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# South Rock Mixed-Use Development Traffic Impact Study

**Columbia, Missouri**

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# Table of Contents

# List of Figures



# List of Tables

# Executive Summary

Lochmueller Group has completed the following traffic study pertaining to the mixed-use development proposed along New Haven Road. The subject site is proposed in Columbia, Missouri, on the south side of New Haven Road, east of US 63. The project would provide for 300 multi-family units, two hotels with 125 rooms each, a 19,602 SF shopping plaza, four 3,000 SF fast-food restaurants, and one gas station/convenience store with 16 pumps.

The intent of this traffic impact study is to determine the future traffic volumes in the immediate area and the ability of the area roads to accommodate the additional traffic as well as any modifications necessary to offset the site's impacts. The following scenarios have been evaluated:

- Year 2040 No Build Conditions
- Year 2040 Forecasted Conditions (assuming development is in place)

Given the nature of the development, the traffic impact study focuses on the weekday morning and evening peak periods. Based upon the analysis of these scenarios, the following conclusions were reached:

- This study analyzed traffic for the 2040 design year. As such, the interchange of US 63 and New Haven Road is expected to be improved by the year 2040. CBB previously completed the "US 63/Route AC Interchange Conceptual Study Report" for MoDOT that evaluated several interchange configurations for US 63 and New Haven Road. It is our understanding that the configuration would result in the northbound Route 63 ramps being modified into a folded diamond concept which would provide a single free-flow ramp for the eastbound Grindstone Parkway to northbound Route 63. In addition, Lenoir Street would be relocated farther to the east along New Haven Road and would be signalized.

- In addition, as part of the reconfiguration of the US 63 and New Haven Road interchange, New Haven Road would be widened to provide for four lanes (initially New Haven Road was proposed to be widened to five lanes of traffic, as outlined in a preceding TIS from 2022). This reconfiguration would provide for one eastbound lane, one dedicated eastbound left-turn lane serving Allstate Consultant's drive and New Haven Elementary School, and two westbound lanes between US 63 and relocated Lenoir Street. East of relocated Lenoir Street, New Haven would narrow down to one lane in each direction as well as a two-way left-turn lane which would serve the relocated access drive to the Woodstock Mobile Home Community and the proposed development, after which the lanes would taper back to a two-lane roadway.

- The 2040 baseline traffic operating conditions indicated that the signalized intersection of New Haven Road and relocated Lenoir Street would operate favorably during the AM and PM peak periods with an overall LOS B and volume to capacity ratios that indicate that there is surplus capacity within the road network.

- The proposed development of 300 multi-family units, two hotels with 125 rooms each, a 19,602 SF shopping plaza, four 3,000 SF fast-food restaurants, and one gas station/convenience store with 16

pumps would generate a total of approximately 420 and 455 trips during the weekday morning and evening peak hours, respectively.

- West of Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive and one right-in only drive. East of Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive, one full access drive located opposite the relocated drive serving the mobile home community located on the north side of the roadway, and an additional right turn only drive located 225 feet further to the east. The extent access would be provided along relocated Lenoir Street is unknown at this time given it will be driven by the development as it occurs. It is our understanding that the City intends to follow the 220 to 330 feet driveway spacing suggested by MoDOT for a minor roadway. Therefore, for the purposes of this analysis three access drives were considered along relocated Lenoir Street (whereas there could be more than three in the future given the amount of frontage along the roadway). Each of the site access drives are proposed as single-lane approaches.

- Under the 2040 forecasted scenario, the study intersections would continue to operate favorably with the proposed development in place. The signalized intersection of New Haven Road and relocated Lenoir Street is expected to operate with an overall LOS C for each peak period. Each of the proposed site access drives are expected to operate favorably with a LOS C or better and queue lengths of approximately two vehicles or less in the Year 2040. In addition, the v/c ratio for each approach indicates that despite the introduction of the development's traffic, the roadway network would still have ample capacity.

- As part of the analysis, no additional right turn lanes were considered for the site access drives. The right-turn volumes into the site are minimal and easily managed by the through lanes and with channelization. From an operational standpoint, as supported by the analysis in this report, dedicated right-turn lanes were not necessary.

- All proposed intersections should conform to the sight distance requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO). Furthermore, as part of the design process, care should be given to ensure that signage and/or landscaping does not pose sight distance limitations at any of the proposed drive locations.

- As part of the improvements to the US 63 and New Haven Road interchange, sidewalks would be provided along both sides of New Haven Road within the study area. Marked crosswalks would be provided along all four legs at New Haven Road and relocated Lenoir Street along with pedestrian push buttons. It is recommended that these crosswalks be continentally stiped to enhance visibility. It is also recommended that sidewalks and continentally striped crosswalks be provided within the site. In addition, per the latest MoDOT preliminary drawings, a dedicated 6-foot (ft) bike lane would be provided along the south side of the road.

The following report outlines in detail the methodology and analysis that supports the above conclusions.

# Introduction

Lochmueller Group has prepared the following traffic study to assess traffic along New Haven Road in Columbia, Missouri assuming construction of the proposed mixed-use development, known as the South Rock subdivision, along the south side of the roadway. As part of the completion of this traffic study, Lochmueller Group reviewed a previously completed traffic study for the proposed development, dated December 2022, that was based upon MoDOT's original improvement plans for New Haven Road. In addition, the associated Synchro analysis files were provided and, ultimately, revised to reflect MoDOT's current proposal to improve New Haven Road to accommodate a four-lane section of roadway.

It is our understanding that the proposed mixed-use development would potentially consist of 300 multi-family units, two hotels with 125 rooms each, a 19,602 SF shopping plaza, four 3,000 SF fast-food restaurants, and one gas station/convenience store with 16 pumps. Lenoir Street would be relocated as part of the development to provide increased spacing with regards to the reconfigured interchange of Route AC with US 63 and would be signalized. West of relocated Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive and one right-in only drive. East of relocated Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive and one full access drive, which would be located opposite the relocated access drive serving the mobile home community on the north side of the road. In addition, there are three access drives proposed along relocated Lenoir Street.

**Figure 1** depicts the study area and the development that is under consideration. A conceptual plan for the proposed development is shown in **Figure 2.**

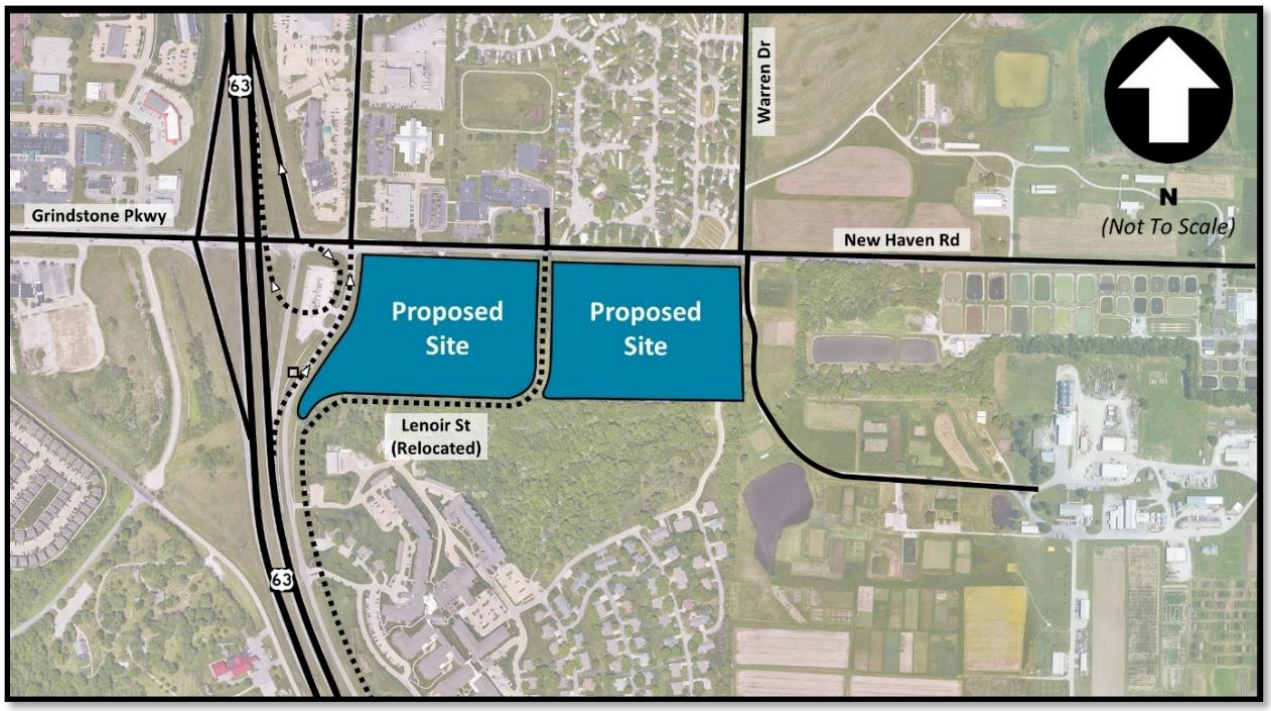


*Figure 1: South Rock Mixed-Use Development Study Area*

The intent of this traffic impact study is to determine the future traffic volumes in the immediate area assuming the proposed development is in place and assess the ability of the improved area roads to accommodate the additional traffic. When necessary, modifications required to offset the site's impacts are recommended. As such, this study evaluates conditions during the morning and evening peak periods of a typical weekday, as these periods represent the most critical times of day for traffic operations within the study area as well as the peak generation periods for the proposed uses. If traffic can be accommodated during these peak periods, it stands to reason that adequate capacity would be available throughout the remainder of the day.

