

## TRAFFIC IMPACT ANALYSIS

# WEST PLACE DEVELOPMENT CITY OF MADISON, WI



Prepared for  
Livesey Company  
2248 Deming Way  
Middleton, WI 53562



TRAFFIC IMPACT STUDY FOR:

**WEST PLACE DEVELOPMENT TRAFFIC IMPACT ANALYSIS**  
CITY OF MADISON, WISCONSIN

DATE SUBMITTED:

**Wednesday, September 20, 2017**

**PREPARED BY:**

MSA Professional Services Inc.  
2901 International Lane, Suite 300  
Madison, WI 53704  
Phone: (608) 242-6658  
Contact: Sarah Gengler, PE, PTOE

*"I certify that this Traffic Impact Analysis has been prepared by me or under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering."*



---

Sarah Gengler, PE, PTOE  
Wisconsin Registration # 44242-6  
Transportation Research Board # 4046  
WisDOT TIA Certification # SE12-804-203  
MSA Professional Services, Inc.



## Table of Contents

Chapter 1 – INTRODUCTION & EXECUTIVE SUMMARY .....	1-1
PART A – PURPOSE OF REPORT AND STUDY OBJECTIVES .....	1-1
PART B – EXECUTIVE SUMMARY.....	1-1
B1. Development Description and Site Location .....	1-1
B2. Land Use and Intensity.....	1-1
B3. Proposed Site Plan .....	1-2
B4. Development Phasing and Timing .....	1-2
B5. Area of Significant Traffic Impact.....	1-2
B6. Off-Site Land Use and Development .....	1-3
B7. Existing Area Roadway System .....	1-3
B8. Future Area Roadway System.....	1-4
B9. Conclusions .....	1-4
2019 Background Traffic.....	1-4
2029 Background Traffic.....	1-4
2049 Background Traffic.....	1-4
2019 Stage I Build Development Traffic .....	1-5
2029 Full Build Development Traffic .....	1-5
2049 Full Build Development Traffic .....	1-5
Chapter 2 – PROPOSED DEVELOPMENT .....	2-1
PART A – ON-SITE DEVELOPMENT .....	2-1
A1. Development Description and Site Location .....	2-1
A2. Land Use and Intensity .....	2-1
A3. Proposed Site Plan .....	2-2
A4. Development Phasing and Timing.....	2-2
PART B – STUDY AREA.....	2-2
B1. Influence Area.....	2-2
B2. Area of Significant Traffic Impact.....	2-2
PART C – OFF-SITE LAND USE AND DEVELOPMENT.....	2-3
PART D – SITE ACCESSIBILITY .....	2-3
Chapter 3 – ANALYSIS OF EXISTING CONDITIONS .....	3-1
PART A – PHYSICAL CHARACTERISTICS .....	3-1

- A1. Existing Area Roadway System ..... 3-1
- A2. Future Area Roadway System..... 3-2
- PART B – TRAFFIC VOLUMES..... 3-2
- PART D – CAPACITY/LEVEL OF SERVICE ..... 3-3
  - C1. Year 2019 Background Traffic Operations..... 3-3
- Chapter 4 – PROJECTED TRAFFIC ..... 4-1
  - PART A - BACKGROUND TRAFFIC FORECASTING ..... 4-1
    - A1. Traffic Forecast ..... 4-1
  - PART B – DEVELOPMENT TRAFFIC AND OFF-SITE DEVELOPMENT TRAFFIC FORECASTING.... 4-1
    - B1. Trip Generation..... 4-1
    - B2. Mode Split..... 4-2
    - B3. Determination of Pass-By, Internally-Linked, Multi-Linked, and Externally-Linked Trip Traffic ..... 4-2
      - B3-1. Determination of Internally Linked Trips ..... 4-2
      - B3-2. Determination of Pass-by Trips ..... 4-3
    - B4. Trip Distribution..... 4-3
    - B5. Trip Assignment ..... 4-3
  - PART C – BUILD AND TOTAL TRAFFIC ..... 4-4
    - C1. Stage I Development..... 4-4
    - C2. Future Build Development..... 4-4
- Chapter 5 – TRAFFIC AND IMPROVEMENT ANALYSIS..... 5-1
  - PART A – Site Access ..... 5-1
  - PART B – Traffic Signal Warrant Analysis..... 5-1
    - B1. Background Traffic Volume Determination..... 5-1
    - B2. Stage I Development Traffic Volume Determination ..... 5-1
    - B3. Traffic Signal Warrant Analysis ..... 5-4
    - B4. Traffic Signal Warrant Conclusion ..... 5-5
  - PART C – CAPACITY/LEVEL OF SERVICE ANALYSIS ..... 5-5
    - C1. Year 2029 Background Traffic Operational Analysis – Existing Transportation System 5-6
    - C2. Year 2049 Background Traffic Operational Analysis – Existing Transportation System 5-6
    - C3. Year 2019 Stage I Development Traffic Operational Analysis – Existing Transportation System..... 5-7
    - C4. Year 2029 Full Build Traffic Operational Analysis – Existing Transportation System.... 5-7

C5. Year 2049 Full Build Traffic Operational Analysis – Existing Transportation System .... 5-8

C6. 2019 Background Traffic Operations – Improved Transportation System..... 5-8

C7. 2029 Background Traffic Operations – Improved Transportation System..... 5-9

C8. 2049 Background Traffic Operations – Improved Transportation System..... 5-9

C9. 2019 Stage I Build Development Traffic Operations, Improved Transportation System 5-10

C10. 2029 Full Build Development Traffic Operations, Improved Transportation System5-11

C11. 2049 Full Build Development Traffic Operations, Improved Transportation System5-11

PART D – QUEUING ANALYSIS..... 5-12

PART F – TRAFFIC CONTROL NEEDS..... 5-13

Chapter 6 – CONCLUSIONS AND RECOMMENDATIONS..... 6-1

PART A – Conclusions & Recommendations..... 6-1

A1. 2019 Background Traffic..... 6-1

A2. 2029 Background Traffic..... 6-2

A3. 2049 Background Traffic..... 6-2

A4. 2019 Stage I Build Development Traffic ..... 6-3

A5. 2029 Full Build Development Traffic ..... 6-4

A6. 2049 Full Build Development Traffic ..... 6-4

## LIST OF EXHIBITS

### Chapter 1

Exhibit 1-1	Existing Transportation System
Exhibit 1-2	Site Plan
Exhibit 1-3	Background Traffic Recommended Improvements
Exhibit 1-4	Build Traffic Recommended Improvements

### Chapter 2

Exhibit 2-1	Existing Transportation System
Exhibit 2-2	Site Plan

### Chapter 3

Exhibit 3-1	2016 Existing Traffic Volumes (Balanced)
Exhibit 3-2	2019 Base Year Background Traffic Volumes
Exhibit 3-3	2019 Base Year Background Traffic – Capacity/LOS Analysis – Existing Transportation System

### Chapter 4

Exhibit 4-1	2029 Interim Year Background Traffic Volumes
Exhibit 4-2	2049 Horizon Year Background Traffic Volumes
Exhibit 4-3	Trip Generation Table
Exhibit 4-4A	Trip Distribution
Exhibit 4-4B	Trip Distribution Stage I
Exhibit 4-4C	Trip Distribution Stage II
Exhibit 4-5	Stage I On-Site Development Traffic Assignment: New Trips
Exhibit 4-6	Stage II On-Site Development Traffic Assignment: New Trips
Exhibit 4-7	2019 Base Year Build Development Traffic Volumes
Exhibit 4-8	2029 Interim Year Build Development Traffic Volumes
Exhibit 4-9	2049 Horizon Year Build Development Traffic Volumes

### Chapter 5

Exhibit 5-1	2029 Interim Year Background Traffic – Capacity/LOS Analysis, Existing Transportation System
Exhibit 5-2	2049 Horizon Year Background Traffic – Capacity/LOS Analysis, Existing Transportation System
Exhibit 5-3	2019 Stage I Build Development Traffic – Capacity/LOS Analysis, Existing Transportation System
Exhibit 5-4	2029 Full Build Development Traffic – Capacity/LOS Analysis, Existing Transportation System
Exhibit 5-5	2049 Full Build Development Traffic – Capacity/LOS Analysis, Existing Transportation System
Exhibit 5-6	2019 Base Year Background Traffic – Capacity/LOS Analysis, Improved Transportation System
Exhibit 5-7	2029 Interim Year Background Traffic – Capacity/LOS Analysis, Improved Transportation System
Exhibit 5-8	2049 Horizon Year Background Traffic – Capacity/LOS Analysis, Improved Transportation System
Exhibit 5-9	2019 Stage I Development Traffic – Capacity/LOS Analysis, Improved Transportation System
Exhibit 5-10	2029 Full Build Development Traffic – Capacity/LOS Analysis, Improved Transportation System
Exhibit 5-11	2049 Full Build Development Traffic – Capacity/LOS Analysis, Improved Transportation System
Exhibit 5-12	Maximum Queue Lengths: 2019 Base Year Background Traffic
Exhibit 5-13	Maximum Queue Lengths: 2029 Interim Year Background Traffic
Exhibit 5-14	Maximum Queue Lengths: 2049 Horizon Year Background Traffic
Exhibit 5-15	Maximum Queue Lengths: 2019 Base Year Build Development (Stage I)

Exhibit 5-16           Maximum Queue Lengths: 2029 Interim Year Full Build Development  
Exhibit 5-17           Maximum Queue Lengths: 2049 Horizon Year Full Build Development

**Chapter 6**

Exhibit 6-1           Intersection Conceptual Drawing – Proposed Road Alignment



## LIST OF APPENDICES

Appendix A.....Traffic

*Raw Traffic Counts*

*Truck Percentages and PHF Summary*

*Projected Future Year Growth Rates provided by MPO*

*Madison Metro Ridership Information*

Appendix B .....Background Traffic Capacity/LOS Analysis - Existing Transportation System

*Year 2019 Base Year*

*Year 2029 Interim Year*

*Year 2049 Horizon Year*

Appendix C.....Development Traffic Capacity/LOS Analysis - Existing Transportation System

*Year 2019 Stage I*

*Year 2029 Full Build*

*Year 2049 Full Build*

Appendix D.....Background Traffic Capacity/LOS Analysis – Improved Transportation System

*Year 2019 Base Year*

*Year 2029 Interim Year*

*Year 2049 Horizon Year*

Appendix E.....Development Traffic Capacity/LOS Analysis – Improved Transportation System

*Year 2019 Stage I*

*Year 2029 Full Build*

*Year 2049 Full Build*

Appendix F .....Traffic Signal Warrant Analysis

*2019 Background Traffic Signal Warrant Analysis Summary*

*2019 Stage I Development Traffic Signal Warrant Analysis Summary*

Appendix G .....Roundabout Analysis

*2049 Full Build Development Traffic: Mineral Point Road & Gammon Road*

## Chapter 1 – INTRODUCTION & EXECUTIVE SUMMARY

### PART A – PURPOSE OF REPORT AND STUDY OBJECTIVES

At the request of Livesey Company (owner), MSA Professional Services has prepared a Traffic Impact Analysis for the West Place Development. This report documents the procedures, findings and conclusions of the traffic impact analysis performed to evaluate the impact of the development on the existing roadway network. The analysis identifies recommended improvements based on existing intersection geometrics, background traffic volumes, and additional traffic expected to be generated by the development.

### PART B – EXECUTIVE SUMMARY

The executive summary contains a synopsis of the proposed development, the findings of the analysis of the impacts, and the recommendations.

#### B1. Development Description and Site Location

West Place Development is proposed to be located on the northwestern quadrant of Mineral Point Road & Gammon Road. The 14-acre site is proposed as a general office park with one main anchor user.

West Towne Mall is located on the southwest quadrant of Mineral Point Road & Gammon Road. It is a major regional destination for shopping. Other smaller retail stores and restaurants also surround Gammon Road and Mineral Point Road.

James Madison Memorial High School is located to the east of Gammon Road adjacent to the site. Full access to the school is located at two study intersections; Memorial Drive and Tree Lane. There is a three-quarter restricted access point (right-in/right-out/left-in) between Memorial Drive and Tree Lane.

A site location map is shown in **Exhibit 1-1, Existing Transportation System**.

#### B2. Land Use and Intensity

The existing site is occupied by the vacant Madison Area Technical College (MATC) West Campus building. The MATC West Campus was vacated in June of 2016 and the building will be razed as part of the new development. As part of the City of Madison's Comprehensive Plan, adopted in January 2006 and amended through March 2012, the land is zoned for commercial and employment uses.

Mixed-use development consisting of primarily office space is proposed for the West Place Development, as seen in **Exhibit 1-2, Site Plan** and summarized below in **Table 1-1**. The ITE Land Use codes associated with each type of development are included as well as the proposed size and unit per land use.

**Table 1-1: On-Site Land Use**

	Building	ITE Land Use	ITE Code	Square Feet	Units	Size
Stage I	A	General Office Building	710	80,000	1,000 Square Feet	80.0
	B	General Office Building	710	30,000	1,000 Square Feet	30.0
	C	High Turnover (Sit-Down) Restaurant	932/Combo	5,000	1,000 Square Feet	5.0
	D	High Turnover (Sit-Down) Restaurant	932/Combo	6,000	1,000 Square Feet	6.0
	E	General Office Building	710	60,000	1,000 Square Feet	60.0
Stage II	F	General Office Building	710	60,000	1,000 Square Feet	60.0
	G	General Office Building	710	24,000	1,000 Square Feet	24.0
	H	General Office Building	710	60,000	1,000 Square Feet	60.0

Commercial land uses, including a day-care and animal hospital currently exist north of the proposed development site. The other existing commercial buildings on the site will remain occupied and in place.

It is assumed that all existing traffic utilizing the intersection of Gammon Road & Memorial Drive are generated by adjacent businesses, and therefore all existing traffic will remain as part of background traffic.

### B3. Proposed Site Plan

There are no new access locations proposed with the West Place Development. Two existing access points will be reused with the new site plan; one access location will be utilized on Gammon Road & Memorial Drive (access to James Madison Memorial High School) and three access locations from the existing Clinic Driveway off of Mineral Point Road.

A preliminary site plan for the West Place Development is shown in **Exhibit 1-2, Site Plan**.

### B4. Development Phasing and Timing

Stage I is anticipated for 2019 construction and will consist of razing the existing MATC building and constructing several general office buildings and two restaurants that will complement the office spaces.

Stage II (full build) is anticipated for completion by 2029. The second stage of development will include additional general office buildings that will fill in the vacant space surrounding the site.

For this study, all development outside of Stage I is considered Stage II and a full build out condition. The following study time periods will be analyzed:

- **2019** = (build year of Stage I)
- **2029** = (full build out; Stage I + Stage II)
- **2049** = (full build out + 20 years)

### B5. Area of Significant Traffic Impact

It is anticipated, for the purpose of this study, that the area of traffic impact is limited to four (4) intersections, as seen in **Exhibit 1-1, Existing Transportation System**. The following intersections will be studied:

1. Gammon Road & Tree Lane (Signalized)
2. Gammon Road & Memorial Drive
3. Gammon Road & Mineral Point Road (Signalized)
4. Mineral Point Road & Clinic Driveway

## B6. Off-Site Land Use and Development

No additional developments of significance are known or included as part of this study. If developed in the future, an additional study analyzing the traffic impacts will need to be coordinated through the City of Madison and its developer.

## B7. Existing Area Roadway System

The existing transportation system consists of Gammon Road, a 35 mile per hour (mph), four-lane divided arterial with shared-use bike and bus lanes. The roadway consists of concrete pavement, urban curb and gutter, grass medians, and sidewalk. The current average daily volume is 20,650 vehicles per day.



**Figure 1-1:** Existing Transportation System

There are four Madison Metro Transit bus stops along Gammon Road that utilize the shared-use outside lane for stops. James Madison Memorial also uses the Madison Metro bus system for school pick-up and drop-off. The high school has an open campus lunch policy in which students may leave the campus during the lunch hour.

Mineral Point Road is posted as a 40 mph arterial with four driving lanes and a shared use outside bike and bus lane. The roadway consists of concrete pavement, urban curb and gutter, grass medians, and sidewalk. The current average daily volume is 32,550 vehicles per day.

**Exhibit 1-1** illustrates the specific intersection diagrams and transportation layout of the study area intersections. In discussions with the City of Madison, the outside bus lanes are reserved for future bus rapid transit (BRT) and cannot be converted to vehicle lanes. Standard two-way stop controlled intersections are present at all other locations not specifically noted as signalized.

## B8. Future Area Roadway System

Gammon Road, from Mineral Point Road to Watts Road, is tentatively proposed for improvement through the Wisconsin Department of Transportation (WisDOT) Surface Transportation Program (STP)-Urban program; improvements as part of that project are unknown at this time.

There are no known additional state or city roadway projects planned in the area.

## B9. Conclusions

### 2019 Background Traffic

*Exhibit 1-3, Background Traffic Recommended Improvements* illustrates this improvement in comparison to the existing conditions.

#### Gammon Road & Memorial Drive

- Install a permanent traffic signal and coordinate with the Gammon Road corridor signalized intersections

#### Gammon Road & Mineral Point Road

- Extend left-turn storage lanes to maximize queue storage to the degree possible to fit within the existing constraints of the environment

#### Mineral Point Road & Clinic Driveway

- Restripe existing intersection geometry on north approach to accommodate shared left/thru lane and exclusive right-turn lane. The existing two-way stop controlled intersection experiences a low volume of vehicles that attempt to make a left-turn from the side street. The side-street shared left/thru lane will operationally improve with the lane redesignation however will still operate at LOS F for the left-turn/thru movement. No additional improvements are recommended at this time.

### 2029 Background Traffic

All signalized intersections are assumed to be retimed and coordinated based on City of Madison best practices.

#### Gammon Road & Mineral Point Road

- Extend left-turn storage lanes to maximize queue storage to the degree possible to fit within the existing constraints of the environment

### 2049 Background Traffic

All signalized intersections are assumed to be retimed and coordinated based on City of Madison best practices.

#### Gammon Road & Mineral Point Road

- Install dual southbound left-turn lanes at Gammon Road & Mineral Point Road
- Extend left-turn storage lanes to maximize queue storage to the degree possible to fit within the existing constraints of the environment

### 2019 Stage I Build Development Traffic

A summary of the recommended improvements for each study intersection is outlined below. **Exhibit 1-4, Build Development Traffic Recommended Improvements** illustrates the recommended improvements for the development scenarios in comparison to the existing conditions.

At a minimum, all signalized intersections are assumed to be retimed and coordinated based on City of Madison best practices.

#### Gammon Road & Mineral Point Road

- Extend left-turn storage lanes to maximize queue storage to the degree possible to fit within the existing constraints of the environment

#### Mineral Point Road & Clinic Driveway

- The increase in southbound left-turn traffic volume due to the development is nominal (approximately 10 vehicles in the peak hour). If West Place Development users find this intersection difficult to complete turning movements, other signalized intersections are available surrounding the site to enter the adjacent corridors. No additional improvements beyond the 2019 background improvements are recommended at this time.

### 2029 Full Build Development Traffic

A summary of the recommended improvements for each study intersection is outlined below. **Exhibit 1-4** illustrates the recommended improvements for the 2029 Full Build development in comparison to the existing conditions and 2019 Stage I Development recommended improvements. The below recommendations are in addition to the previous recommendations for 2019 Stage I Build Development traffic conditions.

At a minimum, all signalized intersections are assumed to be retimed and coordinated based on City of Madison best practices.

#### Gammon Road & Mineral Point Road

- Install dual southbound left-turn lanes at Gammon Road & Mineral Point Road when full build of the development is completed

### 2049 Full Build Development Traffic

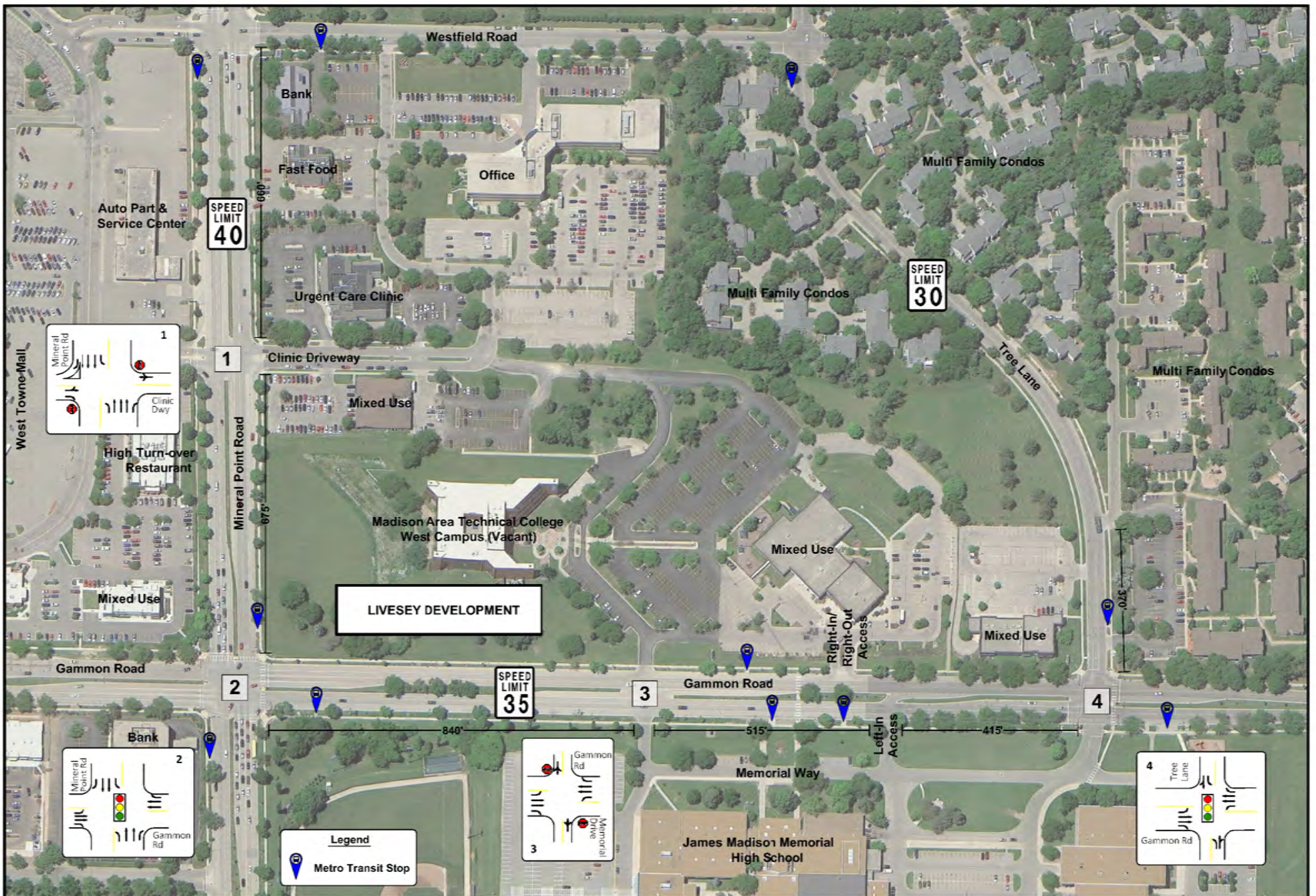
A summary of the recommended improvements for each study intersection is outlined below. **Exhibit 1-4** illustrates the recommended improvements for the 2049 Full Build development in comparison to the existing conditions, 2019 Stage I Build Development, and 2029 Full Build Development recommended improvements. Below are the proposed geometric improvements that would be required to achieve the baseline level of service condition in addition to the previously mentioned improvement recommendations.

At a minimum, all signalized intersections are assumed to be retimed and coordinated based on City of Madison best practices.

Gammon Road & Mineral Point Road

- Install dual northbound left-turn lanes at Gammon Road & Mineral Point Road in the future
- Install dual westbound left-turn lanes at Gammon Road & Mineral Point Road in the future

It is recommended that right-of-way be reserved within the West Place Development site to allow for the construction of the recommended geometric improvements at the intersection of Gammon Road & Mineral Point Road.



