operations are acceptable. At Level E, freedom to maneuver within the traffic stream is extremely difficult with driver frustration being generally high.

For signalized intersections, service levels pertain to each approach as well as an overall value. The unsignalized intersection analysis method in the **Highway Capacity Manual**<sup>3</sup> assigns LOS values for each movement that yields the right-of-way, but not to the overall intersection. This movement is generally a secondary movement from a minor street. At an unsignalized intersection, the primary traffic on the main roadway is virtually uninterrupted. Therefore, the overall level of service is usually much greater than what is represented by the results of the minor street movements. Synchro Version 7.0 will calculate an amount of delay for the overall intersection, but will not assign a LOS value.

Generally, Level of Service D is considered acceptable for signalized intersections in suburban areas during peak periods. With the current method of reporting levels of service for unsignalized intersections, it is not uncommon for some of the minor street movements to be operating at a LOS F during the peak hours.

Table 1 presents criteria of each level of service as indicated in the **Highway Capacity Manual**<sup>3</sup>.

**TABLE 1: LEVEL OF SERVICE CRITERIA**

SIGNALIZED INTERSECTIONS		UNSIGNALIZED INTERSECTIONS	
<b>Level of Service</b>	<b>Stopped Delay Per Vehicle (sec)</b>	<b>Level of Service</b>	<b>Average Total Delay (sec/veh)</b>
A	≤10.0	A	≤10
B	>10.0 and ≤20.0	B	>10 and ≤15
C	>20.0 and ≤35.0	C	>15 and ≤25
D	>35.0 and ≤55.0	D	>25 and ≤35
E	>55.0 and ≤80.0	E	>35 and ≤50
F	>80.0	F	>50

Source: *Highway Capacity Manual*<sup>3</sup> Special Report 209, Transportation Research Board, National Research Council, Washington, D.C., 1998

Synchro Version 7.0 calculates the level of service and delay for each intersection using methods outlined in the *Highway Capacity Manual*<sup>3</sup>. Table 2 summarizes the capacity analyses.

**Capacity Analyses Results**

➤ **2008 Existing Condition**

Using the existing lane configurations and signal timings, levels of service for the existing 2008 scenario were calculated for the study area intersections. Overall, no capacity problems were identified in the study area with the exception of the Broad Street / Northwest Boulevard intersection which is currently operating at LOS E during the afternoon peak hour. The minor northbound movement of the West End Boulevard and Reynolda Road intersection is also experiencing some delays however it is not uncommon for the minor movement of an unsignalized intersection to experience delays. All other intersections in the study area are currently operating at acceptable levels of service. The 2008 Existing Conditions capacity analyses results for the AM and PM peak hours for the study area intersections are included in Table 2.

**Table 2: Existing Conditions LOS Summary**

Intersection	2008 Existing	
	AM Peak Hour	PM Peak Hour
Reynolda Rd. / Northwest Blvd.	D (36.0)	D (37.7)
Broad St. / Northwest Blvd.	C (31.7)	E (75.6)
MLK Jr. Dr. / N. Marshall St.	A (3.6)	A (4.0)
MLK Jr. Dr. / N. Cherry St.	C (31.2)	C (25.0)
MLK Jr. Dr. / Trade St.	A (5.3)	A (5.9)
MLK Jr. Dr. / Buxton St	# (3.8) A (8.5) WB	# (3.7) A (8.6) WB
7 <sup>th</sup> Street / Broad St.	# (1.5) B (10.5) EB B (10.1) WB	# (2.4) B (10.9) EB B (10.6) WB
West End Blvd / Reynolda Rd	# (1.7) C (24.3) NB	# (5.7) E (47.6) NB
West End Blvd / Reynolda Rd / Parking Lot	# (0.8) B (13.1) NB A (0.0) SB	# (1.5) B (11.2) NB C (17.3) SB
Note: # - No letter value assigned by Synchro, only overall intersection delay		

➤ **2015 Opening Year No Build Condition**

The 2015 no build analysis assumes that no improvements have been constructed. Using the existing signal timings, the 2015 No Build levels of service were calculated for the study area intersections. The Broad Street / Northwest Boulevard intersection is predicted to continue to operate at unacceptable levels of service during the PM peak hour. The minor northbound movement of the West End Boulevard and Reynolda Road intersection is also expected to continue to experience elevated delays. All other intersections in the study area are predicted to operate at acceptable levels of service. The 2015 No Build Condition capacity analyses results for the AM and PM peak hours for the study area intersections are included in Table 3.