Given the upcoming improvements to the Route AC/New Haven Road interchange with US 63, the study conservatively analyzed traffic for the 2040 design year using data provided in the previously completed MoDOT study "US 63/Route AC Interchange Conceptual Study Report". It is our understanding that the configuration would result in the northbound Route 63 ramps being modified into a folded diamond concept which would provide a single free-flow ramp for the eastbound Grindstone Parkway to northbound Route 63. In addition, Lenoir Street would be relocated farther to the east and would be signalized.

This study was prepared in accordance with the requirements of the City of Columbia and the Missouri Department of Transportation (MoDOT).

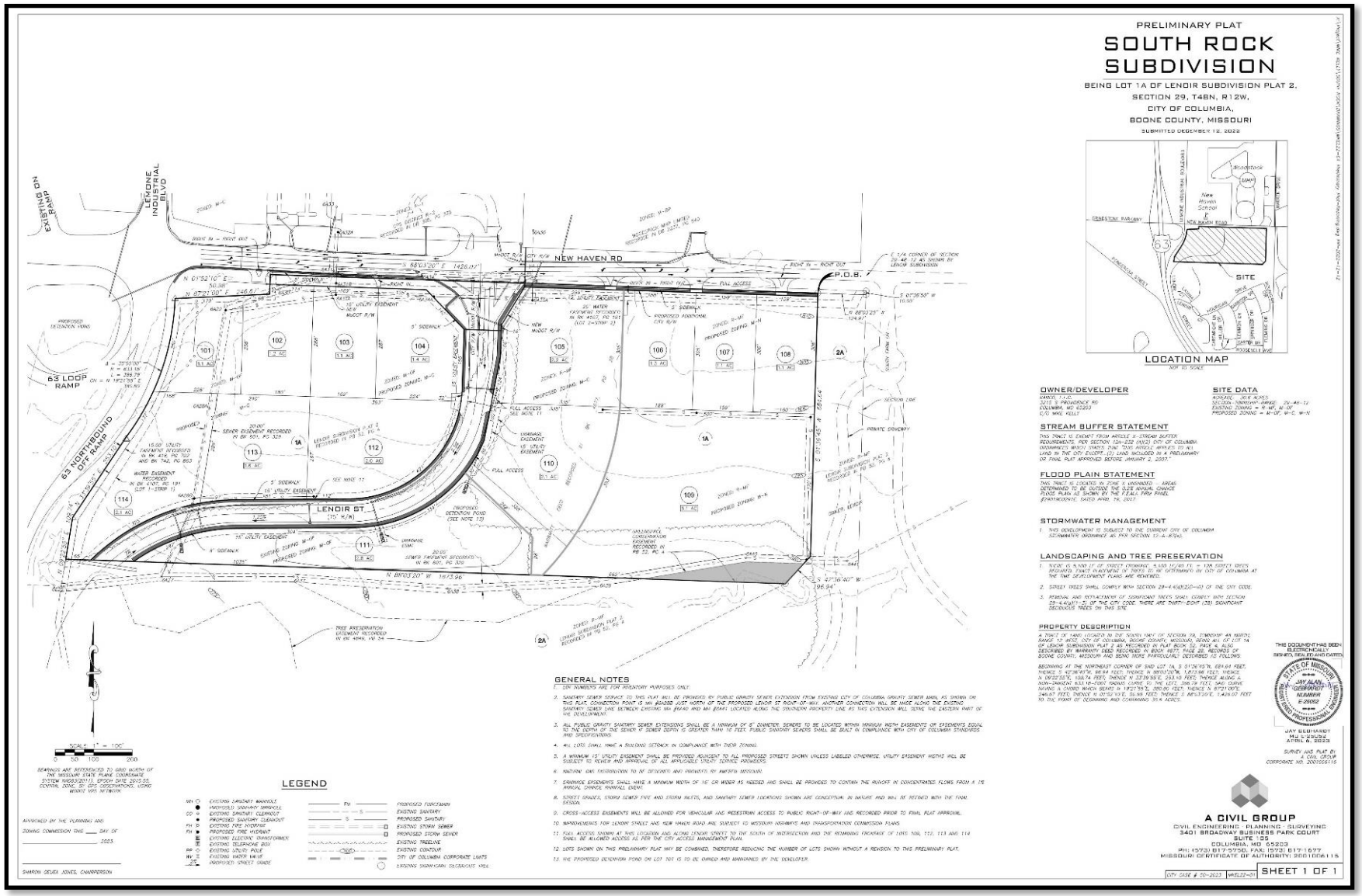


*Figure 2: Preliminary Site Plan (Provided by Others)*

## 2040 Baseline Conditions

To identify the traffic impacts associated with the proposed development, it was first necessary to quantify roadway, traffic, and operating conditions as they would exist prior to the development coming online. The reader is reminded that this analysis was completed for the 2040 baseline year given the pending improvements to the Route AC/New Haven interchange with US 63.

### Roadway Network

The study area includes several connections to the regional road system. US 63 is located directly west of the study area and is connected to the area road system via an interchange with New Haven Road.

As previously mentioned, this study analyses traffic for the 2040 design year. As such, the interchange of US 63 and Route AC/New Haven Road is expected to be improved. A previously completed study for MoDOT, "US 63/Route AC Interchange Conceptual Study Report", evaluated several interchange configurations for US 63 and Route AC/New Haven Road. It is our understanding that the configuration shown in **Figure 3** is what MoDOT intends to put in place. This configuration would result in the northbound Route 63 ramps being modified into a folded diamond concept which would provide a single free-flow ramp for the eastbound Grindstone Parkway to northbound Route 63.