**LIVESEY DEVELOPMENT**

**Legend**  
 Metro Transit Stop



**Exhibit 1-1: Existing Transportation System**  
 City of Madison [Dane County]

NORTH  
 NOT TO SCALE





Legend

- xx' Existing Turn Lane Storage Length (feet)
  - xx' Recommended Turn Lane Storage Length (feet) (2019 Background Traffic)
  - xx' Recommended Turn Lane Storage Length (feet) (2049 Background Traffic)
  - Existing Lane Configuration
  - Recommended Lane Configuration (2019 Background Traffic)
  - Recommended Lane Configuration (2049 Background Traffic)
  - \* Bus Lane/Right-Turn Lane
  - Recommended Signalization (2019 Background Traffic)
  - Ⓐ Storage lengths not anticipated to be accommodated due to existing site layout
  - ⊕ Extend storage length to maximum possible extent
- # Note: Recommended to designate a right-turn lane

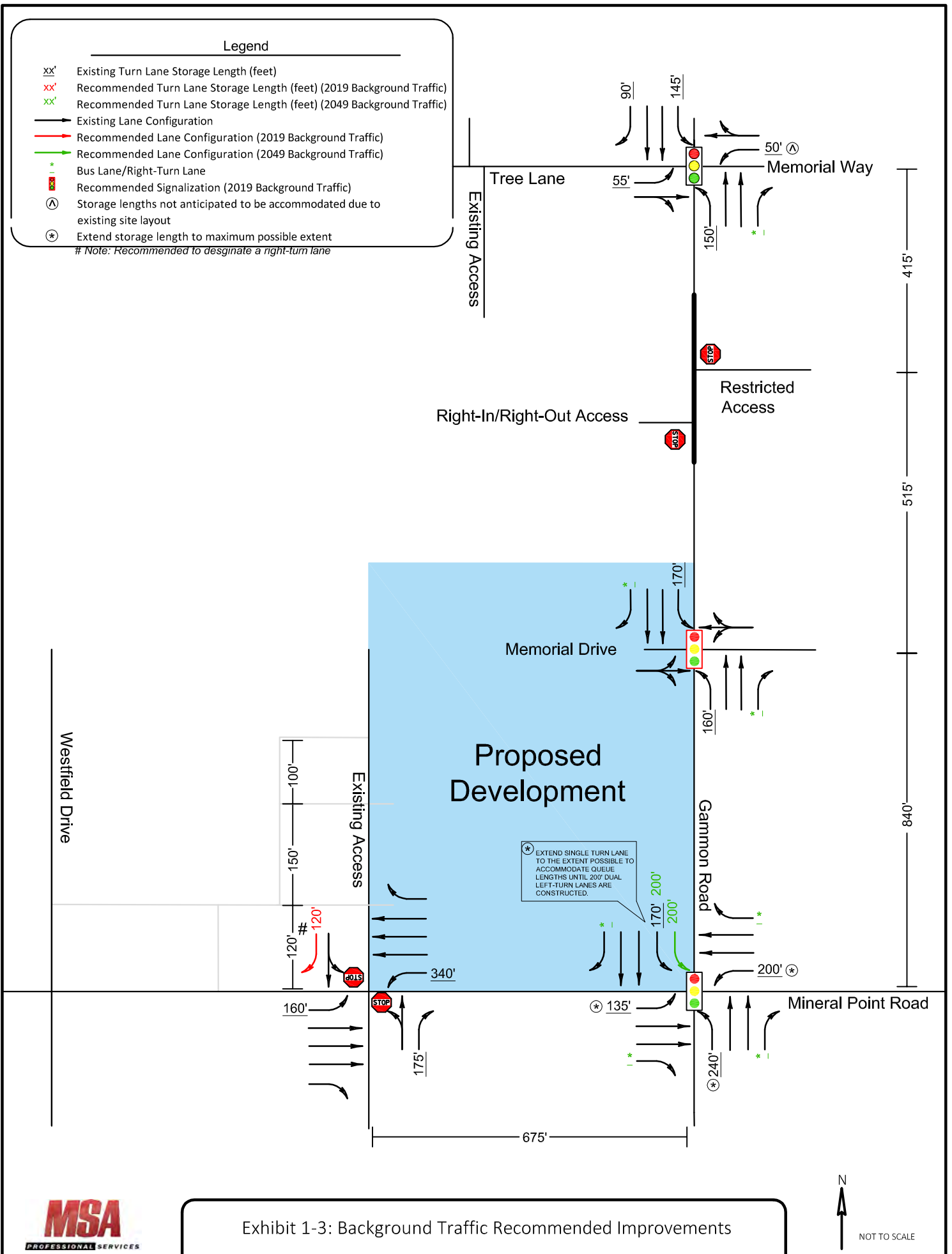


Exhibit 1-3: Background Traffic Recommended Improvements

NOT TO SCALE

**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- xx' Recommended Turn Lane Storage Length (2019 Background Traffic)
- xx' Recommended Turn Lane Storage Length (feet) (2029 Full Build Traffic)
- xx' Recommended Turn Lane Storage Length (feet) (2049 Full Build Traffic)
- Existing Lane Configuration
- Recommended Lane Configuration (2019 Background Traffic)
- Recommended Lane Configuration (2019 Build Traffic)
- Recommended Lane Configuration (2029 Full Build Traffic)
- Recommended Lane Configuration (2049 Full Build Traffic)
- Bus Lane/Right-Turn Lane
- Recommended Signalization (2019 Background Traffic)
- Storage lengths not anticipated to be accommodated due to existing site layout
- Extend storage length to maximum possible extent

# Note: Recommended to designate a right-turn lane

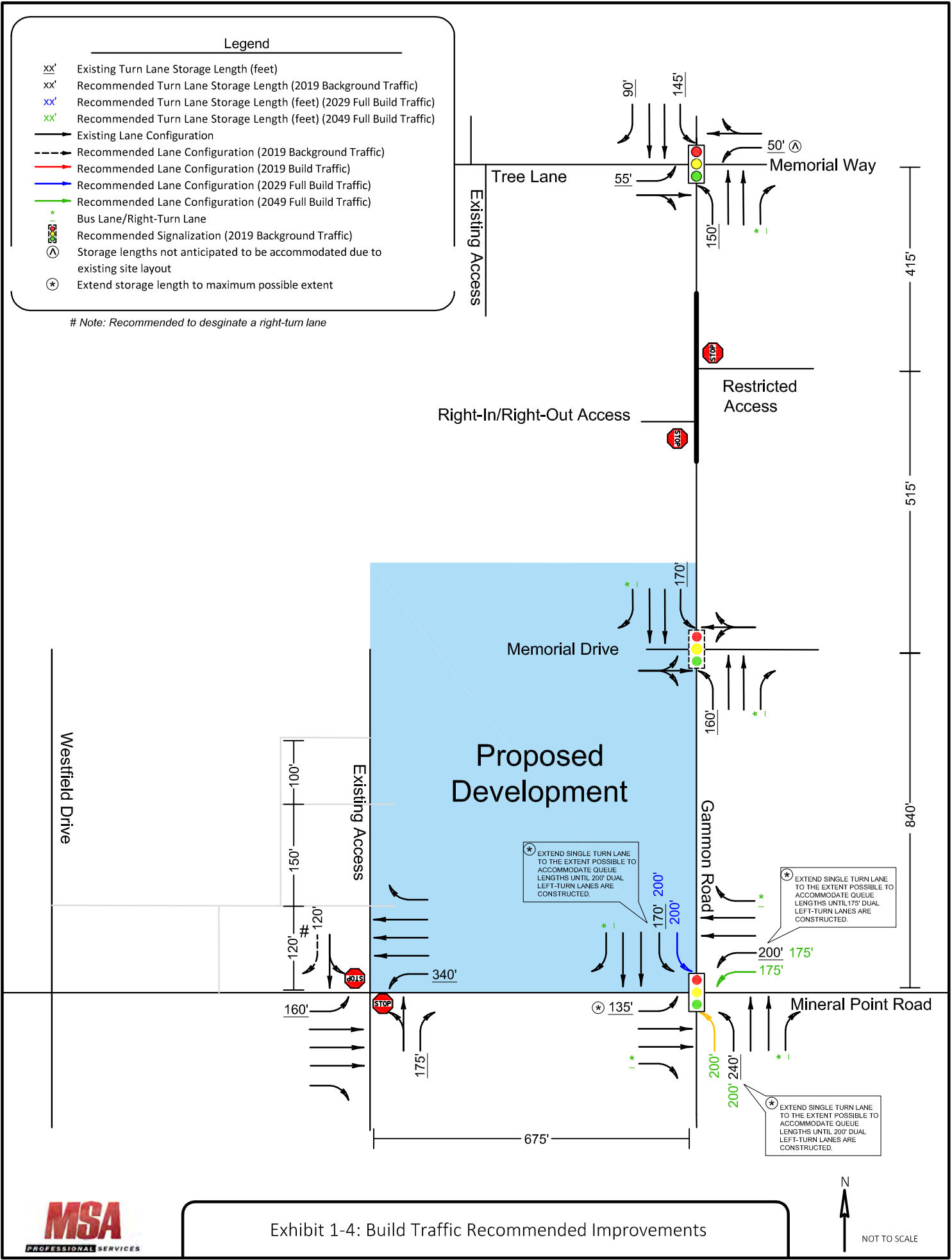


Exhibit 1-4: Build Traffic Recommended Improvements

NOT TO SCALE

## Chapter 2 – PROPOSED DEVELOPMENT

This chapter of the report provides a description of the proposed development and the adjacent area. The description includes the location of the site, the planned land use, the intensity of the development, and the development stages. In addition, the influence area of the development, the area of significant traffic impact, and the site accessibility are identified.

### PART A – ON-SITE DEVELOPMENT

#### A1. Development Description and Site Location

West Place Development is proposed to be located on the northwestern quadrant of Mineral Point Road & Gammon Road. The 14-acre site is proposed as a general office park with one main anchor user.

West Towne Mall is located on the southwest quadrant of Mineral Point Road & Gammon Road. It is a major regional destination for shopping. Other smaller retail stores and restaurants also surround Gammon Road and Mineral Point Road.

James Madison Memorial High School is located to the east of Gammon Road adjacent to the site. Full access to the school is located at two study intersections; Memorial Drive and Tree Lane. There is a three-quarter restricted access point (right-in/right-out/left-in) between Memorial Drive and Tree Lane.

A site location map is shown in **Exhibit 2-1, Existing Transportation System**.

#### A2. Land Use and Intensity

The existing site is occupied by the vacant Madison Area Technical College (MATC) West Campus building. The MATC West Campus was vacated in June of 2016 and the building will be razed as part of the new development. As part of the City of Madison’s Comprehensive Plan, adopted in January 2006 and amended through March 2012, the land is zoned for commercial and employment uses.

Mixed-use development consisting of primarily office space is proposed for the West Place Development, as seen in **Exhibit 2-2, Site Plan** and summarized below in **Table 2-1**. The ITE Land Use codes associated with each type of development are included as well as the proposed size and unit per land use.

**Table 2-1: On-Site Land Use**

	Building	ITE Land Use	ITE Code	Square Feet	Units	Size
Stage I	A	General Office Building	710	80,000	1,000 Square Feet	80.0
	B	General Office Building	710	30,000	1,000 Square Feet	30.0
	C	High Turnover (Sit-Down) Restaurant	932/Combo	5,000	1,000 Square Feet	5.0
	D	High Turnover (Sit-Down) Restaurant	932/Combo	6,000	1,000 Square Feet	6.0
	E	General Office Building	710	60,000	1,000 Square Feet	60.0
Stage II	F	General Office Building	710	60,000	1,000 Square Feet	60.0
	G	General Office Building	710	24,000	1,000 Square Feet	24.0
	H	General Office Building	710	60,000	1,000 Square Feet	60.0

Commercial land uses, including a day-care and animal hospital currently exist north of the proposed development site. The other existing commercial buildings on the site will remain occupied and in place.

It is assumed that all existing traffic utilizing the intersection of Gammon Road & Memorial Drive are generated by adjacent businesses, and therefore all existing traffic will remain as part of background traffic.

### **A3. Proposed Site Plan**

There are no new access locations proposed with the West Place Development. Two existing access points will be reused with the new site plan; one access location will be utilized on Gammon Road & Memorial Drive (access to James Madison Memorial High School) and three access locations from the existing Clinic Driveway off of Mineral Point Road.

A preliminary site plan for the West Place Development is shown in **Exhibit 2-2, Site Plan**.

### **A4. Development Phasing and Timing**

Stage I is anticipated for 2019 construction and will consist of razing the existing MATC building and constructing several general office buildings and two restaurants that will complement the office spaces.

Stage II (full build) is anticipated for completion by 2029. The second stage of development will include additional general office buildings that will fill in the vacant space surrounding the site.

For this study, all development outside of Stage I is considered Stage II and a full build out condition. The following study time periods will be analyzed:

- **2019** = (build year of Stage I)
- **2029** = (full build out; Stage I + Stage II)
- **2049** = (full build out + 20 years)

## **PART B – STUDY AREA**

### **B1. Influence Area**

The proposed project's influence area is the geographic area bounded to the east by Gammon Road, the existing Clinic Driveway to the west, Tree Lane to the north, and Mineral Point Road to the south.

### **B2. Area of Significant Traffic Impact**

It is anticipated, for the purpose of this study, that the area of traffic impact is limited to four (4) intersections, as seen in **Exhibit 2-1, Existing Transportation System**. The following intersections will be studied:

1. Gammon Road & Tree Lane (Signalized)
2. Gammon Road & Memorial Drive
3. Gammon Road & Mineral Point Road (Signalized)
4. Mineral Point Road & Clinic Driveway

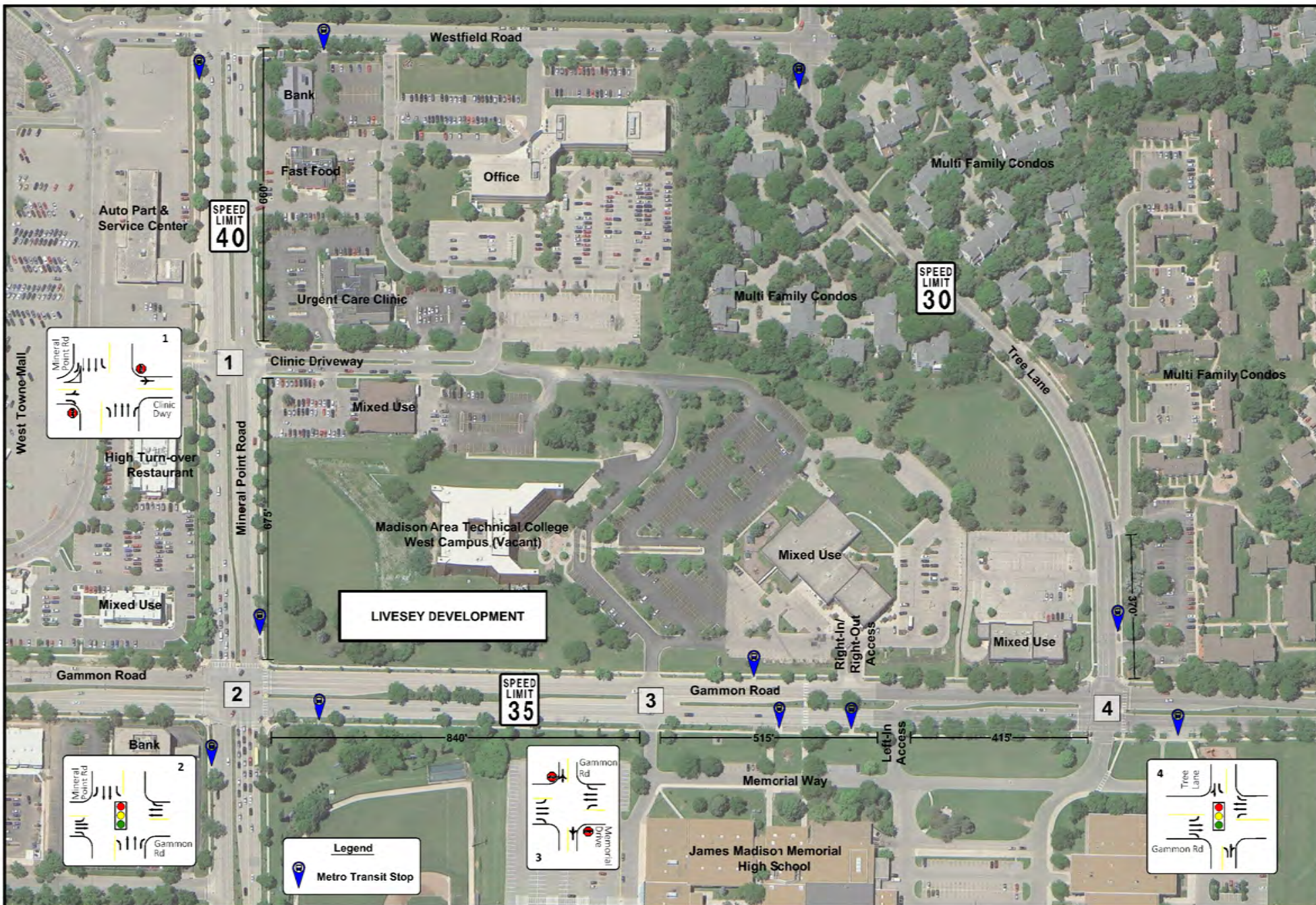
### **PART C – OFF-SITE LAND USE AND DEVELOPMENT**

No additional developments of significance are known or included as part of this study. If developed in the future, an additional study analyzing the traffic impacts will need to be coordinated through the City of Madison and its developer.

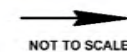
### **PART D – SITE ACCESSIBILITY**

Several residential neighborhoods surround the proposed development. Due to the office space and food industry land uses proposed for the development, it was assumed that some trips would arrive using different modes of transportation including walking, biking, or the local bus system.

Pedestrian and bicycle count data was collected at the surrounding intersections to verify that multimodal trips are common within the study area. Madison Metro Transit also provided ridership information, including average bus trips near the development per day, to further confirm that users may choose to utilize the transit system rather than personal vehicle.



**Exhibit 2-1: Existing Transportation System**  
 City of Madison [Dane County]







## Chapter 3 – ANALYSIS OF EXISTING CONDITIONS

The analysis of existing conditions provides a base against which the incremental traffic impacts of the proposed development can be measured. This chapter includes the following topics:

- Physical characteristics of the existing transportation
- Traffic volumes
- Capacity / Level of Service
- Sources of Data

### PART A – PHYSICAL CHARACTERISTICS

#### A1. Existing Area Roadway System

The existing transportation system consists of Gammon Road, a 35 mile per hour (mph), four-lane divided arterial with shared-use bike and bus lanes. The roadway consists of concrete pavement, urban curb and gutter, grass medians, and sidewalk. The current average daily volume is 20,650 vehicles per day.



**Figure 3-1:** Existing Transportation System

There are four Madison Metro Transit bus stops along Gammon Road that utilize the shared-use outside lane for stops. James Madison Memorial also uses the Madison Metro bus system for school pick-up and drop-off. The high school has an open campus lunch policy in which students may leave the campus during the lunch hour.

Mineral Point Road is posted as a 40 mph arterial with four driving lanes and a shared use outside bike and bus lane. The roadway consists of concrete pavement, urban curb and gutter, grass medians, and sidewalk. The current average daily volume is 32,550 vehicles per day.

**Exhibit 2-1** illustrates the specific intersection diagrams and transportation layout of the study area intersections. In discussions with the City of Madison, the outside bus lanes are reserved for future bus rapid transit (BRT) and cannot be converted to vehicle lanes. Standard two-way stop controlled intersections are present at all other locations not specifically noted as signalized.

## A2. Future Area Roadway System

Gammon Road, from Mineral Point Road to Watts Road, is tentatively proposed for improvement through the Wisconsin Department of Transportation (WisDOT) Surface Transportation Program (STP)-Urban program; improvements as part of that project are unknown at this time.

There are no known additional state or city roadway projects planned in the area.

## PART B – TRAFFIC VOLUMES

Raw traffic volumes were collected on Tuesday, September 27, 2016 and Thursday, September 29, 2016 using Miovision Data Collection units. Units were set up at the following locations:

1. Gammon Road & Tree Lane (Signalized)
2. Gammon Road & Memorial Drive
3. Gammon Road & Mineral Point Road (Signalized)
4. Mineral Point Road & Clinic Driveway

No Saturday turning movement counts were completed. As part of the Initial Review it was determined that the AM and PM peak hours were sufficient for analysis.

Intersection turning movement counts, on-street bike counts, and crosswalk pedestrian volumes were processed from 6:00am to 9:00am and from 3:00pm to 7:00pm, a total of seven hours, to gather peak hour traffic volumes for all study area intersections. A peak hour analysis was conducted to determine the corridor peak hour. **Figure 3-2** below illustrates the variation per intersection. As shown, there is a steady peak hour progression throughout the study area corridor. Raw data traffic volumes are included in **Appendix A**.

A summary of the collected turning movement counts are shown in **Exhibit 3-2A, 2016 Existing Traffic Volumes (Balanced)**.

West Place Development	AM Peak								PM Peak							
	7:00 AM	7:15 AM	7:30 AM	7:45 AM	8:00 AM	8:15 AM	8:30 AM	8:45 AM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM	6:00 PM
Gammon/Tree Lane																
Gammon/Memorial Drive																
Gammon/Mineral Point																
Mineral Point/Clinic Dwy																

**Figure 3-2: Peak Hour Summary**

Traffic forecast rates were provided by the City of Madison and Dane County Metropolitan Planning Organization (MPO). The following forecast rates were used to project the 2016 turning movement counts from **Exhibit 3-2A** to 2019 volumes which will serve as the baseline for the study:

- Mineral Point (Gammon to Westfield) – 0.30%
- Gammon (Mineral Point to Tree Ln) – 0.20%
- Tree Ln (Gammon to Westfield) – 0.25%
- Westfield (Mineral Point to Tree Ln) – 0.15%

The balanced 2016 existing traffic volumes were grown at the corresponding percentages and rebalanced accordingly. A summary of the 2019 background traffic volumes can be seen in **Exhibit 3-2B, 2019 Base Year Background Traffic Volumes**.

## PART D – CAPACITY/LEVEL OF SERVICE

The purpose of this section of the report is to show the relationship between traffic operations and roadway geometrics, and to identify improvement needs. The analysis of the base year traffic volumes, capacity, and Level of Service was performed for the study area intersections.

An operational and capacity analysis was completed for each intersection using Synchro 9 which is based on the procedures, methods, and techniques contained in the Highway Capacity Manual, 2010 Edition. This type of analysis assigns a Level of Service to each movement. Level of Service is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, LOS “A,” to very poor, LOS “F.” The delay is measured in seconds per vehicle, which can be used to determine the Level of Service for the intersection. The below tables represent the delay criteria used for determining the Level of Service at an intersection.

**Table 3-1: Highway Capacity Manual Level of Service**

Level of Service	Average Control Delay (sec/veh)	
	Stop Control	Signal Control
“A” (best)	0 to 10	0 to 10
“B” (good)	> 10 and ≤ 15	> 10 and ≤ 20
“C” (desirable)	> 15 and ≤ 25	> 20 and ≤ 35
“D” (delay)	> 25 and ≤ 35	> 35 and ≤ 55
“E” (congestion)	> 35 and ≤ 50	> 55 and ≤ 80
“F” (forced flow)	> 50	> 80

### C1. Year 2019 Background Traffic Operations

**Exhibit 3-3, 2019 Base Year Background Traffic Capacity/LOS Analysis – Existing Transportation System** shows the base year background traffic analysis for the existing transportation system and City of Madison traffic signal timing plans.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.

- *Gammon Road & Memorial Drive*  
At the intersection of Gammon Road & Memorial Drive, the east and west approaches shared lanes will operate at LOS E and LOS F, as shown in **Exhibit 3-3**. All other intersection movements operate at LOS D or better.
- *Gammon Road & Mineral Point Road*  
At the intersection of Gammon Road & Mineral Point Road several movements operate at LOS E with volume-to-capacity (v/c) ratios nearing 1.0 during the AM and PM peak hours.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 3-3**, the intersection of Mineral Point Road & Clinic Driveway will operate at LOS F in the PM peak hour for the northbound left/thru lane and southbound shared lane. All other intersection movements operate at LOS D or better.

The 2019 background condition was discussed with the City of Madison to establish a baseline delay threshold for all future analyses. Due to the existing and known congestion and capacity issues along the corridors, the following delay thresholds are to be maintained at the study area intersections:

- Gammon Road & Tree Lane – LOS D or better for individual movements
- Gammon Road & Memorial Drive – LOS D or better for individual movements
- Gammon Road & Mineral Point Road – LOS E or better for individual movements
- Mineral Point Road & Clinic Driveway – LOS F or better for the side-street approaches, LOS D or better for the mainline

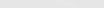
Traffic operations resulting from the West Place Development, improvements, and recommendations are discussed in Chapter 5 and Chapter 6, respectively.

## **PART F – SOURCES OF DATA**

- Turning movement traffic counts - MSA Professional Services Inc.
- Traffic Growth Percentages – Dane County Metropolitan Planning Organization (MPO)
- On-site development information – Urban Assets, Inc.