➤ **2015 Opening Year Build Out Condition**

Under the 2015 Opening Year Build Out scenario, all intersections under Alternatives A, B, and C are expected to operate with acceptable levels of service. However the minor northbound movement of the West End Boulevard / Reynolda Road intersection will continue to experience delays. Unlike the 2015 Opening Year No Build scenario, the LOS for the Broad Street / Northwest Boulevard intersection is expected to improve from LOS D and F to LOS B and C during the PM peak hour under all three (3) alternatives. Adjusting the signal timing at this intersection improved the level of service. The 2015 Buildout Condition capacity analyses results for the AM and PM peak hours for the study area intersections are included in Table 3.

**Table 3: 2015 Opening Year LOS Summary**

Intersection	2015 No Build		2015 Build Alt A		2015 Build Alt B		2015 Build Alt C	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Reynolda Rd. / Northwest Blvd.	D (41.1)	D (36.1)	D (47.7)	D (40.6)	C (31.6)	D (41.4)	C (31.3)	C (29.9)
Broad St. / Northwest Blvd.	D (47.1)	F (114.7)	B (15.0)	B (13.5)	B (13.1)	B (15.3)	C (26.0)	C (26.0)
MLK Jr. Dr. / N. Marshall St.	A (4.0)	A (4.5)	B (15.3)	B (16.8)	B (17.0)	B (17.7)	B (14.9)	B (16.8)
MLK Jr. Dr. / N. Cherry St.	C (31.7)	C (28.1)	B (19.0)	C (21.0)	B (19.2)	C (21.0)	B (18.7)	C (21.0)
MLK Jr. Dr. / Trade St.	A (5.4)	A (6.1)	A (4.9)	A (6.1)	A (5.3)	A (6.7)	A (5.3)	A (6.7)
MLK Jr. Dr. / Broad St. (proposed)	N/A	N/A	N/A	N/A	A (9.8) <sup>1</sup>	B (12.2) <sup>1</sup>	C (28.6)	C (31.9)
MLK Jr. Dr. / Buxton St	# (3.8) A (8.5) WB	# (3.6) A (8.6) WB	# (0.6) C (15.2) NB B (12.7) SB	# (1.0) B (11.7) NB B (14.2) SB	# (0.6) C (15.2) NB B (12.7) SB	# (1.0) B (11.7) NB B (14.2) SB	# (0.6) C (15.2) NB B (12.7) SB	# (1.0) B (11.7) NB B (14.2) SB
7 <sup>th</sup> Street / Broad St.	# (1.6) B (10.7) EB B (10.3) WB	# (2.4) B (11.3) EB B (10.8) WB	# (1.7) B (12.1) EB B (11.3) WB	# (2.8) B (13.5) EB B (12.0) WB	# (1.3) C (18.8) EB C (15.6) WB	# (2.6) C (21.0) EB C (16.2) WB	# (1.3) C (18.6) EB C (15.6) WB	# (2.4) C (18.7) EB C (16.1) WB
West End Blvd / Reynolda Rd	# (2.4) D(34.0) NB	# (12.0) F (99.3) NB	# (2.4) D (34.0) NB	# (12.1) F(100.4) NB	# (1.9) C (23.1) NB	# (6.8) F(50.5) NB	# (1.9) C (23.1) NB	# (10.6) F(86.9) NB
West End Blvd / Reynolda Rd / Parking Lot	# (0.9) B (13.9) NB A (0.0) SB	# (1.6) B (11.6) NB C (19.0) SB	# (0.9) B (13.8) NB A (0.0) SB	# (1.6) B (11.6) NB C (20.8) SB	# (0.9) B (12.9) NB A (0.0) SB	# (1.6) B (11.4) NB C (17.5) SB	# (0.9) B (12.9) NB A (0.0) SB	# (1.6) B (11.8) NB C (20.4) SB
<sup>1</sup> - Single lane roundabout # - No letter value assigned by Synchro, only overall intersection delay								

➤ **2035 No Build Condition**

The 2035 No Build analysis assumes that no improvements have been constructed. Using the existing signal timings, the 2035 No Build levels of service were calculated for the study area intersections. The signalized intersections of Reynolda Road / Northwest Boulevard and Broad Street / Northwest Boulevard are projected to operate at LOS F during the AM and PM peak hours. The signalized intersection of Martin Luther King, Jr. Drive / Cherry Street is expected to operate at LOS E and the minor movement of the unsignalized intersection of Reynolda Road and West End Boulevard will operate with heavy delays. All others are predicted to operate at acceptable levels of service. The 2035 No Build Condition capacity analyses results for the AM and PM peak hours for the study area intersections are included in Table 4.