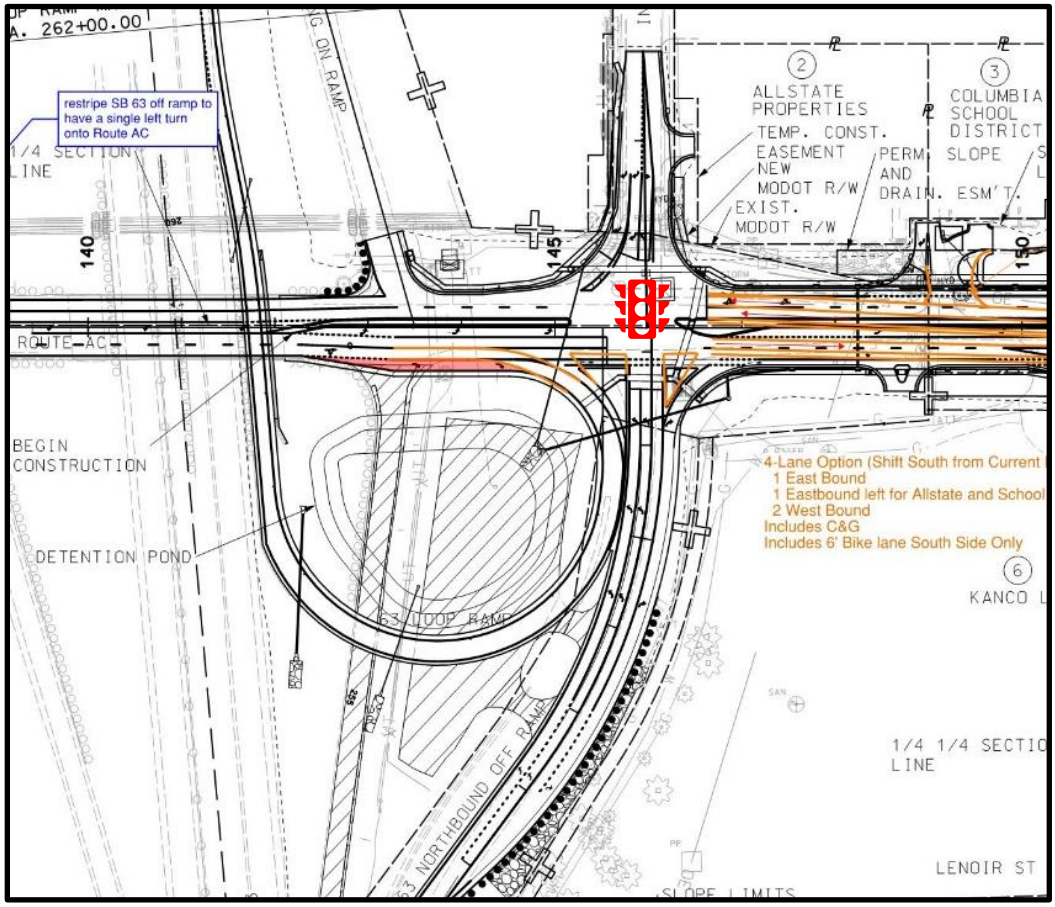


*Figure 3. Proposed US 63 and New Haven Road Interchange Reconfiguration (provided by MoDOT)*

In addition, Lenoir Street would be relocated farther to the east and would be signalized. The resulting spacing with respect to the signalized ramp terminal with US 63/Lenoir Industrial Boulevard would be approximately 850 feet (center to center). Per MoDOT's latest concept plan, four lanes would be provided on New Haven Road east of US 63. This widening would provide for one eastbound lane, one dedicated eastbound left-turn lane serving Allstate Consultant's drive and New Haven Elementary School, and two westbound lanes between US 63 and relocated Lenoir Street. East of relocated Lenoir Street, New Haven would narrow down to one lane in each direction as well as a two-way left-turn lane which would serve the relocated access drive to the Woodstock Mobile Home Community and the proposed development, after which the lanes would taper back to a two-lane roadway. A conceptual drawing of the proposed intersection provided by MoDOT, is shown in **Figure 4.**

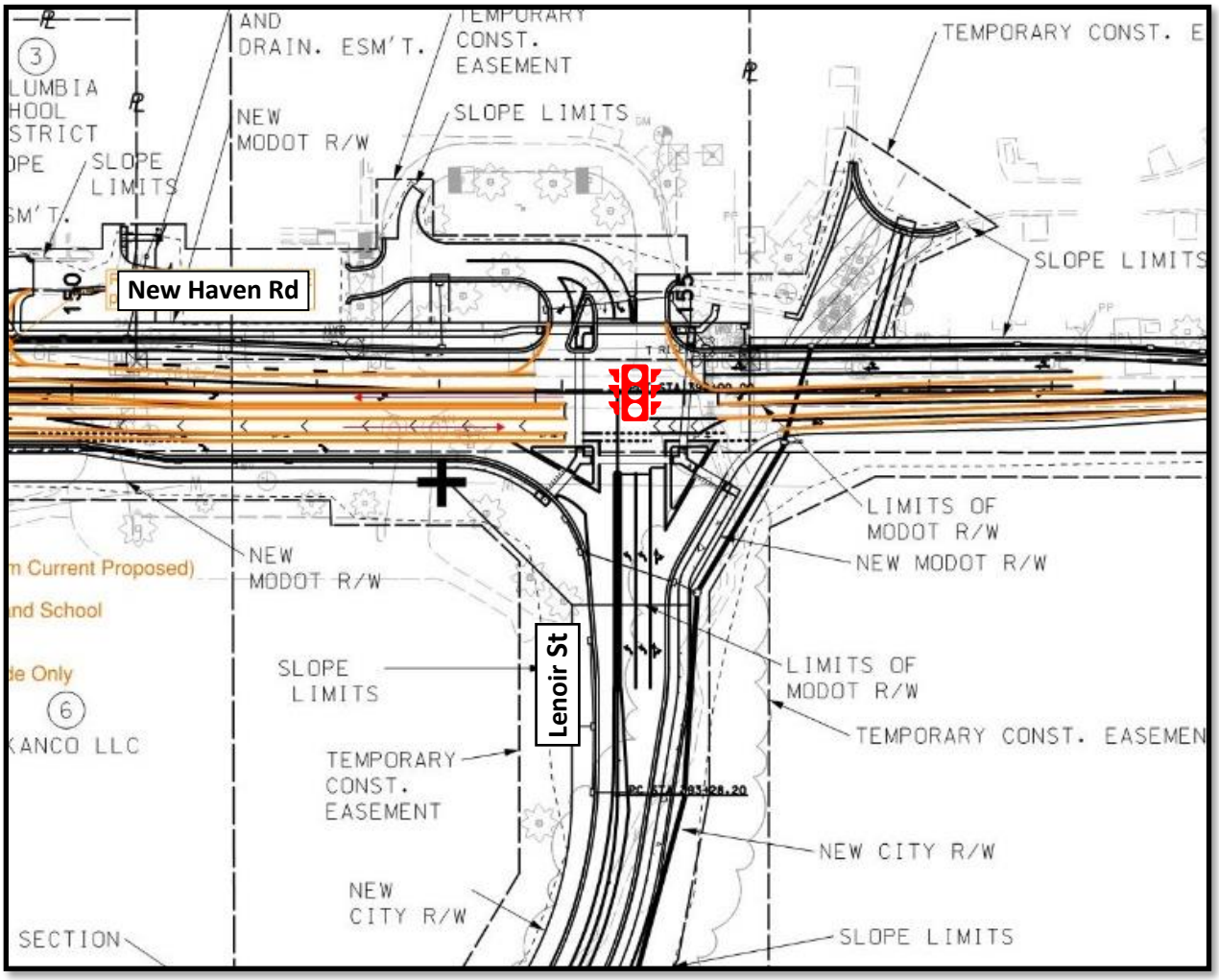


*Figure 4: Proposed Intersection Configuration for New Haven Road and Lenoir Street (provided by MoDOT)*

The study area for this traffic impact study includes the following intersections:

- New Haven Road and relocated Lenoir Street
- New Haven Road and West RIRO Site Drive
- New Haven Road and West Right-In Only Site Drive
- New Haven Road and East RIRO Site Drive
- New Haven Road and East Site Drive
- Lenoir Street and North Site Drive
- Lenoir Street and Middle Site Drive
- Lenoir Street and South Site Drive

**New Haven Road** is functionally classified as a local road with a posted speed limit of 45 miles per hour (mph). New Haven Road runs east-west within the study area and is controlled by the City of Columbia. West of its interchange with US 63, New Haven Road is known and Route AC/Grindstone Parkway, is controlled by MoDOT with a functional classification of a principal arterial.

**Lenoir Street** is functionally classified as a local road with a posted speed limit of 45 miles per hour (mph). Lenoir Street runs north-west within the study area and is controlled by the City of Columbia. North of its current intersection with New Haven Road, Lenoir Street is known as Lemone Industrial Boulevard with a functional classification of a major collector.

The proposed intersection of New Haven Road with relocated Lenoir Street would provide for one left-turn lane, one through lane, and one channelized right-turn lane for the eastbound approach. The westbound approach would be comprised of one left-turn lane and one shared through/right-turn lane. The northbound approach would be comprised of two left-turn lanes and one shared through/right-turn lane where the right turn is channelized. The southbound approach, which would serve New Haven Elementary, would be comprised of one left-turn lane and one shared through/right-turn lane where the right turn is channelized. This intersection would be signalized and part of a coordinated system with signals to the west (US 63 and Grindstone Parkway). Given that the northbound approach would provide for dual left-turn lanes, the left-turn movement is assumed to operate with protected only phasing.