### Legend

-  Restricted Access
- XX AM Peak Hour (7:30- 8:30am)
- (XX) PM Peak Hour (4:45 - 5:45pm)
- (-) Negligible Volumes (less than three vph)

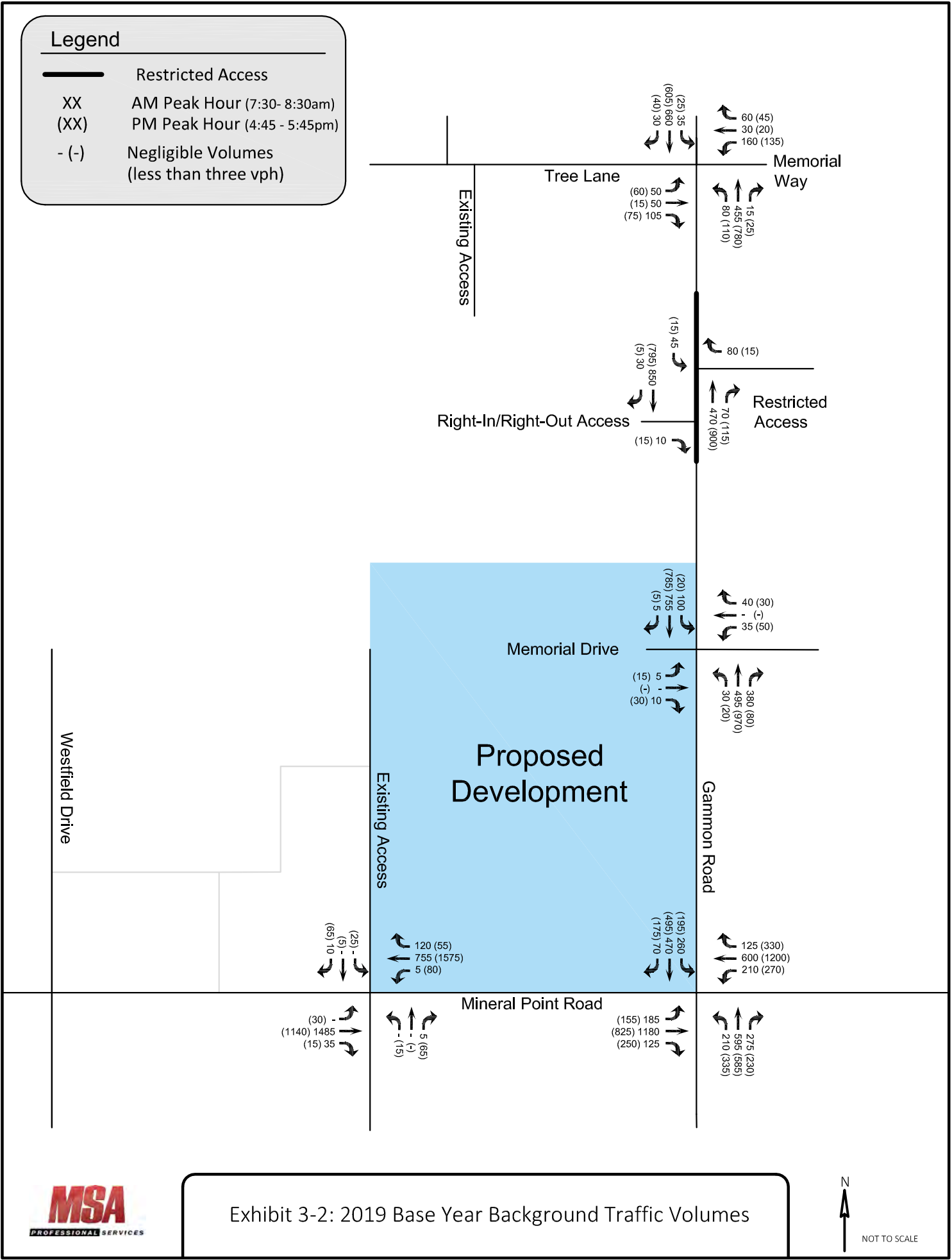
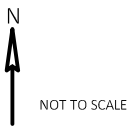






Exhibit 3-2: 2019 Base Year Background Traffic Volumes



### Exhibit 3-3, 2019 Base Year Background Traffic Capacity/LOS Analysis - Existing Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection		
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT			
Gammon Road & Tree Lane		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	B 16.4	
		AM Peak	LOS	C		C		C		C		B	B	B	A	B		A
			Delay (s)	25.2	23.9		33.7		22.4		17.4	14.6	11.8	9.9	10.7	7.9		
			v/c ratio	0.15	0.39		0.61		0.23		0.27	0.34	0.01	0.09	0.41	0.02		
			Queue (ft)	50	125		150		75		75	150	25	25	150	25		
		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1		
PM Peak	LOS	C		C		D		C		A	A	A	A	A	A	B 12.5		
	Delay (s)	31.6	29.6		36.3		28.9		9.3	9.8	7.2	6.4	5.7	4.5				
	v/c ratio	0.21	0.30		0.52		0.21		0.21	0.39	0.01	0.06	0.27	0.02				
	Queue (ft)	75	100		125		50		75	200	25	25	100	25				
Gammon Road & Memorial Drive		Lanes			1			1			1	2	1	1	2	1	A 2.9	
		AM Peak	LOS	D		E			B			A			A 2.9			
			Delay (s)	30.3		48.9			10.1			9.2						
			v/c ratio	0.11		0.54			0.05			0.12						
			Queue (ft)	25		75			25			25						
		Lanes			1			1			1	2	1	1	2	1		
PM Peak	LOS	D		F			A			B			A 5.1					
	Delay (s)	28.3		105.6			9.6			10.5								
	v/c ratio	0.24		0.77			0.03			0.03								
	Queue (ft)	25		125			25			25								
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	D 48.3	
		AM Peak	LOS	C	E	B	E	C	C	D	D	C	D	D	D	D		D 48.3
			Delay (s)	25.0	64.9	19.3	63.3	31.8	26.4	35.7	51.1	31.7	49.3	43.9	38.1			
			v/c ratio	0.51	0.99	0.09	0.90	0.48	0.11	0.62	0.77	0.27	0.84	0.56	0.09			
			Queue (ft)	175	#950	75	250	350	100	175	350	125	#325	250	50			
		Lanes			1	2	1	1	2	1	1	2	1	1	2	1		
PM Peak	LOS	D	D	B	D	D	C	E	D	C	D	D	D	D	D 41.4			
	Delay (s)	35.3	37.0	16.3	35.1	42.8	26.5	57.7	45.5	28.1	38.0	50.0	44.0					
	v/c ratio	0.75	0.67	0.16	0.81	0.87	0.27	0.90	0.68	0.21	0.65	0.72	0.28					
	Queue (ft)	175	#500	100	#300	#850	200	#400	325	100	150	275	125					
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	1	A 0.1		
		AM Peak	LOS	A		C			A			B			A 0.1			
			Delay (s)	0.0		15.6			0.0			19.7						
			v/c ratio	0.00		0.02			0.00			0.02						
			Queue (ft)	0		25			0			25						
		Lanes			1	2	1	1	2	1	1	1	1	1	1			
PM Peak	LOS	C		B			F			B			E 46.9					
	Delay (s)	15.2		12.3			1343.2			14.6								
	v/c ratio	0.08		0.15			1.97			0.15								
	Queue (ft)	25		25			75			25								

HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal

## Chapter 4 – PROJECTED TRAFFIC

The future traffic volumes in the vicinity of the site consist of background traffic plus the additional traffic generated by the proposed development. This section of the report includes:

- Background traffic forecasting
- Site traffic forecasting
- Total traffic

### PART A - BACKGROUND TRAFFIC FORECASTING

#### A1. Traffic Forecast

The background traffic volumes represent the amount of traffic that will be on the area roadway network without the proposed development. The forecast traffic growth represents the growth expectation outside the study area.

Future year volumes were estimated by the Dane County Metropolitan Planning Organization (MPO) models and projections; see **Appendix A**. Due to the development phasing timeline, the collected turning movement counts for the corridor were forecasted to the development phasing years of 2029 and 2049. The rounded and balanced forecast volumes can be seen in the following exhibits:

- **Exhibit 4-1**, *2029 Interim Year Background Traffic Volumes*
- **Exhibit 4-2**, *2049 Horizon Year Background Traffic Volumes*

### PART B – DEVELOPMENT TRAFFIC AND OFF-SITE DEVELOPMENT TRAFFIC FORECASTING

To determine the impact of the proposed development on the future traffic operating conditions, it is necessary to estimate the general characteristics of the additional traffic that will be generated by the proposed development and the distribution of this traffic on the area roadway network. This requires five steps:

1. Trip generation
2. Mode split
3. Determination of internally linked and pass-by trip traffic
4. Trip distribution
5. Trip assignment

#### B1. Trip Generation

The major factors determining the amount of traffic that will be generated are the development's size and land use. In particular, the type of land use (e.g., recreational, residential, retail, industrial, office, etc.) will have a significant impact on the amount of new traffic that will be added to the area roadway network and the time of day when it will occur.



A description of the proposed development, including expected land use and square footage, was provided by Livesey Company. Trip generation rates were supplied by the *ITE Trip Generation Manual, 9th Edition* for the proposed developments.

The Wisconsin Department of Transportation (WisDOT) completed a study to develop local trip generation data for mixed-use developments. As part of the conclusion to the study, WisDOT released the 2017 Mixed-Use Development Trip Generation Guide which identifies new local trip generation rates. The Guide also recommends appropriate situations to use the *ITE Trip Generation Manual* rates, local data found from the study, or a combination of ITE/local trip rates to estimate trip generation. As recommended by the Guide, the High-Turnover (Sit-Down) Restaurant land use was recommended to use a combination of the ITE trip generation rates and local data compiled by WisDOT. The rates are shown in red illustrated in **Exhibit 4-3, Trip Generation Table**. All General Office Building land uses use the ITE Trip Generation Manual.

The number of new trips was calculated, sorted by building and stage, and are summarized in **Exhibit 4-3, Trip Generation Table**. Total new driveway trips for the full build out scenario is provided at the bottom of the table in **Exhibit 4-3**.

All of the trip generation data was approved by the City of Madison through the Initial Submittal process.

## **B2. Mode Split**

Several residential neighborhoods surround the proposed development. Due to the office space and food industry land uses proposed for the development, it was assumed that some trips would arrive using different modes of transportation including walking, biking, or the local bus system.

Pedestrian and bicycle count data was collected at the surrounding intersections to verify that multimodal trips are common within the study area. Madison Metro Transit also provided ridership information, including average bus trips near the development per day, to further confirm that users may choose to utilize the transit system rather than personal vehicle. A combination of all multimodal transportation choices were accumulated and an overall 5% trip generation reduction was discussed and approved by City of Madison staff. The multimodal trip reduction can be seen in **Exhibit 4-3**.

## **B3. Determination of Pass-By, Internally-Linked, Multi-Linked, and Externally-Linked Trip Traffic**

### **B3-1. Determination of Internally Linked Trips**

West Place Development is being constructed primarily as a general office park. Due to the anticipated land uses, it is assumed that most trips will not be linked to other offices within the site. Internally linked trips occur when patrons visit more than one land use without leaving the site (i.e. a person patronizes the restaurant after work). The *ITE Trip Generation Handbook* was used to determine appropriate internally linked trip percentages for each land use.

Land Use	Internally Linked Trip Percentage	Notes
General Office Building	0%	It is assumed that no linked trips between office buildings will occur.
High-Turnover (Sit Down) Restaurant	10%	This percentage includes patrons that are working at the adjacent offices will stop at the restaurant after work. Linked trips were only discounted from the PM peak hour due to the nature of the restaurant business being closed during the morning peak hour.

**Figure 4-1: Linked Trip Rates**

The breakdown of linked trips per site can be seen in **Exhibit 4-3**. Linked trips are deducted from the total trip generation so as not to double count total driveway trips for those users assuming to utilize more than one land use.

No multi-linked or externally-linked trips are assumed for this development based study area.

**B3-2. Determination of Pass-by Trips**

Pass-by trips are drawn away from the adjacent roadway traffic stream. It assumes that patrons will be traveling on Mineral Point Road or Gammon Road, turn into the site, patronize the development, and then return to the adjacent roadway to continue in the same direction. The land uses proposed for this development are not anticipated to attract pass-by traffic. The land uses are destinational in nature and likely to only draw new trips to the site. Therefore, no pass-by percentages were used as part of this study.

**B4. Trip Distribution**

Trip distribution percentages were developed by reviewing the proposed site plan and existing traffic patterns. Trip distribution percentages were generated by verifying raw data traffic splits along the major roadways surrounding the site, as seen in **Exhibit 4-4A, Trip Distribution**.

Trips were dispersed into and out of the development using the nearest or most likely access location for each particular destination for passenger vehicles. Trip distribution patterns into and out of the proposed site for Stage I can be seen in **Exhibit 4-4B, Trip Distribution Stage I**.

Trip distribution patterns into and out of the proposed site for Stage II were adjusted slightly from Stage I. Due to the office infill anticipated as part of Stage II, which is located at the northernmost boundary of the site, it is predicted that more vehicles will enter and exit at the Memorial Drive intersection closer to the parking areas and building entrances. The trip distribution patterns can be seen in **Exhibit 4-4C, Trip Distribution Stage II**.

Comments on the Trip Distribution percentages were provided by the City of Madison as part of the Initial Submittal. Changes were made and implemented as part of this report.

**B5. Trip Assignment**

The additional trips generated by the developments were assigned to the roadway network using the trip distribution percentages corresponding to the appropriate land uses. Trips were dispersed into and out

of the development using the nearest or most likely access location for each particular destination for passenger vehicles.

- **Exhibit 4-5, Stage I On-Site Development Traffic Assignment: New Trips**
- **Exhibit 4-6, Stage II On-Site Development Traffic Assignment: New Trips**

*\*Note that since each Stage includes no pass-by trips, new trips equal driveway trips.*

## **PART C – BUILD AND TOTAL TRAFFIC**

### **C1. Stage I Development**

For the initial stage of development, the following scenarios will be analyzed:

- **(Exhibit 3-2B, 2019 Base Year Background Traffic Volumes) + (Exhibit 4-5, Stage I On-Site Development Traffic Assignment: New Trips)**

**Exhibit 4-7, 2019 Base Year Build Development Traffic Volumes** summarizes the background traffic and new trips that will occur in the base year.

### **C2. Future Build Development**

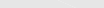
For the second and final stage of the on-site development, the following scenarios will be analyzed:

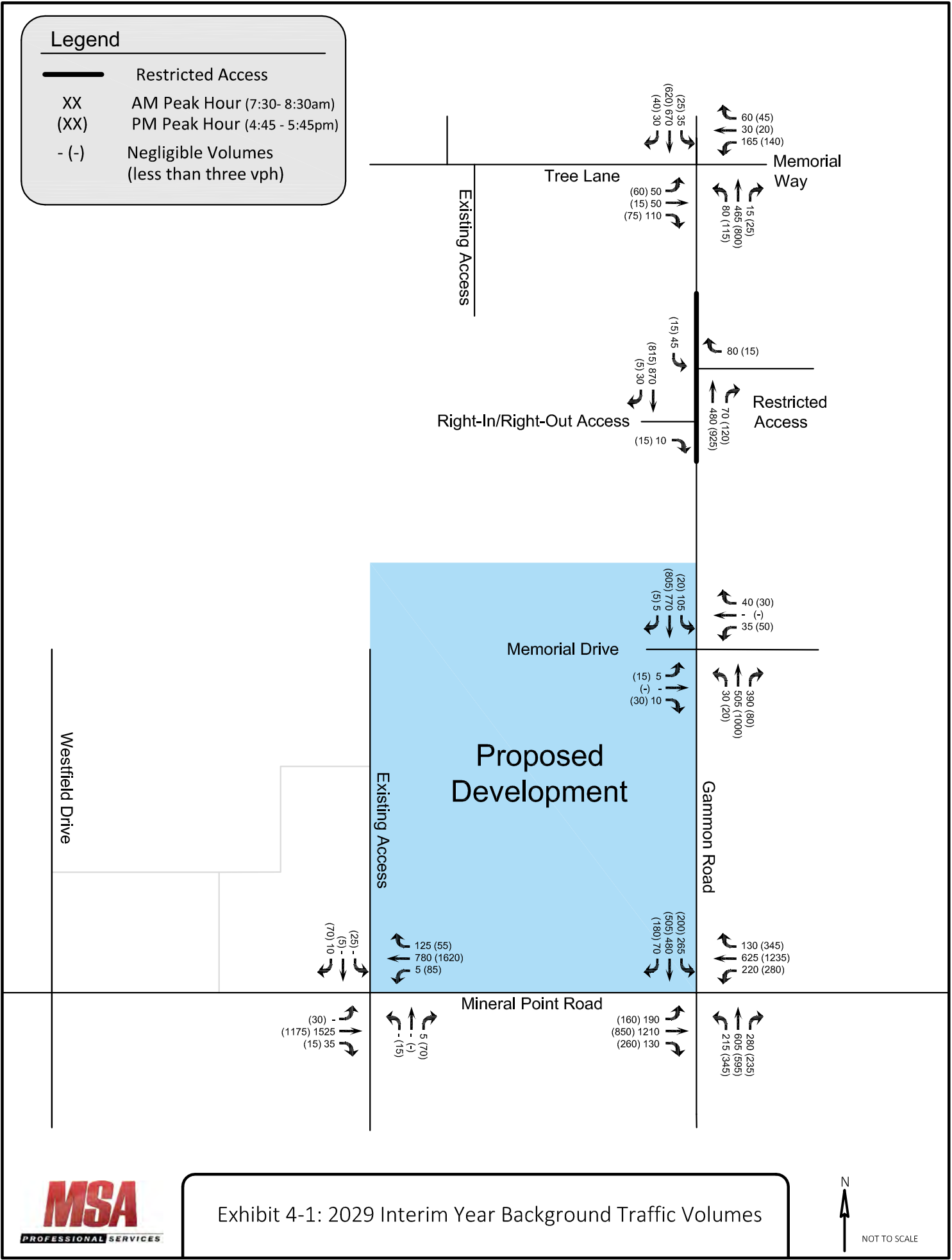
- **(Exhibit 4-1, 2029 Interim Year Background Traffic Volumes) + (Exhibit 4-5, Stage I On-Site Development Traffic Assignment: New Trips) + (Exhibit 4- Stage II On-Site Development Traffic Assignment: New Trips)**
- **(Exhibit 4-2, 2049 Horizon Year Background Traffic Volumes) + (Exhibit 4-5, Stage I On-Site Development Traffic Assignment: New Trips) + (Exhibit 4-6, Stage II On-Site Development Traffic Assignment: New Trips)**

**Exhibit 4-8, 2029 Interim Year Build Development Traffic Volumes** summarizes the background traffic and development trips that will occur in the interim development year.

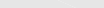
**Exhibit 4-9, 2049 Horizon Year Build Development Traffic Volumes** summarizes the background traffic and development trips that will occur in the horizon development year.

### Legend

-  Restricted Access
- XX AM Peak Hour (7:30- 8:30am)
- (XX) PM Peak Hour (4:45 - 5:45pm)
- (-) Negligible Volumes (less than three vph)



### Legend

-  Restricted Access
- XX AM Peak Hour (7:30- 8:30am)
- (XX) PM Peak Hour (4:45 - 5:45pm)
- (-) Negligible Volumes (less than three vph)

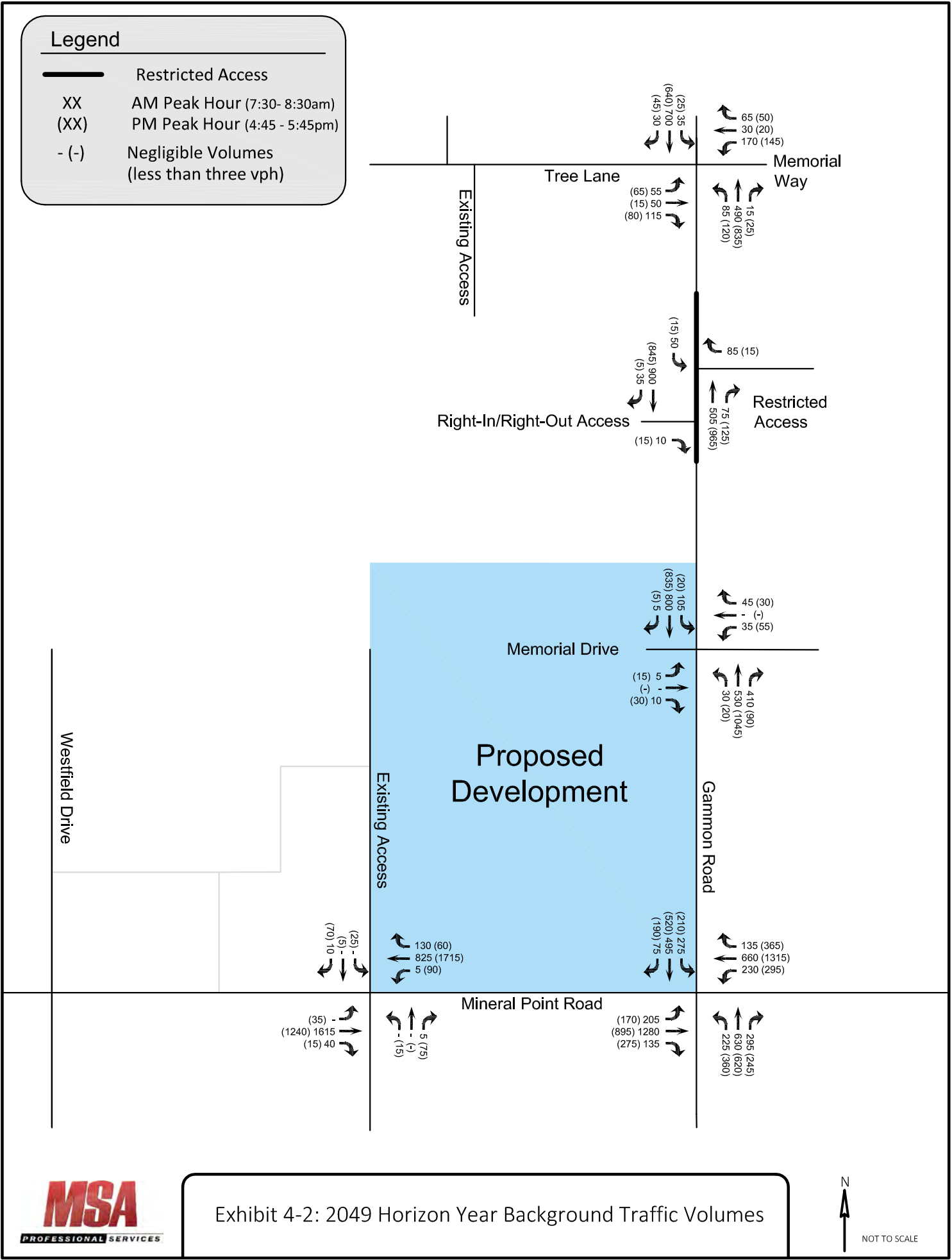
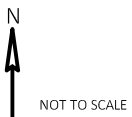


Exhibit 4-2: 2049 Horizon Year Background Traffic Volumes



### Exhibit 4-3, Trip Generation Table

	ITE Land Use	ITE Code	Square Feet	Units	Size	AM Peak Hour			PM Peak Hour			Daily	
						Total	In	Out	Total	In	Out	Two-way	
Stage 1	General Office Building (A)	710	80,000	1,000 Square Feet	80.0	Rates	1.56	1.37	0.19	1.49	0.25	1.24	11.03
						Percentage		88%	12%		17%	83%	
						Trips	125	110	15	120	20	100	880
						Minus On-Site Linked Trips	0%						
	<b>General Office Building Subtotal</b>						<b>125</b>	<b>110</b>	<b>15</b>	<b>120</b>	<b>20</b>	<b>100</b>	<b>880</b>
	General Office Building (E)	710	60,000	1,000 Square Feet	60.0	Rates	1.56	1.37	0.19	1.49	0.25	1.24	11.03
						Percentage		88%	12%		17%	83%	
						Trips	95	80	15	90	15	75	660
						Minus On-Site Linked Trips	0%						
	<b>General Office Building Subtotal</b>						<b>95</b>	<b>80</b>	<b>15</b>	<b>90</b>	<b>15</b>	<b>75</b>	<b>660</b>
	General Office Building (B)	710	30,000	1,000 Square Feet	30.0	Rates	1.56	1.37	0.19	1.49	0.25	1.24	11.03
						Percentage		88%	12%		17%	83%	
						Trips	45	40	5	45	10	35	330
						Minus On-Site Linked Trips	0%						
	<b>General Office Building Subtotal</b>						<b>45</b>	<b>40</b>	<b>5</b>	<b>45</b>	<b>10</b>	<b>35</b>	<b>330</b>
	High Turnover (Sit-Down) Restaurant (C)**	932/ Combo	5,000	1,000 Square Feet	5.0	Rates				9.63	5.78	3.85	127.15
						Percentage					60%	40%	
						Trips				50	30	20	635
						Minus On-Site Linked Trips	10%						(65)
	<b>High Turnover Restaurant Subtotal</b>									<b>50</b>	<b>30</b>	<b>20</b>	<b>570</b>
High Turnover (Sit-Down) Restaurant (D)**	932/ Combo	6,000	1,000 Square Feet	6.0	Rates				9.63	5.78	3.85	127.15	
					Percentage					60%	40%		
					Trips				60	35	25	765	
					Minus On-Site Linked Trips	10%						(75)	
<b>High Turnover Restaurant Subtotal</b>									<b>50</b>	<b>30</b>	<b>20</b>	<b>690</b>	
<b>Stage 1 Subtotal Trips</b>						<b>265</b>	<b>230</b>	<b>35</b>	<b>355</b>	<b>105</b>	<b>250</b>	<b>3130</b>	
<b>Minus Multimodal Trips 5%</b>						<b>(10)</b>	<b>(10)</b>	<b>0</b>	<b>(20)</b>	<b>(10)</b>	<b>(10)</b>	<b>(155)</b>	
<b>Stage 1 Subtotal Trips</b>						<b>255</b>	<b>220</b>	<b>35</b>	<b>335</b>	<b>95</b>	<b>240</b>	<b>2975</b>	
Stage 2	General Office Building (F)	710	60,000	1,000 Square Feet	60.0	Rates	1.56	1.37	0.19	1.49	0.25	1.24	11.03
						Percentage		88%	12%		17%	83%	
						Trips	95	80	15	90	15	75	660
						Minus On-Site Linked Trips	0%						
	<b>General Office Building Subtotal</b>						<b>95</b>	<b>80</b>	<b>15</b>	<b>90</b>	<b>15</b>	<b>75</b>	<b>660</b>
	General Office Building (H)	710	60,000	1,000 Square Feet	60.0	Rates	1.56	1.37	0.19	1.49	0.25	1.24	11.03
						Percentage		88%	12%		17%	83%	
						Trips	95	80	15	90	15	75	660
						Minus On-Site Linked Trips	0%						
	<b>General Office Building Subtotal</b>						<b>95</b>	<b>80</b>	<b>15</b>	<b>90</b>	<b>15</b>	<b>75</b>	<b>660</b>
	General Office Building (G)	710	24,000	1,000 Square Feet	24.0	Rates	1.56	1.37	0.19	1.49	0.25	1.24	11.03
						Percentage		88%	12%		17%	83%	
Trips						35	35	0	35	5	30	265	
Minus On-Site Linked Trips						0%							
<b>General Office Building Subtotal</b>						<b>35</b>	<b>35</b>	<b>0</b>	<b>35</b>	<b>5</b>	<b>30</b>	<b>265</b>	
<b>Stage 2 Subtotal Trips</b>						<b>225</b>	<b>195</b>	<b>30</b>	<b>215</b>	<b>35</b>	<b>180</b>	<b>1585</b>	
<b>Minus Multimodal Trips 5%</b>						<b>(10)</b>	<b>(10)</b>	<b>0</b>	<b>(10)</b>	<b>0</b>	<b>(10)</b>	<b>(80)</b>	
<b>Stage 2 Subtotal Trips</b>						<b>215</b>	<b>185</b>	<b>30</b>	<b>205</b>	<b>35</b>	<b>170</b>	<b>1505</b>	
<b>Subtotal New Driveway Trips</b>						<b>470</b>	<b>405</b>	<b>65</b>	<b>540</b>	<b>130</b>	<b>410</b>	<b>4480</b>	

\*\* High Turnover (Sit-Down) Restaurants are assumed to be closed for breakfast and no new driveway trips were accounted for.