➤ **2035 Build Out Condition**

The signalized intersection of Reynolda Road and Northwest Boulevard will operate at LOS E and F during the peak hours for all three (3) build alternatives. Additionally, the Northwest Boulevard / Broad Street will also operate at LOS E for Alternative C.

The Cherry Street – Marshall Street section had major delays and was predicted to operate at unacceptable level of service. This is due to the westbound left turning movement at Cherry Street and the eastbound left turning movement at Marshall Street. In order for these intersections to operate at acceptable levels of service, it is recommended that the left turn movements at these intersections be prohibited.

The intersection of Reynolda Road and West End Boulevard will continue to operate with major delays during the 2035 Build Out scenario for all three (3) alternatives. It is recommended that this intersection be converted to a single lane roundabout.

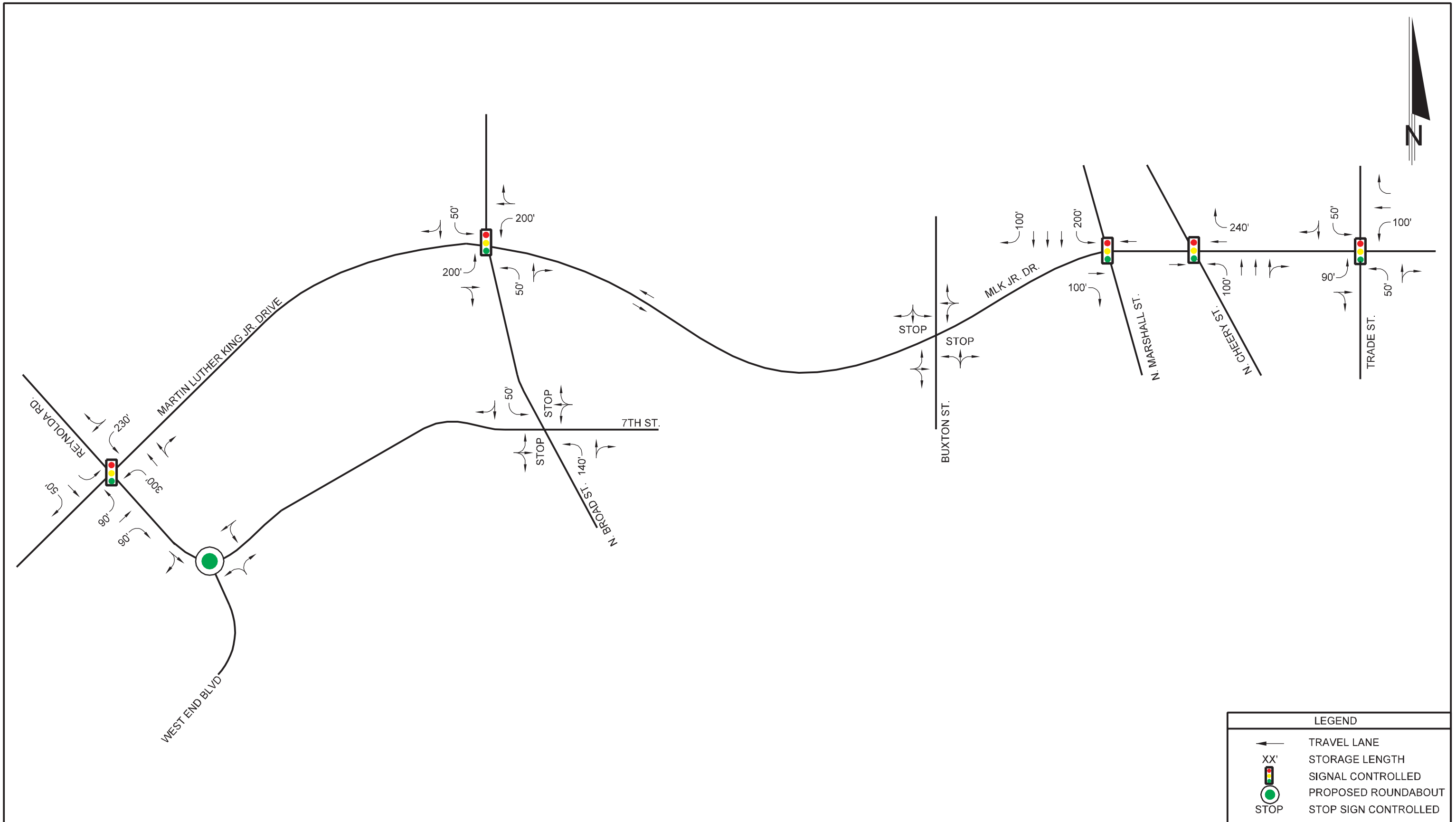
All other intersections for the three (3) build alternatives are expected to operate at acceptable levels of service. The 2035 Buildout Condition capacity analyses results for the AM and PM peak hours for the study area intersections are included in Table 4.

