TMS Engineers, Inc.

Traffic Impact Study

Downtown Phase 2 Project
Hudson, Ohio

May 25, 2018
January 14, 2019
February 15, 2019
REVISED
March 13, 2019

Prepared for:
City of Hudson
115 Executive Parkway #400
Hudson, Ohio 44236

TRAFFIC IMPACT STUDY

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Prepared By:

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2112 Case Parkway S.
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Executive Summary

This traffic impact study has been prepared at the request of the City of Hudson for the proposed Hudson Downtown Phase 2 Project. The project site is located within the downtown core in the City of Hudson, Summit County, Ohio. **Figure 1.1, Page 2** shows the proposed location of the development.

The proposed project is expected to consist of three development components comprised of the following land uses:

Residential	**Office/Commercial**
63 Low-Rise Units	125,804 Square Feet - Office
80 Mid-Rise Units	6,000 Square Feet - Retail
	6,000 Square Feet - Restaurant
TOTAL : 143 Units	**TOTAL: 137,804 Square Feet***

***The 137,804 square feet of office/commercial space is anticipated to include approximately 12,000 square feet of first floor business service/restaurant/personal services uses.**

The year 2021 will be analyzed for the full build out of the development with the previously listed land use components. The year 2041 will be analyzed as the design year for the twenty year analysis.

Access to the development site will be considered along the roadways of Morse Road to the north, Owen Brown Street to the west, Clinton Street to the east, and Village Way to the south. The site plan for the Hudson Downtown Phase 2 project can be seen in **Figure 1.3, Page 4**.

The weekday AM peak hour of traffic was determined to be 7:00 AM to 8:00 AM. The weekday PM peak hour of traffic was found to be 5:00 PM to 6:00 PM at the study intersections.

Site Generated Traffic Volumes

The proposed development is expected to generate the following average hourly traffic during the AM and PM peak periods based upon the rates established by studies from the Institute of Transportation Engineers.

Hudson - Downtown Phase II Project
Full Build

ITE TRIP GENERATION		SIZE	TRIP ENDS			
ITE Code	Description		Weekday AM Peak Hour of Generator (Enter/Exit)		Weekday PM Peak Hour of Generator (Enter/Exit)	
220	Multifamily Housing (Low-Rise)	63 Units	10	26	25	18
221	Multifamily Housing (Mid-Rise)	80 Units	8	21	22	14
710	General Office Building	137,804 SF	194	26	39	178
TOTAL NEW TRIPS			**212**	**73**	**86**	**210**
			285		**296**	

***The 137,804 square feet of office/commercial space is anticipated to include approximately 12,000 square feet of first floor business service/restaurant/personal services uses.**

Existing Improvements to Serve Future Traffic Conditions without the Development

The following improvements were determined to mitigate the poor levels-of-service under the existing conditions at the study area intersections:

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

The intersections of SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make these types of improvement unfeasible.

The following recommendations are made for consideration for future improvements at the following intersections:

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

No additional improvements were recommended to accommodate the existing traffic at the study area intersections.

The following improvements were determined to mitigate the poor levels-of-service under the forecasted 2021 traffic conditions without the site generated traffic:

1. North Main Street (SR 91) & Brandywine Drive

- Construct a center two-way left turn lane.

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

Traffic signal control north of Brandywine Drive and Morning Song Lane at Valley View Road and Herrick Park Drive should be analyzed to determine if traffic signal control is warranted and would be able to produce additional gaps in the southbound traffic flow for the minor street traffic.

The following recommendations are made for consideration for future improvements at the following intersections under the expected 2021 No-Build conditions:

5. SR 91 & Clinton Street/Aurora Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

14. SR 303 & Boston Mills Road
- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street
- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street
- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

The downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for State Route 91 and State Route 303 including intersection improvements, operational improvements, and adding a by-pass. It is recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.

No additional improvements were recommended to accommodate the 2041 traffic conditions at the study area intersections as compared to the 2021 conditions without the site generated traffic.

Recommended Improvements to Mitigate the Traffic Associated with the Development

The following lane use and traffic control are recommended to accommodate the 2021 site generated (Build) traffic:

21. Morse Road & Owen Brown Street

- Maintain stop sign control on all intersection approaches.
- Maintain existing intersection lane use of one lane in each direction for two-way traffic flow.