**Figure 5** illustrates the existing intersection lane configurations and traffic control at the study intersections.

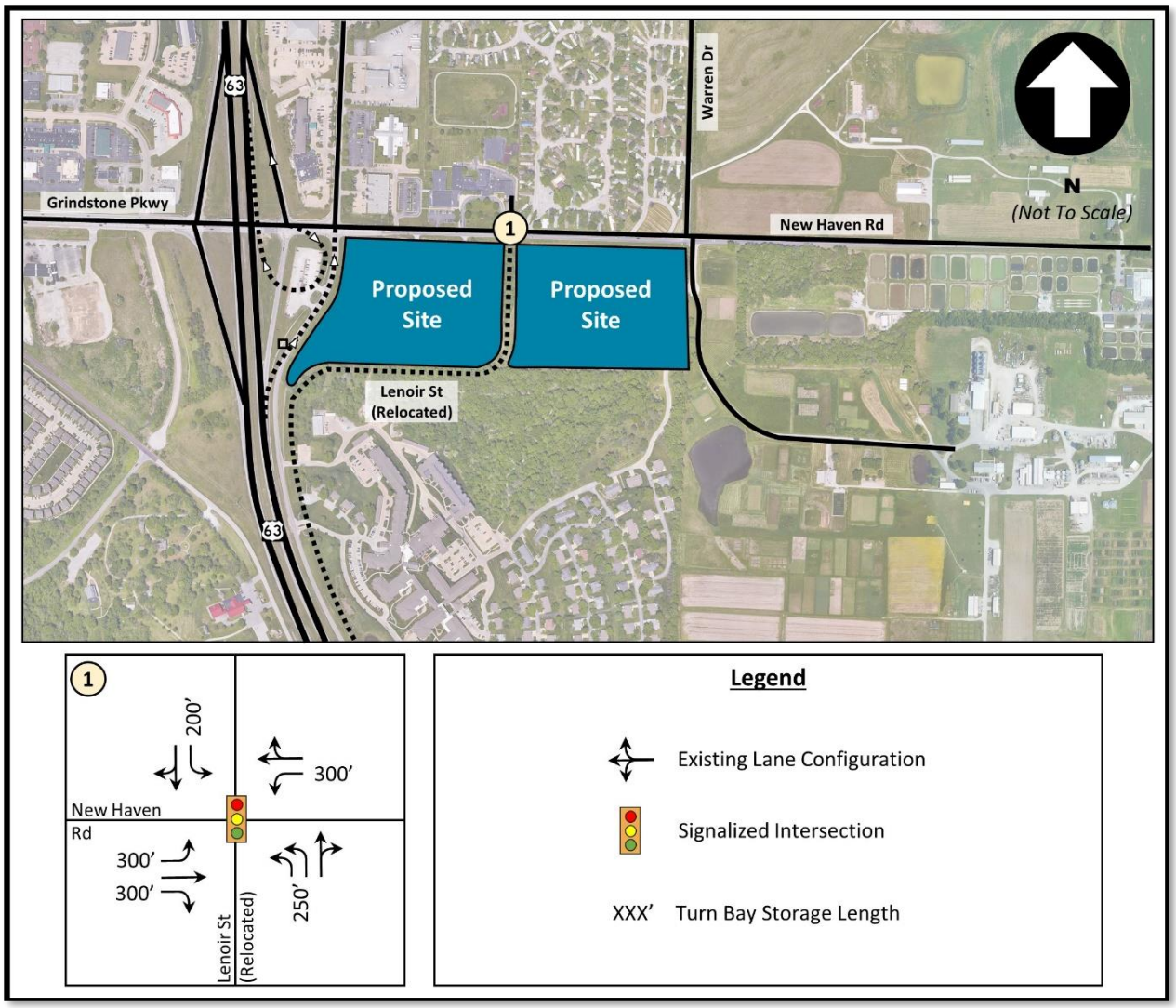


*Figure 5: Proposed Lane Configuration & Traffic Control*

## Pedestrian/Bicycle Accommodations

As part of the improvements to the US 63 and New Haven Road interchange, sidewalks would be provided along both sides of New Haven Road within the study area. Marked crosswalks would be provided along all four legs at New Haven Road and Lenoir Street along with pedestrian push buttons. In addition, per the MoDOT preliminary drawings, a dedicated 6 foot (ft) bike lane would be provided along the south side of the road.

## 2040 Baseline Traffic Volumes

Traffic volume projections were provided in the study CBB completed titled "US 63/Route AC Interchange Conceptual Study," as well as in the CBB study titled "Lenoir Tract Traffic Impact Study." These design year volumes were used as the 2040 baseline volumes for this study. It should be noted that any additional trips as a result of the proposed South Rock development contemplated in this study were not included in the baseline traffic volumes. The 2040 baseline traffic volumes are shown in **Figure 6.**

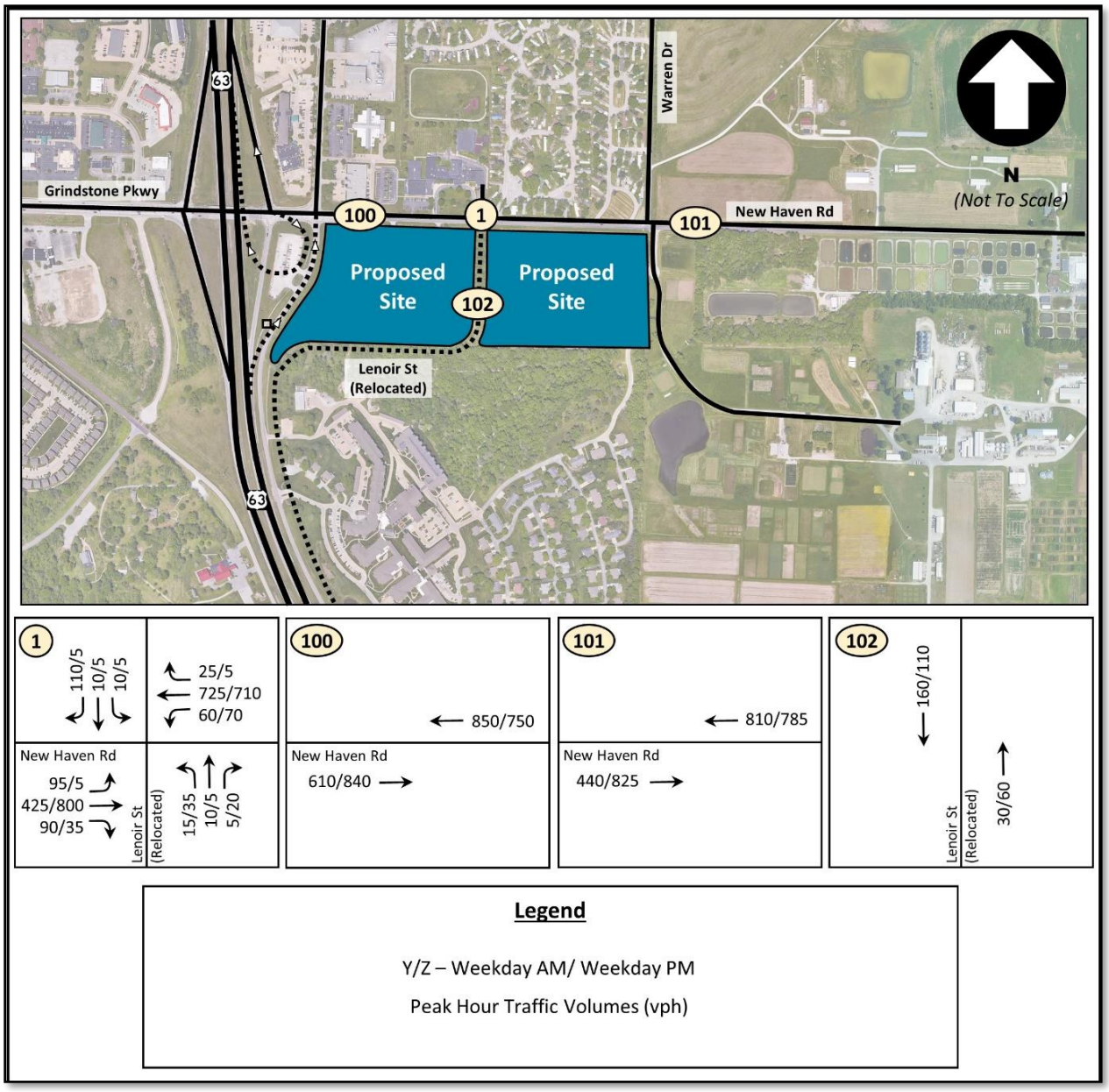


*Figure 6: Year 2040 Baseline Traffic Volumes*

## 2040 Baseline Operating Conditions

The 2040 baseline traffic operating conditions at the critical study intersections were evaluated based upon the traffic volumes presented in Figure 6. The analysis was completed using Synchro 11 traffic modeling software, which is based upon the methodologies outlined in the "Highway Capacity Manual" (HCM) published by the Transportation Research Board.

