

Traffic Analysis

Summit District PUD

Traffic Impact Analysis

Bloomington, Indiana

March 15, 2024



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Executive Summary

The purpose of this Traffic Impact Analysis (TIA) is to identify the potential intersection improvements needed due to the proposed Summit District Planned Unit Development (PUD). The 138.5-acre site is located approximately 1.5 miles southwest of downtown Bloomington, IN. Summit District PUD will include residential and commercial uses. This report documents the analysis and findings.

Study Area

The study area consists of an area roughly bounded by the arterials of Bloomfield Road, Walnut Street, Tapp Road; and Interstate 69. The existing study intersections are:

1. Bloomfield Road & Recreation Center Drive (unsignalized)
2. Bloomfield Road & Weimer Road (unsignalized)
3. Bloomfield Road & Rolling Ridge Way (signalized)
4. Bloomfield Road & Allen Street (unsignalized)
5. Bloomfield Road & Landmark Avenue (signalized)
6. Bloomfield Road/2nd Street & Adams Street (signalized)
7. 2nd Street & Patterson Drive (signalized)
8. Tapp Road & Deborah Drive (signalized)
9. Tapp Road & Vanguard Parkway (unsignalized)
10. Tapp Road & Weimer Road (unsignalized)
11. Tapp Road & Adams Street (roundabout)
12. Tapp Road/Country Club Drive & Rockport Road (signalized)
13. Country Club Drive & Rogers Street (signalized)
14. Country Club Drive/Winslow Road & Walnut Street (signalized)
15. Weimer Road & Sudbury Drive (unsignalized)
16. Weimer Road & Wapehani Road (unsignalized)
17. Allen Street & Adams Street (unsignalized)
18. Allen Street & Strong Drive (unsignalized)
19. Patterson Drive & Allen Street (signalized)
20. Patterson Drive & Fairview Street (signalized)
21. Patterson Drive & Rogers Street (signalized)
22. Walnut Street & Grimes Lane (signalized)
23. Rogers Street & Rockport Road (signalized)

Proposed Development

The proposed development will be located south of Bloomfield Road and will be constructed in five zones consisting of single-family and multifamily housing. There will be a total of 4250 units built by 2034, including 835 single family houses. The development will be accessed by proposed roadway connections to the existing city street network. Sudbury Drive will be connected from Weimer Road to Adams Street. Adams Street will be connected to Allen Street in the north and Tapp Road in the south. These proposed accesses are expected to be open to all modes of traffic by opening day.

Phase	Multifamily Units	Single-Family Units	Ground-Floor Commercial (1000 sf)
Opening Day 2029	1283	553	20
Full Build Year 2034	2132	282	45
Subtotal	3415	835	65
Total		4250	65

Traffic Forecast

Existing turn movement counts were collected at each of the study area intersections. A background growth rate of 0.5% per year was then applied to each turning movement to obtain background opening day traffic volumes. See **Section 3.2** for more information. Existing traffic was then redistributed to the proposed Adams Street and Sudbury Drive connections. Finally, proposed trips from the new development were added to develop traffic forecasts for the following scenarios:

- Scenario 1: Existing Year 2023 volumes
- Scenario 2: Opening Day background 2029 volumes + Phase 1 site generated trips
- Scenario 3: Full Build Year background 2034 volumes + Phase 1 site generated trips
- Scenario 4: Full Build Year background 2034 volumes + Phases 1 and 2 site generated trips
- Scenario 4A: Full Build Year background 2034 volumes + Phases 1 and 2 site generated trips + proposed improvements

Analysis

A capacity and queuing analysis was performed for all study intersections using existing signal timings provided by the City of Bloomington for all study scenarios.

Non-Motorized and Transit Access

A review of existing bicycle and pedestrian facilities was conducted. The proposed Summit PUD will be in close proximity to the B-Line trail, B-Link Trail, and Clear Creek Trail. Many existing sidewalk facilities are present to provide access to these trails. An additional connection east through the development with a mid-block crossing on Rogers Street would increase access to the B-Line trail system.

Additionally, bus stop locations were reviewed. Although existing bus routes travel through the study area, the nearest stop would be an approximate 1-mile walk. Bloomington Transit has shown interest in expanding bus service along the proposed Adams Street connection from Tapp to 2nd Street which would increase access to bus facilities for the Summit PUD.

Findings and Recommendations

All six proposed internal intersections operate at or above acceptable levels of service during both peak hours of all scenarios with the proposed lane configurations. The following existing intersections operate at or above acceptable levels of service during both peak hours of all scenarios and do **not** need improvements:

- Bloomfield Road & Rolling Ridge Way
- 2nd Street & Patterson Drive
- Tapp Road & Deborah Drive
- Tapp Road & Adams Street
- Weimer Road & Sudbury Drive
- Weimer Road & Wapehani Road
- Allen Street & Strong Drive
- Patterson Drive & Allen Street
- Patterson Drive & Fairview Street
- Rogers Street & Rockport Road

The following table shows the intersections that need improvements by phase:

Existing Year 2023 — Without Development

Intersection	Improvement
4. Bloomfield Road & Allen Street	Install EB Right- & NB Left-Turn Lanes
5. Bloomfield Road & Landmark Avenue	Adjust Signal Timings
13. Country Club Drive & Rogers Street	Adjust Signal Timings, Install WB Right-Turn Lane

Opening Day 2029 — With Phase 1 (1836 Units)

Intersection	Improvement
2. Bloomfield Road & Weimer Road	Install Traffic Signal, Install NB Right-Turn Lane
9. Tapp Road & Vanguard Parkway*	Install Left-Turn Acceleration Lane

*Only recommended provided Weimer Road is realigned to Vanguard Parkway

Full Build Year 2034 — With Phase 1 (1836 Units)

Intersection	Improvement
22. Walnut Street & Grimes Lane	Adjust Signal Timings

Full Build Year 2034 — With Phases 1 & 2 (2414 Additional Units)

Intersection	Improvement
6. Bloomfield Road/2nd Street & Adams Street	Adjust Signal Timings
12. Tapp Road/Country Club Drive & Rockport Road	Adjust Signal Timings
14. Country Club Drive/Winslow Road & Walnut Street	Adjust Signal Timings
17. Allen Street & Adams Street	Install Turn Lanes on All Approaches
21. Patterson Drive & Rogers Street	Adjust Signal Timings

The following is a detailed description of the needed improvements:

Bloomfield Road & Recreation Center Drive / Weimer Road

The northbound approach to this intersection operates below the acceptable level of service during both peak hours of Scenarios 2, 3, & 4, starting on opening day 2029 with approximately 45% of units constructed. A traffic signal may be warranted based on available data and a preliminary peak hour volume warrant once the development is approximately 45% constructed. The installation of a new **traffic signal** and the addition of a northbound **right-turn lane** are recommended. If a traffic signal is constructed, it is recommended that Weimer Road and the Recreation Center Drive align and that the signal is coordinated with others along Bloomfield.

Bloomfield Road & Allen Street

The Allen Street approach to this intersection operates below acceptable levels of service during the PM peak hour of all scenarios. Adding an exclusive **left-turn lane** to the Allen Street approach and an exclusive **right-turn lane** to the Bloomfield Road eastbound approach are recommended. With these improvements the Allen Street approach will still be below the acceptable level of service during the PM peak hour. However, the available data showed that a traffic signal would likely not be warranted in any scenario. If the demand increases significantly above what is expected in this study, a signal warrant should be evaluated.

Bloomfield Road & Landmark Street

The southbound approach to this intersection operates below acceptable levels of service in the PM peak hour during all scenarios. **Optimized signal timings** are recommended.

Bloomfield Road/2nd Street & Adams Street

This intersection operates below acceptable levels of service during both peak hours of Scenario 4 when 100% of units are constructed and with the current signal timings. **Optimized signal timings** are recommended.

Tapp Road & Vanguard Parkway

This intersection operates below acceptable levels of service during both peak hours of Scenarios 3 and 4, starting in 2034 with no more than 45% of units built and with the volume from the Weimer Road realignment. Building a **left-turn acceleration lane** for the southbound left-turning movement could improve operations by allowing left-turning vehicles to make a two-stage turn if necessary. Adding an exclusive eastbound **left-turn lane** is also recommended. These improvements should be implemented concurrently with the realignment. The available data showed that a traffic signal would likely not be warranted in any scenario. However, the installation of a traffic signal or a roundabout would improve operations at this intersection. Volumes at this intersection should be monitored and reanalyzed when the Weimer Road realignment project is constructed.

Tapp Road & Weimer Road

The southbound approach to this intersection operates below acceptable levels of service during the PM peak hour of Scenario 1 (existing 2023), and both peak hours of Scenario 2 (2029 with 45% of units constructed). However, since Weimer Road is expected to be realigned to Vanguard Parkway before Scenarios 3 and 4, **no additional improvements** at the intersection with Tapp Road are recommended.

Tapp Road/Country Club Drive & Rockport Road

The eastbound through movement has a volume-to-capacity ratio (v/c) >1 in Scenario 4, when 100% of units are built. **Optimized signal timings** are recommended.

Country Club Drive & Rogers Street

The westbound right-turning movement at this intersection has a volume-to-capacity ratio (v/c) >1 in the PM peak hour of Scenario 1 (existing 2023), and the level of service is below acceptable levels during both peak hours of Scenario 4 (2034 with 100% of units constructed). **Optimized signal timings**, coordination with Country Club Drive/Winslow Road & Walnut Street, and an exclusive westbound **right-turn lane** are recommended. After implementation of optimized traffic signal timings, this intersection should be observed for increased volume due to latent demand and signal timings should be adjusted accordingly.

Country Club Drive/Winslow Road & Walnut Street

The westbound approach to this intersection operates below the acceptable level of service in the PM peak hour during all scenarios. **Optimized signal timings** and coordinating signal timings with Country Club Drive & Rogers Street are recommended.

Allen Street & Adams Street

This intersection operates below the acceptable level of service in both peaks of Scenario 4 when 100% of units are constructed. Building an exclusive northbound **right-turn lane**, an exclusive westbound **left-turn lane**, an exclusive southbound **left-turn lane**, and exclusive eastbound **right-turn lane** are recommended. With these improvements it will still operate below the acceptable level of service during the PM peak hour. Alternatively, a future connection to Strong Drive would improve this intersection to an acceptable level of service. A signal or a roundabout at this intersection would also improve it to an acceptable level of service.

Patterson Drive & Rogers Street

The southbound approach of this intersection operates below the acceptable level of service in the PM peak hour during Scenario 4 when 100% of units are constructed. **Optimized signal timings** are recommended.

Walnut Street & Grimes Lane

The eastbound through and right-turning movements at this intersection have a volume-to-capacity ratio (v/c) > 1 in Scenarios 3 and 4, starting in 2034 with at least 45% of units constructed. **Optimized signal timings** are recommended.

1.0 Introduction

1.1. Purpose

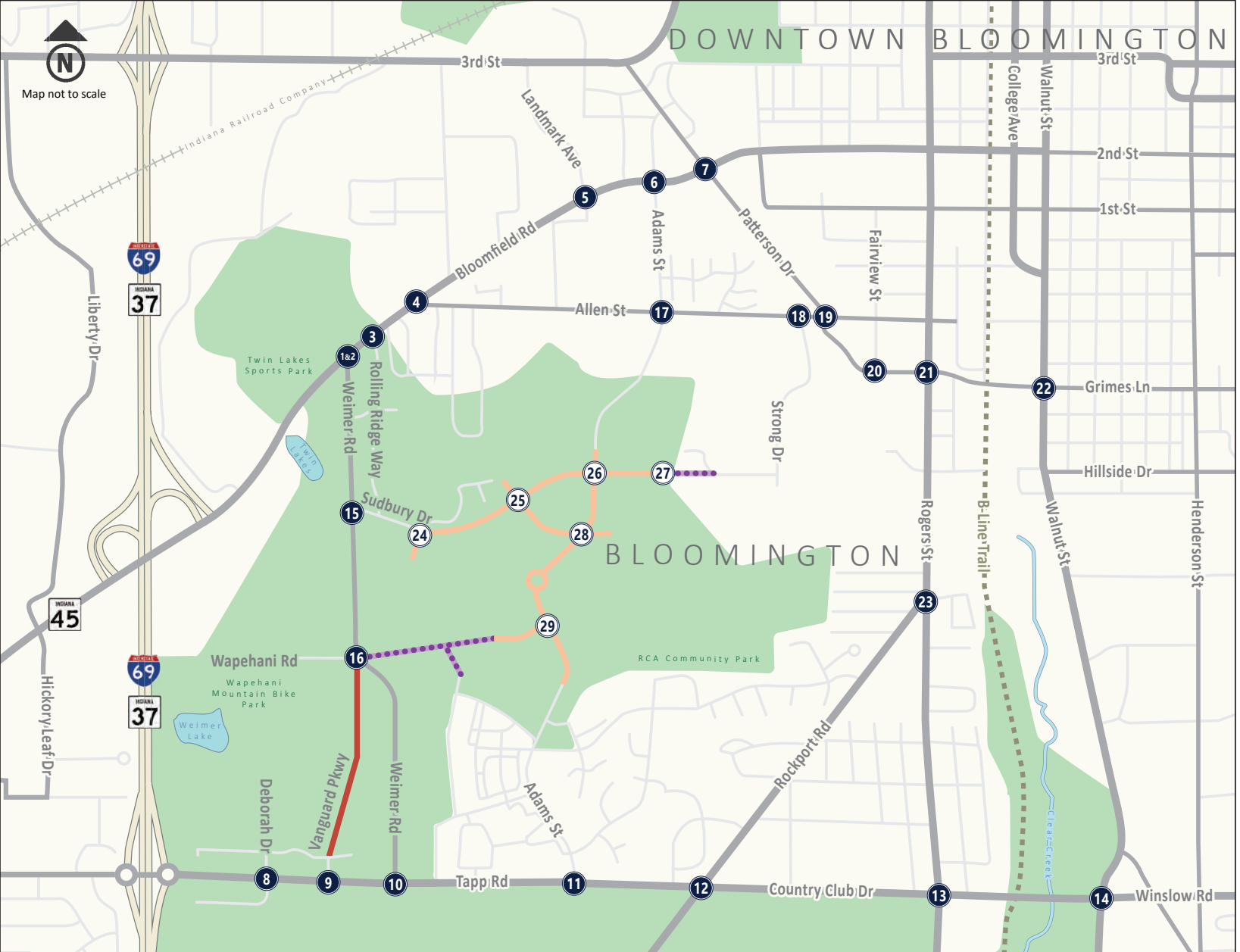
The purpose of this Traffic Impact Analysis (TIA) is to identify the potential intersection improvements needed due to the proposed Summit District Planned Unit Development (PUD).

1.2. Scope

EMCS coordinated with the City of Bloomington (City) and TRG Development to solidify the scope of this traffic impact analysis. The scope as we understand it is detailed below:

Study Intersections

1. Bloomfield Road & Recreation Center Drive (unsignalized)
2. Bloomfield Road & Weimer Road (unsignalized)
3. Bloomfield Road & Rolling Ridge Way (signalized)
4. Bloomfield Road & Allen Street (unsignalized)
5. Bloomfield Road & Landmark Avenue (signalized)
6. Bloomfield Road/2nd Street & Adams Street (signalized)
7. 2nd Street & Patterson Drive (signalized)
8. Tapp Road & Deborah Drive (signalized)
9. Tapp Road & Vanguard Parkway (unsignalized)
10. Tapp Road & Weimer Road (unsignalized)
11. Tapp Road & Adams Street (roundabout)
12. Tapp Road/Country Club Drive & Rockport Road (signalized)
13. Country Club Drive & Rogers Street (signalized)
14. Country Club Drive/Winslow Road & Walnut Street (signalized)
15. Weimer Road & Sudbury Drive (unsignalized)
16. Weimer Road & Wapehani Road (unsignalized)
17. Allen Street & Adams Street (unsignalized)
18. Allen Street & Strong Drive (unsignalized)
19. Patterson Drive & Allen Street (signalized)
20. Patterson Drive & Fairview Street (signalized)
21. Patterson Drive & Rogers Street (signalized)
22. Walnut Street & Grimes Lane (signalized)
23. Rogers Street & Rockport Road (signalized)
24. Sudbury Drive & Shasta Meadows Access (unsignalized)
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (unsignalized)
26. Sudbury Drive & Adams Street (roundabout)
27. Sudbury Drive & Sandia Place Access 1 (unsignalized)
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (roundabout)
29. Adams Street & Denali Woods Access (unsignalized)



LEGEND

Existing Road: —

Proposed Road: —

Future Realignment: —

Future Connection: ⋯

Existing Intersection: #

1. Bloomfield Road and Recreation Center Drive
2. Bloomfield Road and Weimer Road
3. Bloomfield Road and Rolling Ridge Way
4. Bloomfield Road and Allen Street
5. Bloomfield Road and Landmark Avenue
6. Bloomfield Road/2nd Street and Adams Street
7. 2nd Street and Patterson Drive
8. Tapp Road and Deborah Drive
9. Tapp Road and Vanguard Parkway
10. Tapp Road and Weimer Road
11. Tapp Road and Adams Street
12. Tapp Road/Country Club Drive and Rockport Road
13. Country Club Drive and Rogers Street
14. Country Club Drive/Winslow Road and Walnut Street
15. Weimer Road and Sudbury Drive
16. Weimer Road and Wapehani Road
17. Allen Street and Adams Street
18. Allen Street and Strong Drive
19. Patterson Drive and Allen Street
20. Patterson Drive and Fairview Street
21. Patterson Drive and Rogers Street
22. Walnut Street and Grimes Lane
23. Rogers Street and Rockport Road

Proposed Intersection: #

24. Sudbury Drive and Shasta Meadows Access/ Everest Center Access 1
25. Sudbury Drive and Whitney Glen Access/ Everest Center Access 1
26. Sudbury Drive and Adams Street
27. Sudbury Drive and Sandia Place Access 1
28. Adams Street and Sandia Place Access 2/ Everest Center Access 2
29. Adams Street and Denali Woods Access

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



Figure 1: Study Intersections and Project Area

Traffic Data and Forecast

EMCS obtained existing turning movement traffic data for the study intersections from Gewalt Hamilton Associates, Inc. (GHA). Data was collected for four hours from 7:00 AM to 9:00 AM and from 3:30 PM to 5:30 PM on Tuesday, October 24, 2023. The weather was clear, and school was in session.