3. SR 91 & Prospect Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct eastbound left turn lane.

It should be noted that the intersection of North Main Street (SR 91) and Prospect Street was previously analyzed in prior studies and was determined to not require any additional improvements. The primary difference between studies can be attributed to the application of design hour factors and higher trip generation results for the proposed development due to differences in the development site plans under review for each analysis.

Based on the trip generation results and capacity analysis it is recommended that the need for an eastbound left turn lane on West Prospect Street at North Main Street (SR 91) be re-analyzed in a post-construction analysis after the development has reached full build conditions and installed if warranted.

The following recommendations are made for consideration for future improvements at the following intersections under the expected 2021 Build conditions:

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

The following recommendations are made for consideration for future improvements at the following intersections under the 2041 Build conditions:

8. SR 91 & Veterans Way
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct a westbound left turn lane.

15. SR 303 & Atterbury Boulevard/Milford Drive
- Upgrade traffic control signal to operate under an adaptive traffic control system.

16. SR 303 & Library Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.

An alternative to implementing improvements directly at the intersection of SR 91 and SR 303 would be to create by-passes that would provide an alternative route for traffic to traverse through the City while avoiding the downtown core area. By-passes are typically created through the construction of new roadways or providing signage and way-finding directing the through traffic around the intended by-pass area. Further analysis and review of potential by-pass options for the downtown core area should be considered as a potential option to reduce traffic and congestion at the intersection of SR 91 and SR 303 by relocating through traffic to other areas of the City. By-passes would also reduce through traffic at the adjacent signalized intersections along SR 91 and SR 303 in the downtown area, therefore, likely reducing the delay experienced at those intersections as well.

Development Street Network

The site plan shown in **Figure 1.3** proposes to use Morse Road and Owen Brown Street and an extension of Village Way to provide access to and throughout the development. The development also proposes several new local roadways throughout the development as well.

The existing and proposed roadways throughout the development site are shown as two-lane roadways. Two-lane local roadways throughout the development should be sufficient to accommodate the movement of vehicular traffic through and within the development.

The intersections within the development with the exception of Owen Brown Street at Morse Road and at Morse Road and Village Way are recommended to have only minor street stop control. It is our recommendation that the Morse Road, Owen Brown Street, and Village Way approaches operate under free flow conditions with the left turn movements yielding the right-of-way to the opposing traffic at these proposed intersections.

The intersection of Owen Brown Street at Morse Road should be operated under all-way stop sign control due the offset lanes and pedestrian crossing locations. The intersection of Morse Road at Village Way should be operated under all-way stop sign control due the non-perpendicular alignment of the roadways at the intersection.

The development area to the south of Owen Brown Street between the Village Way to the west and Morse Road to the west includes a proposed parking garage. The parking garage is proposed with access along the east side of Village Way and the west side of Morse Road. These proposed intersections should include stop sign control the parking garage approaches. The Village Way access is located between horizontal curves on Village Way. The driveway and approach should be constructed so the exiting vehicle does not have an obstructed view of oncoming traffic due to landscaping or signs.

The proposed street layout and connectivity as shown in the site plan in **Figure 1.3** shows no significant problems in relation to the safety and efficiency of vehicular traffic throughout the site based on the recommendations for traffic control within this section and the report.

Owen Brown Street - Historic Block

Owen Brown Street was reviewed under various access scenarios to determine the existing conditions and potential impacts to the segment of roadway between Morse Road to the west and North Main Street to the east.

The following scenarios were analyzed and reviewed:

1. Study Area Traffic Conditions (Existing & 2021) w/out the proposed development
2. Study Area Traffic Conditions (2021) with the proposed development
3. Right In and Right Out at North Main Street
4. Hammerhead at North Main Street
5. Hammerhead Near the Creek
6. Elongated Roundabout at Morse Road & Owen Brown Street Intersection

The six scenarios listed above were evaluated based on various criteria to consider a range of impacts. A matrix was prepared, which provides a comparative assessment of the scenarios. Information gathered for this report and the analysis contained within it were used to complete the matrix shown in **Figure 5.12, Page 95**.

Based on the development site plan shown in **Figure 1.3** and the matrix shown in **Figure 5.12** our recommendation would be to provide full access to SR 91 to the east and to the downtown interior core to the west for the residents of Owen Brown Street between Morse Road and SR 91.

The traffic patterns on Owen Brown Street should be re-evaluated after the opening of the development to determine if additional traffic calming measures for Owen Brown Street between Morse Road to the west and SR 91 to the east should be implemented.