Intersection performance or traffic operations are quantified by six Levels of Service (LOS), which range from LOS A ("Free Flow") to LOS F ("Fully Saturated"). LOS C is normally used for design purposes and represents a roadway with volumes ranging from 70% to 80% of its capacity. LOS D is considered

acceptable for peak period conditions in urban and suburban areas and would be an appropriate benchmark of acceptable traffic for the study area road system.

Levels of service for intersections are determined based on the average delay experienced by motorists. Signalized intersections reflect higher delay tolerances as compared to unsignalized and roundabout locations because motorists are accustomed to and accepting of longer delays at signals. For signalized and all-way stop intersections, the average control delay per vehicle is estimated for each movement and then aggregated for each approach and the intersection as a whole. For intersections with partial (side-street) stop control, the delay is calculated for the minor movements only (side-street approaches and major road left-turns) since thru traffic on the major road is not required to stop.

**Table 1** summarizes the criterion for both signalized and unsignalized intersections, as defined by the Highway Capacity Manual (HCM) 6th Edition, last updated in 2016 by the Transportation Research Board.

*Table 1: Intersection Level of Service Thresholds*

| Level of Service | Control Delay per Vehicle (sec/veh) | |
|---|---|---|
| | Signalized | Unsignalized |
| **A** | ≤ 10 | 0-10 |
| **B** | > 10-20 | > 10-15 |
| **C** | > 20-35 | > 15-25 |
| **D** | > 35-55 | > 25-35 |
| **E** | > 55-80 | > 35-50 |
| **F** | > 80 | > 50 |

Operating conditions at the study intersections were evaluated using Synchro 11 and are summarized in **Table 2**. The measures of effectiveness reported include LOS, delay, queue, and volume-to-capacity ratio (v/c). The delay is reported in seconds per vehicle. The queue is reported in feet as the 95th percentile queue. The v/c ratio compares vehicle demand to the capacity of an associated lane group. A v/c ratio of 1.0 represents a road segment that is at full capacity.

*Table 2: Year 2040 Baseline Traffic Operating Conditions*

| Intersection & Movements | LOS (Delay, sec) [Queue Length$^{\text{Reporting Lane}}$, feet] <v/c ratio> | |
|---|---|---|
| | AM Peak Hour | PM Peak Hour |
| ***New Haven Road and Relocated Lenoir Street (Signalized)*** | | |
| **Overall** | **B (14.9)** | **B (13.9)** |
| Eastbound Approach | A (9.1) [266$^{T}$] <0.48> | B (15.0) [672$^{T}$] <0.65> |
| Westbound Approach | B (14.9) [651$^{T}$] <0.65> | A (8.9) [529$^{T}$] <0.52> |
| Northbound Approach | E (56.9) [34$^{T}$] <0.12> | D (49.7) [36$^{T}$] <0.22> |
| Southbound Approach | C (26.3) [<25] <0.73> | D (44.9) [<25] <0.15> |

Delay presented in vehicles per second

As shown, the signalized intersection of New Haven Road and relocated Lenoir Street is expected to operate favorably during the 2040 baseline AM and PM peak periods with a LOS B overall during both peak periods. The 95$^{th}$ percentile queue length for the eastbound approach is expected to be contained within the lane and would not impact other access drives. The queue length for the westbound approach would not be expected to extend into the new interchange at US 63. The queue lengths for the northbound and southbound approaches are expected to be minimal at two cars or less. Each approach is expected to have ample capacity with a v/c ratio of 0.73 or less for each approach.

# Proposed Development

The proposed mixed-use development would be located along the south side of New Haven Road. It is our understanding that the mixed-use development would consist of 300 multi-family units, two hotels with 125 rooms each, a 19,602 SF shopping plaza, four 3,000 SF fast-food restaurants, and one gas station/convenience store with 16 pumps.

West of Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive and one right-in only drive. East of Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive, one full access drive located opposite the relocated drive serving the mobile home community located on the north side of the roadway, and an additional right turn only drive located 225 feet further to the east.

The extent access would be provided along relocated Lenoir Street is unknown at this time given it would be driven by development as it occurs. It is our understanding that the City intends to follow the 220 to 330 feet driveway spacing suggested by MoDOT for a minor roadway. Therefore, for the purposes of this study, three access drives were considered along relocated Lenoir Street (whereas there could be more than three in the future given the amount of frontage along the roadway). Each of the site access drives are proposed as single-lane approaches.

## Trip Generation

In forecasting the proposed use's impacts upon traffic conditions, it was necessary to identify the site's trip generation potential, as any impacts to the surrounding road system would be tied to the net increase in trip generation.

The site-generated traffic volumes for the proposed development were estimated using data provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 11th Edition. The following land uses were used:

- LUC 220: Multifamily Housing (Low-Rise)
- LUC 310: Hotel
- LUC 822: Strip Retail Plaza (>40)
- LUC 934: Fast-Food Restaurant with Drive-Through Window
- LUC 945: Gasoline Station with Convenience Store (2-4 kSF)

Due to the nature of the proposed development as a mixed-use site, it is reasonable to conceive that some vehicles, attracted to the site by one land use, would visit other uses within the development before exiting the site. This vehicle behavior is captured in the operational analysis through an internal capture rate. The internal capture reduction for the proposed commercial development was calculated based upon the NCHRP Report 684: Enhancing *Internal Trip Capture Estimation for Mixed-Use Developments* (2011). This report provides an improved methodology to estimate how many internal trips will be generated in mixed-use developments—trips for which both the origin and destination are within the development (NCHRP Report 684 is attached for reference).

The internal capture rate is broken down between entering and exiting trips for the weekday morning and evening peak hours. Using this report, internal capture rates were calculated based on the time of day and presented in **Table 3.** As shown, while the NCHRP calculated values resulted in an internal capture rate of 17% for the AM peak period and 28% for the PM peak period, in order to be conservative, internal capture rates of 15% and 25% were used for the AM and PM peak periods, respectively.

*Table 3. Internal Capture Rates by Time of Day*

| | Weekday AM Peak Hour | | Weekday PM Peak Hour | |
|---|---|---|---|---|
| | Entering | Exiting | Entering | Exiting |
| NCHRP Internal Capture Calculated Rates | 17% | 17% | 28% | 28% |
| Internal Capture Rates used in TIS | 15% | 15% | 25% | 25% |

It should be also emphasized that not all the trips generated by the proposed development would be new to the transportation network. Rather, a portion of the trips would be attracted to the proposed mixed-use development as part of an existing trip to another destination. Studies indicate that convenience-oriented uses such as banks and restaurants attract a sizable amount of "pass-by trips". These trips are already traveling past the site on the adjoining public roadways and would turn into the site to patronize the proposed development before continuing to a different destination. The trips would generate turning movements at the proposed site access driveways but would not represent new trips to the surrounding roadway system.

The Trip Generation Manual, published by ITE, provides pass-by trip percentages for the uses contemplated within this development and are summarized in **Table 4.** It should be noted that the blue italicized value for the weekday AM peak hour for LUC 822: Strip Retail Plaza was derived using the pass-by percentages for similar uses and time periods as specific data was not available.

*Table 4. ITE Pass-By Rates*

| Land Use | Weekday AM Peak Hour | Weekday PM Peak Hour |
|---|---|---|
| LUC 822: Strip Retail Plaza (>40) | *10%* | 40% |
| LUC 934: Fast-Food Restaurant with Drive-Through Window | 50% | 55% |
| LUC 945: Gasoline Station with Convenience Store (2-4 kSF) | 70% | 75% |

The forecasted trips that would be generated by proposed mixed-use development, accounting for internal and pass-by trips, are summarized in **Table 5.** As shown, the proposed development would contribute a total of approximately 420 and 455 new trips during the weekday morning and evening peak hours, respectively.