EMCS identified and applied a growth rate to existing traffic volumes to obtain background traffic volumes for opening day and full build scenarios. The percentage of traffic volumes that may reroute and use the proposed roadways was also determined and added to obtain background traffic volumes.

EMCS determined the number of new vehicle trips generated to and from the proposed development, using information provided by the owner and ITE's *Trip Generation Manual, 11th Edition*¹. The vehicle trips were then adjusted for mode split and internal trips. Then, all new trips were assigned and distributed to the surrounding roadways.

Finally, EMCS compiled all traffic data into forecasts for the following scenarios:

- Scenario 1: Existing Year 2023 volumes
- Scenario 2: Opening Day background 2029 volumes + Phase 1 site generated trips
- Scenario 3: Full Build Year background 2034 volumes + Phase 1 site generated trips
- Scenario 4: Full Build Year background 2034 volumes + Phases 1 and 2 site generated trips
- Scenario 4A: Full Build Year background 2034 volumes + Phases 1 and 2 site generated trips + proposed improvements

Traffic Analysis

EMCS completed a capacity analysis for the study intersections for all scenario traffic volumes for the two highest volume hours of the day: one during the AM peak hour and one during the PM peak hour using the software program Synchro 11 and *Highway Capacity Manual (HCM)*² methodologies.

Additionally, a queuing analysis at applicable intersections and a turn lane analysis were completed for publicly owned roadways.

Documentation

All data, analyses, results, and recommendations are presented in this comprehensive Traffic Impact Analysis.

2.0 Background Information

2.1 Existing Roadway

Below is a list of the roadways (which are all undivided) in the study area as classified by the City's Transportation Plan³. All roadway characteristics listed below are what is present within the study area.

Primary Arterial

Bloomfield Road/2nd Street is a 2-lane northeast-southwest roadway (for this study it is considered east-west) with a posted speed limit that varies from 40 to 30 miles per hour (mph).

Walnut Street is a 4-lane north-south roadway which has a posted speed limit of 30 mph.

Tapp Road/Country Club Drive/Winslow Road is a 2-lane east-west roadway, except at Deborah Drive where it has a 4-lane cross section. It has a posted speed limit of 30 mph.

Secondary Arterial

Patterson Drive/Grimes Lane is a 2-lane northwest-southeast roadway with a posted speed limit that varies between 30 and 40 mph. It is classified as a primary collector east of Walnut Street.

Rogers Street is a 2-lane north-south roadway with a posted speed limit that varies from 25 to 30 mph.

Adams Street is a 2-lane north-south roadway with a posted speed limit that varies from 25 to 30 mph. It provides access to mostly residential areas. It is split into a northern segment which terminates south of Allen Street and a southern segment which terminates north of Tapp Road. The Summit PUD will connect the two segments.

Primary Collector

Rockport Road is a 2-lane northeast-southwest roadway with a posted speed limit of 30 mph.

Allen Street is a 2-lane east-west roadway with a posted speed limit that varies from 25 to 30 mph. East of Patterson Drive it is a local street with midblock curb bump-outs, and a very low through capacity.

Weimer Road is a 2-lane north-south roadway with a speed limit of 35 mph. There are significant horizontal and vertical curves and a single-lane bridge on the southern portion of Weimer Road. The City's Transportation Plan shows a future realignment, discussed in **Section 2.5**.

Local

Sudbury Drive is a 2-lane east-west roadway which falls under the city's general 25 mph speed limit for unposted roads. It currently provides residential access to Weimer Road.

Strong Drive is a 2-lane north-south roadway with a posted speed limit of 25 mph. It currently provides access from Allen Street to an industrial area.

2.2. Existing Intersections

The geometry and traffic controls of the 23 existing intersections are shown in **Figure 2** and **Figure 3**.

2.3. Proposed Development

The 138.5-acre site is located 1.5 miles southwest of downtown Bloomington and will be constructed in five zones. TRG has provided the expected number and type of units in each zone. The zones are comprised of a mix of single family and multifamily residential housing, and ground floor commercial uses. The development will be built steadily over approximately 10 years, however for the purposes of this study, the generated traffic is split into two “phases”, opening day and full build year. This is described in detail in **Section 3.3**.

2.4. Proposed Access

The proposed accesses, which are expected to be open to all modes of traffic by opening day, consists of proposed roadway connections built by the developer that will tie into the existing network in three places: Sudbury Drive just east of Weimer Road, Adams Street just south of Allen Street, and Adams Street just north of Tapp Road. These streets currently do not connect to each other and have few outlets. The proposed roadway connections will also provide improved access for the city and existing traffic in the area, especially by connecting the two segments of Adams Street. Any existing traffic which might reroute through the proposed roadway connections instead is discussed in **Section 3.2.1**. The proposed access includes six proposed internal intersections that were analyzed in this study. Each proposed intersection has one lane per approach as shown in **Figure 4**.

2.5. Weimer Realignment

The southern portion of Weimer Road currently consists of multiple horizontal and vertical curves and includes a single-lane bridge. The City Thoroughfare plan includes realigning Weimer Road to remove the single-lane bridge, but this project is dependent upon future development through this vacant area. The possible alignment will tie in to Weimer Road at Wapehani Road and utilize the existing intersection of Tapp Road & Vanguard Parkway. Additionally, an eastbound left-turn lane is anticipated to be installed at the intersection of Tapp Road & Vanguard Parkway. The old Weimer Road alignment may then be removed or disconnected. An illustration of the realignment is shown in **Figure 4**. In this analysis the proposed Weimer Road realignment is assumed to be open to traffic by the full build year (Scenario 3).

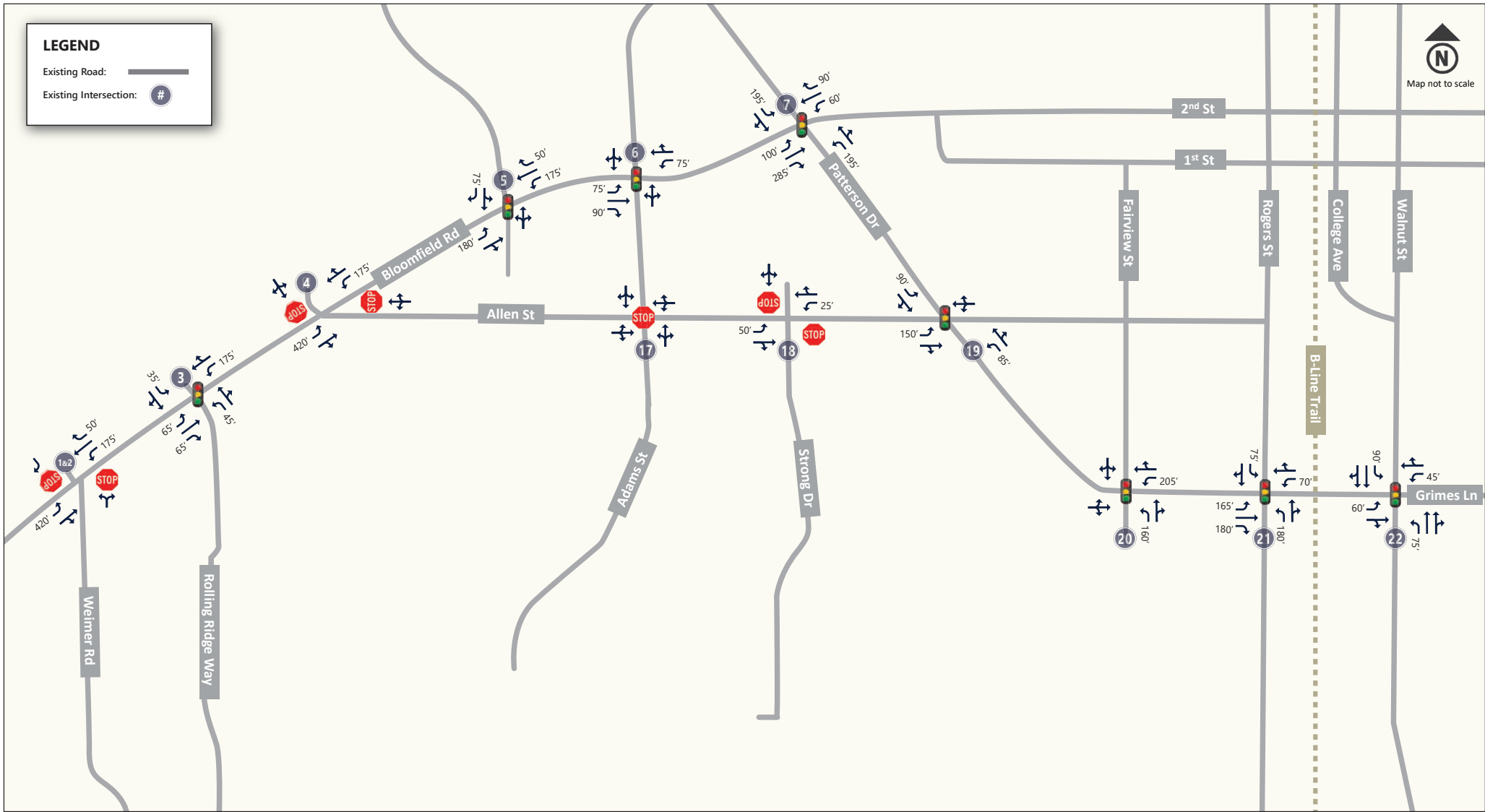


Figure 2: Existing Intersection Geometries: Bloomfield Road / 2nd Street, Allen Street, and Patterson Street



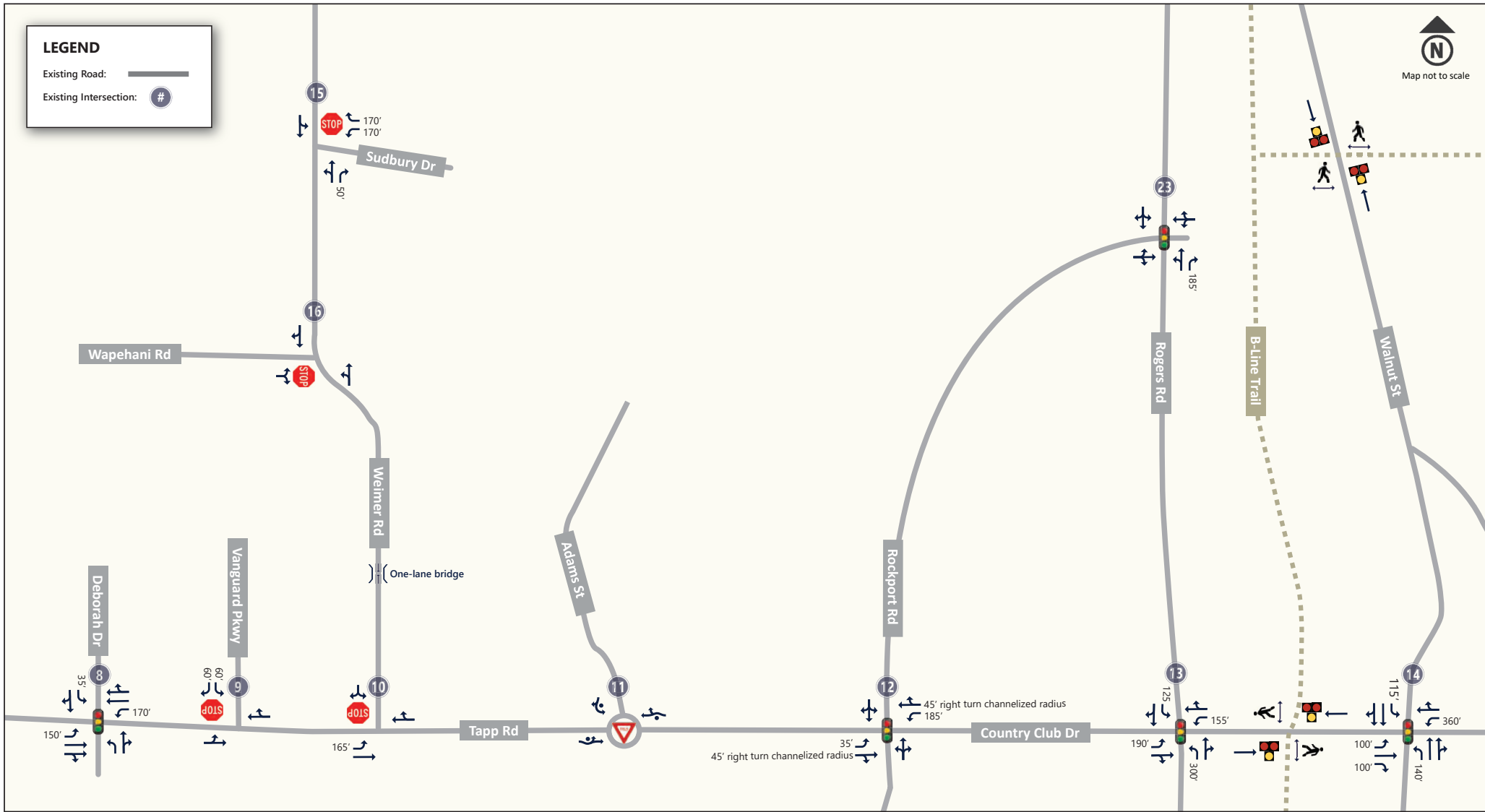


Figure 3: Existing Intersection Geometries: Tapp Road / Country Club Drive / Winslow Road, Weimer Road, Rockport Road, Rogers Street, and Walnut Street