A 10% reduction was applied to both High-Turnover (Sit-Down) Restaurants and the total number was removed from Building D only in order to balance the in and out movements.

Legend

- Restricted Access
- XX% Trip Distribution

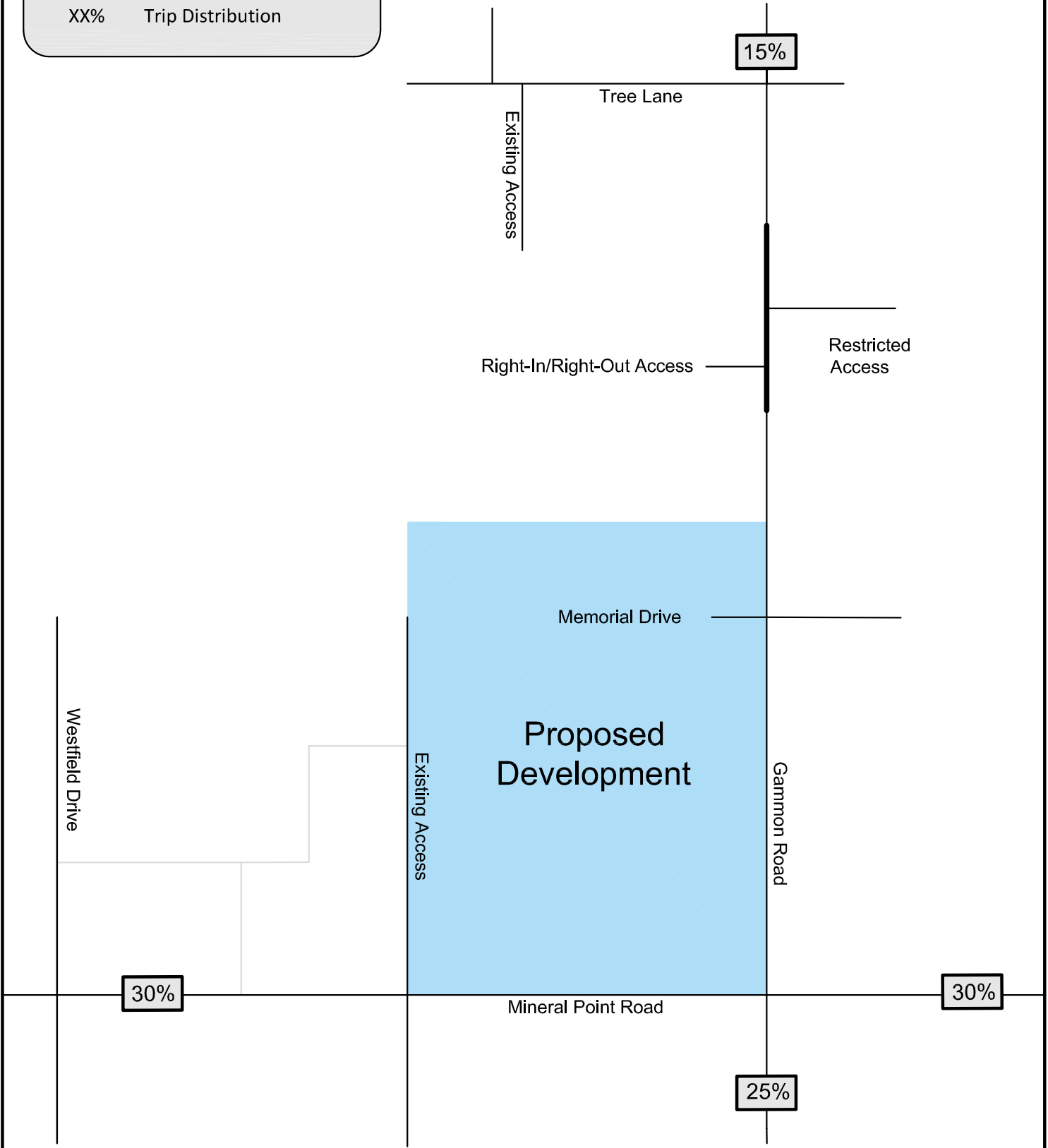
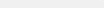


Exhibit 4-4A: Trip Distribution



NOT TO SCALE

**Legend**

-  Restricted Access
- XX Trip Distribution In
- XX Trip Distribution Out

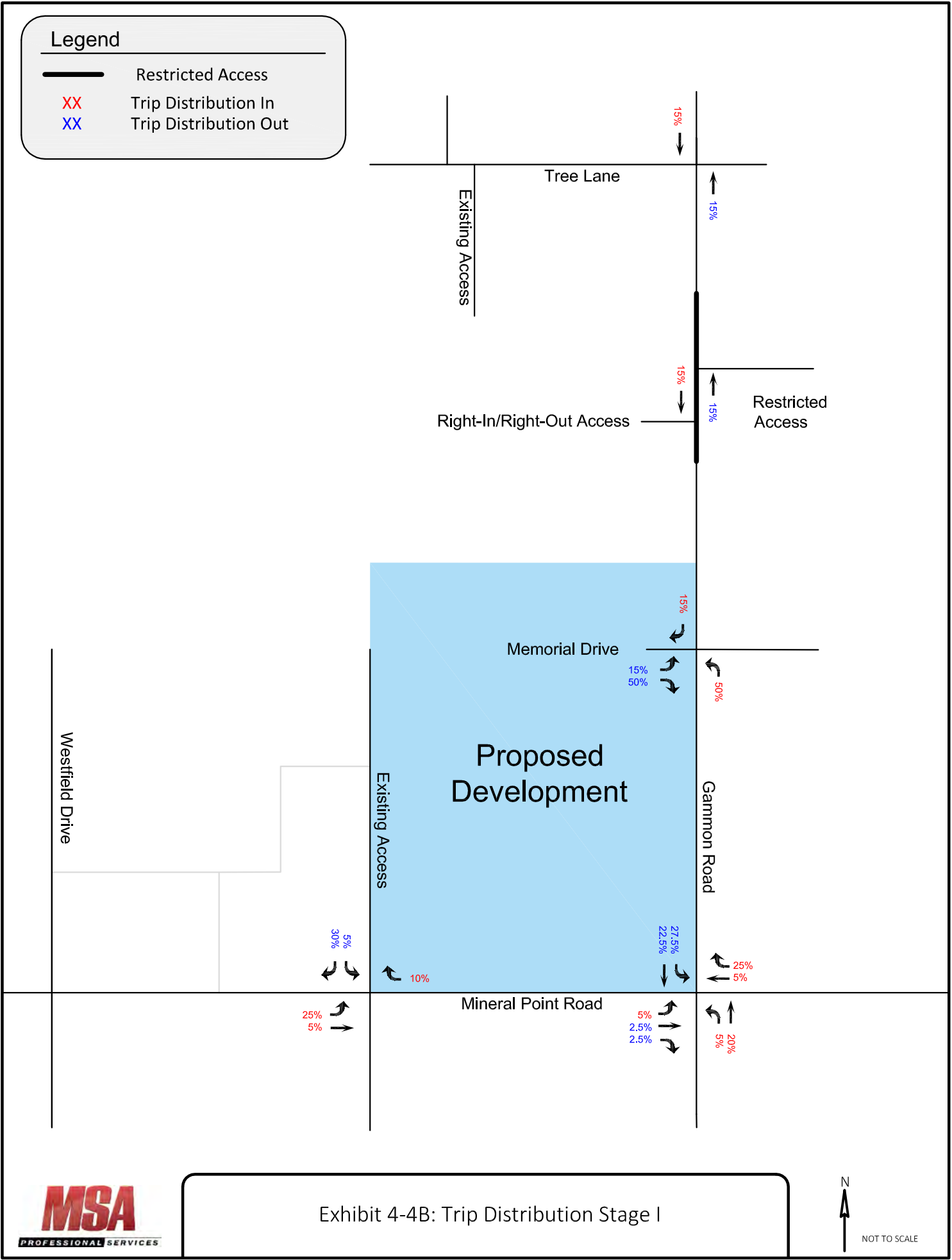


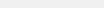
Exhibit 4-4B: Trip Distribution Stage I



NOT TO SCALE



**Legend**

-  Restricted Access
- XX Trip Distribution In
- XX Trip Distribution Out

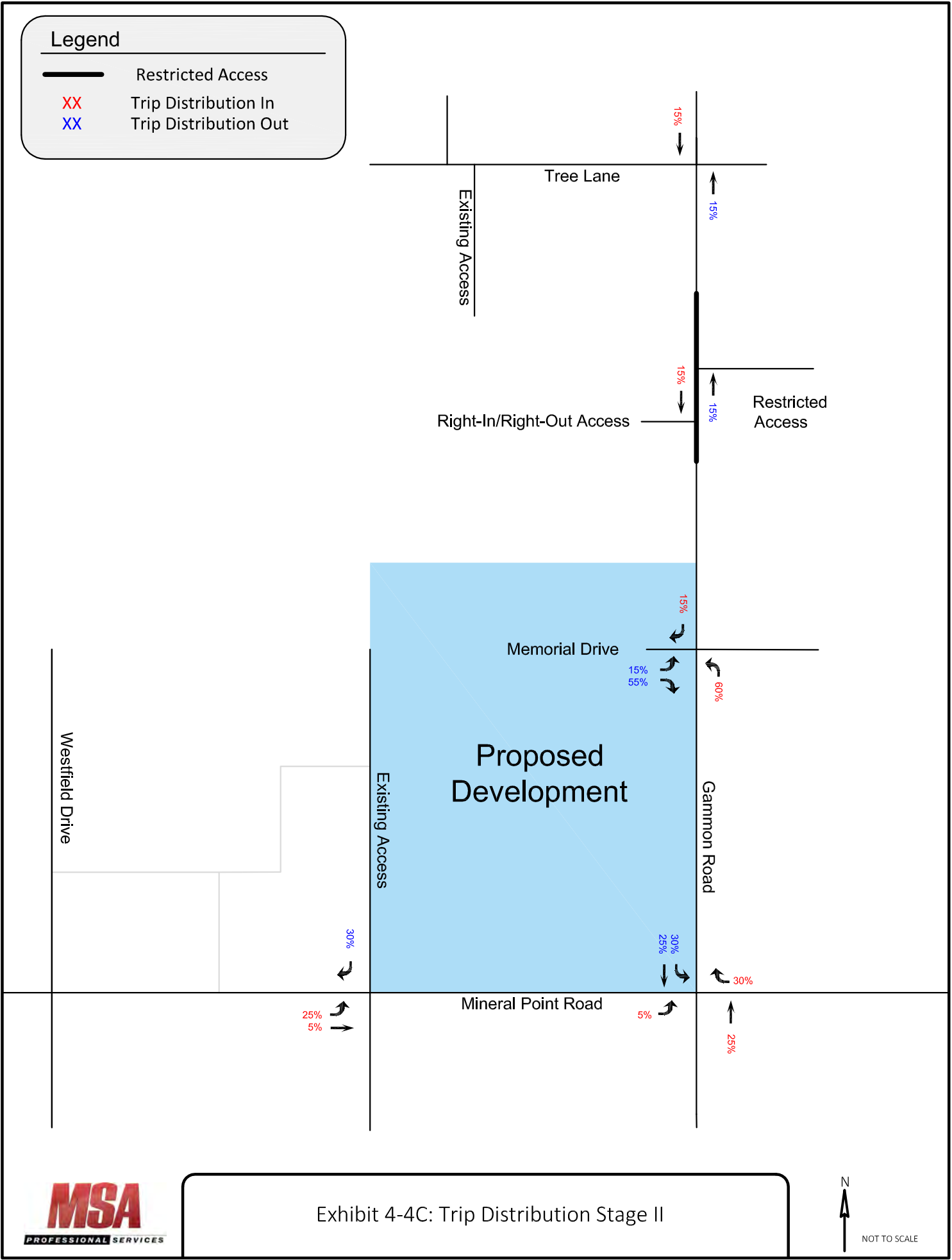
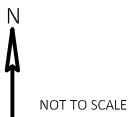



Exhibit 4-4C: Trip Distribution Stage II



### Legend

-  Restricted Access
- XX (XX) New Trips In: AM (PM)
- XX (XX) New Trips Out: AM (PM)

\*Note: Each stage includes no pass-by trips, new trips equal driveway trips

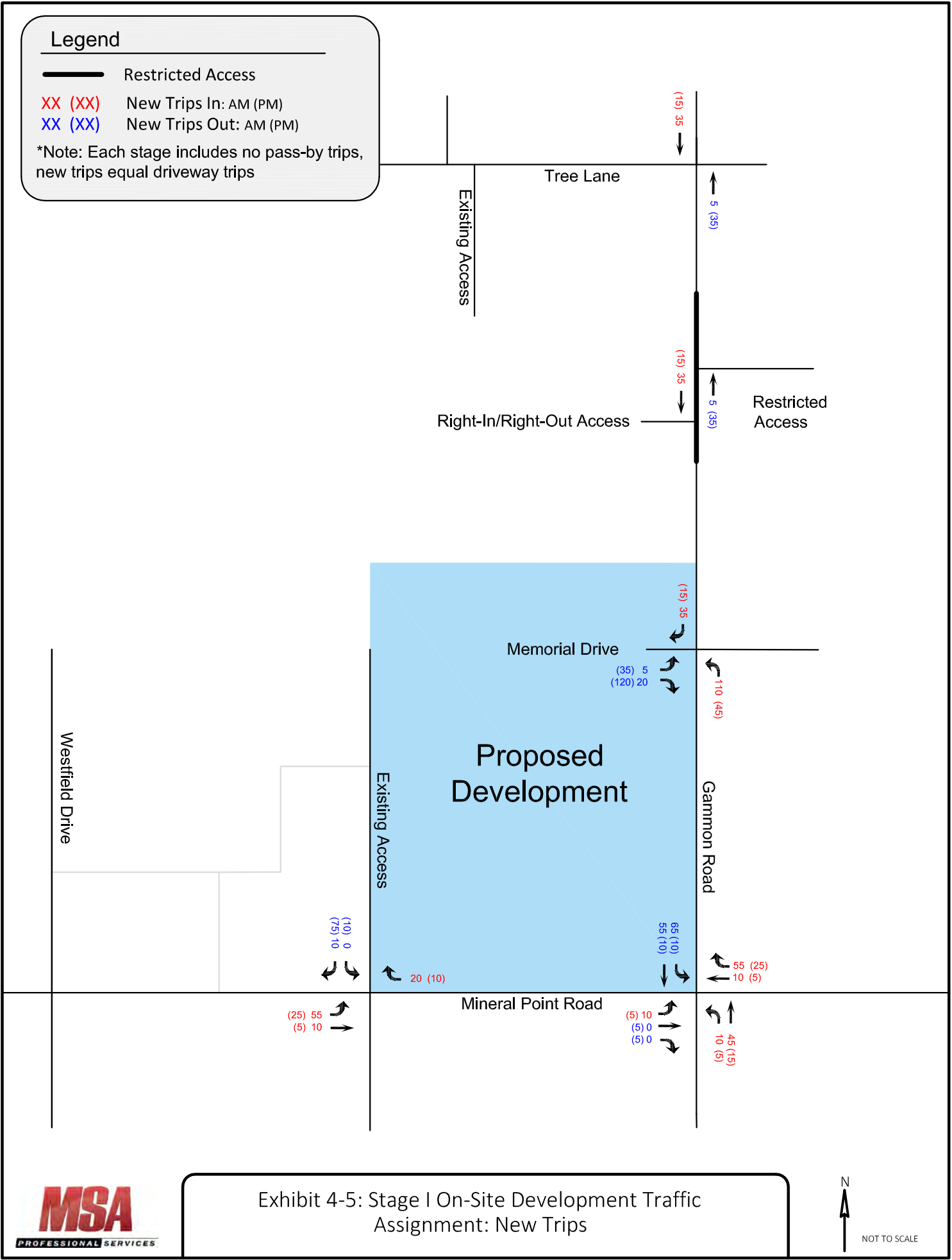



Exhibit 4-5: Stage I On-Site Development Traffic Assignment: New Trips



NOT TO SCALE

**Legend**

-  Restricted Access
  - XX (XX) New Trips In: AM (PM)
  - XX (XX) New Trips Out: AM (PM)
- \*Note: Each stage includes no pass-by trips, new trips equal driveway trips

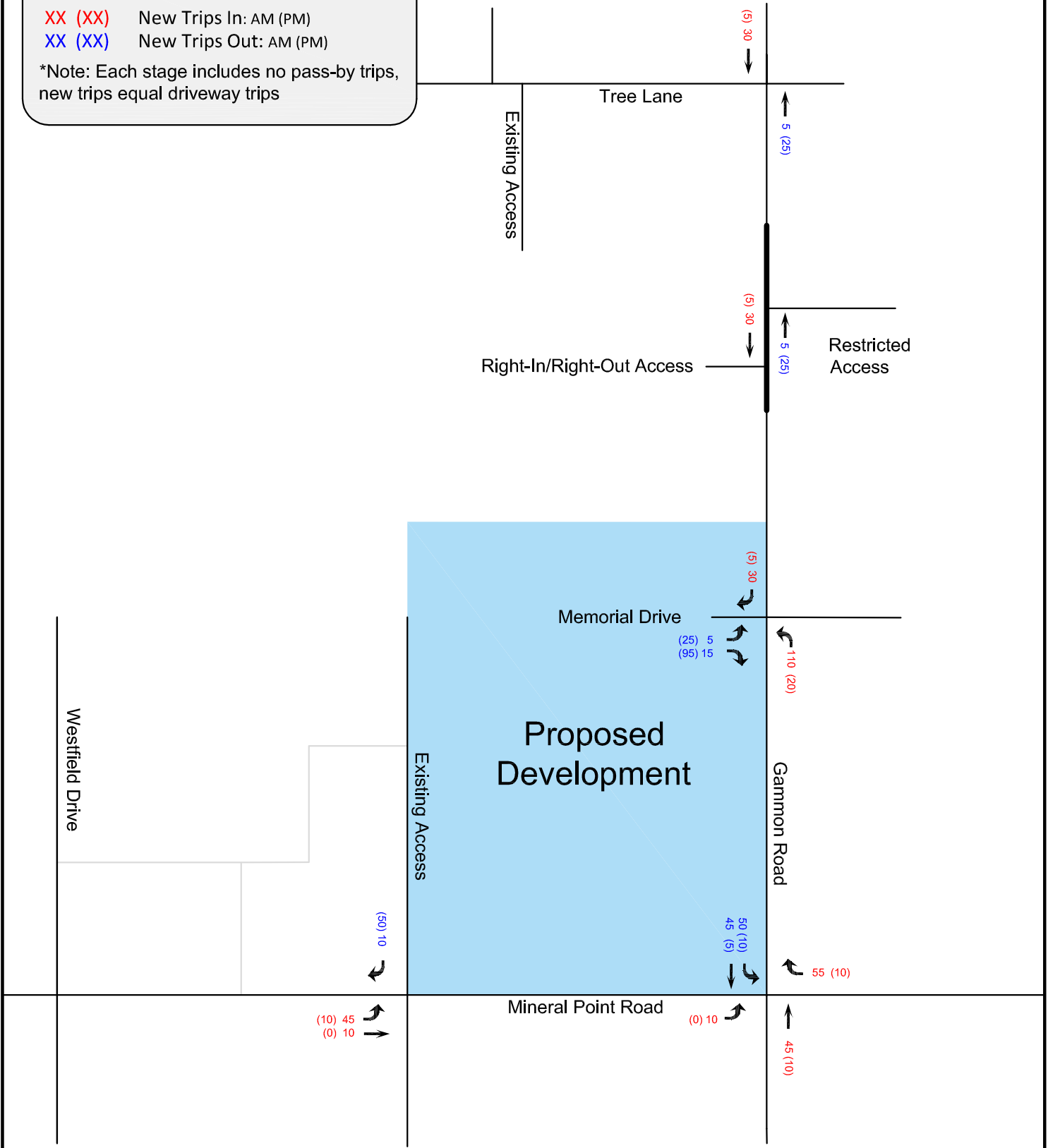
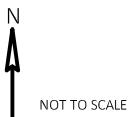



Exhibit 4-6: Stage II On-Site Development Traffic Assignment: New Trips



### Legend

-  Restricted Access
- XX AM Peak Hour (7:30- 8:30am)
- (XX) PM Peak Hour (4:45 - 5:45pm)
- (-) Negligible Volumes (less than three vph)

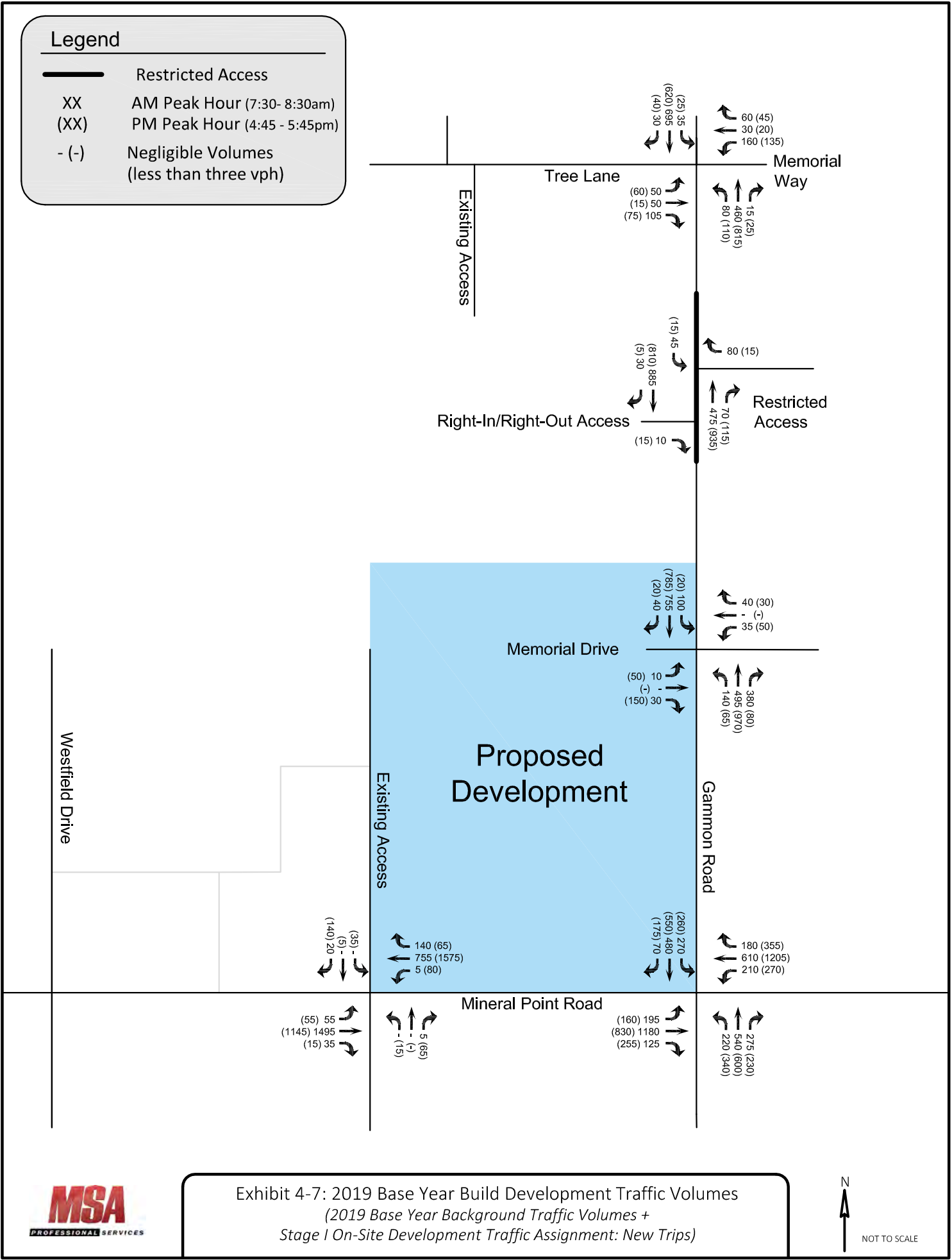
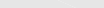


Exhibit 4-7: 2019 Base Year Build Development Traffic Volumes  
 (2019 Base Year Background Traffic Volumes +  
 Stage I On-Site Development Traffic Assignment: New Trips)



### Legend

-  Restricted Access
- XX AM Peak Hour (7:30- 8:30am)
- (XX) PM Peak Hour (4:45 - 5:45pm)
- (-) Negligible Volumes (less than three vph)