*Table 5. South Rock Mixed-Use Development Trip Generation Estimate*

| Land Use | LUC | Size | Weekday AM Peak Hour | | | Weekday PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|
| | | | In | Out | Total | In | Out | Total |
| Multifamily Housing (Low-Rise) | 220 | 300 units | 30 | 90 | 120 | 95 | 55 | 150 |
| Hotel | 310 | 125 rooms | 30 | 25 | 55 | 35 | 30 | 65 |
| Hotel | 310 | 125 rooms | 30 | 25 | 55 | 35 | 30 | 65 |
| Strip Retail Plaza | 822 | 19.6 kSF | 30 | 20 | 50 | 65 | 65 | 130 |
| Fast-Food Restaurant with Drive-Through | 934 | 3 kSF | - | - | - | 50 | 50 | 100 |
| Fast-Food Restaurant with Drive-Through | 934 | 3 kSF | - | - | - | 50 | 50 | 100 |
| Fast-Food Restaurant with Drive-Through | 934 | 3 kSF | 70 | 65 | 135 | 50 | 50 | 100 |
| Fast-Food Restaurant with Drive-Through | 934 | 3 kSF | 70 | 65 | 135 | 50 | 50 | 100 |
| Gasoline Station with Convenience Store (2-4 kSF) | 945 | 16 Pumps | 130 | 130 | 260 | 145 | 145 | 290 |
| **Gross Total Vehicular Trips** | | | **390** | **420** | **810** | **575** | **525** | **1,100** |
| *Internal Capture Reduction* **See Note* | | | *-60* | *-60* | *-120* | *-145* | *-130* | *-275* |
| **Net Total Vehicular Trips - Less Internal Capture** | | | **330** | **360** | **690** | **430** | **395** | **825** |
| *Total Pass-by Trips* ***See Note* | | | *135* | *135* | *270* | *185* | *185* | *370* |
| **Total New Trips** | | | **195** | **225** | **420** | **245** | **210** | **455** |

*Internal capture rates per Table 3 / NCHRP Report

**Pass-by rates per Table 4 / ITE Trip Generation Manual

## Directional Distribution

The development's trip generation would be assigned to the study area roadways in accordance with an anticipated directional distribution that reflects prevailing traffic patterns as well as the anticipated commuter routes for residents. The proposed directional distribution percentages for site generated trips are presented in **Table 6** and shown in **Figure 7.** The resulting site generated traffic for the development is reflected in **Figure 8.**

*Table 6: South Rock Mixed-Use Development Directional Distribution Percentages*

| Routes To & From | Percentage |
|---|---|
| New Haven Road to/from West | 65% |
| New Haven Road to/from East | 25% |
| Lenoir Street to/from South | 10% |