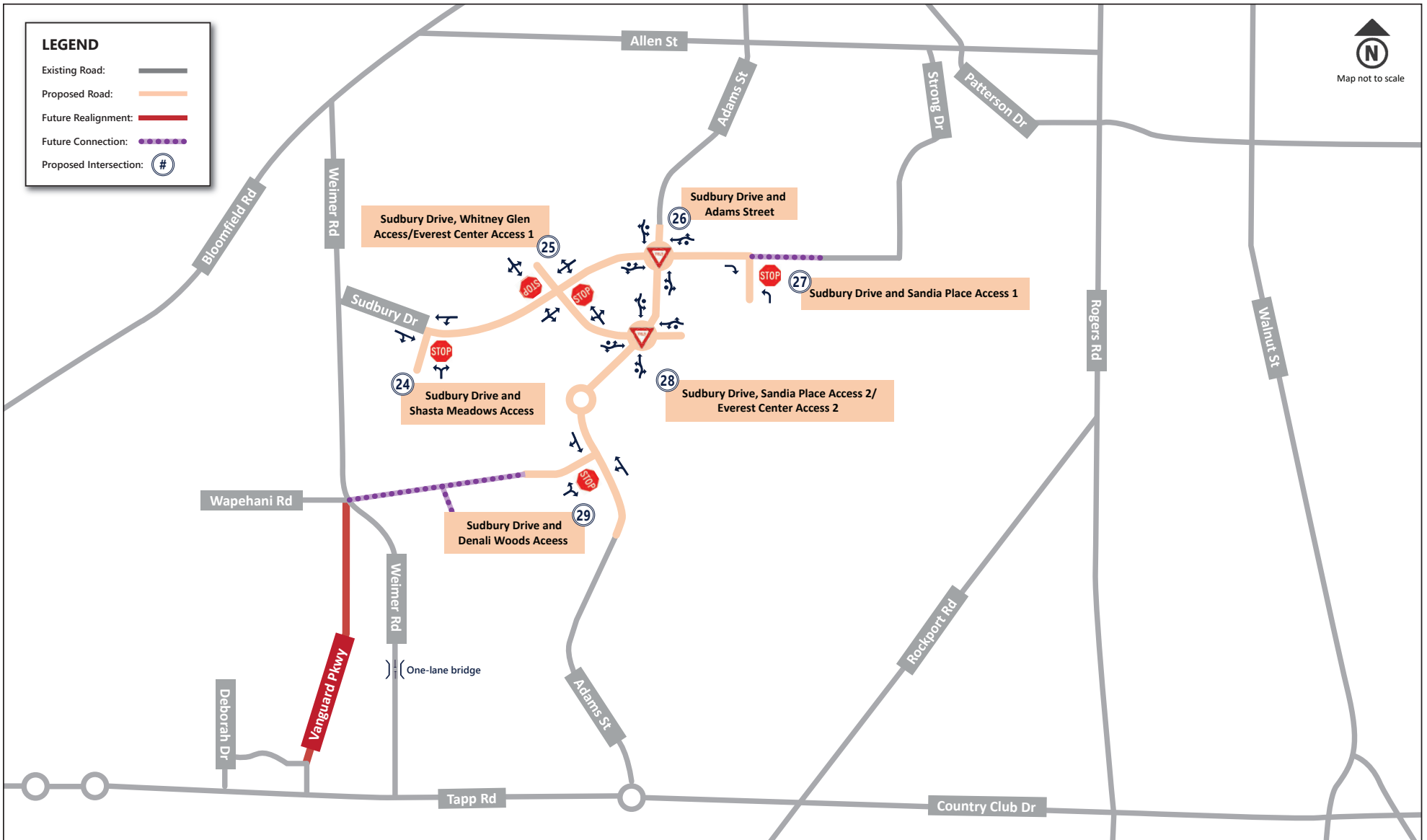


Figure 4: Proposed Intersection & Future Weimer Road Re-alignment

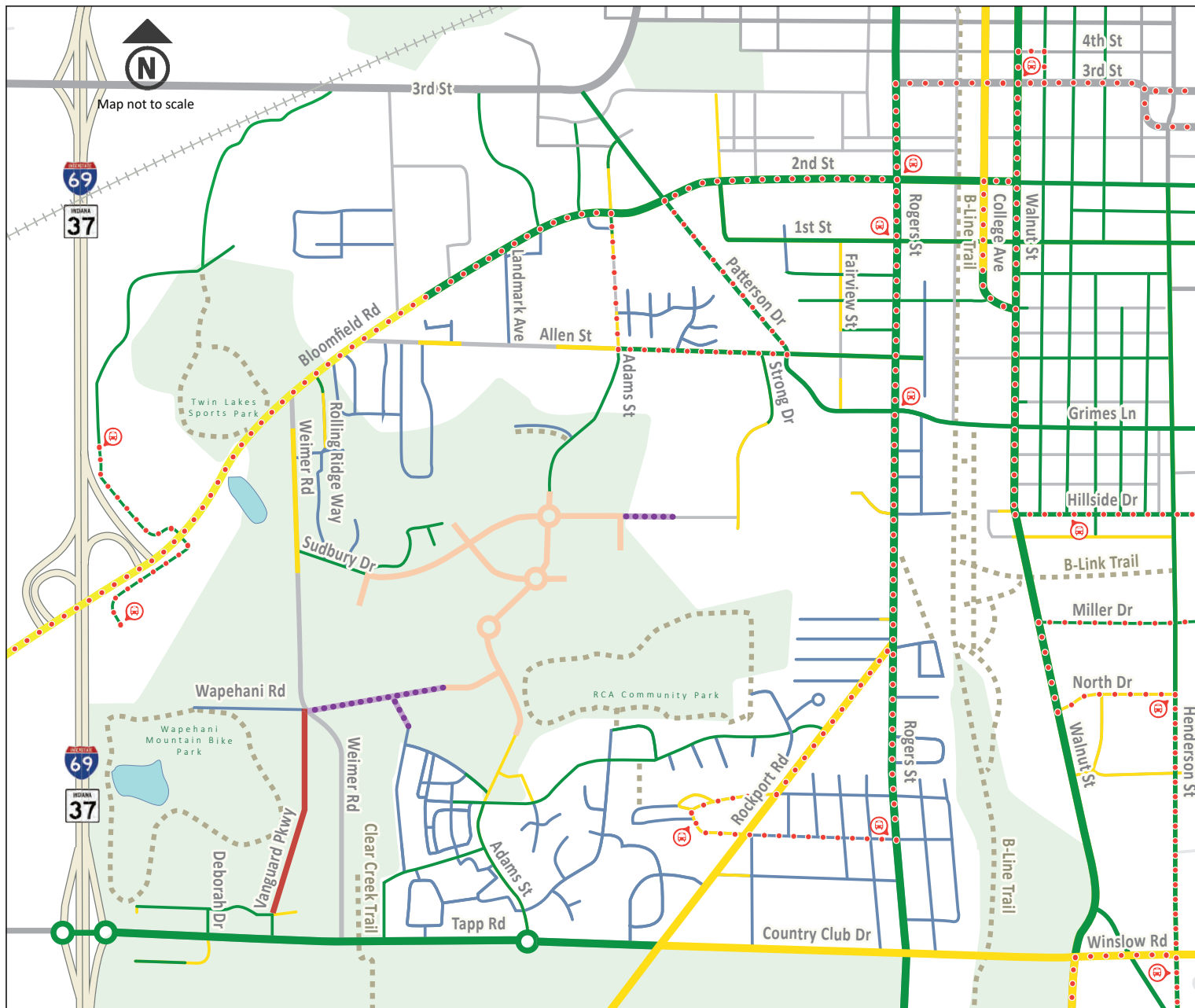
Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."

2.6. Non-Motorized and Transit Access

Figure 5 shows the existing sidewalks, paths, and transit stops in the study area. This map was labeled using the City's Transportation Plan, OpenStreetMap (OSM), and satellite imagery as guides. It shows where sidewalks and off-street trails currently exist. It also shows streets which have lower volumes of vehicular traffic and are therefore generally safer for pedestrians with or without sidewalks. The figure also shows the approximate location of the proposed roadway connections for the development. The development will provide sidewalks or multi-use paths on either side of the proposed roads which will provide access in and out of the site.

There are various transit stops that are connected to the area by sidewalk, however the closest stop is approximately a mile walk from the site. Access could be improved by providing additional sidewalks or paths between the site and surrounding neighborhoods. Also, Bloomington Transit has shown interest in eventually running a bus on the proposed Adams Street from Tapp to 2nd Street.

There are various off-street trails near the proposed development, such as the Clear Creek Trail, the B-Line Trail, and the B-Link Trail. The Clear Creek Trail will be well connected to the proposed development via sidewalks. The B-Line Trail is connected to the proposed development via sidewalks; however, the most direct route on city streets from the site to the trail requires traveling north to Allen Street before heading east to access the trail. Access to the B-Line Trail could be improved by building an off-street trail to the east of the site which crosses Rogers Street at a midblock crossing between Hillside Drive Street and Rockport Road. This connection would also improve access to Rogers Street bus stops. Potential midblock crossing treatments should be further evaluated to determine the right approach for this location.



LEGEND

- Sidewalk on Both Sides: —
- Partial Sidewalk: —
- No Sidewalk: —
- Low Volume Road: —
- Bike/Pedestrian Trail: - - -
- Bus Route: •••••
- Bus Stop:
- Proposed Roads: —
- Future Realignment: —
- Future Connection: •••••

Note: The proposed roads and future realignment are assumed to have sidewalk on both sides of the roadway

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."

Figure 5: Sidewalk, Path, and Transit Map



3.0 Traffic Forecast

3.1 Existing Traffic Data

Turning movement traffic volumes, including truck percentages and peak hour factors, were obtained for all existing intersections. The counts were taken by GHA in October of 2023 on a typical weekday for four hours from 7:00 AM to 9:00 AM and 3:30 PM to 5:30 PM. Two peak hours were included in the analysis. The actual peak hour data at each intersection was used for a conservative analysis. **Table 1** shows the actual peak hours at each intersection. The existing traffic volume data are included in **Appendix B**.

Table 1: Intersection Peak Hours

Intersection	AM Peak	PM Peak
1. Bloomfield Road & Recreation Center Drive	7:45 AM - 8:45 AM	4:30 PM - 5:30 PM
2. Bloomfield Road & Weimer Road	7:45 AM - 8:45 AM	4:30 PM - 5:30 PM
3. Bloomfield Road & Rolling Ridge Way	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
4. Bloomfield Road & Allen Street	7:45 AM - 8:45 AM	4:30 PM - 5:30 PM
5. Bloomfield Road & Landmark Avenue	8:00 AM - 9:00 AM	4:15 PM - 5:15 PM
6. Bloomfield Road/2nd Street & Adams Street	8:00 AM - 9:00 AM	4:00 PM - 5:00 PM
7. 2nd Street & Patterson Drive	8:00 AM - 9:00 AM	4:15 PM - 5:15 PM
8. Tapp Road & Deborah Drive	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
9. Tapp Road & Vanguard Parkway	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
10. Tapp Road & Weimer Road	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
11. Tapp Road & Adams Street	7:30 AM - 8:30 AM	4:00 PM - 5:00 PM
12. Tapp Road/Country Club Drive & Rockport Road	7:45 AM - 8:45 AM	4:15 PM - 5:15 PM
13. Country Club Drive & Rogers Street	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
14. Country Club Drive/Winslow Road & Walnut Street	7:15 AM - 8:15 AM	4:30 PM - 5:30 PM
15. Weimer Road & Sudbury Drive	8:00 AM - 9:00 AM	3:45 PM - 4:45 PM
16. Weimer Road & Wapehani Road	7:45 AM - 8:45 AM	4:30 PM - 5:30 PM
17. Allen Street & Adams Street	7:15 AM - 8:15 AM	4:30 PM - 5:30 PM
18. Allen Street & Strong Drive	7:30 AM - 8:30 AM	4:15 PM - 5:15 PM
19. Patterson Drive & Allen Street	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
20. Patterson Drive & Fairview Street	7:15 AM - 8:15 AM	4:30 PM - 5:30 PM
21. Patterson Drive & Rogers Street	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM
22. Walnut Street & Grimes Lane	8:00 AM - 9:00 AM	4:30 PM - 5:30 PM
23. Rogers Street & Rockport Road	7:30 AM - 8:30 AM	4:30 PM - 5:30 PM

3.2. Background Traffic

The background growth rate was used to increase the existing traffic volumes at a flat rate per year to create background volumes for the opening day and full build year scenarios.

Background volume represents anticipated growth in traffic independent of the proposed development’s construction. The growth rate was based on historic trends in the area shown in the Indiana Department of Transportation’s Traffic Count Database System⁴ and a comparison of the existing traffic data to historic traffic data found in Bloomington’s Synchro Model. EMCS also reviewed the City’s comprehensive plan⁵ to identify areas for future growth that could contribute to background growth within the area. The proposed growth rate is **0.5%/year** to represent a realistic but conservative estimate of growth in the area.

3.2.1. Proposed Roadway Connections Traffic Adjustments

Once the proposed roadway connections are complete, existing traffic will be free to reroute onto Adams Street or Sudbury Street. Because traffic count volumes do not yet exist on these proposed roadways, an adjustment was made to account for rerouting which reduced some trips from the surrounding roadways. This adjustment was done in PTV Vistro 2022 using the entering and exiting volumes at Sudbury Drive, and Adams Street. It was assumed that only 25% of trips that could reroute would do so. The proposed roadway connections traffic adjustments were applied to both the opening day and the full build year scenarios. See **Figure 6** and **Figure 7** for the adjusted volumes.

3.3. Trip Generation

The site plan and schedule of completion were provided by TRG. The quantity of single-family housing (ITE Code 210), multifamily housing (ITE Code 221) and ground-floor commercial (ITE Code 821) and the anticipated construction timeline is shown in **Table 2**. For the purposes of this study, the development was analyzed at two points in time: opening day (2029), when all of zones 1, 2, and part of zones 3 & 4 will be complete; and full build year (2034), when all zones will be complete. These quantities were used to calculate the Base Vehicle Trip Generation. See **Appendix B** for full trip generation and development phasing discussion.

Table 2: Land uses and construction timeline

Zone	Neighborhood	Single-Family Units	Multifamily Units	Ground-Floor Commercial	Construction Start Year	Construction Finish Year
1	Shasta Meadows	275	275	–	2025	2028
2	Denali Woods	250	250	–	2025	2029
3	Everest Center	0	1700	65,000 sf	2027	2034
4	Sandia Place	110	990	–	2028	2032
5	Whitney Glen	200	200	–	2033	2034

Ground-floor commercial space is measured in square feet.

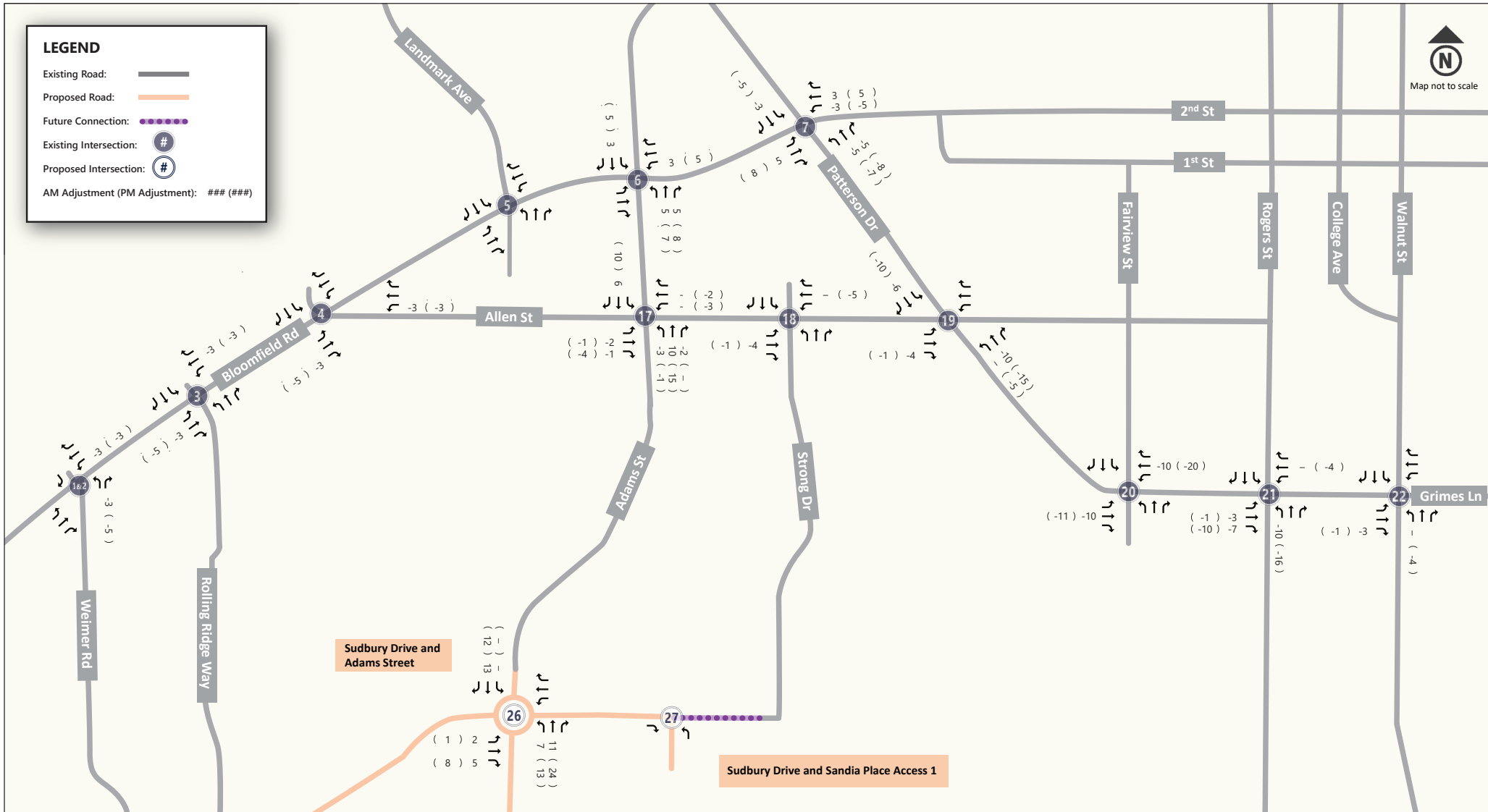


Figure 6: Connection Adjustments - Bloomfield Road, Allen Street, Patterson Drive

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



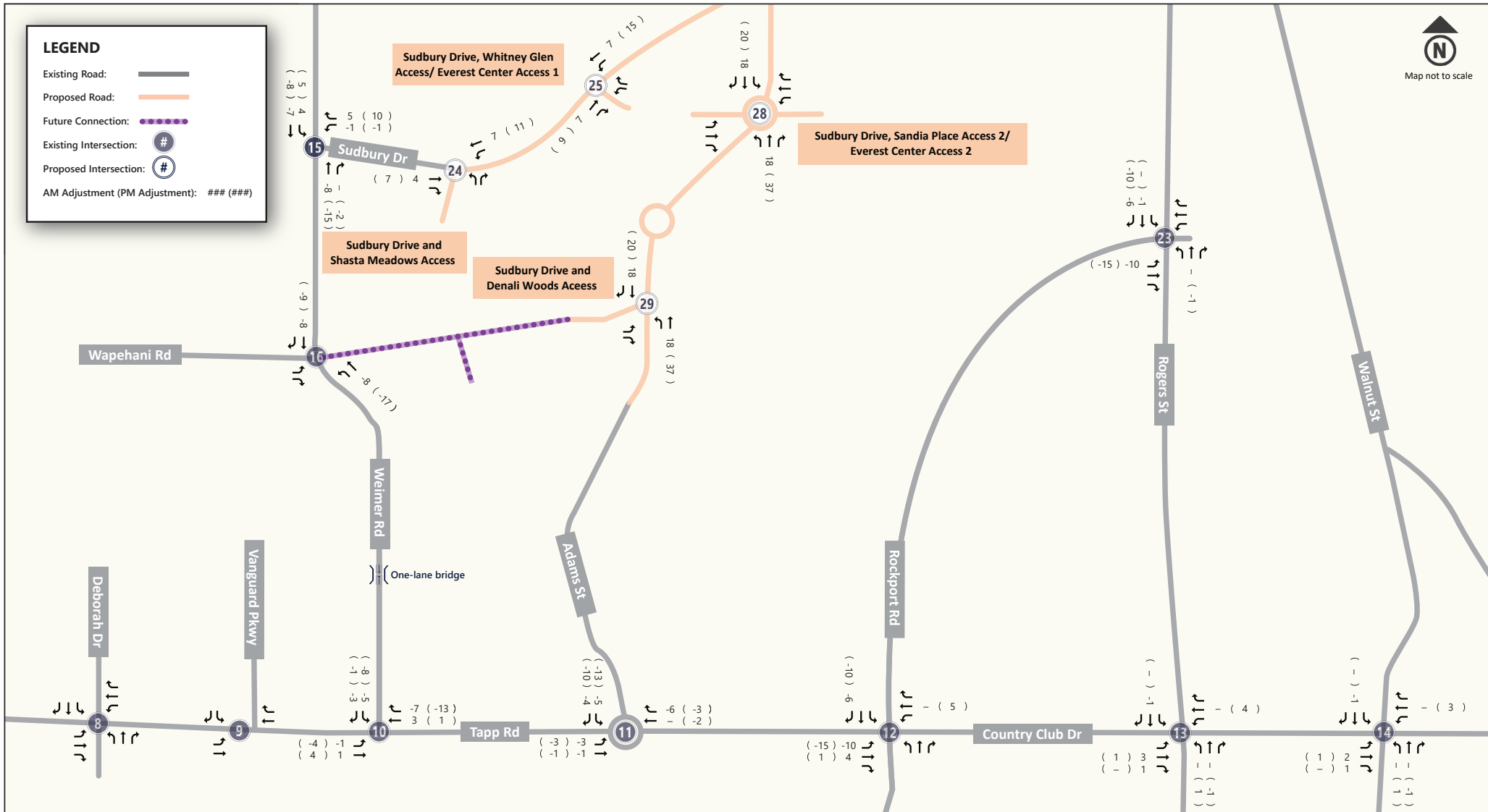


Figure 7: Connection Adjustments - Tapp Road, Sudbury Drive, Rogers Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



3.4. Internal Capture & Mode Split Adjustments

Because there will be commercial and residential uses within the same development, it can be expected that some trips will occur without using external roadways. This is called internal capture. Adjustments were made based on the ITE Trip Generation Handbook, 3rd Edition⁶ to determine internal capture and vehicle occupancy.