The recommended lane configurations and traffic control for the three (3) conceptual alternatives are shown in Figures 9-11.


Capacity analyses for all studied intersections are included in Appendix B.

**Table 4: 2035 LOS Summary**

Intersection	2035 No Build		2035 Build Alt A		2035 Build Alt B		2035 Build Alt C	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Reynolda Rd. / Northwest Blvd.	F (104.6)	F (97.1)	F (114.0)	E (63.6)	E (79.8)	F (113.0)	E (79.8)	E (75.3)
Broad St. / Northwest Blvd.	F (145.9)	F (309.2)	B (18.0)	B (15.7)	B (13.9)	B (16.3)	E (66.3)	E (78.0)
MLK Jr. Dr. / N. Marshall St.	A (5.9)	A (6.3)	C (20.5)	C (24.3)	C (21.7)	C (25.3)	C (20.1)	C (24.2)
MLK Jr. Dr. / N. Cherry St.	E (80.0)	D (44.2)	C (24.2)	C (30.8)	C (24.2)	C (30.9)	C (24.3)	C (30.8)
MLK Jr. Dr. / Trade St.	A (5.8)	A (6.7)	A (6.6)	A (8.4)	A (7.3)	A (9.7)	A (7.3)	A (9.7)
MLK Jr. Dr. / Broad St. (proposed)	N/A	N/A	N/A	N/A	D (37.7) <sup>1</sup>	C (24.4) <sup>1</sup>	D (48.3)	C (23.8)
MLK Jr. Dr. / Buxton St	# (3.8) A (8.6) WB	# (3.7) A (8.7) WB	# (0.9) C (20.4) NB C (15.7) SB	# (1.4) B (13.1) NB C (19.3) SB	# (0.9) C (20.4) NB C (15.7) SB	# (1.4) B (13.1) NB C (19.3) SB	# (0.9) C (20.4) NB C (15.7) SB	# (1.4) B (13.1) NB C (19.3) SB
7 <sup>th</sup> Street / Broad St.	# (1.7) B (11.7) EB B (11.0) WB	# (2.7) B (12.7) EB B (11.7) WB	# (2.0) B (14.3) EB B (12.7) WB	# (3.5) C (17.5) EB B (14.1) WB	# (2.1) D (30.8) EB C (21.6) WB	# (4.6) E (43.7) EB C (23.4) WB	# (2.3) D (33.4) EB C (22.9) WB	# (3.6) D (27.5) EB C (20.5) WB
West End Blvd / Reynolda Rd	# (33.2) F (**) A (9.1) <sup>1</sup>	# (**) F (**) B (15.6) <sup>1</sup>	# (28.6) F (**) NB	# (**) F (**) NB	# (9.3) F (114.0) NB	# (67.9) F (**) NB	# (9.3) F (114.0) NB	# (103.7) F (**) NB
West End Blvd / Reynolda Rd / Parking Lot	# (1.5) C (23.8) NB A (0.0) SB	# (2.5) B (14.3) NB D (33.8) SB	# (1.5) C (24.3) NB A (0.0) SB	# (2.5) B (14.3) NB D (33.8) SB	# (1.2) C (17.3) NB A (0.0) SB	# (2.2) B (13.9) NB D (27.8) SB	# (1.2) C (17.3) NB A (0.0) SB	# (2.5) B (14.9) NB D (36.9) SB
Note: <sup>1</sup> - Single lane roundabout      ** - Exceeds the limits of Synchro      # - No letter value assigned by Synchro, only overall intersection delay								