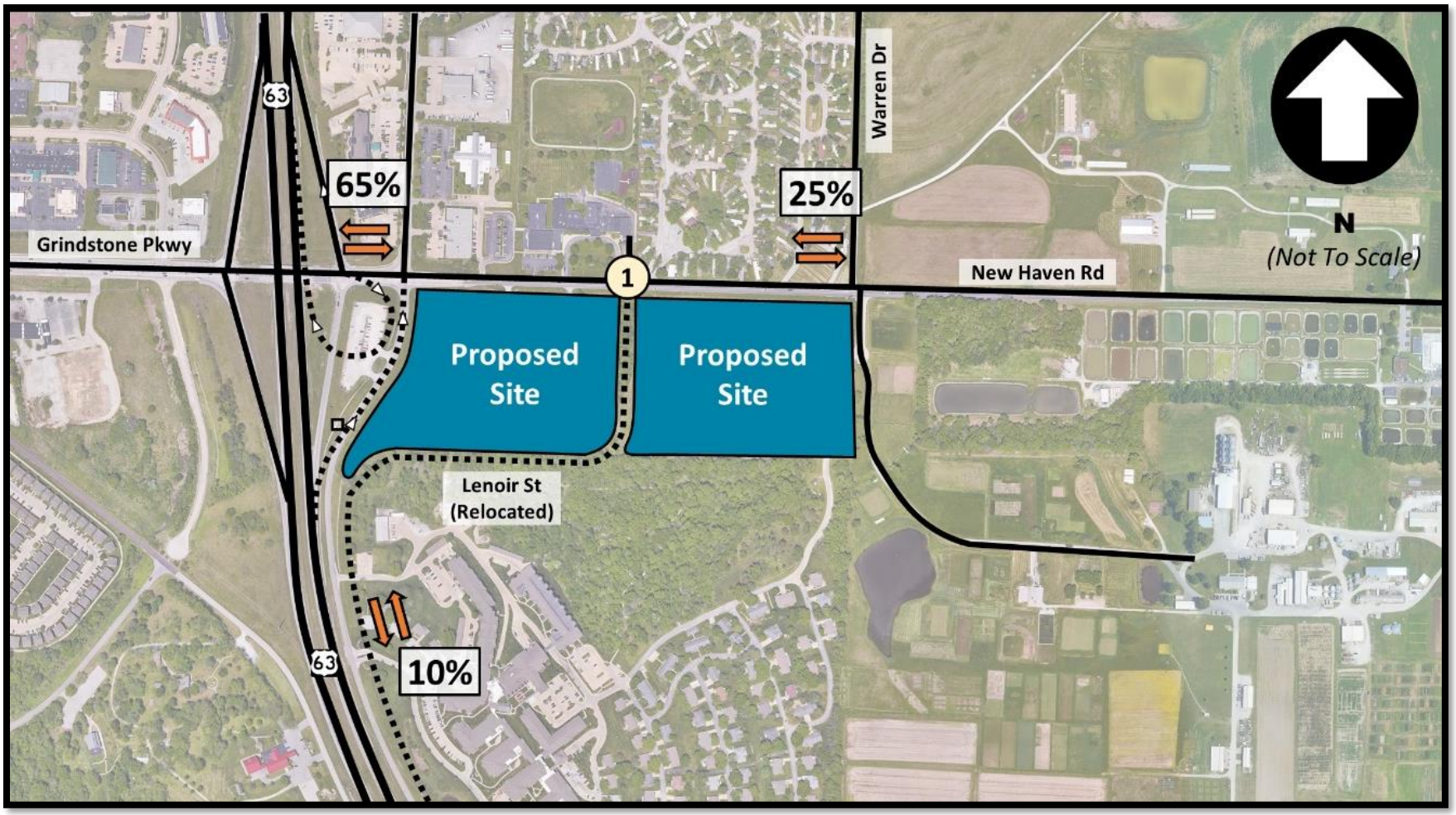


*Figure 7: South Rock Mixed-Use Development Directional Distribution*

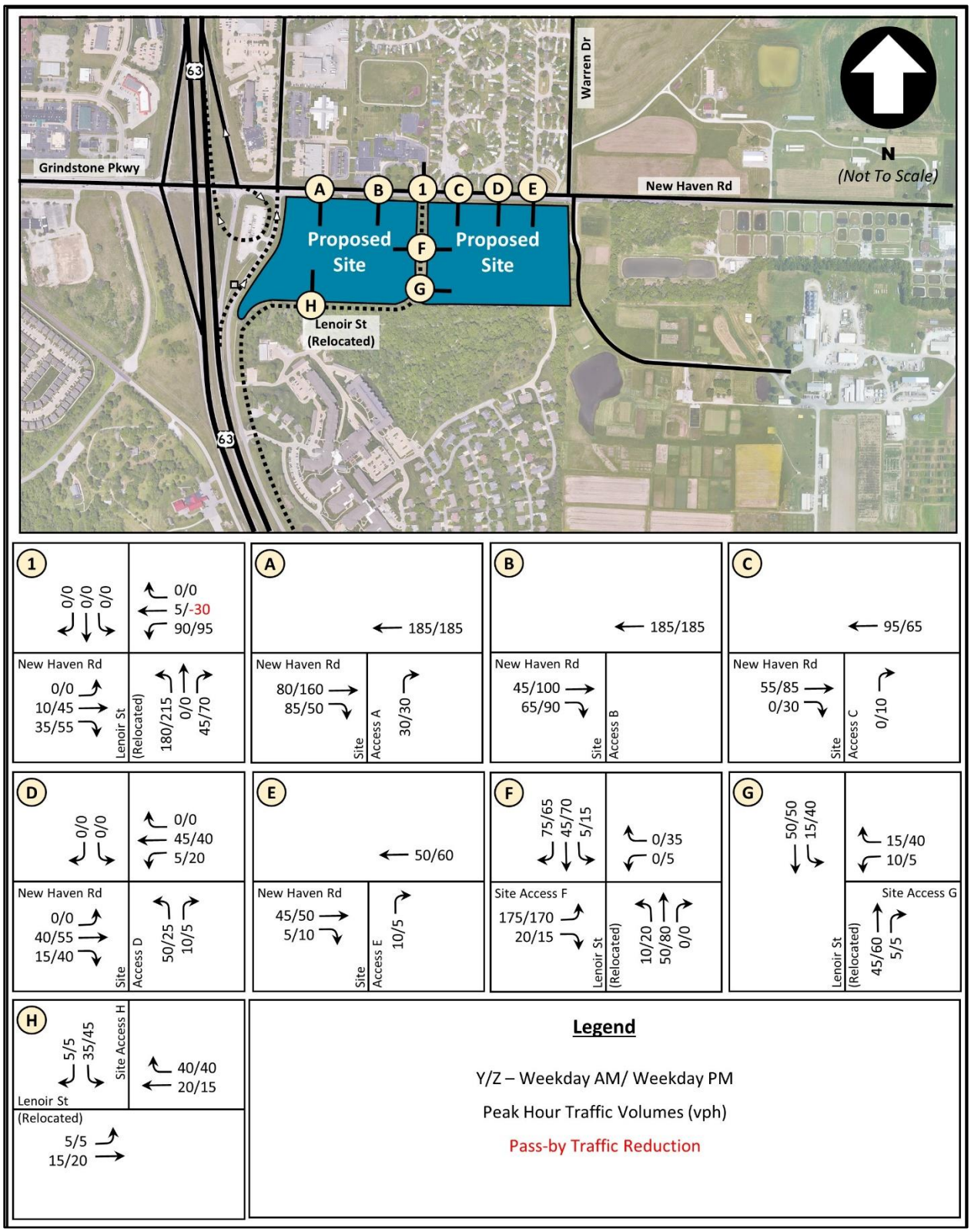


*Figure 8: South Rock Mixed-Use Development Site Generated Traffic Volumes*

# Year 2040 Forecasted Conditions

The 2040 forecasted scenario represents conditions in 2040 with the proposed mixed-use development in place and fully occupied. Forecasted operating conditions were evaluated using the same methodology applied to existing conditions.

## Forecasted Traffic Volumes

The site generated traffic, shown in Figure 8, was aggregated with existing traffic volumes (Figure 6) to produce the 2040 traffic forecast shown in **Figure 9**.

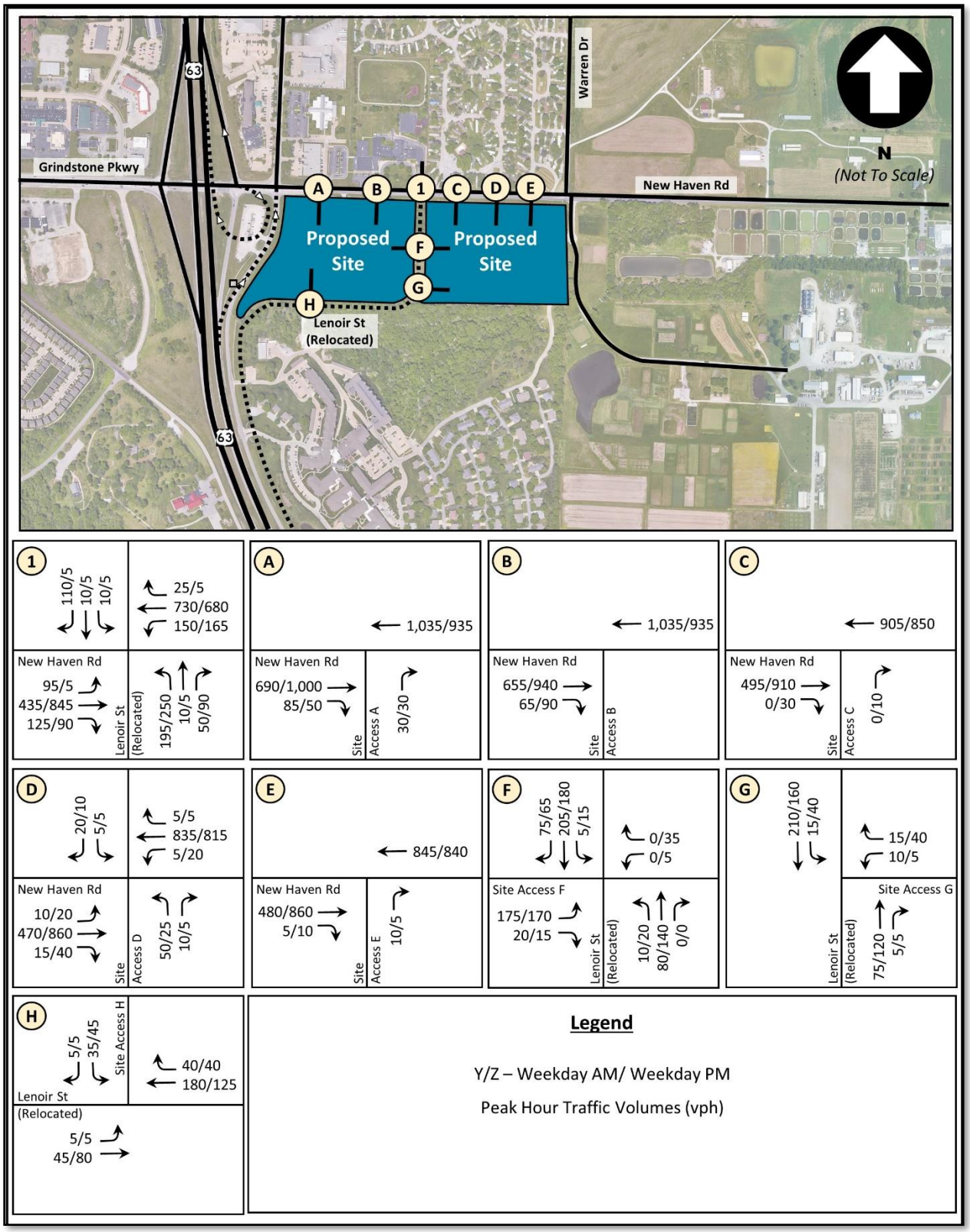


*Figure 9: Year 2040 Forecasted Traffic Volumes*

## Forecasted Operating Conditions

**Table 7** summarizes the year 2040 forecasted operating conditions that reflect the additional trips generated by the proposed development.

*Table 7: Year 2040 Forecasted Traffic Operating Conditions*

| Intersection & Movements | LOS (Delay, sec) [Queue Length$^{Reporting\ Lane}$, feet] <v/c ratio> | |
|---|---|---|
| | AM Peak Hour | PM Peak Hour |
| ***New Haven Road and Relocated Lenoir Street (Signalized)*** | | |
| **Overall Intersection** | **C (27.0)** | **C (25.9)** |
| Eastbound Approach | B (19.9) [363$^{T}$] <0.38> | C (23.4) [891$^{T}$] <0.77> |
| Westbound Approach | C (24.8) [813$^{T}$] <0.35> | B (16.1) [588$^{T}$] <0.71> |
| Northbound Approach | E (56.7) [136$^{T}$] <0.10> | E (55.4) [173$^{L}$] <0.72> |
| Southbound Approach | C (25.4) [<25] <0.72> | D (42.4) [<25] <0.15> |
| ***New Haven Road and Proposed West RIRO Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Approach | Free Flow | Free Flow |
| Northbound Right-Turn | C (15.2) [<25] <0.08> | C (21.4) [<25] <0.13> |
| ***New Haven Road and Proposed West Right-In Only Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Approach | Free Flow | Free Flow |
| ***New Haven Road and Proposed Middle RIRO Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Approach | Free Flow | Free Flow |
| Northbound Right-Turn | A (0.0) [<25] <0.00> | C (17.8) [<25] <0.04> |
| ***New Haven Road and Proposed East Apartments Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Left-Turn | A (9.9) [<25] <0.02> | A (9.9) [<25] <0.03> |
| Westbound Left-Turn | A (8.5) [<25] <0.01> | B (10.3) [<25] <0.03> |
| Northbound Approach | D (26.5) [28] <0.28> | D (32.7) [<25] <0.20> |
| Southbound Approach | C (18.1) [<25] <0.09> | C (21.2) [<25] <0.07> |
| ***New Haven Road and Proposed East RIRO Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Approach | Free Flow | Free Flow |
| Northbound Right-Turn | B (11.7) [<25] <0.02> | C (16.5) [<25] <0.02> |
| ***Relocated Lenoir Street and North Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Approach | B (14.8) [43] <0.37> | C (17.9) [53] <0.42> |
| Westbound Approach | B (12.0) [<25] <0.01> | A (9.9) [<25] <0.06> |
| Northbound Left-Turn | A (7.9) [<25] <0.01> | A (7.8) [<25] <0.02> |
| Southbound Left-Turn | A (7.4) [<25] <0.00> | A (7.5) [<25] <0.01> |
| ***Relocated Lenoir Street and Middle Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Westbound Approach | A (9.5) [<25] <0.03> | A (9.4) [<25] <0.06> |
| Northbound Approach | Free Flow | Free Flow |
| Southbound Left-Turn | A (7.4) [<25] <0.01> | A (7.6) [<25] <0.03> |
| ***Relocated Lenoir Street and South Site Drive (Unsignalized, Side-Street STOP)*** | | |
| Eastbound Left-Turn | A (7.7) [<25] <0.00> | A (7.6) [<25] <0.00> |

| Intersection & Movements | LOS (Delay, sec) [Queue Length$^{Reporting\ Lane}$, feet] <v/c ratio> | |
|---|---|---|
| | AM Peak Hour | PM Peak Hour |
| Westbound Approach | Free Flow | Free Flow |
| Southbound Approach | B (10.3) [<25] <0.06> | B (10.2) [<25] <0.07> |