Additionally, some entering or exiting residents or customers will likely choose to enter or exit the development using transit or non-motorized transport. This is called external mode split. A conservative assumption of 5% was made for non-motorized and transit trips. Pass-by trips were not included because the number of pass-by trips would be minimal and would be expected to be internal pass-by trips rather than external. **Table 3** contains a summary of adjusted generated trips during both peak hours. A more detailed discussion of the mode split and internal capture process as well as the full calculation of trips can be found in **Appendix B**.

Table 3: Trip Generation

Zone #	Development Phase	ITE Code	Size	Unit	AM	AM	AM	PM	PM	PM
					Peak Total	Peak Enter	Peak Exit	Peak Total	Peak Enter	Peak Exit
1	Opening Day Base Total	210 & 221	550	DU	296	74	222	365	228	137
	Internal and Mode Split Reduction				17	4	13	25	16	9
	Opening Day New External Total	210 & 221	550	DU	279	70	209	340	212	128
2	Opening Day Base Total	210 & 221	500	DU	269	67	202	333	208	125
	Internal and Mode Split Reduction				15	4	11	23	15	8
	Opening Day New External Total	210 & 221	500	DU	254	63	191	310	193	117
3	Opening Day Base Total	221 & 821	510 / 20	DU / 1000 SF	248	71	177	303	172	131
	Internal and Mode Split Reduction				19	8	11	37	16	21
	Opening Day New External Total	221 & 821	510 / 20	DU / 1000 SF	229	63	166	266	156	110
3	Full Build Year Base Total	221 & 821	1190 / 45	DU / 1000 SF	590	166	424	698	398	300
	Internal and Mode Split Reduction				47	18	29	93	43	50
	Additional Full Build Year New External Total	221 & 821	1190 / 45	DU / 1000 SF	543	148	395	605	355	250
4	Opening Day Base Total	210 & 221	276	DU	121	29	92	127	78	49
	Internal and Mode Split Reduction				7	2	5	8	5	3
	Opening Day New External Total	210 & 221	276	DU	114	27	87	119	73	46
4	Full Build Year Base Total	210 & 221	824	DU	377	88	289	372	229	143
	Internal and Mode Split Reduction				23	6	17	32	21	11
	Additional Full Build Year New External Total	210 & 221	824	DU	354	82	272	340	208	132
5	Full Build Year Base Total	210 & 221	400	DU	216	53	163	269	168	101
	Internal and Mode Split Reduction				13	3	10	23	16	7
	Full Build Year New External Total	210 & 221	400	DU	203	50	153	246	152	94
1,2,3,4,5	Opening Day	210, 221, & 821	1836 / 20	DU / 1000 SF	876	223	653	1035	634	401
	Full Build Year	210, 221, & 821	2414 / 45	DU / 1000 SF	1100	280	820	1191	715	476
	Total New Trips	210, 221, & 821	4250 / 65	DU / 1000 SF	1976	503	1473	2226	1349	877

3.5. Trip Assignment and Distribution

Existing traffic patterns, census data, roadway characteristics, and existing and future land use data were considered when developing the overall trip distribution. EMCS coordinated with the City, and ultimately distribution percentages were agreed upon in December 2023. **Figure 8** shows the overall distribution percentages used in the analysis. The documentation for the development of the distribution percentages can be found in **Appendix B**.

To develop turning movement traffic volumes from the proposed development, the generated trips were then assigned to the study intersections using the software program PTV Vistro 2022. The site-generated trips and assignment percentages at each intersection are shown in **Appendix B**.



Figure 8: Assignment & Distribution Percentages

3.6. Scenario Traffic Volumes

Future vehicular traffic volumes to be generated by the proposed facilities were added to the background traffic volumes and proposed roadway connection adjustments to obtain the opening day and full build year traffic turning movement volumes. Note that traffic has been shifted for the Weimer Road realignment in **Scenarios 3** and **4** from Tapp Road & Weimer Road to Tapp Road & Vanguard Parkway. See **Section 2.5** for more details. The resulting turning movement volumes for all scenarios and peak hours are shown in **Appendix B** and in **Section 4.0**.

4.0 Traffic Analysis

4.1 Capacity Analysis

A capacity analysis was performed for all study intersections and scenarios. The capacity analysis was performed using SIDRA (Version 9.0) with the SIDRA standard capacity model for roundabouts (intersections 11, 26, and 28) and using Synchro 11 with the *HCM 6th Edition*² methodology for all other intersections.

The standard parameter for measuring traffic operating conditions is level-of-service (LOS). The LOS ranges from A-F with each indicating driving operations from best to worst. Each letter represents a range of the average delay per vehicle. The *HCM 6th Edition* provides LOS criteria for signalized and unsignalized intersections. These criteria are shown in **Table 4**. Roundabouts used the same LOS criteria as signalized intersections. An **LOS D or better** was assumed as the minimum level of service for the overall intersection based on guidance from the HCM and on standard industry practice. In addition, all approaches were evaluated to have a volume-to-capacity ratio (v/c) less than 1. However some communities choose to adopt a lower threshold for LOS based on community concerns for competing vehicle, pedestrian, and other road users.

Per the *HCM 6th Edition*, at two-way stop-controlled intersections, LOS is not defined for the major-street approaches or for the overall intersection, as major-street through vehicles are assumed to experience no delay.

Capacity analysis result printouts are included in **Appendix C**. Queuing results are in **Appendix E**.

Table 4: Level of Service - Unsignalized Intersection Control Delay and Signalized Intersection Control Delay

Signalized Intersection		Unsignalized Intersection	
LOS	Control Delay (sec/veh)	LOS	Control Delay (sec/veh)
A	<10	A	<10
B	>10 and <20	B	>10 and <15
C	>20 and <35	C	>15 and <25
D	>35 and <55	D	>25 and <35
E	>55 and <80	E	>35 and <50
F	>80	F	>50

Note: Signalized delay criteria also used for roundabouts.

The capacity analysis was performed for the AM and PM peak hours for the following scenarios:

- Scenario 1: Existing Year 2023 volumes
- Scenario 2: Opening Day background 2029 volumes + Phase 1 site generated trips
- Scenario 3: Full Build Year background 2034 volumes + Phase 1 site generated trips
- Scenario 4: Full Build Year background 2034 volumes + Phases 1 and 2 site generated trips
- Scenario 4A: Full Build Year background 2034 volumes + Phases 1 and 2 site generated trips + proposed improvements

Scenario	1	2	3	4	4A
Existing Year 2023 Volumes	X				
Opening Day Background 2029 Volumes		X			
Full Build Year Background 2034 Volumes			X	X	X
Site-generated Trips – Phase 1		X	X	X	X
Site-generated Trips – Phase 2				X	X
Proposed Roadway Connections		X	X	X	X
Potential Weimer Realignment			X	X	X
Proposed Improvements					X

4.2. Scenario 1: Existing Year 2023 Volumes Capacity Analysis

Table 5 summarizes capacity results for Scenario 1 with the following inputs:

- Existing signal timings provided by the City
- Existing roadway geometry (see **Section 2.2**)
- Existing Year 2023 traffic volumes (see **Figure 9** and **Figure 10**)

Table 5: Intersection LOS and Delay (sec/veh) Results – Scenario 1

Scenario 1: Existing Year 2023	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
1. Bloomfield Road & Recreation Center Drive (AM Peak)*	A (8.9)	–	n/a	B (12.9)	–
1. Bloomfield Road & Recreation Center Drive (PM Peak)*	B (10.5)	–	n/a	A (0)	–
2. Bloomfield Road & Weimer Road (AM Peak)*	–	A (9.9)	C (19.9)	n/a	–
2. Bloomfield Road & Weimer Road (PM Peak)*	–	A (9.6)	C (20.4)	n/a	–
3. Bloomfield Road & Rolling Ridge Way (AM Peak)	B (11.5)	A (5.0)	D (50.5)	D (47.7)	B (12.5)
3. Bloomfield Road & Rolling Ridge Way (PM Peak)	B (11.3)	B (17.4)	D (47.8)	D (47.8)	B (17.3)
4. Bloomfield Road & Allen Street (AM Peak)**	A (0)	B (11.6)	C (20.1)	A (9.8)	–
4. Bloomfield Road & Allen Street (PM Peak)**	B (10.8)	A (9.4)	E (42.9)	C (21.7)	–
5. Bloomfield Road & Landmark Avenue (AM Peak)	A (5.4)	A (3.2)	D (41.3)	D (45.3)	B (10.4)
5. Bloomfield Road & Landmark Avenue (PM Peak)	A (6.0)	A (2.6)	D (38.7)	F (103.5)	C (27.9)
6. Bloomfield Road/2nd Street & Adams Street (AM Peak)	A (0.8)	A (0.6)	D (49.6)	D (45.2)	A (5.5)
6. Bloomfield Road/2nd Street & Adams Street (PM Peak)	A (0.7)	A (1.2)	D (48.4)	D (44.3)	A (7.4)
7. 2nd Street & Patterson Drive (AM Peak)‡	A (1.7)	A (1.1)	D (49.5)	D (37.0)	C (22.4)
7. 2nd Street & Patterson Drive (PM Peak)‡	A (2.0)	A (4.9)	E (56.3)	C (31.8)	C (22.3)
8. Tapp Road & Deborah Drive (AM Peak)	B (11.8)	B (10.9)	B (19.2)	B (19.2)	B (11.6)
8. Tapp Road & Deborah Drive (PM Peak)	B (13.5)	B (13.4)	B (19.4)	C (20.6)	B (14.1)
9. Tapp Road & Vanguard Parkway (AM Peak)*	A (9.3)	–	n/a	B (14.2)	–
9. Tapp Road & Vanguard Parkway (PM Peak)*	A (9.5)	–	n/a	D (34.5)	–
10. Tapp Road & Weimer Road (AM Peak)*	A (9.4)	–	n/a	D (28.3)	–
10. Tapp Road & Weimer Road (PM Peak)*	A (9.7)	–	n/a	F (50.5)	–
11. Tapp Road & Adams Street (AM Peak)	A (2.8)	A (2.4)	n/a	A (4.4)	A (2.8)
11. Tapp Road & Adams Street (PM Peak)	A (3.5)	A (2.6)	n/a	A (5.5)	A (3.4)
12. Tapp Road/Country Club Drive & Rockport Road (AM Peak)§	B (11.7)	B (17.0)	B (18.8)	B (15.8)	B (15.3)
12. Tapp Road/Country Club Drive & Rockport Road (PM Peak)§	B (13.7)	B (16.5)	C (21.1)	C (23.3)	B (16.7)

Scenario 1: Existing Year 2023	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
13. Country Club Drive & Rogers Street (AM Peak)	C (29.8)	C (24.1)	D (36.9)	C (26.5)	C (29.8)
13. Country Club Drive & Rogers Street (PM Peak)	C (32.7)	D (45.0)	C (33.2)	D (37.9)	D (37.8)
14. Country Club Drive/Winslow Road & Walnut Street (AM Peak)	C (21.9)	D (53.5)	C (28.0)	C (23.7)	C (30.3)
14. Country Club Drive/Winslow Road & Walnut Street (PM Peak)	C (29.5)	D (41.0)	C (32.4)	D (36.1)	C (34.9)
15. Weimer Road & Sudbury Drive (AM Peak)*	n/a	A (8.7)	–	A (7.3)	–
15. Weimer Road & Sudbury Drive (PM Peak)*	n/a	A (9)	–	A (7.4)	–
16. Weimer Road & Wapehani Road (AM Peak)*	A (9)	n/a	A (7.3)	–	–
16. Weimer Road & Wapehani Road (PM Peak)*	A (8.7)	n/a	A (7.3)	–	–
17. Allen Street & Adams Street (AM Peak)	A (8.6)	A (7.5)	A (7.9)	A (8.3)	A (8.3)
17. Allen Street & Adams Street (PM Peak)	A (9.9)	A (8.4)	A (8.3)	A (9.1)	A (9.2)
18. Allen Street & Strong Drive (AM Peak)*	A (7.3)	A (8.2)	B (11.3)	B (11.7)	–
18. Allen Street & Strong Drive (PM Peak)*	A (0)	A (7.8)	B (11.5)	B (12.2)	–
19. Patterson Drive & Allen Street (AM Peak)	D (38.9)	C (29.2)	A (7.2)	A (6.7)	B (15.1)
19. Patterson Drive & Allen Street (PM Peak)	D (42.4)	C (32.2)	A (0.9)	A (7.7)	B (14.9)
20. Patterson Drive & Fairview Street (AM Peak)†	A (5.8)	A (0.7)	D (36.1)	D (40.7)	A (4.1)
20. Patterson Drive & Fairview Street (PM Peak)†	A (8.7)	A (0.7)	D (38.2)	D (42.8)	A (8.4)
21. Patterson Drive & Rogers Street (AM Peak)	A (8.9)	C (29.3)	D (44.0)	C (27.0)	C (29.8)
21. Patterson Drive & Rogers Street (PM Peak)	B (10.3)	C (31.8)	D (36.6)	D (51.2)	C (31.8)
22. Walnut Street & Grimes Lane (AM Peak)	C (24.9)	C (27.4)	C (27.8)	C (28.0)	C (27.3)
22. Walnut Street & Grimes Lane (PM Peak)	E (64.4)	D (36.0)	C (21.2)	C (32.2)	D (35.3)
23. Rogers Street & Rockport Road (AM Peak)#	A (9.8)	A (7.4)	A (8.8)	A (7.8)	A (8.8)
23. Rogers Street & Rockport Road (PM Peak)#	B (16.2)	B (12.6)	A (6.3)	B (14.2)	B (12.8)

*For two-way stop control (TWSC), major street results are shown for left-turning movements.

†At this intersection, Allen Street was considered northbound.

‡At this intersection, Patterson Drive was considered northbound/southbound.

§At this intersection, Rockport Road was considered northbound/southbound.

||At this intersection, Patterson Drive was considered northbound/southbound.

††At this intersection, Patterson Drive was considered eastbound/westbound.

#At this intersection, Rockport Road was considered eastbound/westbound.

Note: n/a means the approach does not exist.



Figure 9: Turning Movements Scenario 1: Bloomfield Road / 2nd Street, Allen Street, and Patterson Street



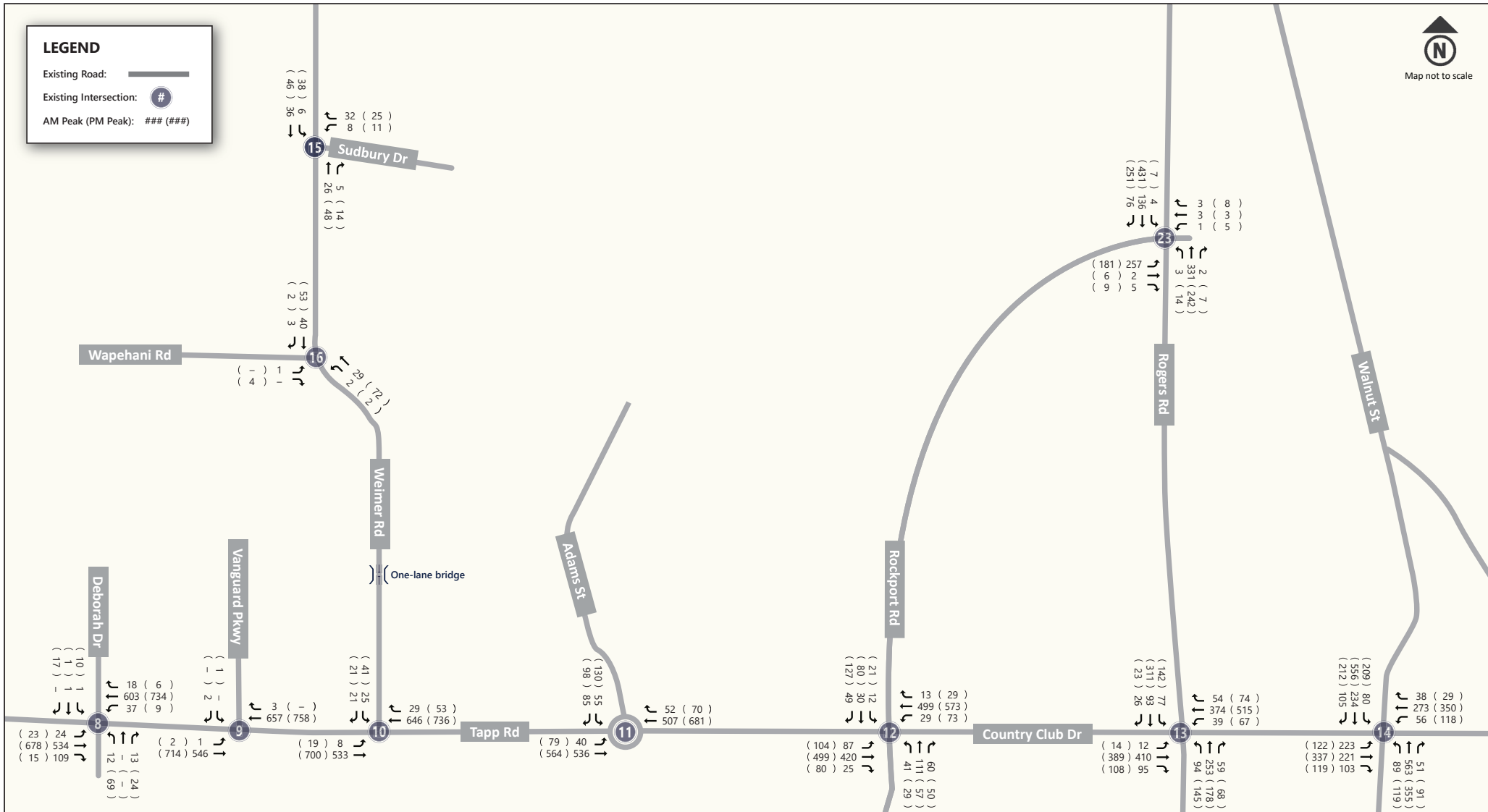


Figure 10: Turning Movements Scenario 1: Tapp Road / Country Club Drive / Winslow Road, Weimer Road, Rockport Road, Rogers Street, and Walnut Street