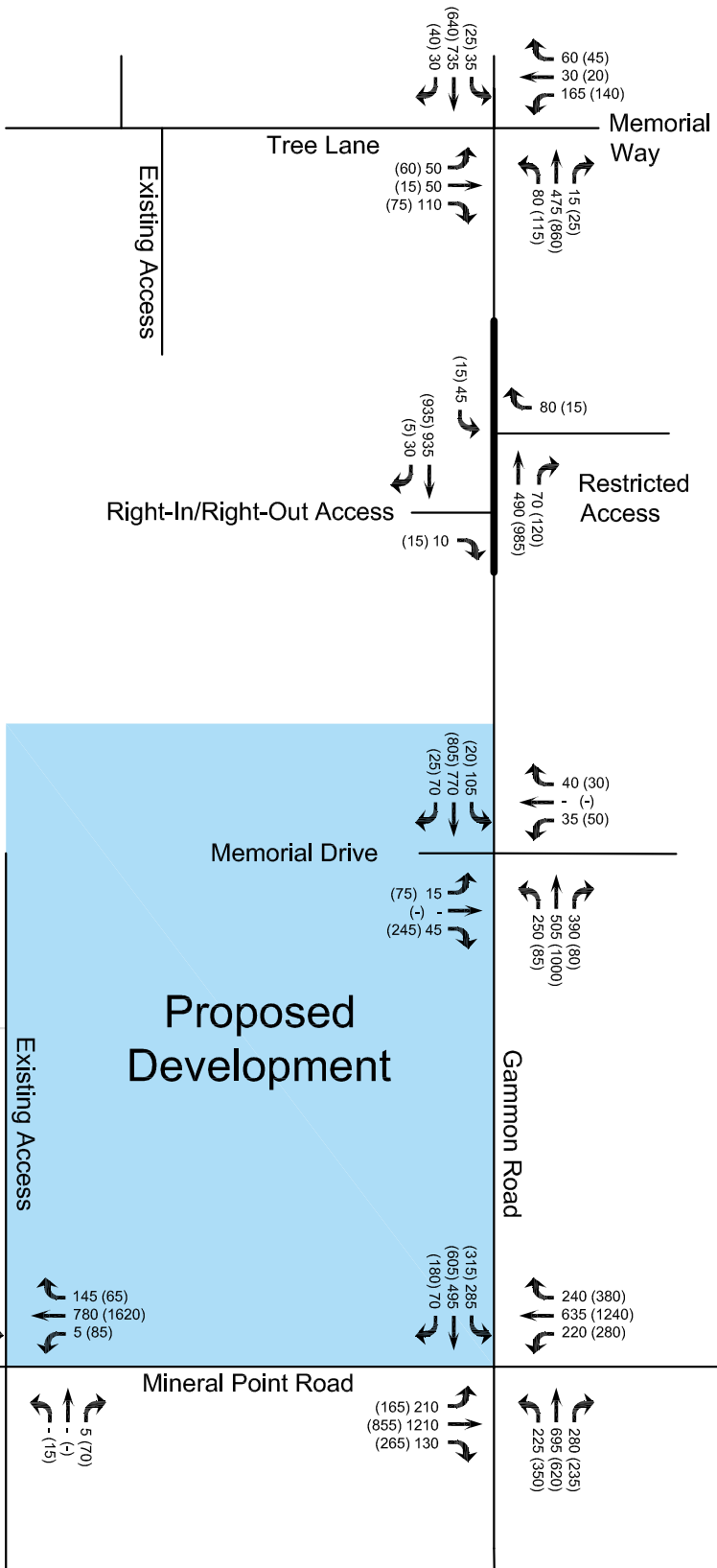
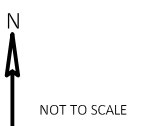



Exhibit 4-8: 2029 Interim Year Build Development Traffic Volumes  
 (2029 Interim Year Background Traffic Volumes +  
 Stage I On-Site Development Traffic Assignment: New Trips +  
 Stage II On-Site Development Traffic Assignment: New Trips)



### Legend

-  Restricted Access
- XX AM Peak Hour (7:30- 8:30am)
- (XX) PM Peak Hour (4:45 - 5:45pm)
- (-) Negligible Volumes (less than three vph)

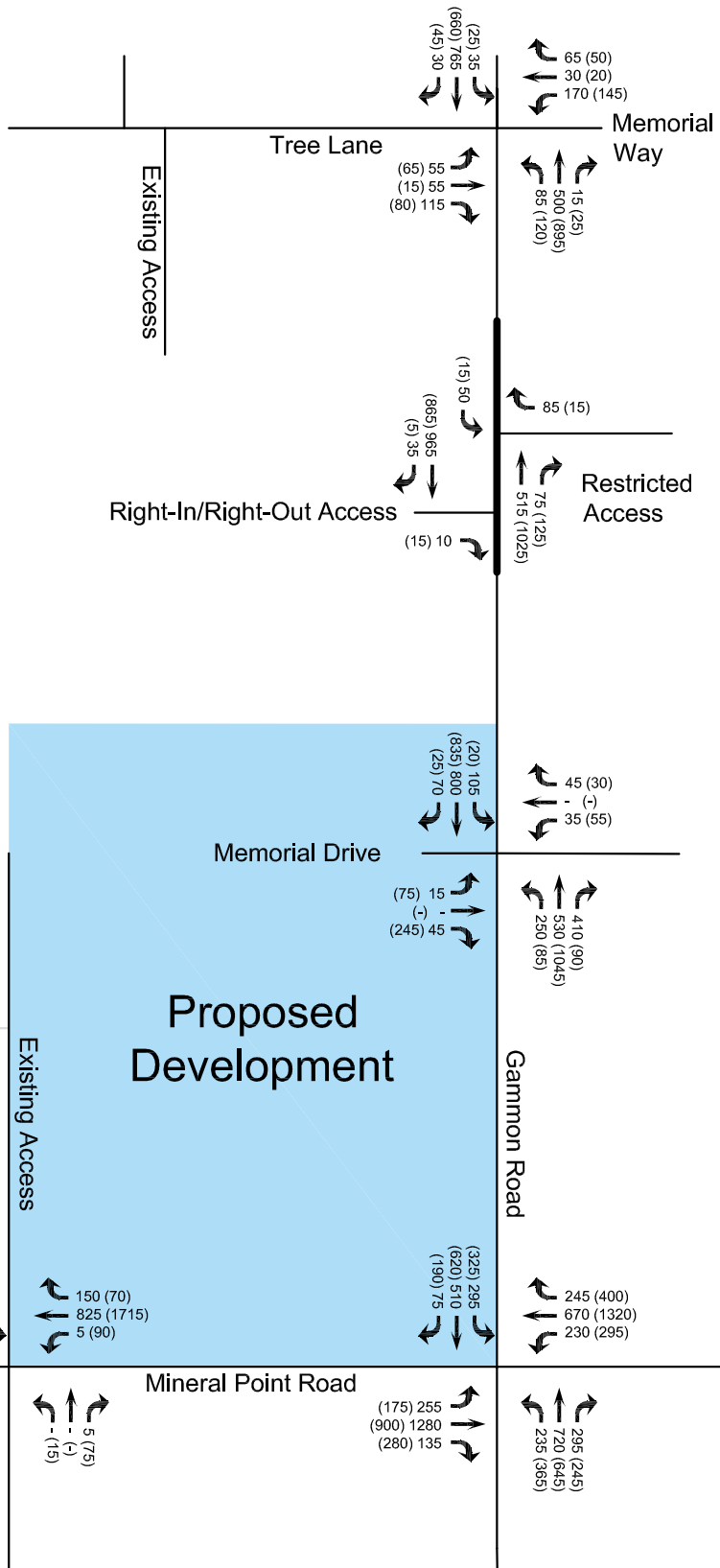


Exhibit 4-9: 2049 Horizon Year Build Development Traffic Volumes  
 (2049 Horizon Year Background Traffic Volumes +  
 Stage I On-Site Development Traffic Assignment: New Trips +  
 Stage II On-Site Development Traffic Assignment: New Trips)



NOT TO SCALE

## Chapter 5 – TRAFFIC AND IMPROVEMENT ANALYSIS

After the traffic forecasts were made for the 2019, 2029, and 2049 horizon years, the next step in the process was to analyze the future traffic conditions, identify needs (if any), and analyze alternative improvements. The analysis of the roadway and intersections included the following elements:

- Site access
- Traffic signal warrant analysis
- Capacity / level of service analysis
- Queuing analysis
- Pedestrian, bicycle, and multi-use trail considerations
- Traffic control needs

### PART A – SITE ACCESS

The main access to West Place Development is proposed to be the west approach of the existing intersection of Gammon Road & Memorial Drive. The intersection is 1,110-ft north of the Mineral Point Road intersection with Gammon Road. An additional site access is proposed at three existing access locations located along the UW Health Clinic Driveway off of Mineral Point Road. No other access points are proposed along Gammon Road or Mineral Point Road.

### PART B – TRAFFIC SIGNAL WARRANT ANALYSIS

The existing 2019 background traffic operations at the intersection of Gammon Road & Memorial Drive reach LOS F during the base year under the existing two-way stop control conditions on the minor street approaches, as shown in **Exhibit 3-3**. An intersection improvement is likely necessary to provide the safe and efficient movement of vehicles.

Two traffic signal warrant analyses were completed for evaluation including a 2019 background scenario and a 2019 Stage I development traffic volume scenario. The following are the traffic signal warrant analyses procedure for the intersection of Gammon Road & Memorial Drive.

#### **B1. Background Traffic Volume Determination**

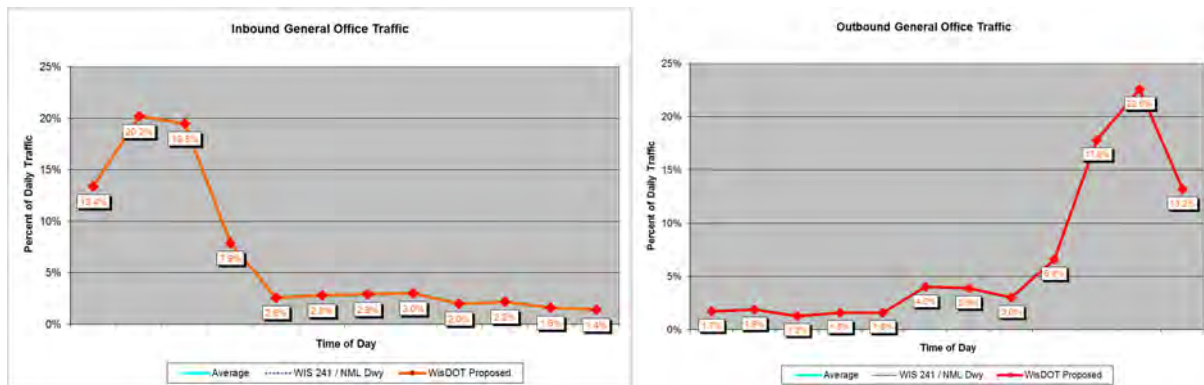
The 2016 12-hour raw data counts were projected to year 2019 using the forecast rates provided. The projected data was compiled and reviewed to determine if the intersection meets any of the nine warrants outlined in the Manual on Uniform Traffic Control Devices (MUTCD).

#### **B2. Stage I Development Traffic Volume Determination**

A traffic signal warrant analysis at the existing intersection of Gammon Road & Memorial Drive for Stage I of development was completed. A warrant analysis was used to determine if the intersection meets any of the nine warrants outlined in the MUTCD based on the anticipated trip generation for the proposed West Place Development and 2019 background traffic volumes.

Peak hour trip generation rates were calculated using the *ITE Trip Generation Manual* as described in Chapter 4. The Wisconsin Department of Transportation (WisDOT) has generated 12 hour breakdowns of land uses based on data collected within the state of Wisconsin, see **Figure 5-1** below for an example distribution.

Hour	WisDOT Proposed	
	% In	% Out
6-7 am	13.4%	1.7%
7-8 am	20.2%	1.9%
8-9 am	19.5%	1.3%
9-10 am	7.9%	1.6%
10-11 am	2.6%	1.6%
11am-12pm	2.8%	4.0%
12-1 pm	2.9%	3.9%
1-2 pm	3.0%	3.0%
2-3 pm	2.0%	6.6%
3-4 pm	2.2%	17.8%
4-5 pm	1.6%	22.6%
5-6 pm	1.4%	13.2%
	79.5%	79.2%



**Figure 5-1: WisDOT Hourly Distribution by Land Use**

For each land use in Stage I, the dispersion of traffic volume into and out of the site were calculated by applying the respective WisDOT 12-hour distribution percentages. This was accomplished by taking the Total Daily Two-Way volume, from the *ITE Trip Generation Manual* for each land use, and dividing the Two-Way volume in half to represent a one-way volume ingress and egress to the site. The hourly 'In Volume' and 'Out Volume' were calculated by multiplying the one-way volume to the WisDOT hourly percentage. The turning movement breakdown on Gammon Road & Memorial Drive was determined using *2019 Stage I Development - Trip Distribution* percentages as illustrated in **Exhibit 4-4B**.



**Table 5-1: Hourly Distribution**

		General Office Building									
	Hour	In Volume	In %	Left In (50%)	Right In (15%)	Out Volume	Out %	Left Out (15%)	Right Out (45%)		
AM	6-7	125	13.4%	63	19	16	1.7%	2	7		
	7-8	189	20.2%	95	28	18	1.9%	3	8		
	8-9	182	19.5%	91	27	12	1.3%	2	5		
	9-10	74	7.9%	37	11	15	1.6%	2	7		
	10-11	24	2.6%	12	4	15	1.6%	2	7		
	11-12	26	2.8%	13	4	37	4.0%	6	17		
PM	12-1	27	2.9%	14	4	36	3.9%	5	16		
	1-2	28	3.0%	14	4	28	3.0%	4	13		
	2-3	19	2.0%	10	3	62	6.6%	9	28		
	3-4	21	2.2%	11	3	166	17.8%	25	75		
	4-5	15	1.6%	8	2	211	22.6%	32	95		
	5-6	13	1.4%	7	2	123	13.2%	18	55		
		Total Daily %			79.50%		Total Daily %			79.20%	
24-hour Total (1-Way)		935			24-hour Total (1-Way)		935				
		Total Daily Two-Way			1870						

		High Turn Over Sit Down									
	Hour	In Volume	In %	Left In (50%)	Right In (15%)	Out Volume	Out %	Left Out (15%)	Right Out (45%)		
AM	6-7		0.0%	0	0		0.0%	0	0		
	7-8		0.0%	0	0		0.0%	0	0		
	8-9		0.0%	0	0		0.0%	0	0		
	9-10	21	3.3%	11	3	11	1.7%	2	5		
	10-11	26	4.1%	13	4	14	2.2%	2	6		
	11-12	47	7.4%	24	7	24	3.8%	4	11		
PM	12-1	54	8.6%	27	8	42	6.6%	6	19		
	1-2	30	4.8%	15	5	54	8.6%	8	24		
	2-3	20	3.2%	10	3	35	5.5%	5	16		
	3-4	19	3.0%	10	3	25	4.0%	4	11		
	4-5	55	5.6%	28	8	30	4.5%	5	14		
	5-6	61	9.7%	31	9	29	4.6%	4	13		
		Total Daily %			49.70%		Total Daily %			41.50%	
24-hour Total (1-Way)		630			24-hour Total (1-Way)		630				
		Total Daily Two-Way			1260						

The total 'In Volume' and 'Out Volume' was further distributed by the Trip Assignment percentages for Stage I for each movement at the intersection of Gammon Road & Memorial Drive. See **Figure 5-1** for a sample breakdown for the General Office Space land use. Not all development traffic is anticipated to use this intersection; other site access locations account for the 'missing' trips in the In Volume and Out Volume totals.

The hourly distribution procedure was completed for each land use and then aggregated into the appropriate turning movements on Gammon Road and Memorial Drive. The total trips were added to the 2019 background volume as the basis of the warrant analysis. The final traffic volumes used in the warrant analysis can be seen in **Table 5-2**.

**Table 5-2: 2019 Background + Stage I Development Traffic Volumes for Warrant Analysis**

2016 BACKGROUND TRAFFIC																						
Start Time	NORTHSOUTH ROADWAY										TOTAL	EASTWEST ROADWAY								TOTAL		
	SB					NB						WB				EB						
	LT	TH	RT	LT+TH	TOTAL	LT	TH	RT	LT+TH	TOTAL		LT	TH	RT	LT+TH	TOTAL	LT	TH	RT		LT+TH	TOTAL
6-7 am	2	185	1	187	188	3	141	8	144	152	340	3	0	0	3	3	0	0	0	0	3	
7-8 am	71	597	8	668	676	25	506	266	531	797	1473	20	0	20	20	40	2	0	3	2	5	45
8-9 am	51	100	6	151	157	34	428	177	462	639	796	23	0	31	23	54	5	2	17	7	24	78
9-10 am	10	442	3	452	455	25	332	20	357	377	832	7	0	4	7	11	4	1	13	5	18	29
10-11 am	6	452	4	458	462	16	417	22	433	455	917	10	0	7	10	17	3	1	14	4	18	35
11-12 pm	9	533	3	542	545	9	484	18	493	511	1056	21	0	15	21	36	1	0	11	1	12	48
12-1 pm	29	596	6	625	631	14	540	87	554	641	1272	67	3	9	70	79	5	9	23	14	37	116
1-2 pm	8	511	2	519	521	22	501	35	523	558	1079	24	0	24	24	48	2	1	9	3	12	60
2-3 pm	11	591	1	602	603	13	561	38	574	612	1215	32	1	32	33	65	2	0	8	2	10	75
3-4 pm	17	680	3	697	700	14	652	79	666	745	1445	68	1	68	69	137	7	0	20	7	27	164
4-5 pm	23	658	2	681	683	12	788	84	800	884	1567	60	2	60	62	122	7	0	15	7	22	144
5-6 pm	24	746	4	770	774	27	921	66	948	1014	1788	53	0	53	53	106	19	1	33	20	53	159

2019 BACKGROUND TRAFFIC																						
Start Time	NORTHSOUTH ROADWAY										TOTAL	EASTWEST ROADWAY								TOTAL		
	SB					NB						WB				EB						
	LT	TH	RT	LT+TH	TOTAL	LT	TH	RT	LT+TH	TOTAL		LT	TH	RT	LT+TH	TOTAL	LT	TH	RT		LT+TH	TOTAL
6-7 am	2	196	1	198	199	3	149	8	152	160	359	3	0	0	3	3	0	0	0	0	0	3
7-8 am	75	633	8	708	716	27	536	282	563	845	1561	21	0	21	21	42	2	0	3	2	5	47
8-9 am	54	106	6	160	166	36	454	188	490	678	844	24	0	33	24	57	5	2	18	7	25	82
9-10 am	11	469	3	480	483	27	352	21	379	400	883	7	0	4	7	11	4	1	14	5	19	30
10-11 am	6	479	4	485	489	17	442	23	459	482	971	11	0	7	11	18	3	1	15	4	19	37
11-12 pm	10	565	3	575	578	10	513	19	523	542	1120	22	0	16	22	38	1	0	12	1	13	51
12-1 pm	31	632	6	663	669	15	572	92	587	679	1348	71	3	10	74	84	5	10	24	15	39	123
1-2 pm	8	542	2	550	552	23	531	37	554	591	1143	25	0	25	25	50	2	1	10	3	13	63
2-3 pm	12	626	1	638	639	14	595	40	609	649	1288	34	1	34	35	69	2	0	8	2	10	79
3-4 pm	18	721	3	739	742	15	691	84	706	790	1532	72	1	72	73	145	7	0	21	7	28	173
4-5 pm	24	697	2	721	723	13	835	89	848	937	1660	64	2	64	66	130	7	0	16	7	23	153
5-6 pm	25	791	4	816	820	29	976	70	1005	1075	1895	56	0	56	56	112	20	1	35	21	56	168

Stage I Development TMC																							
Start Time	NORTHSOUTH ROADWAY										TOTAL	EASTWEST ROADWAY								TOTAL			
	SB					NB						WB				EB							
	LT	TH	RT	LT+TH	TOTAL	LT	TH	RT	LT+TH	TOTAL		LT	TH	RT	LT+TH	TOTAL	LT	TH	RT		LT+TH	TOTAL	
6-7 am	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7-8 am	0	0	28	0	28	95	0	0	95	95	123	0	0	0	0	0	0	0	8	3	11	11	
8-9 am	0	0	27	0	27	91	0	0	91	91	118	0	0	0	0	0	0	2	0	5	7	7	
9-10 am	0	0	14	0	14	48	0	0	48	48	62	0	0	0	0	0	0	4	0	12	4	16	16
10-11 am	0	0	8	0	8	25	0	0	25	25	33	0	0	0	0	0	0	4	0	13	4	17	17
11-12 pm	0	0	11	0	11	37	0	0	37	37	48	0	0	0	0	0	0	9	0	27	9	36	36
12-1 pm	0	0	12	0	12	41	0	0	41	41	53	0	0	0	0	0	0	12	0	35	12	47	47
1-2 pm	0	0	9	0	9	29	0	0	29	29	38	0	0	0	0	0	0	12	0	37	12	49	49
2-3 pm	0	0	6	0	6	20	0	0	20	20	26	0	0	0	0	0	0	15	0	44	15	59	59
3-4 pm	0	0	6	0	6	20	0	0	20	20	26	0	0	0	0	0	0	29	0	86	29	115	115
4-5 pm	0	0	11	0	11	35	0	0	35	35	46	0	0	0	0	0	0	36	0	108	36	144	144
5-6 pm	0	0	11	0	11	37	0	0	37	37	48	0	0	0	0	0	0	23	0	68	23	91	91

2019 Background + Stage I Build Traffic Volumes																						
Start Time	NORTHSOUTH ROADWAY										TOTAL	EASTWEST ROADWAY								TOTAL		
	SB					NB						WB				EB						
	LT	TH	RT	LT+TH	TOTAL	LT	TH	RT	LT+TH	TOTAL		LT	TH	RT	LT+TH	TOTAL	LT	TH	RT		LT+TH	TOTAL
6-7 am	2	196	20	198	218	66	149	8	215	223	441	3	0	0	3	3	2	0	7	2	9	12
7-8 am	75	633	36	708	744	122	536	282	658	940	1684	21	0	21	21	42	5	0	11	5	16	58
8-9 am	54	106	33	160	193	127	454	188	581	769	962	24	0	33	24	57	7	2	23	9	32	89
9-10 am	11	469	17	480	497	75	352	21	427	448	945	7	0	4	7	11	8	1	26	9	35	46
10-11 am	6	479	12	485	497	42	442	23	484	507	1004	11	0	7	11	18	7	1	28	8	36	54
11-12 pm	10	565	14	575	589	47	513	19	560	579	1168	22	0	16	22	38	10	0	39	10	49	87
12-1 pm	31	632	18	663	681	56	572	92	628	720	1401	71	3	10	74	84	17	10	59	27	86	170
1-2 pm	8	542	11	550	561	52	531	37	583	620	1181	25	0	25	25	50	14	1	47	15	62	112
2-3 pm	12	626	7	638	645	34	595	40	629	669	1314	34	1	34	35	69	17	0	52	17	69	138
3-4 pm	18	721	9	739	748	35	691	84	726	810	1558	72	1	72	73	145	36	0	107	36	143	288
4-5 pm	24	697	13	721	734	48	835	89	883	972	1706	64	2	64	66	130	43	0	124	43	167	297
5-6 pm	25	791	15	816	831	66	976	70	1042	1112	1943	56	0	56	56	112	43	1	103	44	147	259

**B3. Traffic Signal Warrant Analysis**

The Manual on Uniform Traffic Control Devices 2009 Edition (MUTCD) specifies nine warrants that are used to justify the installation of a traffic signal. Typically, the eight hour vehicular volume (Warrant 1) and four-hour vehicular volume (Warrant 2) are the main warrants evaluated to determine if a traffic signal should be installed at an intersection. The other signal warrant conditions were also evaluated to understand if other factors justify the installation of a traffic signal.

The warrant analysis was performed using the 100 percent volume level since the mainline road posted speed is not greater than 40mph and the built-up area population surrounding the intersection is greater than 10,000. The east approach of the intersection is proposed to remain single lane approach, therefore a 100% right-turn inclusion was used. The west approach will remain a single lane but due to minimal left-turn volume a 50% right-turn inclusion was used to represent a conservative approach to the warrant analysis.

### **B3.A 2019 Background Volumes**

A preliminary warrant analysis was completed using the background volumes at the intersection of Gammon Road & Memorial Drive. The background traffic volumes satisfy the following warrants:

- Warrant 2 (Four-Hour Volume)
- Warrant 3 (Peak Hour Volume)
- Warrant 5 (School Crossing)
- Warrant 8 (Roadway Network)

Outputs for the background warrant analysis of can be reviewed in **Appendix F**.

### **B3.B 2019 Background plus Stage I Development Volumes**

A second traffic signal warrant analysis was completed which incorporated the planned Stage I development traffic volumes to determine if additional warrants would be met. The background plus development traffic volumes satisfy the following warrants:

- Warrant 2 (Four-Hour Volume)
- Warrant 3 (Peak Hour Volume)
- Warrant 5 (School Crossing)
- Warrant 8 (Roadway Network)

No additional warrants beyond those identified as being met in the 2019 Background scenario were met.

Outputs for the development traffic warrant analysis of can be reviewed in **Appendix F**.

## **B4. Traffic Signal Warrant Conclusion**

Given the results of the warrant analysis based on MUTCD guidelines, a traffic signal is warranted for installation at the intersection of Gammon Road & Memorial Drive based on background volumes and the existing lane configuration. The intersection spacing between other signalized intersections is long enough to coordinate and time the progression of through traffic within the study area.

The existing lane configuration on the west approach is currently a single, shared use lane. However, if the infrastructure required for a traffic signal is installed, an exclusive left-turn lane and shared thru/right lane should be considered to provide increased capacity and efficiency on the west approach of the intersection. It should be noted that the Wisconsin Department of Transportation (WisDOT) Facilities Development Manual (FDM) states that a shared left/thru lane is not desirable at signalized intersections due to driver hesitation and a history of angle crashes and is not recommended.

## **PART C – CAPACITY/LEVEL OF SERVICE ANALYSIS**

An operational and capacity analysis was completed for each intersection using Synchro 9 which is based on the procedures, methods, and techniques contained in the Highway Capacity Manual, 2010 Edition.

As discussed in **Chapter 3**, the 2019 background condition was discussed with the City of Madison to establish a baseline delay threshold for all future analyses. Due to the existing and known congestion and capacity issues along the corridors, the following delay thresholds are to be maintained at the study area intersections:

- Gammon Road & Tree Lane – LOS D or better for individual movements
- Gammon Road & Memorial Drive – LOS D or better for individual movements
- Gammon Road & Mineral Point Road – LOS E or better for individual movements
- Mineral Point Road & Clinic Driveway – LOS F or better for the side-street approaches, LOS D or better for the mainline

All operational outputs can be viewed in Appendixes B through D.