LEGEND	
←	TRAVEL LANE
XX'	STORAGE LENGTH
🚦	SIGNAL CONTROLLED
🟢	PROPOSED ROUNDABOUT
STOP	STOP SIGN CONTROLLED

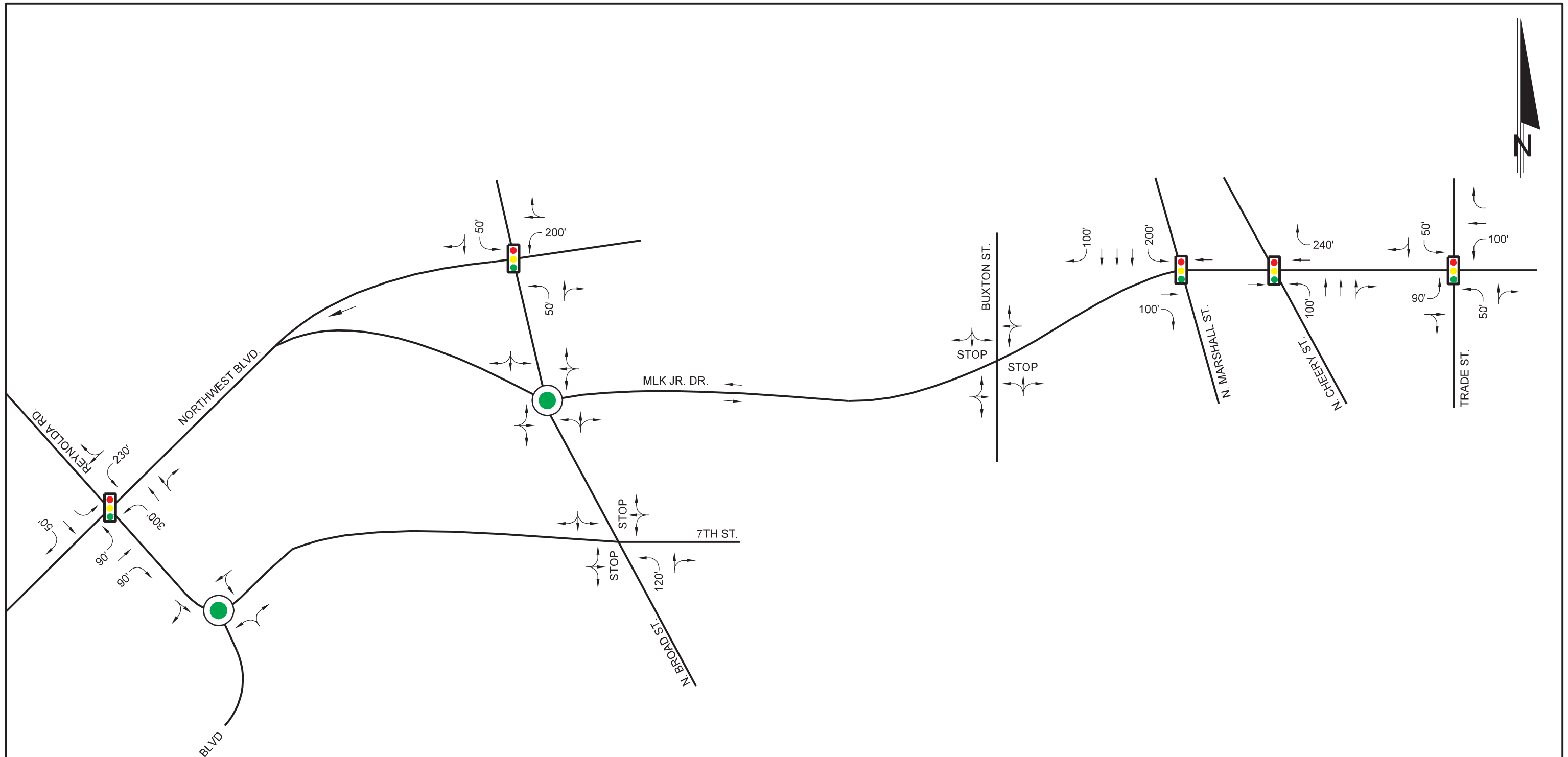

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FEASIBILITY STUDY  
 MARTIN LUTHER KING JR. DRIVE EXTENSION  
 WINSTON SALEM, NORTH CAROLINA

RECOMMENDED LANE  
 CONFIGURATIONS & TRAFFIC CONTROL  
 ALTERNATIVE A

FIGURE: 9

SCALE: NONE



LEGEND	
	TRAVEL LANE
	STORAGE LENGTH
	SIGNAL CONTROLLED
	PROPOSED ROUNDABOUT
	STOP SIGN CONTROLLED



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 WINSTON SALEM, NORTH CAROLINA

RECOMMENDED LANE  
 CONFIGURATIONS & TRAFFIC CONTROL  
 ALTERNATIVE B

FIGURE: 10

SCALE: NONE