4.3. Scenario 2: Opening Day Background 2029 Volumes + Site Generated Trips Due to Phase 1 of the Proposed Developments Capacity Analysis

Table 6 summarizes capacity results for Scenario 2 with the following inputs:

- Existing intersection geometry (see **Section 2.2**)
- Proposed roadway connections and adjustments (see **Sections 2.4** and **3.2.1**)
- Existing signal timings provided by the City
- Opening day background 2029 volumes + site generated trips due to Phase 1 of the proposed development (see **Figure 11** and **Figure 12**)

Table 6: Intersection LOS and Delay (Sec/veh) Results – Scenario 2

Scenario 2: Opening Day 2029 - Phase 1	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
1. Bloomfield Road & Recreation Center Drive (AM Peak)*	A (9.5)	–	n/a	B (14.8)	–
1. Bloomfield Road & Recreation Center Drive (PM Peak)*	B (11)	–	n/a	A (0)	–
2. Bloomfield Road & Weimer Road (AM Peak)*	–	B (10.4)	F (88.6)	n/a	–
2. Bloomfield Road & Weimer Road (PM Peak)*	–	B (10.8)	F (107.7)	n/a	–
3. Bloomfield Road & Rolling Ridge Way (AM Peak)	B (13.8)	A (5.2)	D (50.6)	D (47.7)	B (13.9)
3. Bloomfield Road & Rolling Ridge Way (PM Peak)	B (12.5)	C (22.2)	D (47.9)	D (48.0)	C (20.3)
4. Bloomfield Road & Allen Street (AM Peak)**	A (0)	B (13)	C (22.6)	B (10)	–
4. Bloomfield Road & Allen Street (PM Peak)**	B (11.3)	A (9.6)	F (53.1)	C (24.5)	–
5. Bloomfield Road & Landmark Avenue (AM Peak)	A (6.1)	A (3.7)	D (40.7)	D (44.9)	B (10.4)
5. Bloomfield Road & Landmark Avenue (PM Peak)	A (6.2)	A (3.0)	D (38.7)	F (112.1)	C (28.9)
6. Bloomfield Road/2nd Street & Adams Street (AM Peak)	A (1.4)	A (0.8)	D (48.1)	D (38.5)	B (10.3)
6. Bloomfield Road/2nd Street & Adams Street (PM Peak)	A (1.2)	A (1.5)	D (49.0)	D (39.7)	B (10.9)
7. 2nd Street & Patterson Drive (AM Peak)‡	A (2.5)	A (1.1)	D (51.2)	D (36.9)	C (21.2)
7. 2nd Street & Patterson Drive (PM Peak)‡	A (1.9)	A (7.4)	E (59.5)	C (32.9)	C (22.6)
8. Tapp Road & Deborah Drive (AM Peak)	B (11.9)	B (11.5)	B (19.9)	B (19.9)	B (11.9)
8. Tapp Road & Deborah Drive (PM Peak)	B (14.0)	B (13.7)	C (20.7)	C (22.0)	B (14.5)
9. Tapp Road & Vanguard Parkway (AM Peak)*	A (10)	–	n/a	C (16.4)	–
9. Tapp Road & Vanguard Parkway (PM Peak)*	A (9.9)	–	n/a	E (46.9)	–
10. Tapp Road & Weimer Road (AM Peak)*	B (10.1)	–	n/a	F (94.9)	–
10. Tapp Road & Weimer Road (PM Peak)*	B (10.5)	–	n/a	F (>180)	–

Scenario 2: Opening Day 2029 - Phase 1	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
11. Tapp Road & Adams Street (AM Peak)	A (3.8)	A (2.6)	n/a	A (5.3)	A (3.6)
11. Tapp Road & Adams Street (PM Peak)	A (4.5)	A (3.9)	n/a	A (6.3)	A (4.5)
12. Tapp Road/Country Club Drive & Rockport Road (AM Peak)§	B (16.6)	C (21.5)	B (19.8)	B (16.4)	B (18.9)
12. Tapp Road/Country Club Drive & Rockport Road (PM Peak)§	B (17.5)	C (27.2)	C (21.2)	C (23.4)	C (22.6)
13. Country Club Drive & Rogers Street (AM Peak)	D (42.2)	C (25.8)	D (42.0)	C (29.2)	D (36.0)
13. Country Club Drive & Rogers Street (PM Peak)	D (42.8)	F (84.0)	D (36.5)	D (41.0)	D (54.7)
14. Country Club Drive/Winslow Road & Walnut Street (AM Peak)	C (24.1)	E (65.1)	C (29.0)	C (24.7)	C (33.6)
14. Country Club Drive/Winslow Road & Walnut Street (PM Peak)	C (33.3)	D (50.8)	C (33.2)	D (39.8)	D (39.4)
15. Weimer Road & Sudbury Drive (AM Peak)*	n/a	B (10)	–	A (7.5)	–
15. Weimer Road & Sudbury Drive (PM Peak)*	n/a	B (11.4)	–	A (8)	–
16. Weimer Road & Wapehani Road (AM Peak)*	A (9.6)	n/a	A (7.5)	–	–
16. Weimer Road & Wapehani Road (PM Peak)*	A (8.9)	n/a	A (7.4)	–	–
17. Allen Street & Adams Street (AM Peak)	B (10.3)	A (9.1)	B (10.8)	A (9.3)	B (10.2)
17. Allen Street & Adams Street (PM Peak)	B (13.6)	B (12.3)	B (11.5)	B (13.1)	B (12.7)
18. Allen Street & Strong Drive (AM Peak)*	A (7.4)	A (8.5)	B (12.4)	B (13.1)	–
18. Allen Street & Strong Drive (PM Peak)*	A (0)	A (8)	B (12.9)	B (14)	–
19. Patterson Drive & Allen Street (AM Peak)	D (37.7)	C (25.6)	C (22.4)	A (9.3)	C (23.3)
19. Patterson Drive & Allen Street (PM Peak)	D (43.2)	C (29.4)	A (1.4)	A (9.4)	B (16.2)
20. Patterson Drive & Fairview Street (AM Peak)¶	A (6.4)	A (0.8)	D (36.1)	D (40.7)	A (4.4)
20. Patterson Drive & Fairview Street (PM Peak)¶	A (9.3)	A (0.7)	D (38.2)	D (42.8)	A (8.4)
21. Patterson Drive & Rogers Street (AM Peak)	B (11.9)	C (32.4)	D (46.3)	C (26.5)	C (31.2)
21. Patterson Drive & Rogers Street (PM Peak)	B (13.1)	D (35.9)	D (36.7)	E (57.0)	C (34.9)
22. Walnut Street & Grimes Lane (AM Peak)	C (22.3)	C (27.8)	C (32.3)	C (28.8)	C (29.3)
22. Walnut Street & Grimes Lane (PM Peak)	E (69.1)	D (37.1)	C (24.9)	D (38.3)	D (39.8)
23. Rogers Street & Rockport Road (AM Peak)#	A (10.0)	A (7.4)	A (9.1)	A (8.0)	A (9.1)
23. Rogers Street & Rockport Road (PM Peak)#	B (16.6)	B (12.9)	A (6.3)	B (15.2)	B (13.5)
24. Sudbury Drive & Shasta Meadows Access (AM Peak)	–	A (7.4)	B (11.2)	n/a	–
24. Sudbury Drive & Shasta Meadows Access (PM Peak)	–	A (7.9)	B (11.9)	n/a	–

Scenario 2: Opening Day 2029 - Phase 1	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (AM Peak)	A (0)	A (7.4)	A (9.5)	A (0)	-
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (PM Peak)	A (0)	A (7.5)	A (9.9)	A (0)	-
26. Sudbury Drive & Adams Street (AM Peak)	A (4.9)	A (3)	A (2.9)	A (2.3)	A (3.2)
26. Sudbury Drive & Adams Street (PM Peak)	A (4.2)	A (2.7)	A (2.9)	A (2.3)	A (2.9)
27. Sudbury Drive & Sandia Place Access 1 (AM Peak)	-	A (0)	A (8.7)	n/a	-
27. Sudbury Drive & Sandia Place Access 1 (PM Peak)	-	A (0)	A (8.7)	n/a	-
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (AM Peak)	A (3.8)	A (5.2)	A (2.4)	A (2.2)	A (3.1)
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (PM Peak)	A (4.1)	A (5.1)	A (3.1)	A (2.4)	A (3.1)
29. Adams Street & Denali Woods Access (AM Peak)	B (11.3)	n/a	A (7.6)	-	-
29. Adams Street & Denali Woods Access (PM Peak)	B (12.2)	n/a	A (7.8)	-	-

*For two-way stop control (TWSC), major street results are shown for left-turning movements.

†At this intersection, Allen Street was considered northbound.

‡At this intersection, Patterson Drive was considered northbound/southbound.

§At this intersection, Rockport Road was considered northbound/southbound.

||At this intersection, Patterson Drive was considered northbound/southbound.

¶At this intersection, Patterson Drive was considered eastbound/westbound.

#At this intersection, Rockport Road was considered eastbound/westbound.

Note: n/a means the approach does not exist.

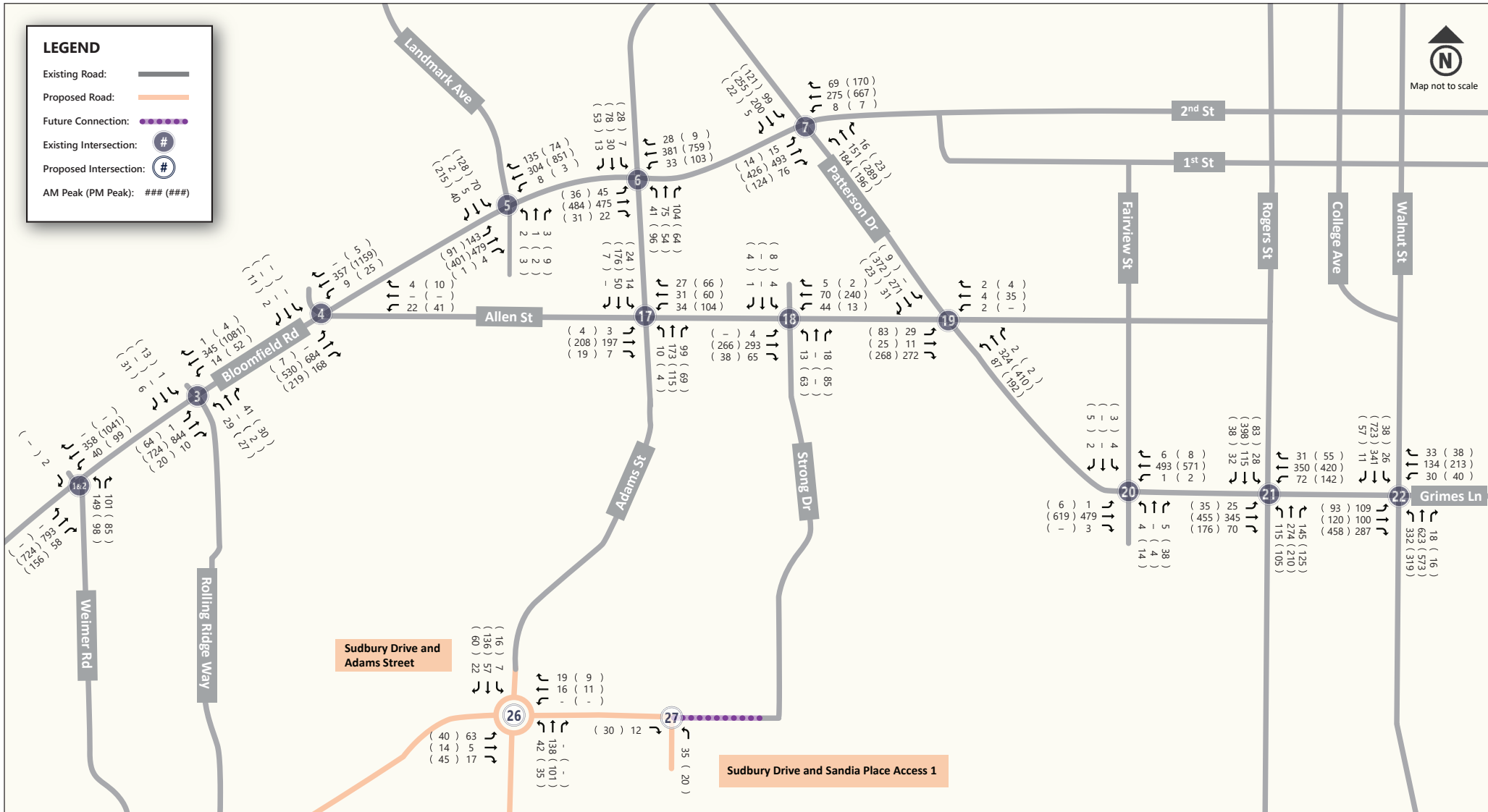


Figure 11: Turning Movements Scenario 2: Bloomfield Road / 2nd Street, Allen Street, and Patterson Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



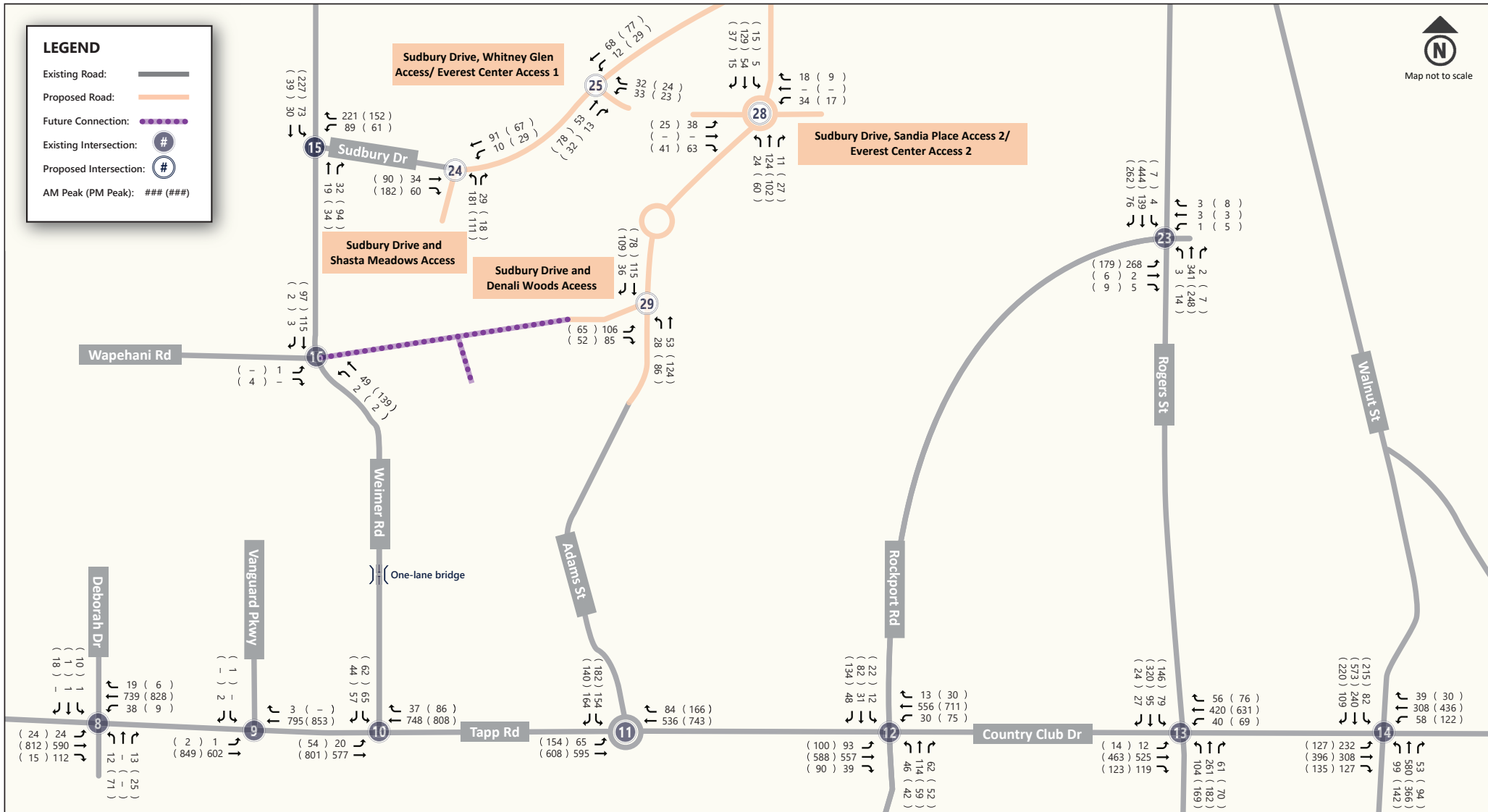


Figure 12: Turning Movements Scenario 2: Tapp Road / Country Club Drive / Winslow Road, Weimer Road, Rockport Road, Rogers Street, and Walnut Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