As can be seen, the study intersections continue to operate favorably despite the introduction of the development's traffic. The signalized intersection of New Haven Road and relocated Lenoir Street would be expected to operate at a LOS C overall during both peak periods. The queue lengths at this intersection for the eastbound and westbound approaches do extend past some of the proposed site access drives but would not interfere with the interchange at US 63. However, the new interchange west of this interchange would be signalized and presumably coordinated with this new signal at relocated Lenoir Street. As such, the queue lengths and delays would be reduced by the coordinated signal system due to platooning of vehicles. Furthermore, signal timings adjustments could be considered to mitigate queueing issues should they arise. However, even without considering the benefits of coordination and/or signal timing adjustments, the v/c ratios indicate that each approach can easily accommodate the forecasted traffic volumes resulting from the proposed development.

The proposed site access drives would operate favorably as well with each approach expected to operate at a LOS C or better, assuming a single lane approach for each proposed access drive. The queue lengths at each of the site access drives proposed on New Haven Road are minimal, with an expected queue length of approximately one vehicle or less. Whereas all of the site access drives assumed along Lenoir Street have an expected queue length of approximately two vehicles or less.

The v/c ratios of the proposed site access drives are expected to be 0.42 or less, which indicate that there is surplus capacity in the road network, despite the introduction of the proposed development's traffic, in the design year of 2040.

Therefore, it is evident that acceptable traffic operation could be maintained along New Haven Road and relocated Lenoir Street through the year 2040 despite the introduction of the proposed development's traffic. As such, there is no need for additional lanes or mitigation beyond the current configuration proposed by MoDOT for New Haven Road east of US 63.

## Site Access Review

The proposed site plan, shown in Figure 2, provides for numerous site access drives. West of relocated Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive and one right-in only drive. East of relocated Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive, one full access drive and an eastern right-in/right-out drive. In addition, three access drives were assumed for the purposes of this study along relocated Lenoir Street.

It is assumed that each site access drive would be comprised of a single lane. Furthermore, no additional turn lanes were provided for entry into the site access drives. MoDOT's proposal would provide for a two-way left turn lane along New Haven Road that would serve the full access drive proposed east of relocated

Lenoir Drive. The right-turn volumes into the site at any one location are not forecasted to exceed 100 vehicles per hour, which typically serves as a general indication that a right-turn lane may be operationally necessary. This was reinforced by the operational analysis reflected in Table 7 that demonstrates that acceptable conditions could be provided without the construction of dedicated right turn lanes on New Haven Road or relocated Lenoir Street through the year 2040.

Lastly, all proposed intersections should conform to the sight distance requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO). Furthermore, as part of the design process, care should be given to ensure that signage and/or landscaping does not pose sight distance limitations at any of the proposed drive locations.

As part of the improvements to the US 63 and New Haven Road interchange, sidewalks would be provided along both sides of New Haven Road within the study area. Marked crosswalks would be provided along all four legs at New Haven Road and Lenoir Street along with pedestrian push buttons. It is recommended that these crosswalks be continentally stiped. It is also recommended that sidewalks and continentally striped crosswalks be provided within the site to encourage pedestrian activity between the various uses. In addition, per the MoDOT preliminary drawings, a dedicated 6 foot (ft) bike lane will be provided along the south side of the road.

## Conclusions

Lochmueller Group has completed the preceding traffic study pertaining to the mixed-use development proposed along New Haven Road in Columbia, MO. Based on the preceding study, the following can be concluded:

- This study analyzed traffic for the 2040 design year. As such, the interchange of US 63 and New Haven Road is expected to be improved by the year 2040. CBB previously completed the "US 63/Route AC Interchange Conceptual Study Report" for MoDOT that evaluated several interchange configurations for US 63 and New Haven Road. It is our understanding that the configuration would result in the northbound Route 63 ramps being modified into a folded diamond concept which would provide a single free-flow ramp for the eastbound Grindstone Parkway to northbound Route 63. In addition, Lenoir Street would be relocated farther to the east along New Haven Road so as to provide approximately 850 feet of separation and would be signalized.

- In addition, as part of the reconfiguration of the US 63 and New Haven Road interchange, New Haven Road would be widened to provide for four lanes (initially New Haven Road was proposed to be widened to five lanes of traffic, as outlined in a preceding TIS from 2022). This reconfiguration would provide for one eastbound lane, one dedicated eastbound left-turn lane serving Allstate Consultant's drive and New Haven Elementary School, and two westbound lanes between US 63 and relocated Lenoir Street. East of relocated Lenoir Street, New Haven would narrow down to one lane in each direction as well as a two-way left-turn lane which would serve the relocated access drive to the Woodstock Mobile Home Community and the proposed development, after which the lanes would taper back to a two-lane roadway.

- The 2040 baseline traffic operating conditions indicated that the signalized intersection of New Haven Road and Lenoir Street would operate favorably during the AM and PM peak periods with an overall LOS B and volume to capacity ratios that indicate that there is surplus capacity within the road network.

- The proposed development of 300 multi-family units, two hotels with 125 rooms each, a 19,602 SF shopping plaza, four 3,000 SF fast-food restaurants, and one gas station/convenience store with 16 pumps would generate a total of approximately 420 and 455 trips during the weekday morning and evening peak hours, respectively.

- West of Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive and one right-in only drive. East of Lenoir Street, access to the mixed-use development would be provided along New Haven Road via a new right-in/right-out (RIRO) drive, one full access drive located opposite the relocated drive serving the mobile home community located on the north side of the roadway, and an additional right turn only drive located 225 feet further to the east. The extent access would be provided along relocated Lenoir Street is unknown at this time given it will be driven by the development as it occurs. It is our understanding that the City intends to follow the 220 to 330 feet driveway spacing suggested by MoDOT for a minor

roadway. Therefore, for the purposes of this analysis three access drives were considered along relocated Lenoir Street (whereas there could be more than three in the future given the amount of frontage along the roadway). Each of the site access drives are proposed as single-lane approaches.

- Under the 2040 forecasted scenario, the study intersections would continue to operate favorably with the proposed development in place. The signalized intersection of New Haven Road and relocated Lenoir Street is expected to operate with an overall LOS C for each peak period. Each of the proposed site access drives are expected to operate favorably with a LOS C or better and queue lengths of approximately two vehicles or less in the Year 2040. In addition, the v/c ratio for each approach indicates that despite the introduction of the development's traffic, the roadway network would still have ample capacity.

- As part of the analysis, no additional right turn lanes were considered for the site access drives. The right-turn volumes into the site are minimal and easily managed by the through lanes and with channelization. From an operational standpoint, as supported by the analysis in this report, dedicated right-turn lanes were not necessary.

- All proposed intersections should conform to the sight distance requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO). Furthermore, as part of the design process, care should be given to ensure that signage and/or landscaping does not pose sight distance limitations at any of the proposed drive locations.

- As part of the improvements to the US 63 and New Haven Road interchange, sidewalks would be provided along both sides of New Haven Road within the study area. Marked crosswalks would be provided along all four legs at New Haven Road and relocated Lenoir Street along with pedestrian push buttons. It is recommended that these crosswalks be continentally stiped to enhance visibility. It is also recommended that sidewalks and continentally striped crosswalks be provided within the site. In addition, per the latest MoDOT preliminary drawings, a dedicated 6-foot (ft) bike lane would be provided along the south side of the road.

Please contact our offices at (314) 446-3791 with any questions or comments concerning this report.

**Completed by Lochmueller Group, Inc**