### **C1. Year 2029 Background Traffic Operational Analysis – Existing Transportation System**

As shown in **Exhibit 5-1**, *2029 Interim Year Background Traffic – Capacity/LOS Analysis, Existing Transportation System*, several intersections fail in the existing condition. The following is a summary of the operations:

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
At the intersection of Gammon Road & Memorial Drive, the shared westbound lane will operate at LOS F, as shown in **Exhibit 5-1**. The shared eastbound lane and mainline left-turn movements on Gammon Road will operate at LOS D or better.
- *Gammon Road & Mineral Point Road*  
The intersection of Mineral Point Road & Gammon Road will operate at LOS E or better in the peak hours if the traffic signal timing plan is optimized. The LOS E threshold has been established as the baseline condition from the 2019 background analysis in **Chapter 3**.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-1**, the intersection of Mineral Point Road & Clinic Driveway will operate at LOS F in the PM peak hour for the northbound left/thru lane and southbound shared lane. The side-street movements currently appear to self-regulate in which left-turning vehicles generally find other controlled intersections to progress on their route. The left-turn volume on the side street is relatively low in volume in comparison to the less intrusive right-turning movements.

### **C2. Year 2049 Background Traffic Operational Analysis – Existing Transportation System**

As shown in **Exhibit 5-2**, *2049 Horizon Year Background Traffic – Capacity/LOS Analysis, Existing Transportation System*, all study area intersections, except Gammon Road & Tree Lane, will operate below the established delay and LOS thresholds.

### C3. Year 2019 Stage I Development Traffic Operational Analysis – Existing Transportation System

As shown in **Exhibit 5-3, 2019 Stage I Build Development Traffic – Capacity/LOS Analysis, Existing Transportation System**, several intersections fail in the existing condition. The following is a summary of the operations:

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
At the intersection of Gammon Road & Memorial Drive, both the eastbound and westbound shared lanes will operate at LOS F, as shown in **Exhibit 5-3**. The mainline left-turn movements on Gammon Road will operate at LOS B or better.
- *Gammon Road & Mineral Point Road*  
The intersection of Mineral Point Road & Gammon Road timing plans were optimized with the inclusion of development traffic and will maintain the baseline LOS E or better operational condition.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-3**, the intersection of Mineral Point Road & Clinic Driveway will operate at LOS F in the PM peak hour for the northbound left/thru lane and southbound shared lane.

### C4. Year 2029 Full Build Traffic Operational Analysis – Existing Transportation System

As shown in **Exhibit 5-4, 2029 Full Build Development Traffic – Capacity/LOS Analysis, Existing Transportation System**, several intersections fail in the existing condition. The following is a summary of the operations:

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
At the intersection of Gammon Road & Memorial Drive, both the eastbound and westbound shared lanes will operate at LOS F, as shown in **Exhibit 5-4**. The mainline left-turn movements on Gammon Road will operate at LOS B or better.
- *Gammon Road & Mineral Point Road*  
The intersection of Mineral Point Road & Gammon Road timing plans were optimized however several movements will be over capacity and reach LOS F in the AM and PM peak hours. Additional geometric improvements are required in order to maintain acceptable operations.

- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-3**, the intersection of Mineral Point Road & Clinic Driveway will operate at LOS F in the PM peak hour for the northbound left/thru lane and southbound shared lane.

### **C5. Year 2049 Full Build Traffic Operational Analysis – Existing Transportation System**

As shown in **Exhibit 5-5**, *2049 Full Build Development Traffic – Capacity/LOS Analysis, Existing Transportation System*, all study area intersections, except Gammon Road & Tree Lane, will operate below the established delay and LOS thresholds.

### **C6. 2019 Background Traffic Operations – Improved Transportation System**

Improvements to accommodate base year background traffic volume are shown below and summarized in *Chapter 6 – Recommendations and Conclusions*.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
As discussed in **Part B**, traffic signal warrants were reviewed at the intersection of Gammon Road & Memorial Drive. One of the primary volume traffic signal warrants, Warrant 2, is met in the background condition. Traffic signals are generally only installed if the primary volume warrants (Warrant 1 and/or Warrant 2) are met. Additional warrants including Peak Hour Volume, School Crossing, and Roadway Network are also met.

In addition, the intersection experienced poor intersection operations and long queues under the stop control condition. As seen in **Exhibit 5-6**, *2019 Background Traffic – Capacity/LOS Analysis, Improved Transportation System*, the installation of a traffic signal will achieve LOS D or better for all movements at the intersection of Gammon Road & Memorial Drive.

- *Gammon Road & Mineral Point Road*  
Traffic signal retiming at the intersection of Gammon Road & Mineral Point Road will accommodate operations of LOS E or better. No additional geometric improvements are required at this time to maintain baseline conditions.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-6**, the intersection of Mineral Point Road & Clinic Driveway is recommended to be designated to include a shared left/thru lane and an exclusive right-turn lane. The recommended lane designation will filter vehicles to the appropriate queueing areas and reduce the blocking of adjacent intersections and driveways. Based on the video data collected, drivers currently operate the north approach under the recommended configuration in which right-turning vehicles do have sufficient space to complete turning movements while left-turning vehicles wait for gaps in traffic.

While the intersection does still experience LOS F on the northbound left/thru-turn and southbound left/thru-turn movements, it does maintain the existing condition.

## C7. 2029 Background Traffic Operations – Improved Transportation System

In addition to the improvements described for the 2019 Background Traffic Operations, the following improvements are also needed to accommodate 2029 interim year background traffic volume. The additional improvements are shown below and also summarized in *Chapter 6 – Recommendations and Conclusions*.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
It is anticipated that traffic signals will be installed at the intersection of Gammon Road & Memorial Drive as part of the 2019 background improvements. As seen in **Exhibit 5-7, 2029 Background Traffic – Capacity/LOS Analysis, Improved Transportation System**, the installation of a traffic signal will achieve LOS D or better for all movements at the intersection of Gammon Road & Memorial Drive.
- *Gammon Road & Mineral Point Road*  
Traffic signal retiming at the intersection of Gammon Road & Mineral Point Road will accommodate operations of LOS E or better. No additional geometric improvements are required at this time to maintain baseline conditions.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-7**, under the recommended lane configuration improvement as part of the 2019 background condition, the intersection will continue to operate at LOS F on the northbound left/thru lane and southbound left/thru lane movements which will maintain the existing condition.

## C8. 2049 Background Traffic Operations – Improved Transportation System

In addition to the improvements described for the 2019 and 2029 Background Traffic Operations, the following improvements are also needed to accommodate 2049 horizon year background traffic volume. The additional improvements are provided below and also summarized in *Chapter 6 – Recommendations and Conclusions*. **Exhibit 5-8, 2049 Background Traffic – Capacity/LOS Analysis, Improved Transportation System** shows the expected improvements and outputs based on the improvement recommendations.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
It is anticipated that traffic signals will be installed at the intersection of Gammon Road & Memorial Drive as part of the 2019 background improvements. As seen in **Exhibit 5-8**, the installation of a traffic signal will achieve LOS D or better for all movements at the intersection of Gammon Road & Memorial Drive.

- *Gammon Road & Mineral Point Road*  
As shown in **Exhibit 5-8**, in order to improve the movements to LOS E or better (the baseline condition), accommodating dual southbound left-turn lanes at the intersection increases the capacity to achieve LOS E or better for all intersection movements.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-8**, under the recommended lane configuration improvement as part of the 2019 background condition, the intersection will continue to operate at LOS F on the northbound left/thru lane and southbound left/thru lane movements which will maintain the existing condition.

### **C9. 2019 Stage I Build Development Traffic Operations, Improved Transportation System**

Improvements to accommodate base year background traffic volume plus Stage I on-site development traffic volumes are summarized below and also in *Chapter 6 – Recommendations and Conclusions. Exhibit 5-9, 2019 Stage I Development Traffic Operations – Capacity/LOS Analysis, Improved Transportation System* shows the expected improvements to maintain the existing traffic conditions.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
A traffic signal warrant analysis was completed for the intersection of Gammon Road & Memorial Drive in which traffic signal warrants were reviewed and met as part of 2019 background scenario; see **Part B** for additional information.

As seen in **Exhibit 5-9**, the installation of a traffic signal will achieve LOS D or better for all movements at the intersection of Gammon Road & Memorial Drive.

- *Gammon Road & Mineral Point Road*  
Traffic signal retiming at the intersection of Gammon Road & Mineral Point Road will accommodate operations of LOS E or better. No additional geometric improvements are required at this time to maintain baseline conditions.
- *Mineral Point Road & Clinic Driveway*  
Concurring with the background condition improvement and as seen in **Exhibit 5-9**, the intersection of Mineral Point Road & Clinic Driveway is recommended to be designated to include a shared left/thru lane and an exclusive right-turn lane. The recommended lane designation will filter vehicles to the appropriate queueing areas and reduce the blocking of adjacent intersections and driveways. Based on the video data collected, drivers currently operate the north approach under the recommended configuration in which right-turning vehicles do have sufficient space to complete turning movements while left-turning vehicles wait for gaps in traffic.

While the intersection does still experience LOS F on the northbound left/thru-turn and southbound left/thru-turn movements, it does maintain the existing condition.



### **C10. 2029 Full Build Development Traffic Operations, Improved Transportation System**

Improvements to accommodate interim year background traffic volume plus Stage I and Stage II on-site development traffic volumes are summarized below and also in *Chapter 6 – Recommendations and Conclusions*. **Exhibit 5-10, 2029 Full Build Development Traffic Operations – Capacity/LOS Analysis, Improved Transportation System** shows the expected improvements to maintain the existing traffic conditions.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
As shown in **Exhibit 5-10**, the intersection of Gammon Road & Memorial Drive will operate at LOS D or better with no additional geometric improvements.
- *Gammon Road & Mineral Point Road*  
As shown in **Exhibit 5-10**, in order to improve the movements to LOS E or better (the baseline condition), providing dual southbound left-turn lanes at the intersection increases the capacity to achieve LOS E or better for all intersection movements. As part of the intersection geometric improvement, the dual southbound left-turn lanes should be reconstructed to accommodate a minimum 200-ft storage length for future use.
- *Mineral Point Road & Clinic Driveway*  
As seen in **Exhibit 5-10**, under the recommended lane configuration improvement as part of the 2019 background condition, the intersection will continue to operate at LOS F on the northbound left/thru lane and southbound left/thru lane movements which will maintain the existing condition.

### **C11. 2049 Full Build Development Traffic Operations, Improved Transportation System**

Improvements to accommodate horizon year background traffic volume plus Stage I and Stage II on-site development traffic volumes are summarized in *Chapter 6 – Recommendations and Conclusions*. **Exhibit 5-11, 2049 Full Build Development Traffic Operations – Capacity/LOS Analysis, Improved Transportation System** shows the expected improvements to maintain the existing traffic conditions.

- *Gammon Road & Tree Lane*  
The intersection of Gammon Road & Tree Lane is expected to operate at LOS D or better during the weekday peak hours with acceptable volume to capacity ratios and delays.
- *Gammon Road & Memorial Drive*  
As shown in **Exhibit 5-11**, the intersection of Gammon Road & Memorial Drive will operate at LOS D or better with no additional geometric improvements.
- *Gammon Road & Mineral Point Road*  
As shown in **Exhibit 5-11**, improvements beyond the *2029 Full Build Development Traffic Operations, Improved Transportation System* recommendations, include adding dual westbound

left-turn lanes and dual northbound left-turn lanes which would increase capacity to achieve LOS E or better for all movements. As part of the intersection geometric improvement, the dual westbound left-turn lanes should be reconstructed to accommodate a minimum 175-ft storage length, and the northbound left-turn lanes should be reconstructed to accommodate a minimum 200-ft storage length for future use.

- *Mineral Point Road & Clinic Driveway*

As seen in **Exhibit 5-11**, under the recommended lane configuration improvement as part of the 2019 background condition, the intersection will continue to operate at LOS F on the northbound left/thru lane and southbound left/thru lane movements which will maintain the existing condition.

## **PART D – QUEUING ANALYSIS**

A queuing analysis was conducted for all movements in the study area intersections. The primary purpose of this analysis is to estimate the queue lengths that may need to be accommodated at the intersections. The 95<sup>th</sup> percentile queue may be used for the design of turn bays at traffic signals and stop controlled intersections. The following exhibits summarize the 95<sup>th</sup> percentile queue lengths obtained from Synchro for each scenario.

*Exhibit 5-12, Maximum Queue Lengths: 2019 Base Year Background Traffic*

*Exhibit 5-13, Maximum Queue Lengths: 2029 Interim Year Background Traffic*

*Exhibit 5-14, Maximum Queue Lengths: 2049 Horizon Year Background Traffic*

*Exhibit 5-15, Maximum Queue Lengths: 2019 Stage I Development Traffic*

*Exhibit 5-16, Maximum Queue Lengths: 2029 Full Build Development Traffic*

*Exhibit 5-17, Maximum Queue Lengths: 2049 Full Build Development Traffic*

The proposed West Place Development site plan should provide internal queue storage on the west approach of the intersection of Gammon Road & Memorial Drive to the degree possible in order to accommodate the horizon year full build traffic volumes. If the lane configuration on the west approach remains a single lane approach, queues could reach a maximum of 275-ft in the PM peak hour. If a left-turn lane and shared thru/right lane are installed as discussed in Part B, queue lengths are anticipated to be reduced.

The intersection of Gammon Road & Mineral Point Road eastbound and westbound thru queue will reach up to 700-ft in the full build development scenarios. While the mainline traffic queues are anticipated to be long, they are expected to clear within one cycle length. In reviewing the 50<sup>th</sup> percentile queues, queues will not extend nor block adjacent intersections. Several of the exclusive left-turn lanes will extend past the existing storage capacity and consideration should be given to extend left-turn lanes as traffic volumes warrant.

The north approach of Mineral Point Road & Clinic Driveway has several driveways within close proximity; one full driveway access 150-ft and 300-ft north of the intersection. The improvement scenario, designating a shared left/turn lane and an exclusive right-turn lane, will reduce queues however in the horizon year the nearest adjacent driveway may be blocked during the PM peak hour and will require vehicles to circulate to alternative access points.





## **PART E – PEDESTRIAN, BICYCLE, AND MULTI-USE TRAIL CONSIDERATIONS**

It is recommended that convenient walking and bike paths from the existing sidewalks to the development be included in the redevelopment plan. Bicycle parking racks should also be included near entrances to office and restaurant spaces. Providing safe and convenient paths and parking may increase the likelihood of multi-use trips to the development. Any improvements to traffic signal infrastructure, including the new signal at Gammon Road & Memorial Drive, should include pedestrian push buttons, count down timers, and consideration should be given for accessible pedestrian signals (APS) when appropriate.

## **PART F – TRAFFIC CONTROL NEEDS**





A roundabout operational analysis was performed to determine the feasibility of the intersection control at Gammon Road & Mineral Point Road; analyses were run using Highway Capacity Software (HCS) Software. It was determined that a multilane roundabout would not be an appropriate intersection control as the anticipated traffic volumes exceed the recommended capacity for a multilane roundabout. Based on the operational outputs, a multilane roundabout is not a feasible alternative and is not recommended as a long term solution at the intersection of Gammon Road & Mineral Point Road. The operational analysis is included in **Appendix G**.

## Exhibit 5-1, 2029 Interim Year Background Traffic Capacity/LOS Analysis - Existing Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Tree Lane		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	B 13.7
		AM Peak	LOS	B	B		C	B		B	B	B	A	A	A	A	
			Delay (s)	19.7	19.1		30.0	17.6		14.1	12.8	10.1	8.2	8.7	6.2		
			v/c ratio	0.16	0.45		0.65	0.25		0.26	0.39	0.01	0.09	0.43	0.02		
			Queue (ft)	50	100		125	50		50	100	25	25	100	25		
		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	
PM Peak	LOS	C	C		C	C		A	B	A	A	A	A	A			
	Delay (s)	22.3	21.1		25.8	20.5		9.6	10.2	7.2	6.5	5.6	4.4				
	v/c ratio	0.19	0.30		0.48	0.21		0.24	0.47	0.02	0.06	0.30	0.02				
	Queue (ft)	50	75		#125	50		75	175	25	25	75	25				
Gammon Road & Memorial Drive		Lanes			1			1			1	2	1	1	2	1	A 3.0
		AM Peak	LOS	D			F			B			A				
			Delay (s)	32.3			53.3			10.2			9.3				
			v/c ratio	0.12			0.57			0.05			0.13				
			Queue (ft)	25			75			25			25				
		Lanes			1			1			1	2	1	1	2	1	
PM Peak	LOS	D			F			A			B						
	Delay (s)	30.1			122.1			9.7			10.7						
	v/c ratio	0.25			0.83			0.03			0.03						
	Queue (ft)	25			125			25			25						
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	D 38.8
		AM Peak	LOS	B	C	A	E	C	C	D	E	C	D	C	C	C	
			Delay (s)	19.4	32.7	6.0	57.5	27.9	22.9	36.2	70.2	32.3	50.7	32.3	26.8		
			v/c ratio	0.52	0.97	0.09	0.90	0.49	0.11	0.65	0.95	0.31	0.88	0.67	0.11		
			Queue (ft)	m125	#700	50	#275	275	75	200	#400	150	#350	250	m50		
		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	
PM Peak	LOS	D	D	B	D	D	C	D	D	C	C	D	D	D			
	Delay (s)	54.3	36.3	14.9	35.8	45.7	22.6	51.9	39.0	22.1	33.1	46.0	35.9				
	v/c ratio	0.85	0.79	0.18	0.84	0.95	0.30	0.91	0.75	0.21	0.65	0.81	0.32				
	Queue (ft)	#200	#400	100	#275	#575	150	#350	250	100	150	250	100				
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	1	A 0.1	
		AM Peak	LOS	A			C			A			B				
			Delay (s)	0.0			16.0			0.0			20.2				
			v/c ratio	0.00			0.02			0.00			0.02				
			Queue (ft)	0			25			0			25				
		Lanes			1	2	1	1	2	1	1	1	1	1	1		
PM Peak	LOS	C			B			F			B						
	Delay (s)	15.7			12.7			1891.5			15.0						
	v/c ratio	0.09			0.16			2.63			0.17						
	Queue (ft)	25			25			75			25						





HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal

## Exhibit 5-2, 2049 Horizon Year Background Traffic Capacity/LOS Analysis - Existing Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Tree Lane		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	B 14.3
		AM Peak	LOS	B	B		C	B		B	B	B	A	A	A	A	
			Delay (s)	19.1	18.3		29.2	16.9		16.1	13.8	10.7	8.9	9.5	6.7		
			v/c ratio	0.17	0.45		0.65	0.25		0.30	0.43	0.01	0.10	0.46	0.02		
			Queue (ft)	50	100		125	75		75	125	25	25	125	25		
		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	
PM Peak	LOS	C	C		C	C		A	B	A	A	A	A	A			
	Delay (s)	22.5	21.0		26.0	20.4		10.0	10.7	7.4	6.8	5.8	4.5				
	v/c ratio	0.20	0.31		0.49	0.22		0.25	0.49	0.02	0.07	0.31	0.02				
	Queue (ft)	50	75		#125	50		75	175	25	25	75	25				
Gammon Road & Memorial Drive		Lanes			1			1			1	2	1	1	2	1	A 3.4
		AM Peak	LOS	E			F			B			A				
			Delay (s)	35.2			61.1			10.3			9.5				
			v/c ratio	0.13			0.63			0.05			0.14				
			Queue (ft)	25			75			25			25				
		Lanes			1			1			1	2	1	1	2	1	
PM Peak	LOS	D			F			A			B						
	Delay (s)	33.3			186.5			9.8			10.9						
	v/c ratio	0.27			1.02			0.03			0.03						
	Queue (ft)	25			150			25			25						
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	E 56.2
		AM Peak	LOS	B	F	B	E	C	C	C	E	C	E	D	C		
			Delay (s)	19.6	80.2	13.9	78.9	26.7	21.2	34.6	72.5	27.7	68.2	41.4	32.6		
			v/c ratio	0.57	1.08	0.09	0.98	0.56	0.13	0.71	0.99	0.34	0.96	0.74	0.13		
			Queue (ft)	125	#650	50	#275	275	75	#200	#350	125	#300	250	50		
		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	
PM Peak	LOS	E	D	B	D	D	C	E	D	C	D	E	D				
	Delay (s)	76.4	36.8	14.0	45.1	51.9	22.1	64.4	40.9	22.1	40.2	64.0	38.1				
	v/c ratio	0.95	0.81	0.18	0.89	0.99	0.31	0.97	0.79	0.22	0.73	0.94	0.38				
	Queue (ft)	#200	375	75	#325	#625	150	#375	275	100	#200	#300	125				
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	1	A 0.1	
		AM Peak	LOS	A			C			A			B				
			Delay (s)	0.0			17.2			0.0			21.7				
			v/c ratio	0.00			0.02			0.00			0.03				
			Queue (ft)	0			25			0			25				
		Lanes			1	2	1	1	2	1	1	1	1	1	1		
PM Peak	LOS	C			B			F			C						
	Delay (s)	17.0			13.3			6323.0			15.9						
	v/c ratio	0.11			0.18			7.90			0.19						
	Queue (ft)	25			25			100			25						





HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal

### Exhibit 5-3, 2019 Stage I Development Traffic Capacity/LOS Analysis - Existing Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Tree Lane		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	B 13.7
		AM Peak	LOS	B		C		B		B	B	B	A	A	A		
			Delay (s)	18.8	18.0		26.2		16.8		15.7	13.5	10.7	8.8	9.5	6.7	
			v/c ratio	0.15	0.41		0.58		0.24		0.28	0.40	0.01	0.10	0.46	0.02	
			Queue (ft)	50	100		100		50		75	100	25	25	125	25	
		PM Peak	LOS	C		C		C		A	B	A	A	A	A		
Delay (s)	28.2		26.4		32.3		25.8		9.5	10.2	7.3	6.6	5.8	4.6			
v/c ratio	0.20		0.29		0.49		0.21		0.22	0.43	0.01	0.06	0.28	0.02			
Queue (ft)	50		75		125		75		75	200	25	25	100	25			
Gammon Road & Memorial Drive		Lanes			1		1		1	2	1	1	2	1	A 8.4		
		AM Peak	LOS	F		F		F		B			A				
			Delay (s)	53.8		163.6		11.3		11.3			9.2				
			v/c ratio	0.40		0.96		0.23		0.23			0.12				
			Queue (ft)	50		150		25		25			25				
		PM Peak	LOS	F		F		F		A			B				
Delay (s)	117.2		275.1		9.9		9.9			10.5							
v/c ratio	1.02		1.20		0.09		0.09			0.03							
Queue (ft)	250		175		25		25			25							
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	D 45.4
		AM Peak	LOS	B	D	B	E	C	C	C	E	C	E	D	C		
			Delay (s)	20.0	55.0	14.7	66.2	26.9	22.6	33.1	56.9	27.6	66.2	39.2	32.6		
			v/c ratio	0.54	0.99	0.09	0.93	0.51	0.17	0.67	0.92	0.30	0.94	0.66	0.11		
			Queue (ft)	125	#600	50	#250	250	100	#200	#350	125	#325	225	50		
		PM Peak	LOS	D	C	B	C	D	C	D	D	B	D	D	C		
Delay (s)	42.8		34.9	14.4	33.9	51.8	22.3	54.1	35.5	19.8	50.2	50.7	32.5				
v/c ratio	0.80		0.80	0.18	0.82	0.99	0.33	0.93	0.75	0.21	0.86	0.89	0.32				
Queue (ft)	#150		325	75	#250	#525	150	#325	250	75	#250	#275	100				
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	A 0.4		
		AM Peak	LOS	B		C		C		A		C		B			
			Delay (s)	10.2		15.7		15.7		0.0		19.8		11.7			
			v/c ratio	0.09		0.02		0.02		0.00		0.02		0.04			
			Queue (ft)	25		25		25		0		25		25			
		PM Peak	LOS	C		B		B		F		B		F			
Delay (s)	16.0		12.3		12.3		2995.9		14.6		2139.8						
v/c ratio	0.15		0.15		0.15		3.95		0.16		5.26						
Queue (ft)	25		25		25		75		25		550						





HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal

## Exhibit 5-4, 2029 Full Build Development Traffic Capacity/LOS Analysis - Existing Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Tree Lane	 Signal	Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	B 13.8
		AM Peak	LOS	B	B		C	B		B	B	B	A	A	A	A	
			Delay (s)	19.7	19.1		30.0	17.6		15.4	12.8	10.1	8.2	9.0	6.2		
			v/c ratio	0.16	0.45		0.65	0.25		0.28	0.40	0.01	0.10	0.47	0.02		
			Queue (ft)	50	100		125	50		50	100	25	25	125	25		
		PM Peak	LOS	C	C		C	C		A	B	A	A	A	A	A	
Delay (s)	22.3		21.1		25.8	20.5		9.7	10.6	7.2	6.7	5.6	4.4				
v/c ratio	0.19		0.30		0.48	0.21		0.24	0.50	0.02	0.07	0.31	0.02				
Queue (ft)	50		75		#125	50		75	175	25	25	75	25				
Gammon Road & Memorial Drive	 Stop (East/West)	Lanes			1			1			1	2	1	1	2	1	D 31.8
		AM Peak	LOS	F			F			B			A				
			Delay (s)	278.9			663.6			13.3			9.3				
			v/c ratio	1.17			2.01			0.41			0.13				
			Queue (ft)	150			250			50			25				
		PM Peak	LOS	F			F			B			B				
Delay (s)	406.5			585.4			10.2			10.7							
v/c ratio	1.77			1.83			0.11			0.03							
Queue (ft)	600			225			25			25							
Gammon Road & Mineral Point Road	 Signal	Lanes			1	2	1	1	2	1	1	2	1	1	2	1	D 52.1
		AM Peak	LOS	C	E	B	F	C	C	D	F	C	F	D	C		
			Delay (s)	21.0	55.2	15.7	94.4	28.4	24.4	38.6	75.6	29.4	91.9	38.9	32.6		
			v/c ratio	0.59	0.98	0.09	1.02	0.53	0.22	0.72	1.00	0.31	1.03	0.63	0.10		
			Queue (ft)	150	#650	50	#300	275	125	#200	#425	125	#350	250	50		
		PM Peak	LOS	D	D	B	D	D	C	F	D	C	E	E	D		
Delay (s)	49.6		36.5	15.0	36.1	52.0	23.9	74.7	53.0	24.3	67.2	68.9	36.0				
v/c ratio	0.83		0.79	0.18	0.85	0.98	0.34	1.00	0.90	0.24	0.96	0.97	0.32				
Queue (ft)	#175		#400	75	#275	#600	150	#375	#325	100	#350	#350	100				
Mineral Point Road & Clinic Driveway	 Stop (North/South)	Lanes			1	2	1	1	2	1	1	1	1	1	1	A 0.7	
		AM Peak	LOS	B			C			A			C				
			Delay (s)	10.8			16.3			0.0			20.6				
			v/c ratio	0.16			0.02			0.00			0.03				
			Queue (ft)	25			25			0			25				
		PM Peak	LOS	C			B			F			C				
Delay (s)	17.0			12.7			12986.7			15.1							
v/c ratio	0.19			0.16			15.79			0.17							
Queue (ft)	25			25			100			25							

HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal



## Exhibit 5-5, 2049 Full Build Development Traffic Capacity/LOS Analysis - Existing Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection		
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT			
Gammon Road & Tree Lane		Lanes			1	1 Shared		1	1 Shared		1	2	1	1	2	1	B 14.4	
		AM Peak	LOS	B			C			B			A					
			Delay (s)	19.1	18.3		29.2			16.9		17.7	13.9	10.7	8.9	9.9		6.7
			v/c ratio	0.17	0.45		0.65			0.25		0.33	0.44	0.01	0.10	0.51		0.02
			Queue (ft)	50	100		125			75		75	175	25	25	125		25
		PM Peak	LOS	C			C			C			A					
Delay (s)	22.5		21.0		26.0			20.4		10.1	11.1	7.4	7.0	5.9	4.5			
v/c ratio	0.20		0.31		0.49			0.22		0.26	0.53	0.02	0.07	0.32	0.02			
Queue (ft)	50		75		#125			50		75	200	25	25	75	25			
Gammon Road & Memorial Drive		Lanes			1			1			1	2	1	1	2	1	E 35.8	
		AM Peak	LOS	F			F			B			A					
			Delay (s)	307.0			745.1			13.8			9.5					
			v/c ratio	1.23			2.19			0.42			0.14					
			Queue (ft)	150			250			50			25					
		PM Peak	LOS	F			F			B			B					
Delay (s)	475.8			812.9			10.3			10.9								
v/c ratio	1.91			2.29			0.12			0.03								
Queue (ft)	625			250			25			25								
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	1	2	1	E 64.7	
		AM Peak	LOS	C	F	B	F	C	C	C	E	C	F	D	C			
			Delay (s)	25.9	99.9	17.2	103.7	34.1	28.6	34.1	69.2	30.0	80.6	41.7	34.9			
			v/c ratio	0.67	1.11	0.10	1.04	0.60	0.24	0.68	0.97	0.30	0.99	0.63	0.10			
			Queue (ft)	m175	#775	m25	#350	350	150	200	#450	150	#400	275	50			
		PM Peak	LOS	F	D	B	D	F	C	F	E	C	F	F	D			
Delay (s)	81.9		39.6	15.3	48.9	61.8	23.5	89.8	58.6	24.1	80.7	75.2	36.1					
v/c ratio	0.96		0.84	0.19	0.91	1.02	0.35	1.05	0.94	0.24	1.01	1.00	0.34					
Queue (ft)	#200		#400	100	#325	#650	150	#400	#350	100	#350	#350	100					
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	1	A 0.6		
		AM Peak	LOS	B			C			A			C					
			Delay (s)	11.1			17.5			0.0			22.1					
			v/c ratio	0.17			0.02			0.00			0.03					
			Queue (ft)	25			25			0			25					
		PM Peak	LOS	C			B			F			C					
Delay (s)	18.6			13.4			-			15.9								
v/c ratio	0.22			0.18			-			0.19								
Queue (ft)	25			25			-			775								

HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 - delay exceeds outputs





## Exhibit 5-6, 2019 Base Year Background Traffic Capacity/LOS Analysis - Improved Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection		
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT			
Gammon Road & Memorial Drive	 Signal	Lanes			1			1			1			1			A 2.4	
		AM Peak	LOS	D			D			A			A			A 2.4		
			Delay (s)	36.7			39.5			0.1			0.2					
			v/c ratio	0.08			0.41			0.07			0.19					
			Queue (ft)	25			100			25			m150					
		Lanes			1			1			1			1				
PM Peak	LOS	D			D			A			A			A 2.9				
	Delay (s)	40.0			41.4			0.1			0.3							
	v/c ratio	0.22			0.39			0.04			0.37							
	Queue (ft)	50			100			m25			50							
Mineral Point Road & Clinic Driveway	 Stop (North/South)	Lanes			1	2	1	1	2	1	1		1*		1*		A 0.1	
		AM Peak	LOS	A			C			A		C		A		B		
			Delay (s)	0.0			15.6			0.0		19.7		0.0		11.6		
			v/c ratio	0.00			0.02			0.00		0.02		0.00		0.02		
			Queue (ft)	0			25			0		25		0		25		
		Lanes			1	2	1	1	2	1	1		1*		1*			
PM Peak	LOS	C			B			F		B		F		C				
	Delay (s)	15.2			12.3			1343.2		14.6		1527.8		19.6				
	v/c ratio	0.08			0.15			1.97		0.15		2.87		0.22				
	Queue (ft)	25			25			75		25		125		25				




HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 Red indicates an improvement is Recommended  
 \* indicates recommendation to designated right-turn lane at approach

### Exhibit 5-7, 2029 Interim Year Background Traffic Capacity/LOS Analysis - Improved Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Memorial Drive	 Signal	Lanes			1			1			1			1			A 2.6
		AM Peak	LOS	D			D			A			A			A 2.6	
			Delay (s)	41.6			45.0			0.1			0.2				
			v/c ratio	0.09			0.45			0.07			0.19				
			Queue (ft)	25			100			m25			m25				
		Lanes			1			1			1			1			
PM Peak	LOS	D			D			A			A			A 2.8			
	Delay (s)	40.0			41.4			0.1			0.0						
	v/c ratio	0.22			0.39			0.04			0.30						
	Queue (ft)	50			100			m25			m25						
Mineral Point Road & Clinic Driveway	 Stop (North/South)	Lanes			1			2			1			1			A 0.1
		AM Peak	LOS	A			C			A			C			A 0.1	
			Delay (s)	0.0			16.0			0.0			20.2				
			v/c ratio	0.00			0.02			0.00			0.02				
			Queue (ft)	0			25			0			25				
		Lanes			1			2			1			1			
PM Peak	LOS	C			B			F			B			D 28.8			
	Delay (s)	15.7			12.7			1891.5			15.0						
	v/c ratio	0.09			0.16			2.63			0.17						
	Queue (ft)	25			25			75			25						



HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 Red indicates an improvement is Recommended

## Exhibit 5-8, 2049 Horizon Year Background Traffic Capacity/LOS Analysis - Improved Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Memorial Drive		Lanes			1			1			1			1			A 4.3
		AM Peak	LOS	D			D			A			A				
			Delay (s)	41.5			45.3			0.6			0.2				
			v/c ratio	0.09			0.48			0.08			0.23				
			Queue (ft)	25			100			m25			m50				
		Lanes			1			1			1			1			
PM Peak	LOS	D			D			A			A						
	Delay (s)	42.5			44.4			0.4			0.1						
	v/c ratio	0.23			0.43			0.04			0.08						
	Queue (ft)	75			100			m25			m75						
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	2	1	D 44.8	
		AM Peak	LOS	B	D	B	E	C	B	D	E	C	E	C	C		
			Delay (s)	17.2	46.9	12.8	69.2	23.6	18.9	43.6	72.5	29.3	68.1	34.0	25.2		
			v/c ratio	0.54	0.97	0.09	0.87	0.51	0.12	0.79	0.99	0.36	0.91	0.78	0.13		
			Queue (ft)	125	#600	50	#150	250	75	#250	#350	125	#175	250	50		
		Lanes			1	2	1	1	2	1	1	2	1	2	1		
PM Peak	LOS	E	C	B	D	D	C	E	D	C	D	E	D				
	Delay (s)	75.7	34.8	13.7	54.3	51.9	22.1	72.2	39.0	23.0	50.9	68.9	43.2				
	v/c ratio	0.95	0.78	0.18	0.82	0.99	0.31	0.99	0.76	0.23	0.74	0.94	0.38				
	Queue (ft)	#200	375	75	#150	#625	150	#400	#350	100	100	#275	75				
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	A 0.1		
		AM Peak	LOS	A			C			A			B				
			Delay (s)	0.0			17.2			0.0			21.7				
			v/c ratio	0.00			0.02			0.00			0.03				
			Queue (ft)	0			25			0			25				
		Lanes			1	2	1	1	2	1	1	1	1	1			
PM Peak	LOS	C			B			F			B						
	Delay (s)	15.7			12.7			1891.5			15.0						
	v/c ratio	0.09			0.16			2.63			0.17						
	Queue (ft)	25			25			75			25						




HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 Red indicates an improvement is Recommended

## Exhibit 5-9, 2019 Stage I Development Traffic Capacity/LOS Analysis - Improved Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Memorial Drive	 Signal	Lanes			1			1			1			1			A 4.7
		AM Peak	LOS	D			D			A			A			A 4.7	
			Delay (s)	45.1			47.3			1.6			0.1				
			v/c ratio	0.25			0.46			0.34			0.21				
			Queue (ft)	50			100			m25			m50				
		Lanes			1			1			1			1			
PM Peak	LOS	D			C			A			A			A 5.1			
	Delay (s)	38.2			34.1			0.3			0.3						
	v/c ratio	0.67			0.32			0.13			0.41						
	Queue (ft)	175			75			m25			125						
Mineral Point Road & Clinic Driveway	 Stop (North/South)	Lanes			1			2			1			1			A 0.1
		AM Peak	LOS	B			C			A			C			A 0.1	
			Delay (s)	10.2			15.7			0.0			19.8				
			v/c ratio	0.09			0.02			0.00			0.02				
			Queue (ft)	25			25			0			25				
		Lanes			1			2			1			1			
PM Peak	LOS	C			B			F			B			D 47.2			
	Delay (s)	16.0			12.3			2995.9			14.6						
	v/c ratio	0.15			0.15			3.95			0.16						
	Queue (ft)	25			25			75			25						




HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 Red indicates an improvement is Recommended

## Exhibit 5-10, 2029 Full Build Development Traffic Capacity/LOS Analysis - Improved Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Memorial Drive		Lanes			1			1			1*			1			A 3.9
		AM Peak	LOS	C			C			A			A				
			Delay (s)	22.7			23.1			5.9			0.2				
			v/c ratio	0.23			0.28			0.54			0.27				
			Queue (ft)	50			50			m150			m50				
		Lanes			1			1			1*			2			
PM Peak	LOS	D			C			A			A						
	Delay (s)	39.3			31.4			8.0			3.9						
	v/c ratio	0.77			0.30			0.17			0.47						
	Queue (ft)	275			75			m25			m150						
Gammon Road & Mineral Point Road		Lanes			1	2	1	1	2	1	1	2	1	2	1	D 40.4	
		AM Peak	LOS	B	C	A	D	C	B	D	E	B	E	D	D		
			Delay (s)	19.3	29.0	5.1	54.0	28.7	11.7	54.4	63.5	14.3	68.4	50.1	39.9		
			v/c ratio	0.58	0.96	0.08	0.90	0.50	0.21	0.77	0.94	0.29	0.86	0.78	0.12		
			Queue (ft)	m150	#700	m50	#275	300	125	#275	#425	100	#200	#250	m50		
		Lanes			1	2	1	1	2	1	1	2	1	2	1		
PM Peak	LOS	E	D	B	D	D	A	E	D	B	D	E	D				
	Delay (s)	67.6	35.9	14.2	49.2	52.0	9.7	77.6	46.6	10.1	50.1	72.9	41.5				
	v/c ratio	0.91	0.78	0.18	0.90	0.98	0.34	0.96	0.86	0.24	0.71	0.97	0.32				
	Queue (ft)	#200	350	75	#325	#600	150	#400	275	75	#175	#325	m75				
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	A 0.1		
		AM Peak	LOS	B			C			A			B				
			Delay (s)	10.8			16.3			0.0			20.6				
			v/c ratio	0.16			0.02			0.00			0.03				
			Queue (ft)	25			25			0			25				
		Lanes			1	2	1	1	2	1	1	1	1	1			
PM Peak	LOS	C			B			F			C						
	Delay (s)	17.0			12.7			12986.7			15.1						
	v/c ratio	0.19			0.16			15.79			0.17						
	Queue (ft)	25			25			100			25						

HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 Red indicates an improvement is Recommended  
 \* Protected/Permissive phasing is Recommended

## Exhibit 5-11, 2049 Full Build Development Traffic Capacity/LOS Analysis - Improved Transportation System

Intersection	Traffic Control	Peak Hour	Parameters	West Approach			East Approach			South Approach			North Approach			Overall Intersection	
				LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT		
Gammon Road & Memorial Drive		Lanes			1			1			1*			1			A 3.6
		AM Peak	LOS	C			C			A			A				
			Delay (s)	22.7			23.1			6.4			0.1				
			v/c ratio	0.22			0.30			0.56			0.28				
			Queue (ft)	50			75			m100			m50				
		Lanes			1			1			1*			1			
PM Peak	LOS	D			C			A			A						
	Delay (s)	39.6			32.0			7.6			0.4						
	v/c ratio	0.77			0.32			0.18			0.49						
	Queue (ft)	275			75			m50			m350						
Gammon Road & Mineral Point Road		Lanes			1	2	1	2	2	1	2	2	1	2	2	1	D 46.3
		AM Peak	LOS	C	C	A	E	C	C	E	E	C	E	D	D		
			Delay (s)	20.2	34.8	5.8	73.8	30.1	25.5	65.8	69.2	31.5	76.4	51.4	43.2		
			v/c ratio	0.63	0.99	0.09	0.85	0.54	0.22	0.82	0.97	0.32	0.90	0.65	0.11		
			Queue (ft)	m150	#700	m50	#175	300	125	#150	#450	150	#200	300	m50		
		Lanes			1	2	1	2	2	1	2	2	1	2	2	1	
PM Peak	LOS	E	C	B	D	D	C	E	D	C	E	E	D				
	Delay (s)	59.3	33.4	15.8	54.3	52.7	22.6	63.4	51.0	25.0	78.6	66.2	41.0				
	v/c ratio	0.89	0.77	0.20	0.82	0.99	0.34	0.89	0.89	0.25	0.95	0.95	0.32				
	Queue (ft)	#200	375	100	#150	#625	150	#200	#325	100	#200	#350	m100				
Mineral Point Road & Clinic Driveway		Lanes			1	2	1	1	2	1	1	1	1	1	A 0.1		
		AM Peak	LOS	B			C			A			C				
			Delay (s)	11.1			17.5			0.0			22.1				
			v/c ratio	0.17			0.02			0.00			0.03				
			Queue (ft)	25			25			0			25				
		Lanes			1	2	1	1	2	1	1	1	1	1			
PM Peak	LOS	C			B			F			C						
	Delay (s)	18.6			13.4			-			15.9						
	v/c ratio	0.22			0.18			-			0.19						
	Queue (ft)	25			25			-			25						

HCM 2010 Outputs using Synchro 9 Software, queues reported using Synchro outputs.  
 All yield control right turn lanes were reported using HCM 2000 outputs for delay and v/c ratio.  
 #: 95th percentile volume exceed capacity, queue may be longer  
 m: volume for 95th percentile queue is metered by upstream signal  
 Red indicates an improvement is Recommended  
 - delay exceeds outputs  
 \* Protected/Permissive phasing is Recommended

**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- \* Bus Lane/Right-Turn Lane
- Existing Lane Configuration
- Recommended Turn Lane Improvement
- xx' AM Peak Hour Traffic Queue Length (feet)
- (xx') PM Peak Hour Traffic Queue Length (feet)
- +xx' Recommended Turn Lane Extension (feet)
- Recommended Signalization

# Note: Recommended to designate a right-turn lane

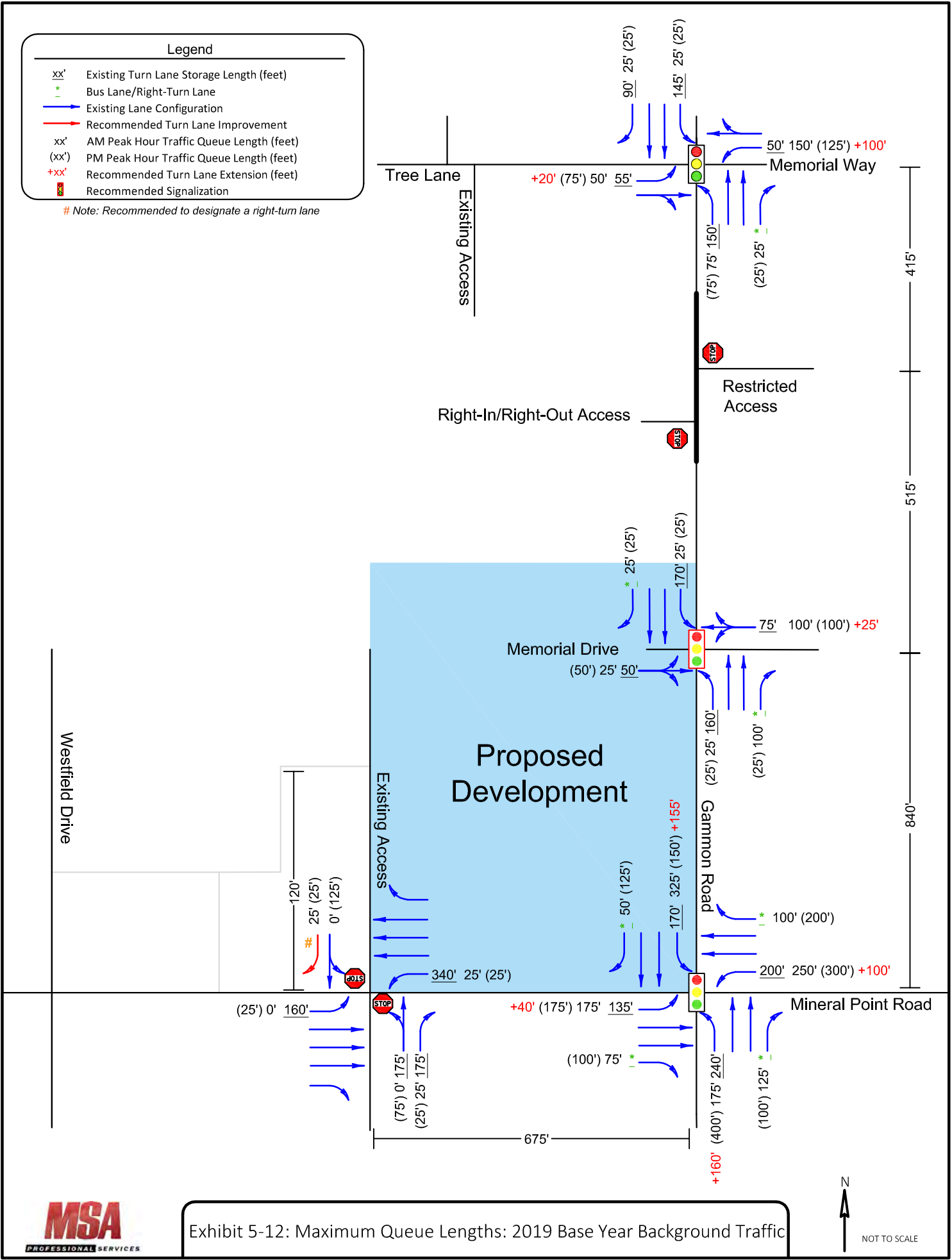
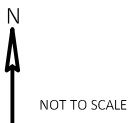


Exhibit 5-12: Maximum Queue Lengths: 2019 Base Year Background Traffic



**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- \* Bus Lane/Right-Turn Lane
- Existing Lane Configuration
- Recommended Turn Lane Improvement
- xx' AM Peak Hour Traffic Queue Length (feet)
- (xx') PM Peak Hour Traffic Queue Length (feet)
- Recommended Signalization for 2019 Background Volumes

# Note: Recommended to designate a right-turn lane

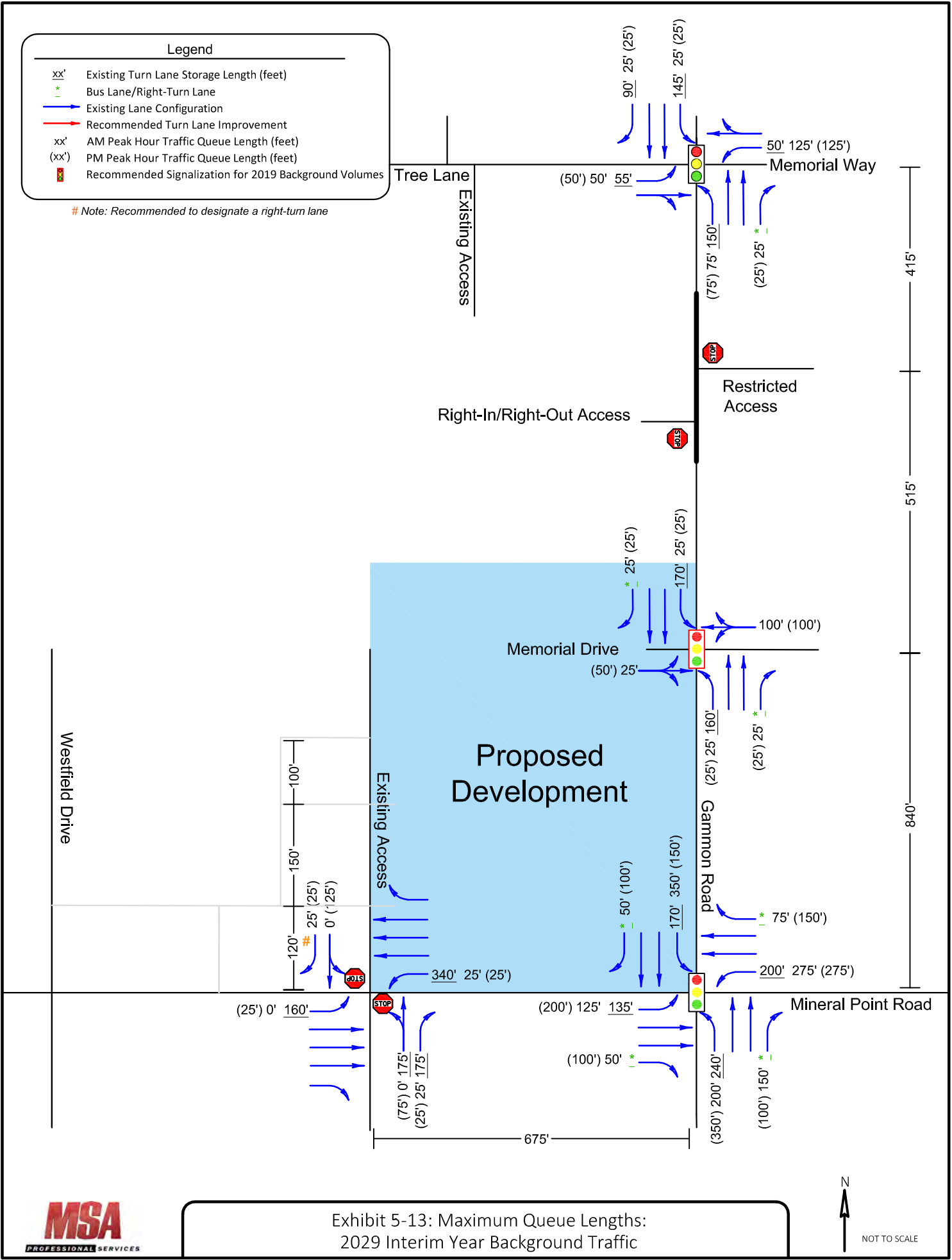
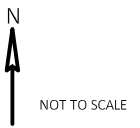


Exhibit 5-13: Maximum Queue Lengths:  
2029 Interim Year Background Traffic





**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- \* Bus Lane/Right-Turn Lane
- Existing Lane Configuration
- Recommended Turn Lane Improvement
- xx' AM Peak Hour Traffic Queue Length (feet)
- (xx') PM Peak Hour Traffic Queue Length (feet)
- Recommended Signalization for 2019 Background Volumes