4.4. Scenario 3: Full Build Year Background 2034 Volumes+ Site Generated Trips Due to Phase 1 of the Proposed Developments Capacity Analysis

Table 7 summarizes capacity results for Scenario 3 with the following inputs:

- Existing signal timings provided by the City
- Existing intersection geometry (see **Section 2.2**)
- Proposed roadway connections (see **Sections 2.4** and **3.2.1**)
- Weimer Road realignment (see **Section 3.6**)
- Full build year background 2034 volumes + site generated trips due to Phase 1 of the proposed development (see **Figure 13** and **Figure 14**)

Table 7: Intersection LOS and Delay (sec/veh) Results – Scenario 3

Scenario 3: Full Build Year 2034 - Background	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
1. Bloomfield Road & Recreation Center Drive (AM Peak)*	A (9.6)	–	n/a	C (15)	–
1. Bloomfield Road & Recreation Center Drive (PM Peak)*	B (11.2)	–	n/a	A (0)	–
2. Bloomfield Road & Weimer Road (AM Peak)*	–	B (10.5)	F (97.4)	n/a	–
2. Bloomfield Road & Weimer Road (PM Peak)*	–	B (10.9)	F (120.9)	n/a	–
3. Bloomfield Road & Rolling Ridge Way (AM Peak)	B (14.7)	A (5.3)	D (50.7)	D (47.7)	B (14.6)
3. Bloomfield Road & Rolling Ridge Way (PM Peak)	B (13.0)	C (24.1)	D (48.0)	D (48.2)	C (21.5)
4. Bloomfield Road & Allen Street (AM Peak)**	A (0)	B (13.3)	C (23.7)	B (10)	–
4. Bloomfield Road & Allen Street (PM Peak)**	B (11.5)	A (9.7)	F (59.3)	D (25.9)	–
5. Bloomfield Road & Landmark Avenue (AM Peak)	A (6.5)	A (4.0)	D (40.2)	D (44.4)	B (10.7)
5. Bloomfield Road & Landmark Avenue (PM Peak)	A (6.3)	A (3.3)	D (38.7)	F (118.5)	C (30.5)
6. Bloomfield Road/2nd Street & Adams Street (AM Peak)	A (1.4)	A (0.9)	D (48.2)	D (38.4)	B (10.2)
6. Bloomfield Road/2nd Street & Adams Street (PM Peak)	A (1.3)	A (1.6)	D (49.1)	D (39.5)	B (10.8)
7. 2nd Street & Patterson Drive (AM Peak)‡	A (2.6)	A (1.4)	D (53.3)	D (36.7)	C (21.8)
7. 2nd Street & Patterson Drive (PM Peak)‡	A (2.3)	A (8.9)	E (60.2)	C (32.7)	C (23.3)
8. Tapp Road & Deborah Drive (AM Peak)	B (12.1)	B (11.7)	B (20.0)	C (20.1)	B (12.1)
8. Tapp Road & Deborah Drive (PM Peak)	B (14.1)	B (13.8)	C (21.0)	C (22.2)	B (14.7)
9. Tapp Road & Vanguard Parkway (AM Peak)*	B (10.2)	–	n/a	F (56)	–
9. Tapp Road & Vanguard Parkway (PM Peak)*	B (10.6)	–	n/a	F (130.5)	–
10. Tapp Road & Weimer Road (AM Peak)*	A (0)	–	n/a	A (0)	–
10. Tapp Road & Weimer Road (PM Peak)*	A (0)	–	n/a	A (0)	–

Scenario 3: Full Build Year 2034 - Background	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
11. Tapp Road & Adams Street (AM Peak)	A (3.8)	A (2.6)	n/a	A (5.4)	A (3.7)
11. Tapp Road & Adams Street (PM Peak)	A (4.7)	A (4.2)	n/a	A (6.5)	A (4.8)
12. Tapp Road/Country Club Drive & Rockport Road (AM Peak)§	B (17.2)	C (23.2)	C (20.1)	B (16.6)	B (19.8)
12. Tapp Road/Country Club Drive & Rockport Road (PM Peak)§	B (18.3)	C (30.2)	C (21.2)	C (23.4)	C (24.2)
13. Country Club Drive & Rogers Street (AM Peak)	D (45.7)	C (26.9)	D (43.0)	C (29.4)	D (37.8)
13. Country Club Drive & Rogers Street (PM Peak)	D (45.4)	F (96.9)	D (37.9)	D (41.8)	E (60.1)
14. Country Club Drive/Winslow Road & Walnut Street (AM Peak)	C (25.0)	E (70.1)	C (29.9)	C (25.1)	D (35.2)
14. Country Club Drive/Winslow Road & Walnut Street (PM Peak)	C (34.1)	D (52.4)	C (33.9)	D (41.5)	D (40.7)
15. Weimer Road & Sudbury Drive (AM Peak)*	n/a	B (10)	–	A (7.5)	–
15. Weimer Road & Sudbury Drive (PM Peak)*	n/a	B (11.5)	–	A (8)	–
16. Weimer Road & Wapehani Road (AM Peak)*	A (9.6)	n/a	A (7.5)	–	–
16. Weimer Road & Wapehani Road (PM Peak)*	A (8.9)	n/a	A (7.4)	–	–
17. Allen Street & Adams Street (AM Peak)	B (10.4)	A (9.1)	B (10.9)	A (9.3)	B (10.3)
17. Allen Street & Adams Street (PM Peak)	B (13.9)	B (12.5)	B (11.6)	B (13.2)	B (12.9)
18. Allen Street & Strong Drive (AM Peak)*	A (7.4)	A (8.5)	B (12.6)	B (13.2)	–
18. Allen Street & Strong Drive (PM Peak)*	A (0)	A (8)	B (13.1)	B (14.4)	–
19. Patterson Drive & Allen Street (AM Peak)	D (37.8)	C (25.4)	C (22.8)	A (9.6)	C (23.5)
19. Patterson Drive & Allen Street (PM Peak)	D (43.3)	C (29.1)	A (1.5)	A (9.6)	B (16.3)
20. Patterson Drive & Fairview Street (AM Peak)¶	A (6.5)	A (0.8)	D (36.1)	D (40.7)	A (4.5)
20. Patterson Drive & Fairview Street (PM Peak)¶	A (9.5)	A (0.7)	D (38.2)	D (42.8)	A (8.5)
21. Patterson Drive & Rogers Street (AM Peak)	B (12.2)	C (32.5)	D (49.6)	C (26.5)	C (32.5)
21. Patterson Drive & Rogers Street (PM Peak)	B (13.5)	D (36.3)	D (37.6)	E (60.5)	D (36.1)
22. Walnut Street & Grimes Lane (AM Peak)	C (22.8)	C (28.0)	C (34.3)	C (29.0)	C (30.4)
22. Walnut Street & Grimes Lane (PM Peak)	E (72.5)	D (37.5)	C (26.3)	D (40.3)	D (41.7)
23. Rogers Street & Rockport Road (AM Peak)#	B (10.1)	A (7.5)	A (9.3)	A (8.2)	A (9.2)
23. Rogers Street & Rockport Road (PM Peak)#	B (17.0)	B (13.2)	A (6.4)	B (16.8)	B (14.5)
24. Sudbury Drive & Shasta Meadows Access (AM Peak)	–	A (7.4)	B (11.2)	n/a	–
24. Sudbury Drive & Shasta Meadows Access (PM Peak)	–	A (7.9)	B (11.9)	n/a	–

Scenario 3: Full Build Year 2034 - Background	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (AM Peak)	A (0)	A (7.4)	A (9.5)	A (0)	-
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (PM Peak)	A (0)	A (7.5)	A (9.9)	A (0)	-
26. Sudbury Drive & Adams Street (AM Peak)	A (4.9)	A (3)	A (2.9)	A (2.3)	A (3.2)
26. Sudbury Drive & Adams Street (PM Peak)	A (4.2)	A (2.7)	A (2.9)	A (2.3)	A (2.9)
27. Sudbury Drive & Sandia Place Access 1 (AM Peak)	-	A (0)	A (8.7)	n/a	-
27. Sudbury Drive & Sandia Place Access 1 (PM Peak)	-	A (0)	A (8.7)	n/a	-
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (AM Peak)	A (3.8)	A (5.2)	A (2.4)	A (2.2)	A (3.1)
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (PM Peak)	A (4.1)	A (5.1)	A (3.1)	A (2.4)	A (3.1)
29. Adams Street & Denali Woods Access (AM Peak)	B (11.3)	n/a	A (7.6)	-	-
29. Adams Street & Denali Woods Access (PM Peak)	B (12.2)	n/a	A (7.8)	-	-

*For two-way stop control (TWSC), major street results are shown for left-turning movements.

†At this intersection, Allen Street was considered northbound.

‡At this intersection, Patterson Drive was considered northbound/southbound.

§At this intersection, Rockport Road was considered northbound/southbound.

||At this intersection, Patterson Drive was considered northbound/southbound.

¶At this intersection, Patterson Drive was considered eastbound/westbound.

#At this intersection, Rockport Road was considered eastbound/westbound.

Note: n/a means the approach does not exist.

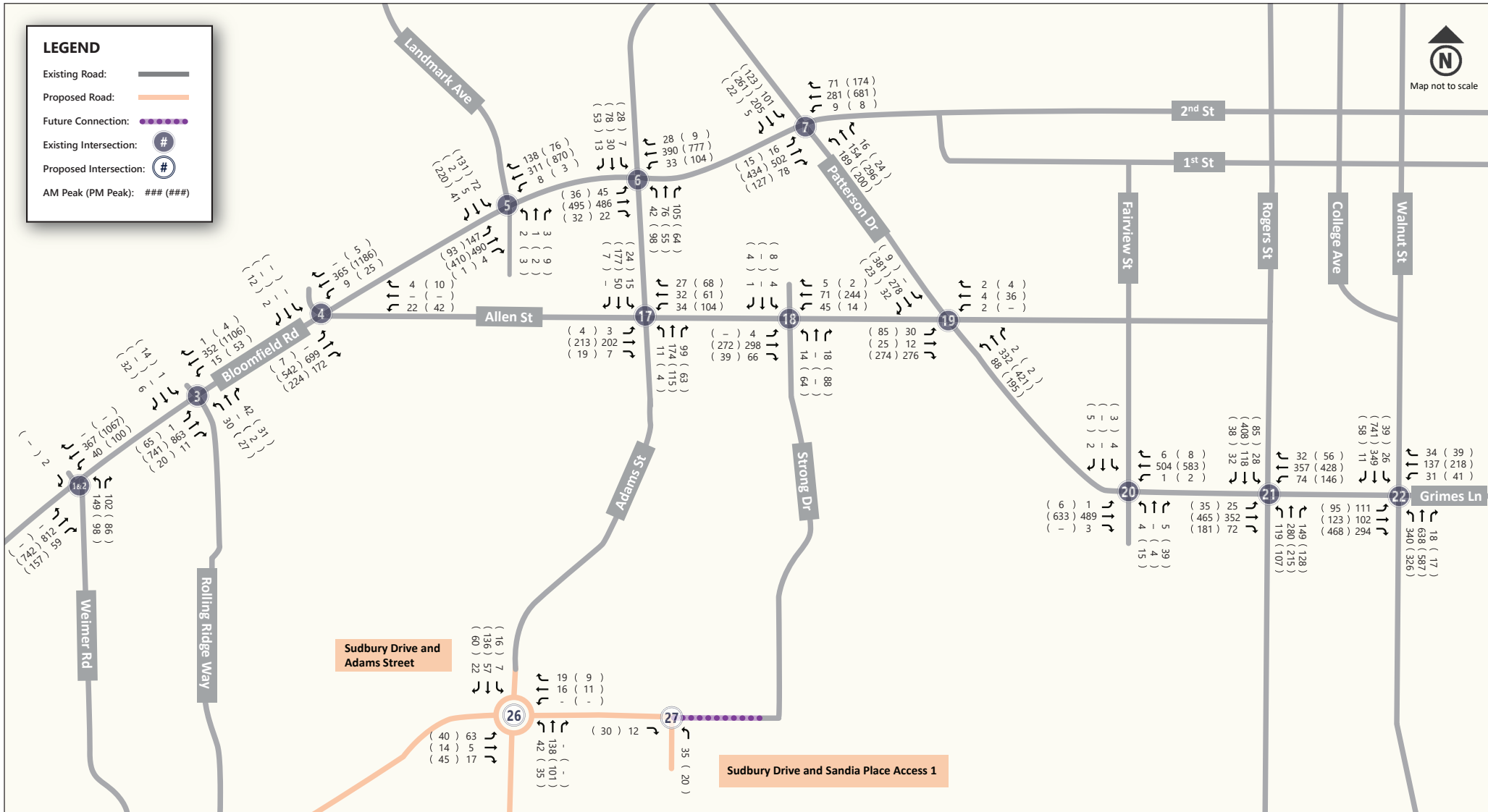


Figure 13: Turning Movements Scenario 3: Bloomfield Road / 2nd Street, Allen Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



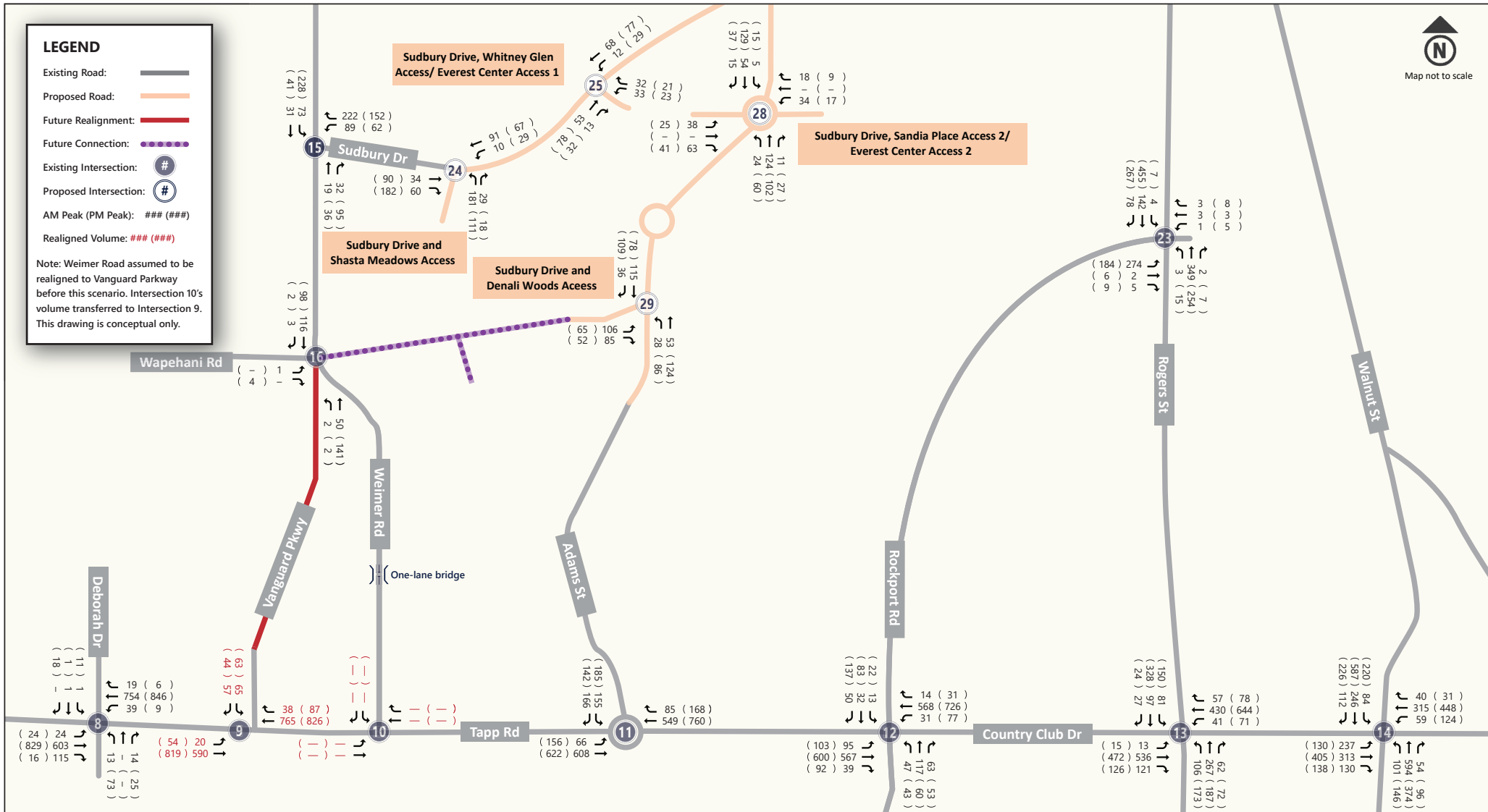


Figure 14: Turning Movements Scenario 3: Tapp Road / Country Club Drive / Winslow Road, Weimer Road, Rockport Road, Rogers Street, and Walnut Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



4.5. Scenario 4: Full Build Year Background 2034 Volumes + Site Generated Trips due to Phases 1 & 2 of the Proposed Development Capacity Analysis

Table 8 summarizes capacity results for Scenario 4 with the following inputs:

- Existing intersection geometry (see **Section 2.2**)
- Proposed roadway connections (see **Sections 2.4** and **3.2.1**)
- Weimer Road realignment (see **Section 3.6**)
- Existing signal timings provided by the City
- Full build year background 2034 volumes + site generated trips due to Phases 1 & 2 (see **Figure 15** and **Figure 16**)

Table 8: Intersection LOS and Delay (sec/veh) Results – Scenario 4

Scenario 4: Full Build Year 2034 - Phases 1 & 2	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
1. Bloomfield Road & Recreation Center Drive (AM Peak)*	B (10.4)	–	n/a	C (18)	–
1. Bloomfield Road & Recreation Center Drive (PM Peak)*	B (11.7)	–	n/a	A (0)	–
2. Bloomfield Road & Weimer Road (AM Peak)*	–	B (10.9)	F (>180)	n/a	–
2. Bloomfield Road & Weimer Road (PM Peak)*	–	B (11.9)	F (>180)	n/a	–
3. Bloomfield Road & Rolling Ridge Way (AM Peak)	B (15.0)	A (5.3)	D (50.7)	D (47.7)	B (14.8)
3. Bloomfield Road & Rolling Ridge Way (PM Peak)	B (13.1)	C (24.6)	D (48.0)	D (48.2)	C (21.8)
4. Bloomfield Road & Allen Street (AM Peak)**	A (0)	B (13.5)	C (23.8)	B (10.1)	–
4. Bloomfield Road & Allen Street (PM Peak)**	B (11.5)	A (9.8)	F (60.2)	D (26.1)	–
5. Bloomfield Road & Landmark Avenue (AM Peak)	A (6.5)	A (4.0)	D (40.2)	D (44.4)	B (10.7)
5. Bloomfield Road & Landmark Avenue (PM Peak)	A (6.3)	A (3.0)	D (38.7)	F (118.5)	C (30.4)
6. Bloomfield Road/2nd Street & Adams Street (AM Peak)	A (2.1)	A (1.2)	F (93.6)	C (31.9)	C (27.8)
6. Bloomfield Road/2nd Street & Adams Street (PM Peak)	A (1.7)	A (1.3)	F (89.3)	D (37.9)	C (20.6)
7. 2nd Street & Patterson Drive (AM Peak)‡	A (4.2)	A (1.6)	D (53.0)	D (36.7)	C (20.7)
7. 2nd Street & Patterson Drive (PM Peak)‡	A (2.9)	B (18.5)	E (60.1)	C (32.7)	C (25.8)
8. Tapp Road & Deborah Drive (AM Peak)	B (12.0)	B (12.8)	C (21.1)	C (21.2)	B (12.6)
8. Tapp Road & Deborah Drive (PM Peak)	B (14.7)	B (13.9)	C (22.5)	C (23.8)	B (15.1)
9. Tapp Road & Vanguard Parkway (AM Peak)*	B (11)	–	n/a	F (89.9)	–
9. Tapp Road & Vanguard Parkway (PM Peak)*	B (11.3)	–	n/a	F (>180)	–
10. Tapp Road & Weimer Road (AM Peak)*	A (0)	–	n/a	A (0)	–
10. Tapp Road & Weimer Road (PM Peak)*	A (0)	–	n/a	A (0)	–

Scenario 4: Full Build Year 2034 - Phases 1 & 2	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
11. Tapp Road & Adams Street (AM Peak)	A (8.2)	A (3)	n/a	A (9.2)	A (6.8)
11. Tapp Road & Adams Street (PM Peak)	A (8.7)	C (21.5)	n/a	A (9.7)	B (14.5)
12. Tapp Road/Country Club Drive & Rockport Road (AM Peak)§	D (40.2)	C (31.4)	C (20.7)	B (17.0)	C (32.8)
12. Tapp Road/Country Club Drive & Rockport Road (PM Peak)§	C (24.7)	E (70.7)	C (21.6)	C (23.4)	D (44.4)
13. Country Club Drive & Rogers Street (AM Peak)	F (101.6)	C (29.2)	D (43.1)	C (30.0)	E (59.5)
13. Country Club Drive & Rogers Street (PM Peak)	E (72.2)	F (149.0)	D (42.5)	D (42.3)	F (87.0)
14. Country Club Drive/Winslow Road & Walnut Street (AM Peak)	C (24.1)	F (91.8)	C (30.1)	C (25.6)	D (39.2)
14. Country Club Drive/Winslow Road & Walnut Street (PM Peak)	D (41.0)	E (76.3)	C (34.6)	D (44.7)	D (49.1)
15. Weimer Road & Sudbury Drive (AM Peak)*	n/a	B (11.6)	–	A (7.6)	–
15. Weimer Road & Sudbury Drive (PM Peak)*	n/a	C (16.3)	–	A (8.6)	–
16. Weimer Road & Wapehani Road (AM Peak)*	A (9.9)	n/a	A (7.5)	–	–
16. Weimer Road & Wapehani Road (PM Peak)*	A (9)	n/a	A (7.5)	–	–
17. Allen Street & Adams Street (AM Peak)	B (14.7)	B (12.9)	F (65)	B (12.8)	E (42.6)
17. Allen Street & Adams Street (PM Peak)	E (44)	F (60.4)	F (80.8)	F (125.5)	F (81.7)
18. Allen Street & Strong Drive (AM Peak)*	A (7.4)	A (9)	B (14.9)	C (16)	–
18. Allen Street & Strong Drive (PM Peak)*	A (0)	A (8.3)	C (16.3)	C (18.6)	–
19. Patterson Drive & Allen Street (AM Peak)	D (40.7)	C (21.7)	C (28.6)	B (13.9)	C (29.3)
19. Patterson Drive & Allen Street (PM Peak)	D (46.6)	C (25.9)	A (3.7)	B (11.9)	B (19.0)
20. Patterson Drive & Fairview Street (AM Peak)¶	A (7.5)	A (0.8)	D (36.1)	D (40.7)	A (5.1)
20. Patterson Drive & Fairview Street (PM Peak)¶	B (10.5)	A (0.7)	D (38.2)	D (42.8)	A (8.5)
21. Patterson Drive & Rogers Street (AM Peak)	B (15.6)	C (34.8)	D (49.6)	C (26.8)	C (32.8)
21. Patterson Drive & Rogers Street (PM Peak)	B (15.5)	D (35.7)	D (38.0)	F (82.0)	D (41.3)
22. Walnut Street & Grimes Lane (AM Peak)	C (24.7)	C (28.2)	D (38.6)	C (29.2)	C (32.9)
22. Walnut Street & Grimes Lane (PM Peak)	E (76.1)	D (38.1)	C (33.7)	E (62.5)	D (52.2)
23. Rogers Street & Rockport Road (AM Peak)#	B (10.1)	A (7.5)	A (9.3)	A (8.2)	A (9.2)
23. Rogers Street & Rockport Road (PM Peak)#	B (17.0)	B (13.2)	A (6.4)	B (16.8)	B (14.5)
24. Sudbury Drive & Shasta Meadows Access (AM Peak)	–	A (7.6)	C (15.5)	n/a	–
24. Sudbury Drive & Shasta Meadows Access (PM Peak)	–	A (8.5)	C (16.9)	n/a	–

Scenario 4: Full Build Year 2034 - Phases 1 & 2	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (AM Peak)	A (7.6)	A (7.5)	B (14)	B (14.6)	-
25. Sudbury Drive & Whitney Glen Access/Everest Center Access 1 (PM Peak)	A (7.8)	A (8)	C (17.8)	C (18.8)	-
26. Sudbury Drive & Adams Street (AM Peak)	A (5.5)	A (4.4)	A (3.9)	A (3)	A (4.2)
26. Sudbury Drive & Adams Street (PM Peak)	A (5.7)	A (3.6)	A (4.1)	A (3.2)	A (4)
27. Sudbury Drive & Sandia Place Access 1 (AM Peak)	-	A (0)	A (9.4)	n/a	-
27. Sudbury Drive & Sandia Place Access 1 (PM Peak)	-	A (0)	A (9.2)	n/a	-
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (AM Peak)	A (5)	A (6.2)	A (3.8)	A (3.4)	A (4.7)
28. Adams Street & Sandia Place Access 2/Everest Center Access 2 (PM Peak)	A (5)	A (6.3)	A (4.6)	A (4.2)	A (4.7)
29. Adams Street & Denali Woods Access (AM Peak)	C (19.1)	n/a	A (8.4)	-	-
29. Adams Street & Denali Woods Access (PM Peak)	C (20.3)	n/a	A (8.4)	-	-

*For two-way stop control (TWSC), major street results are shown for left-turning movements.

†At this intersection, Allen Street was considered northbound.

‡At this intersection, Patterson Drive was considered northbound/southbound.

§At this intersection, Rockport Road was considered northbound/southbound.

||At this intersection, Patterson Drive was considered northbound/southbound.

¶At this intersection, Patterson Drive was considered eastbound/westbound.

#At this intersection, Rockport Road was considered eastbound/westbound.

Note: n/a means the approach does not exist.

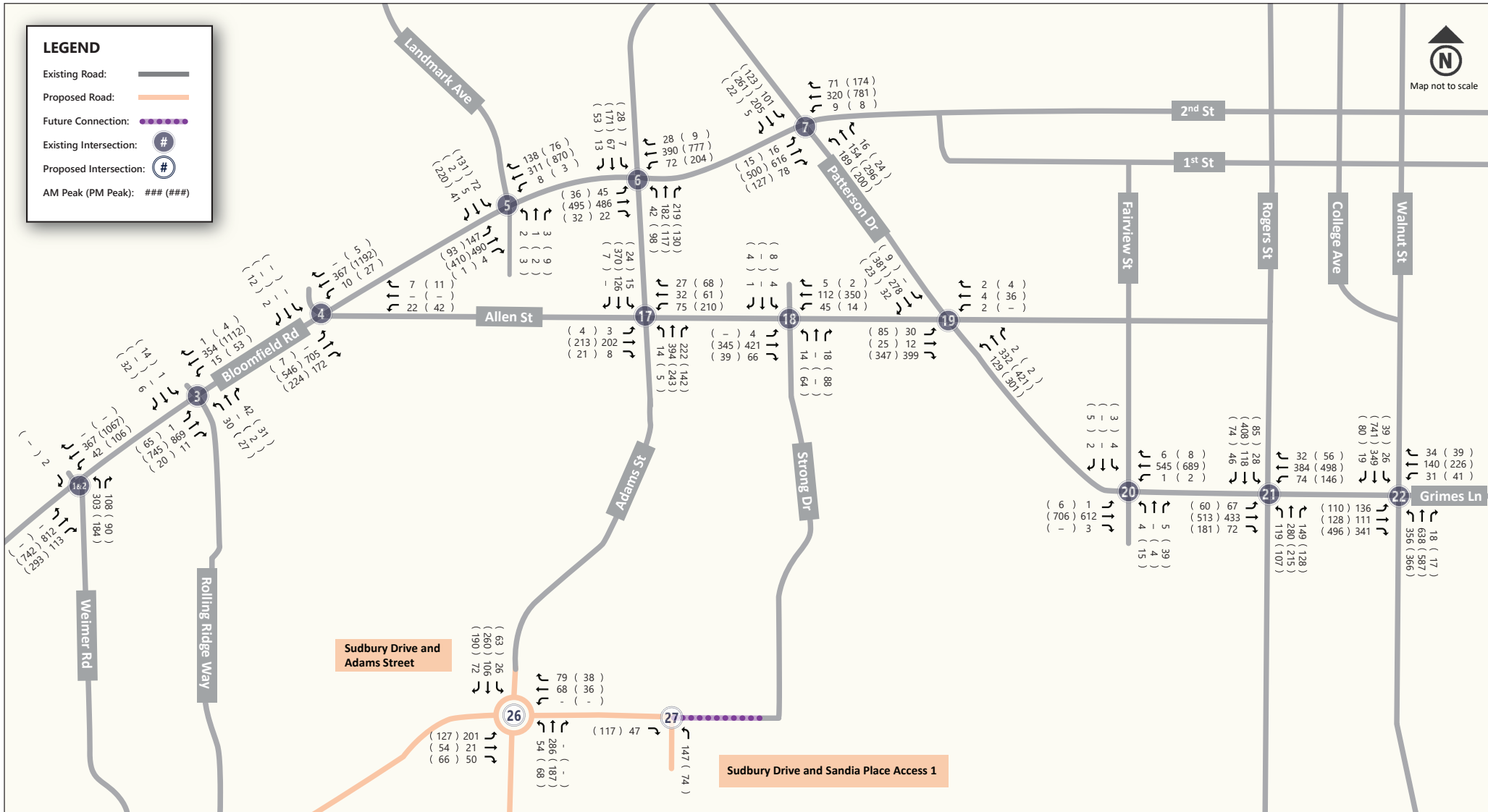


Figure 15: Turning Movements Scenario 4: Bloomfield Road / 2nd Street, Allen Street, and Patterson Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."



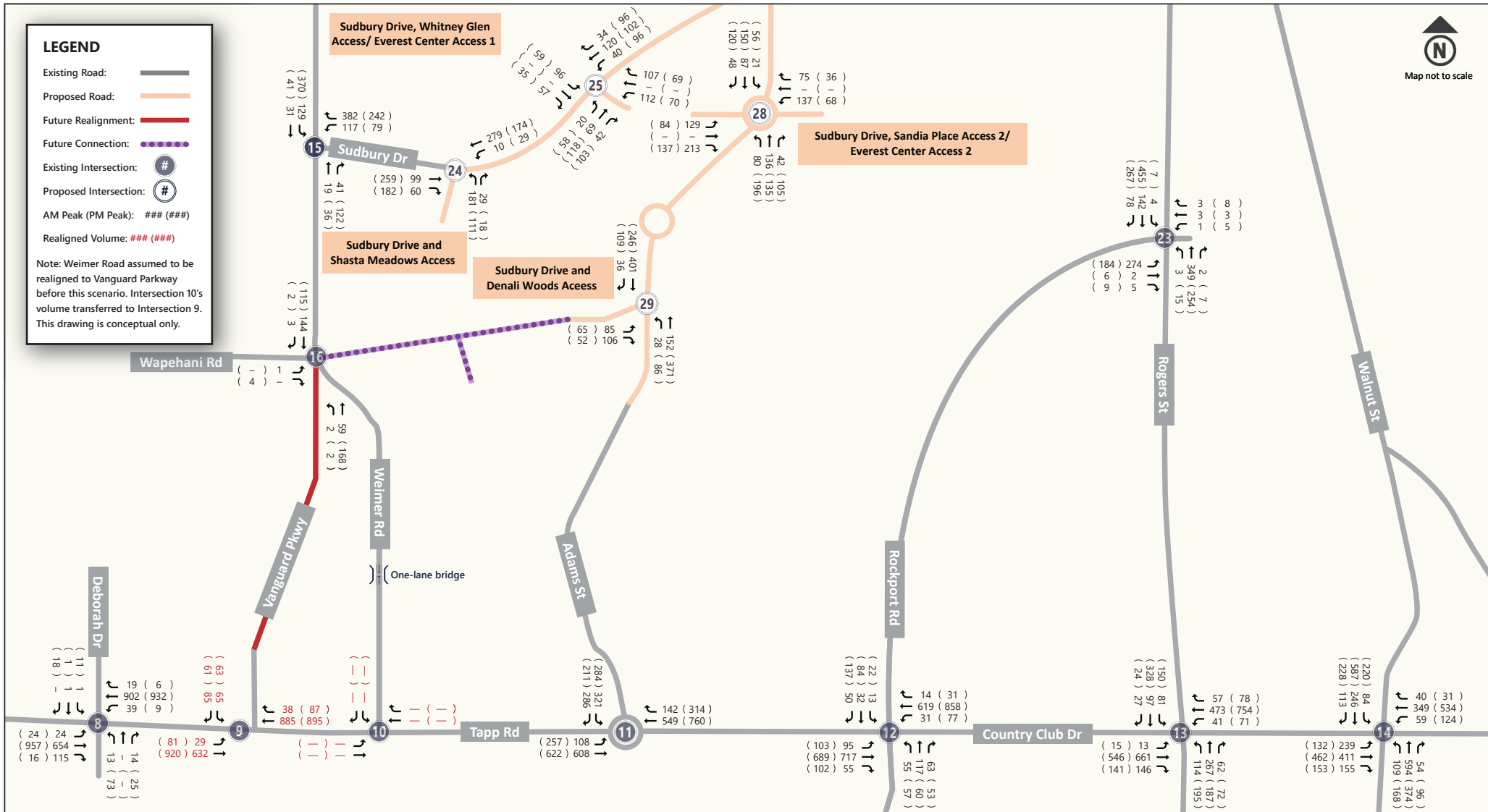


Figure 16: Turning Movements Scenario 4: Tapp Road / Country Club Drive / Winslow Road, Weimer Road, Rockport Road, Rogers Street, and Walnut Street

Disclaimer: Refer to Appendix A for the detailed internal network. The internal network is proposed to be a grid-like network. For the purposes of this study, the internal network was simplified down to 6 key internal intersections (Intersections 24-29). Traffic was not assigned to "Future Connections."

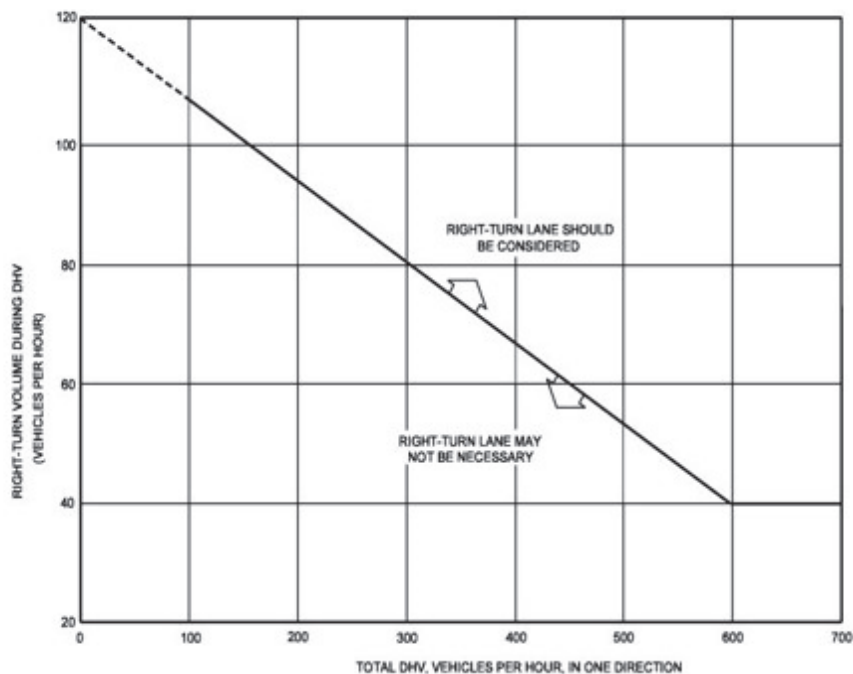


4.6. Turn Lane Warrant Analysis

Turn lane warrants were analyzed for the proposed development access points that are two-way stop-controlled intersections (TWSC). The following section discusses more.