# Note: Recommended to designate a right-turn lane

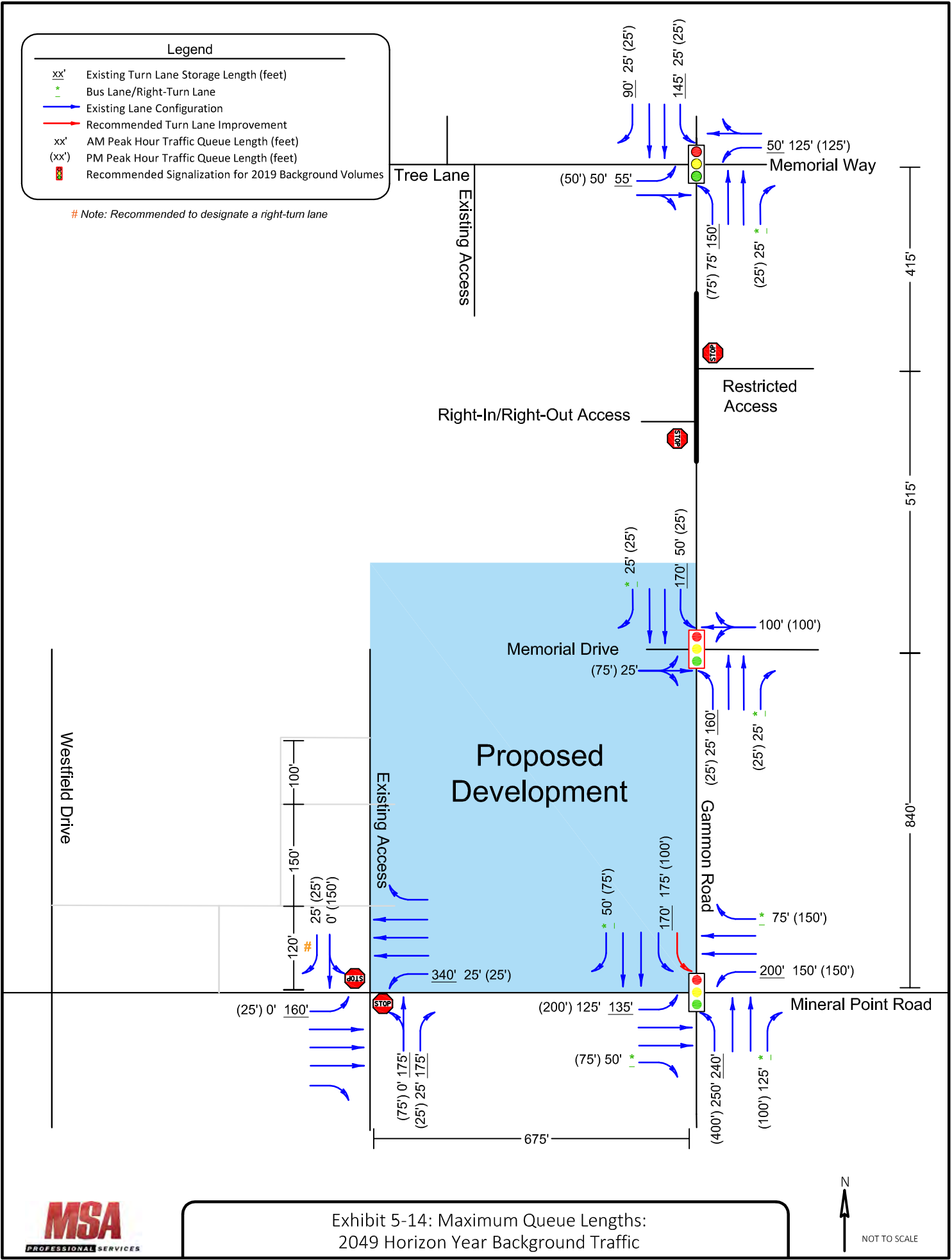
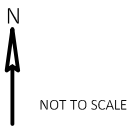


Exhibit 5-14: Maximum Queue Lengths:  
2049 Horizon Year Background Traffic



**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- \* Bus Lane/Right-Turn Lane
- Existing Lane Configuration
- Recommended Turn Lane Improvement
- xx' AM Peak Hour Traffic Queue Length (feet)
- (xx') PM Peak Hour Traffic Queue Length (feet)
- Recommended Signalization for 2019 Background Volumes

# Note: Recommended to designate a right-turn lane

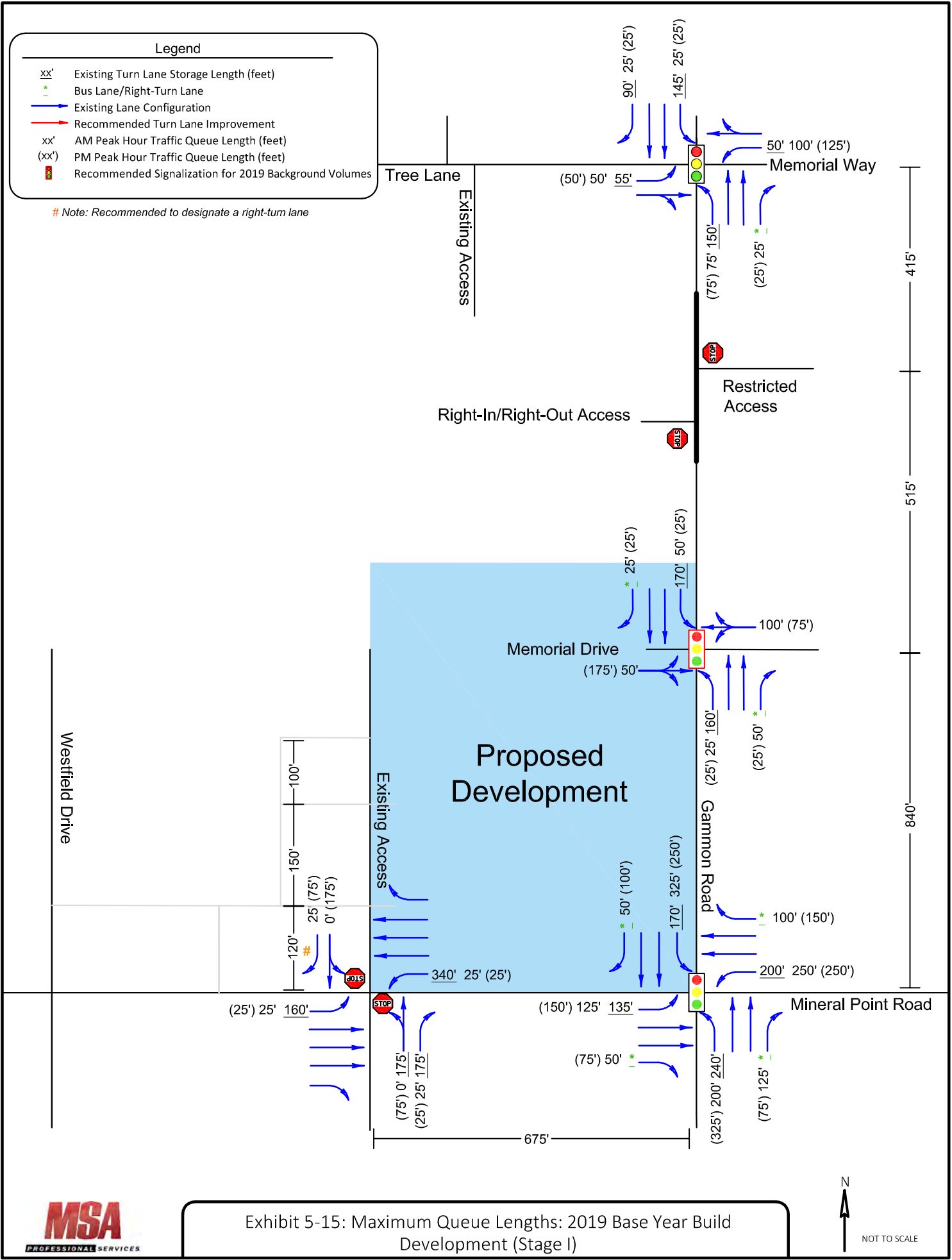


Exhibit 5-15: Maximum Queue Lengths: 2019 Base Year Build Development (Stage I)

N  
NOT TO SCALE

**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- \* Bus Lane/Right-Turn Lane
- Existing Lane Configuration
- Recommended Turn Lane Improvement
- xx' AM Peak Hour Traffic Queue Length (feet)
- (xx') PM Peak Hour Traffic Queue Length (feet)
- Recommended Signalization for 2019 Background Volumes

# Note: Recommended to designate a right-turn lane

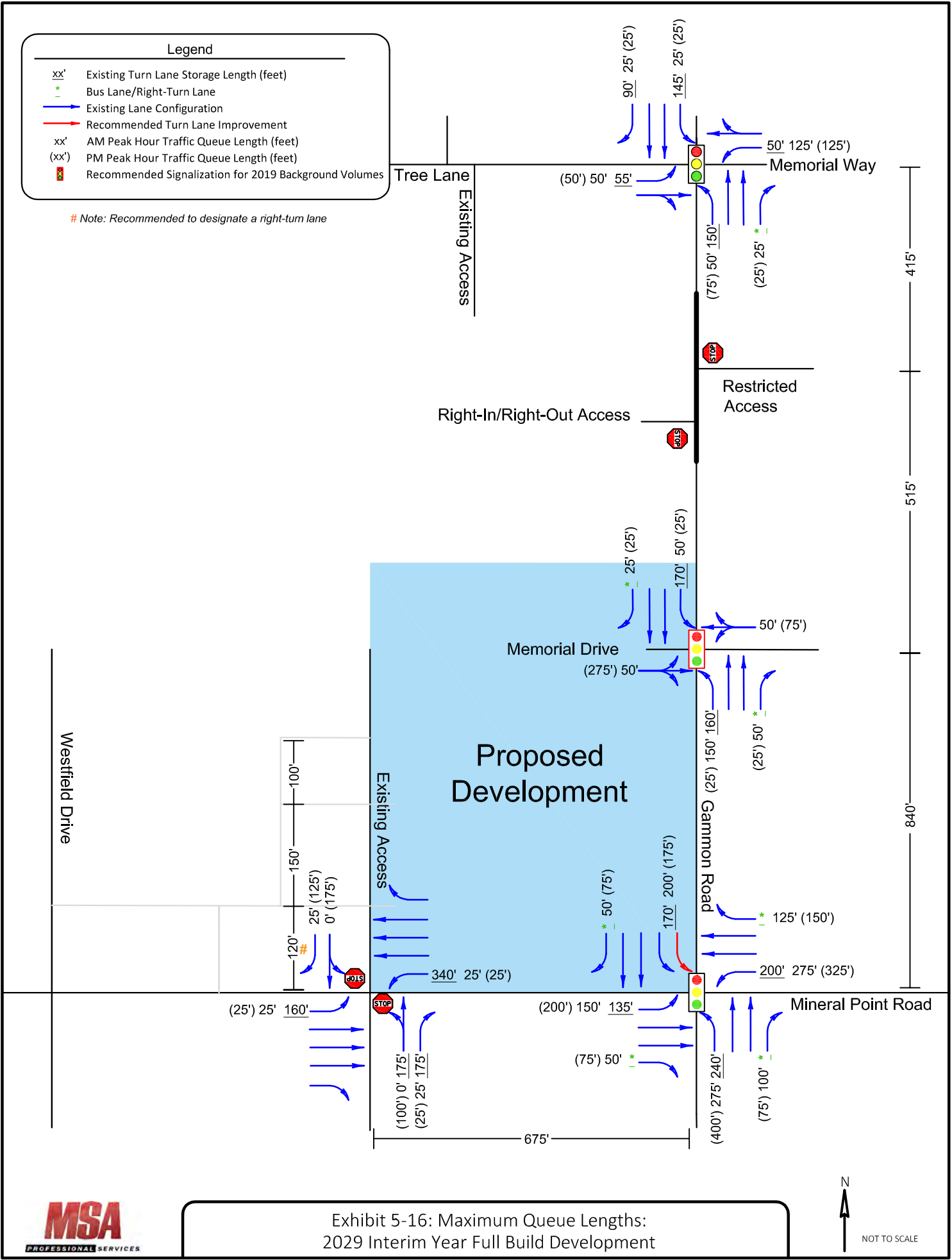


Exhibit 5-16: Maximum Queue Lengths:  
2029 Interim Year Full Build Development



NOT TO SCALE

**Legend**

- xx' Existing Turn Lane Storage Length (feet)
- \* Bus Lane/Right-Turn Lane
- Existing Lane Configuration
- Recommended Turn Lane Improvement
- xx' AM Peak Hour Traffic Queue Length (feet)
- (xx') PM Peak Hour Traffic Queue Length (feet)
- Recommended Signalization for 2019 Background Volumes

# Note: Recommended to designate a right-turn lane  
 (-) Note: Delay exceeds output

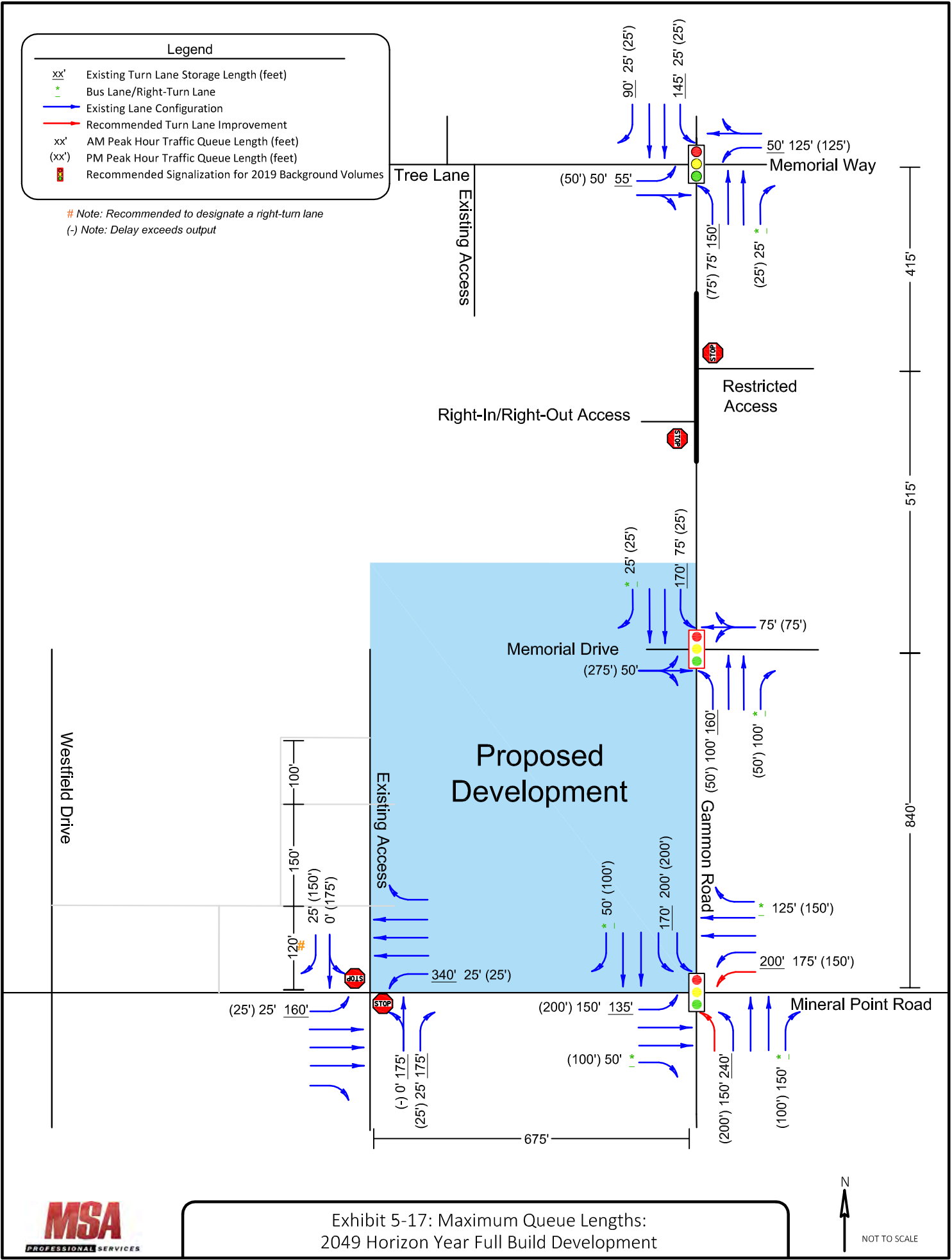
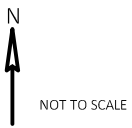


Exhibit 5-17: Maximum Queue Lengths:  
 2049 Horizon Year Full Build Development



## Chapter 6 – CONCLUSIONS AND RECOMMENDATIONS

This chapter contains the conclusions that were drawn in regard to the analysis of existing and future conditions. Based upon the conclusions, recommendations are made to mitigate the identified deficiencies and the preferred alternative is described.

Note that improvements are recommended to the City of Madison for consideration and are not legally binding. The City reserves the right to determine alternative solutions.

### PART A – CONCLUSIONS & RECOMMENDATIONS

#### A1. 2019 Background Traffic

##### Gammon Road & Tree Lane

The intersection of Gammon Road & Tree Lane will not require geometric improvements however it is recommended to retime the traffic signal. The signal is currently actuated however uncoordinated with adjacent intersections. Consideration should be made to coordinate the signal to allow for more corridor progression.

##### Gammon Road & Memorial Drive

A permanent traffic signal at the intersection of Gammon Road & Memorial Drive, if installed, would improve operations to acceptable levels. Volume warrants are met at this time as well as other relevant traffic signal warrants. Converting the existing stop controlled intersection to a signalized intersection has several safety benefits along with improvements to side-street delay. Other improvements, such as a roundabout, do not cost-effectively improve operations and are not considered viable due to the needs of future build year traffic. It is recommended that a traffic signal be installed as part of the background condition.

The existing lane configuration on the west approach is currently a single, shared use lane. However, if desired, an exclusive left-turn lane and shared thru/right lane could be accommodated to increase capacity and efficiency on the west approach of the intersection. It is recommended that consideration be given to accommodate a two-lane west approach when a traffic signal is installed.

If the City decides to install a traffic signal, it should include monotubes and follow head-per-lane requirements as outlined in the Manual on Uniform Traffic Control Devices (MUTCD), Traffic Engineering, Operations, and Safety Manual (TEOpS), and Traffic Signal Design Manual (TSDM).

##### Gammon Road & Mineral Point Road

The intersection of Gammon Road & Mineral Point Road will not require geometric improvements however it is recommended to retime the traffic signal.

Anticipated left-turn queues are likely to extend past the existing storage lengths on each of the intersection approaches. It is recommended to maximize queue storage to the degree possible to fit within the existing constraints of the environment.

### Mineral Point Road & Clinic Driveway

The existing two-way stop controlled intersection of Mineral Point Road & Clinic Driveway fails on the side street approaches in the background condition. This intersection experiences a low volume of vehicles that attempt to make a left turn from the side street and appears to be self-regulating to other area signalized intersections. Due to the proximity of other signalized intersections, a full traffic signal is not recommended for installation at Mineral Point Road & Clinic Driveway.

It is recommended to redesignate the north approach of the intersection as a shared left/thru and exclusive right-turn lane in order to stack cars appropriately and minimize queuing concerns. Based on the video data collected, drivers currently operate the north approach under the recommended configuration in which right-turning vehicles do have sufficient space to complete turning movements while left-turning vehicles wait for gaps in traffic. While the side-street approaches will operate at LOS F, the traffic volume is low. No additional improvements are recommended.

## **A2. 2029 Background Traffic**

No additional improvements beyond the 2019 background traffic improvements are required as part of this scenario beyond traffic signal retiming of the study area intersections.

## **A3. 2049 Background Traffic**

### Gammon Road & Tree Lane

The intersection of Gammon Road & Tree Lane will not require geometric improvements however it is recommended to retime the traffic signal.

### Gammon Road & Memorial Drive

The intersection of Gammon Road & Memorial Drive will not require geometric improvements however it is recommended to retime the traffic signal installed as part of the 2019 background condition. Consideration should be made to coordinate the signal with adjacent Gammon Road intersections to allow for more corridor progression.

### Gammon Road & Mineral Point Road

The intersection of Gammon Road & Mineral Point Road will fall below LOS E even with traffic signal retiming in the horizon year. A majority of movements are over capacity and delays reaching 80 seconds or more. The main concern is that the current intersection configuration cannot accommodate the future traffic volumes with single left turn lanes and two through lanes. Additional capacity is needed at the intersection in order to perform at an acceptable level.

It is recommended to install dual southbound left-turn lanes at the intersection of Gammon Road & Mineral Point Road to accommodate additional capacity. Per the FDM (Chapter 11-25, 5.4.3.1) dual left turn lanes should be considered at a signalized intersection when demand exceeds 300 vehicles per hour (vph). The analysis shows that the background volumes will not exceed the threshold for the southbound left-turn vehicles during each peak hour however the operational benefit of installation does meet the criteria for installation. Therefore, it is recommended to accommodate southbound dual left-turn lanes, including appropriate storage lengths, traffic signal improvements, and lane configuration, into the improved transportation system.

Gammon Road, from Mineral Point Road to Watts Road, is tentatively proposed for improvement through the WisDOT STP-Urban program; improvements as part of that project are unknown at this time. Traffic volumes on Gammon Road will be evaluated and may indicate additional capacity is needed along the corridor. Any capacity improvements should consider the inclusion of the Mineral Point Road intersection for continuity along the corridor. Other recommendations for the corridor include adaptive signal timing to increase progression and time-of-day operational efficiency.

#### Mineral Point Road & Clinic Driveway

No additional improvements are recommended at this time.

### **A4. 2019 Stage I Build Development Traffic**

#### Gammon Road & Tree Lane

The intersection of Gammon Road & Tree Lane will not require geometric improvements however it is recommended to retime the traffic signal. The signal is currently actuated however uncoordinated with adjacent intersection. Consideration should be made to coordinate the signal to allow for more corridor progression.

#### Gammon Road & Memorial Drive

No additional geometric or intersection control improvements beyond the 2019 background improvement, which recommends installation of a traffic signal, is required.

The existing lane configuration on the west approach will operate at LOS D or better as a single, shared use lane. However, as discussed previously, an exclusive left turn lane and shared thru/right lane should be included to increase capacity and efficiency on the west approach of the intersection. It is recommended that the West Place Development site plan accommodate a two-lane west approach at the intersection of Gammon Road & Memorial Drive.

New pedestrian curb ramps and crosswalks should also be installed for pedestrians surrounding the intersection and internally within the site which may encourage additional multimodal trips.

#### Gammon Road & Mineral Point Road

The intersection of Gammon Road & Mineral Point Road will not require geometric improvements however it is recommended to retime the traffic signal.

Anticipated left-turn queues are likely to extend past the existing storage lengths on each of the intersection approaches. It is recommended to maximize queue storage to the degree possible to fit within the existing constraints of the environment.

#### Mineral Point Road & Clinic Driveway

The existing two-way stop controlled intersection of Mineral Point Road & Clinic Driveway fails on the side street approaches in the Stage I development condition. This intersection experiences a low volume of vehicles that attempt to make a left turn from the side street and appears to be self-regulating to other area signalized intersections. The increase in southbound left-turn traffic volume due to the development is nominal (approximately 10 vehicles in the peak hour). If West Place Development users find this intersection difficult to complete turning movements, other signalized intersections are available surrounding the site to enter the adjacent corridors. No additional improvements beyond the 2019 background improvements are recommended at this time.

## A5. 2029 Full Build Development Traffic

### Gammon Road & Tree Lane

The intersection of Gammon Road & Tree Lane will not require geometric improvements however it is recommended to retime the traffic signal.

### Gammon Road & Memorial Drive

The intersection of Gammon Road & Memorial Drive will not require geometric improvements however it is recommended to retime the traffic signal installed as part of the 2019 background condition. Consideration should be made to coordinate the signal with adjacent Gammon Road intersections to allow for more corridor progression.

### Gammon Road & Mineral Point Road

The intersection of Gammon Road & Mineral Point Road will begin to experience operational pressure during the full build out condition of West Place Development. Additional capacity is needed at the intersection in order to perform at an acceptable level.

It is recommended to install dual southbound left-turn lanes at the intersection of Gammon Road & Mineral Point Road to accommodate additional capacity. Per the FDM (Chapter 11-25, 5.4.3.1) dual left turn lanes should be considered at a signalized intersection when demand exceeds 300 vehicles per hour (vph). The analysis shows that Stage I development volumes will exceed the threshold for the southbound left-turn vehicles during the PM peak hour. Therefore, it is recommended to accommodate southbound dual left-turn lanes, including appropriate storage lengths, traffic signal improvements, and lane configuration, once full build of West Place Development has been constructed or an additional traffic study is completed that warrants such improvement.

### Mineral Point Road & Clinic Driveway

No additional improvements are recommended at this time.

## A6. 2049 Full Build Development Traffic

*Exhibit 6-1: Intersection Conceptual Drawing – Proposed Road Alignment*, illustrates the improvements to the existing transportation system.

### Gammon Road & Tree Lane

The intersection of Gammon Road & Tree Lane will not require geometric improvements however it is recommended to retime the traffic signal.

### Gammon Road & Memorial Drive

The intersection of Gammon Road & Memorial Drive will not require geometric improvements however it is recommended to retime the traffic signal installed as part of the 2019 background condition.

### Gammon Road & Mineral Point Road

The intersection of Gammon Road & Mineral Point Road will degrade in the horizon year full build out condition. Several intersection movements are over capacity with long delays. Additional capacity is needed at the intersection in order to perform at an acceptable level.



In conjunction with 2029 full build improvements, dual left-turn lanes are also recommended for installation on the south and east approaches of the intersection based on the FDM criteria for dual turn lanes outlined in the previous section.

While not operationally necessary, dual left-turn lanes should be constructed and painted for future use on the west approach of the intersection as well. The accommodation of the additional lanes allow for future use but also provides proper sight distance for eastbound left-turning vehicles on permissive movements and aligns the thru lanes across the intersection on all approaches.

If in the future when the entire West Place Development site is constructed, a new TIA should be completed. The TIA should include updated turning movement counts and trip generation to accurately analyze the impacts. A supplemental Traffic Impact Analysis for any future development outside of Stage I and Stage II conditions as set forth in this study is recommended.

It is recommended that the right-of-way to accommodate dual-left turn lanes on all approaches of the intersection of Gammon Road & Mineral Point Road be reserved for future construction at a time when traffic volumes warrant the installation. As part of the site plan development, right-of-way should be reserved for future use by the City of Madison.

Mineral Point Road & Clinic Driveway

No additional improvements are recommended at this time.