4.6.1. Right-turn Lane Warrant

The *Indiana Design Manual (IDM)*⁷ states that a right-turn lane should be installed at an unsignalized intersection on a 2-lane urban or rural highway which satisfies the criteria shown in **Figure 17**. This applies to both Bloomfield Road and to Tapp Road/Country Club Drive/Winslow Road. It also states that a right-turn lane should be considered at an intersection where a capacity analysis determines that a right-turn lane is necessary to meet the level-of-service criteria. It also states that a right-turn lane should be considered for uniformity of intersection design along the highway if other intersections have right-turn lanes.



GUIDELINES FOR RIGHT-TURN LANES AT UNSIGNALIZED INTERSECTIONS ON 2-LANE HIGHWAYS

Figure 17: Guidelines for Right-Turn Lanes on 2-Lane Highways

4.6.2. Left-turn Lane Warrant

The *IDM*⁵ states that a left-turn lane should be constructed at an unsignalized intersection on a 2-lane urban or rural highway which satisfies the criteria shown in **Figure 18**. It also states that a left-turn lane should be considered at an intersection where a capacity analysis determines a left-turn lane is necessary to meet the level-of-service criteria.

Tapp Road operates at a speed of 30 mph which is not shown in the figure below. Since the operating speed of 30 mph is not shown in **Figure 18** the advancing volumes were interpolated.

A summary of all turn lane warrants can be found in **Table 9**. The full turn lane analysis can be found in **Appendix D**.

Operating Speed (mph)	Opposing Volume (veh/h)	Advancing Volume (veh/h)			
		5% Left Turns	10% Left Turns	20% Left Turns	30% Left Turns
40	800	330	240	180	160
	600	410	305	225	200
	400	510	380	275	245
	200	640	470	350	305
	100	720	515	390	340
50	800	280	210	165	135
	600	350	260	195	170
	400	430	320	240	210
	200	550	400	300	270
	100	615	445	335	295
60	800	230	170	125	115
	600	290	210	160	140
	400	365	270	200	175
	200	450	330	250	215
	100	505	370	275	240

VOLUME GUIDELINES FOR LEFT-TURN LANE ON TWO-LANE HIGHWAY

Figure 18: Guidelines for Left-Turn Lanes

Table 9: Turn Lane Warrant Summary

		Approach	Right-Turn Lane	Warranted Scenarios	Approach	Left-Turn Lane	Warranted Scenarios
Bloomfield Road & Weimer Road	AM Peak	East-bound	MET	Scenarios 2-4	West-bound	N/A	—
	PM Peak	East-bound	MET	Scenarios 2-4	West-bound	N/A	—
Tapp Road & Vanguard	AM Peak	West-bound	NOT MET	—	East-bound	MET	Scenarios 1-4
	PM Peak	West-bound	MET	Scenarios 3-4*	East-bound	MET	Scenarios 1-4
Weimer Road & Sudbury Drive	AM Peak	North-bound	N/A	—	South-bound	NOT MET	—
	PM Peak	North-bound	N/A	—	South-bound	MET	Scenario 4
Bloomfield Road & Allen Street	AM Peak	East-bound	MET	Scenarios 1-4	West-bound	N/A	—
	PM Peak	East-bound	MET	Scenarios 1-4	West-bound	N/A	—

Notes:

All the evaluated approaches were major approaches to two-way stop-controlled intersections.

N/A means the warrant was not evaluated because a turn lane already exists.

* Warrant MET in 3-4 because of Weimer Road realignment.

4.7. Proposed Improvements

To achieve acceptable LOS at all study intersections, improvements were identified for the full build scenario. Proposed improvements were analyzed and documented as Scenario 4A. The needed improvements are summarized in are summarized in **Table 11**, and described in **Section 4.7.1**. The capacity analysis results for the improved intersections. Full reports are available in **Appendix C**.

Table 10: Needed Improvements – By Development Phase

Existing Year 2023 — Without Development	
Intersection	Improvement
4. Bloomfield Road & Allen Street	Install EB Right- & NB Left-Turn Lanes
5. Bloomfield Road & Landmark Avenue	Adjust Signal Timings
13. Country Club Drive & Rogers Street	Adjust Signal Timings, Install WB Right-Turn Lane

Opening Day 2029 — With Phase 1 (1836 Units)	
Intersection	Improvement
2. Bloomfield Road & Weimer Road	Install Traffic Signal, Install NB Right-Turn Lane
9. Tapp Road & Vanguard Parkway*	Install Left-Turn Acceleration Lane
*Only recommended provided Weimer Road is realigned to Vanguard Parkway	

Full Build Year 2034 — With Phase 1 (1836 Units)	
Intersection	Improvement
22. Walnut Street & Grimes Lane	Adjust Signal Timings

Full Build Year 2034 — With Phases 1 & 2 (2414 Additional Units)	
Intersection	Improvement
6. Bloomfield Road/2nd Street & Adams Street	Adjust Signal Timings
12. Tapp Road/Country Club Drive & Rockport Road	Adjust Signal Timings
14. Country Club Drive/Winslow Road & Walnut Street	Adjust Signal Timings
17. Allen Street & Adams Street	Install Turn Lanes on All Approaches
21. Patterson Drive & Rogers Street	Adjust Signal Timings

4.7.1. Proposed Improvement Descriptions

Bloomfield Road & Recreation Center Drive / Weimer Road– This intersection can be improved by installing a traffic signal and a northbound right-turn lane. The available data showed that a signal may be warranted in Scenarios 2-4 based on a preliminary peak hour volume warrant. Ideally, Recreation Center Drive should align with Weimer Road.

Bloomfield Road & Allen Street– Operations at this intersection will improve if an exclusive northbound left-turn lane and an exclusive eastbound right-turn lane are added to the existing lane configuration. However, it will still operate below the acceptable level of service during the PM peak hour of all scenarios. The available data showed that a signal would likely not be warranted in any scenario.

Bloomfield Road & Landmark Street– This intersection can be improved by adjusting the traffic signal timings to give more time to the northbound and southbound phases.

Bloomfield Road/2nd Street & Adams Street– This intersection can be improved by adjusting the traffic signal timings to give more time to the northbound and southbound phases.

Tapp Road & Vanguard Parkway– This intersection can be improved by adding an exclusive eastbound left-turn lane and by allowing the southbound left-turning movement to make a two-stage turn. This could be accomplished by building a left-turn acceleration lane. In addition, the available data showed that a signal would likely not be warranted in any scenario. A roundabout would operate well at this location, however, since the adjacent intersections are signalized, a roundabout would not be the most ideal configuration.

Tapp Road/Country Club Drive & Rockport Road– This intersection can be improved by adjusting the traffic signal timings to give more time to the westbound through phase.

Country Club Drive & Rogers Street–The westbound right-turn movement at this intersection has a volume-to-capacity ratio (v/c) > 1 in the PM peak hour of Scenario 1, and the level of service is below acceptable levels during both peak hours of Scenario 4. Field observations and turn movement count videos showed that the whole westbound approach is affected, with queues spilling back to Walnut Street during every cycle for at least 15 minutes in the PM peak hour. Because the westbound approach is currently at or above capacity, the demand may not be fully reflected in the existing turn movement counts. The level of service and the delay can be improved by coordinating this intersection with Country Club Drive/Winslow Road & Walnut Street, by adjusting the traffic signal timings to give the westbound phase more time, and by adding a westbound right-turn lane.

Country Club Drive/Winslow Road & Walnut Street– This intersection can be improved by coordinating Country Club Drive & Rogers Street to match this intersection and by adjusting the traffic signal timings to give the westbound through phase more time.

Allen Street & Adams Street– This intersection can be improved by adding an exclusive northbound right-turn lane, an exclusive westbound left-turn lane, an exclusive southbound left-turn lane, and exclusive eastbound right-turn lane. However, with all turn lanes added it will still operate below the acceptable level of service. Alternatively, a future connection to Strong Drive would improve this intersection to an acceptable level of service. A signal or a roundabout at this intersection would also improve it to an acceptable level of service.

Patterson Drive & Rogers Street– This intersection can be improved by adjusting the traffic signal timings to give the southbound through phase more time.

Walnut Street & Grimes Lane– This intersection can be improved by adjusting the traffic signal timings to give the eastbound through phase more time.

Table 11: Intersection LOS and Delay (sec/veh) Results – Scenario 4A Potential Improvements

Scenario 4A: Full Build Year 2034 - Phases 1 & 2 - Improvements	Eastbound	Westbound	Northbound	Southbound	Overall Intersection
2. Bloomfield Road & Weimer Road (AM Peak)	B (17.0)	B (11.4)	D (40.5)	n/a	C (21.3)
2. Bloomfield Road & Weimer Road (PM Peak)	A (7.2)	B (10.8)	D (47.5)	n/a	B (13.8)
4. Bloomfield Road & Allen Street (AM Peak)*†	A (0)	B (13.5)	C (19.1)	B (10.1)	–
4. Bloomfield Road & Allen Street (PM Peak)*†	B (11.5)	A (9.8)	F (51.9)	D (26.1)	–
5. Bloomfield Road & Landmark Avenue (AM Peak)	A (3.7)	A (0.3)	D (46.4)	D (49.5)	A (8.7)
5. Bloomfield Road & Landmark Avenue (PM Peak)	A (8.4)	A (3.6)	C (34.5)	D (54.6)	B (16.7)
6. Bloomfield Road/2nd Street & Adams Street (AM Peak)	A (2.8)	A (2.0)	D (45.1)	D (27.1)	C (15.1)
6. Bloomfield Road/2nd Street & Adams Street (PM Peak)	A (1.9)	B (2.0)	E (50.2)	C (32.9)	C (13.8)
9. Tapp Road & Vanguard Parkway (AM Peak)*	B (11)	–	n/a	D (27.4)	–
9. Tapp Road & Vanguard Parkway (PM Peak)*	B (11.3)	–	n/a	D (30.6)	–
12. Tapp Road/Country Club Drive & Rockport Road (AM Peak)§	D (40.2)	C (31.4)	C (20.7)	B (17.0)	C (32.8)
12. Tapp Road/Country Club Drive & Rockport Road (PM Peak)§	B (16.2)	A (3.3)	D (45.4)	D (48.8)	B (16.3)
13. Country Club Drive & Rogers Street (AM Peak)	D (49.6)	C (21.4)	E (70.0)	D (39.8)	D (46.2)
13. Country Club Drive & Rogers Street (PM Peak)	C (23.9)	D (51.4)	E (72.5)	D (47.5)	D (47.3)
14. Country Club Drive/Winslow Road & Walnut Street (AM Peak)	B (17.8)	D (54.8)	D (36.6)	C (28.8)	C (32.9)
14. Country Club Drive/Winslow Road & Walnut Street (PM Peak)	D (36.9)	E (63.2)	D (38.5)	D (49.4)	D (47.6)
17. Allen Street & Adams Street (AM Peak)	C (15.1)	B (11.7)	C (21.3)	B (12.1)	C (17.8)
17. Allen Street & Adams Street (PM Peak)	D (28.3)	C (20.9)	C (21.7)	F (65.2)	E (35.6)
21. Patterson Drive & Rogers Street (AM Peak)	B (15.6)	C (34.8)	D (49.6)	C (26.8)	C (32.8)
21. Patterson Drive & Rogers Street (PM Peak)	B (16.1)	D (41.3)	D (39.8)	E (62.8)	D (39.0)
22. Walnut Street & Grimes Lane (AM Peak)	C (24.7)	C (28.2)	D (38.6)	C (29.2)	C (32.9)
22. Walnut Street & Grimes Lane (PM Peak)	E (65.1)	D (35.7)	D (40.7)	E (64.3)	D (52.7)

*For two-way stop control (TWSC), major street results are shown for left-turning movements.

†At this intersection, Allen Street was considered northbound.

§At this intersection, Rockport Road was considered northbound/southbound.

Note: n/a means the approach does not exist.

5.0 Findings & Recommendations

All six proposed internal intersections operate at or above acceptable levels of service during both peak hours of all scenarios with the proposed lane configurations. The following existing intersections operate at or above acceptable levels of service during both peak hours of all scenarios and do **not** need improvements:

- Bloomfield Road & Rolling Ridge Way
- 2nd Street & Patterson Drive
- Tapp Road & Deborah Drive
- Tapp Road & Adams Street
- Weimer Road & Sudbury Drive
- Weimer Road & Wapehani Road
- Allen Street & Strong Drive
- Patterson Drive & Allen Street
- Patterson Drive & Fairview Street
- Rogers Street & Rockport Road

The following existing intersections need improvements:

Bloomfield Road & Recreation Center Drive / Weimer Road– The northbound approach to this intersection operates below the acceptable level of service during both peak hours of Scenarios 2, 3, & 4, starting on opening day 2029 with approximately 45% of units constructed. A traffic signal may be warranted based on available data and a preliminary peak hour volume warrant once the development is approximately 45% constructed. The installation of a new **traffic signal** and the addition of a northbound **right-turn lane** are recommended. If a traffic signal is constructed, it is recommended that Weimer Road and the Recreation Center Drive align and that the signal is coordinated with others along Bloomfield.

Bloomfield Road & Allen Street– The Allen Street approach to this intersection operates below acceptable levels of service during the PM peak hour of all scenarios. Adding an exclusive **left-turn lane** to the Allen Street approach and an exclusive **right-turn lane** to the Bloomfield Road eastbound approach are recommended. With these improvements the Allen Street approach will still be below the acceptable level of service during the PM peak hour. However, the available data showed that a traffic signal would likely not be warranted in any scenario. If the demand increases significantly above what is expected in this study, a signal warrant should be evaluated.

Bloomfield Road & Landmark Street– The southbound approach to this intersection operates below acceptable levels of service in the PM peak hour during all scenarios. **Optimized signal timings** are recommended.

Bloomfield Road/2nd Street & Adams Street– This intersection operates below acceptable levels of service during both peak hours of Scenario 4 when 100% of units are constructed and with the current signal timings. **Optimized signal timings** are recommended.

Tapp Road & Vanguard Parkway– This intersection operates below acceptable levels of service during both peak hours of Scenarios 3 and 4, starting in 2034 with no more than 45% of units built and with the volume from the Weimer Road realignment. Building a **left-turn acceleration lane** for the southbound left-turning movement could improve operations by allowing left-turning vehicles to make a two-stage turn if necessary. Adding an exclusive eastbound **left-turn lane** is also recommended. These improvements should be implemented concurrently with the realignment. The available data showed that a traffic signal would likely not be warranted in any scenario. However, the installation of a traffic signal or a roundabout would improve operations at this intersection. Volumes at this intersection should be monitored and reanalyzed when the Weimer Road realignment project is constructed.

Tapp Road & Weimer Road– The southbound approach to this intersection operates below acceptable levels of service during the PM peak hour of Scenario 1 (existing 2023), and both peak hours of Scenario 2 (2029 with 45% of units constructed). However, since Weimer Road is expected to be realigned to Vanguard Parkway before Scenarios 3 and 4, **no additional improvements** at the intersection with Tapp Road are recommended.

Tapp Road/Country Club Drive & Rockport Road– The eastbound through movement has a volume-to-capacity ratio (v/c) >1 in Scenario 4, when 100% of units are built. **Optimized signal timings** are recommended.

Country Club Drive & Rogers Street– The westbound right-turning movement at this intersection has a volume-to-capacity ratio (v/c) >1 in the PM peak hour of Scenario 1 (existing 2023), and the level of service is below acceptable levels during both peak hours of Scenario 4 (2034 with 100% of units constructed). **Optimized signal timings**, coordination with Country Club Drive/Winslow Road & Walnut Street, and an exclusive westbound **right-turn lane** are recommended. After implementation of optimized traffic signal timings, this intersection should be observed for increased volume due to latent demand and signal timings should be adjusted accordingly.

Country Club Drive/Winslow Road & Walnut Street– The westbound approach to this intersection operates below the acceptable level of service in the PM peak hour during all scenarios. **Optimized signal timings** and coordinating signal timings with Country Club Drive & Rogers Street are recommended.

Allen Street & Adams Street– This intersection operates below the acceptable level of service in both peaks of Scenario 4 when 100% of units are constructed. Building an exclusive northbound **right-turn lane**, an exclusive westbound **left-turn lane**, an exclusive southbound **left-turn lane**, and exclusive eastbound **right-turn lane** are recommended. With these improvements it will still operate below the acceptable level of service during the PM peak hour. Alternatively, a future connection to Strong Drive would improve this intersection to an acceptable level of service. A signal or a roundabout at this intersection would also improve it to an acceptable level of service.

Patterson Drive & Rogers Street– The southbound approach of this intersection operates below the acceptable level of service in the PM peak hour during Scenario 4 when 100% of units are constructed. **Optimized signal timings** are recommended.

Walnut Street & Grimes Lane– The eastbound through and right-turning movements at this intersection have a volume-to-capacity ratio (v/c) > 1 in Scenarios 3 and 4, starting in 2034 with at least 45% of units constructed. **Optimized signal timings** are recommended.

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