It is our opinion that the measures previously detailed should then be considered and implemented if necessary in a progressive manner of the least impact to access for the Owen Brown residents to the greatest impact. The preferred sequencing of the traffic calming measures for Owen Brown Street between Morse Road and SR 91 is shown below.

1. Scenario #2 - Full access at Morse Road & SR 91
2. Scenario #3 - Limited access at SR 91 & full access at Morse Road
3. Scenario #6 - Full access at SR 91 & limited access at Morse Road
4. Scenario #4 - No access at SR 91 & full access at Morse Road
5. Scenario #5 - Full access at SR 91 & no access at Morse Road

Owen Brown Street Underpass at Norfolk Southern Railroad

A rail overpass operated by Norfolk Southern crosses Owen Brown Street approximately 480 feet east of Lennox Road and 860 feet west of Morse Road. To the west of the railroad overpass, the abutting property is generally residential. To the east of the overpass is the proposed Downtown Phase 2 development. Owen Brown Street serves as a connection between the west side residential areas to the east side down town retail / commercial area. There are no sidewalks on either side of the street between Morse Road and Lennox Road, therefore pedestrians and bicyclists must share the roadway with motor vehicles.

The distance between the underpass and the intersection of Owen Brown Street and Village Way should be adequate to store queued vehicles without impacting the intersection.

It is our recommendation to install stop signs on each side of the underpass for traffic control with the intention to re-evaluate the need for traffic signal control after the construction and opening of the proposed development. It is recommended to consider the "bonding" of traffic signal cost so funds are in place and available if it is determined that traffic signal control is necessary at the under pass after the opening of the development.

Conclusion

The proposed development is expected to increase traffic volumes on the adjacent street network. Based upon the results of the analysis in this study and the corresponding recommendations, it can be seen that the development traffic can be accommodated without adversely impacting the area roadway network.

Definitions & Abbreviations

ACCESS MANAGEMENT: Methods that regulate physical access to streets, roads, and highways from public roads and private driveways. Requires balancing access to developed land while ensuring movement of traffic in a safe and efficient manner (McRae, Bloomberg and Muldoon).

ACCESS POINT: An intersection, driveway, or opening on a public street providing entry to a private development or property.

AMERICANS WITH DISABILITIES ACT (ADA): A civil rights law that prohibits discrimination against individuals with disabilities in all areas of public life, including jobs, schools, transportation, and all public and private places that are open to the general public. The purpose of the law is to make sure that people with disabilities have the same rights and opportunities as everyone else. The ADA gives civil rights protections to individuals with disabilities similar to those provided to individuals on the basis of race, color, sex, national origin, age, and religion. It guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, state and local government services, and telecommunications.

ADJACENT STREET: Roadways directly servicing the proposed development. If the development is serviced by multiple adjacent streets, the adjacent street for peak hour determination is that with the highest counted peak hour volume.

ADJACENT STREET TRAFFIC: All traffic with direct access to a development site

AVERAGE DAILY TRAFFIC (ADT): The number of vehicles that traverse a segment of roadway over a 24 hour period, factored to an annual average.

ANNUAL AVERAGE DAILY TRAFFIC (AADT): The total annual volume of traffic passing a point or segment of a highway in both directions divided by the number of days in the year (American Association of State Highway Transportation Officials).

AUXILIARY LANE: Any additional special purpose lane such as: speed change lanes, hill climbing lanes, and turning lanes.

BUILD: The future scenario involving the addition of site generated traffic. Refers only to the change in study area traffic volumes. The geometric conditions remain unchanged from existing conditions unless specifically detailed.

CAPACITY: The maximum sustainable flow rate at which vehicles or persons reasonably can be expected to traverse a point or uniform segment of roadway during a specified time period under given roadway, geometric, traffic, environmental, and control conditions, usually expressed as vehicles per hour.

COLLECTORS (Classification 05/06): Roadways that serve the critical role of gathering and channeling traffic from Local Roads to the Arterial network. Collectors are broken down into two categories: Major Collectors (Classification 05) and Minor Collectors (Classification 06). The determination of whether a roadway is a Major Collector or Minor Collector is frequently one of the biggest challenges in roadway functional classification. The distinctions are often subtle. Generally, Major Collector routes are longer; have fewer connecting driveways; have higher posted speed limits; are spaced at greater intervals; have higher annual average traffic volumes; and may have more travel lanes than Minor Collector routes (Ohio Department of Transportation).

CYCLE LENGTH: The time period required for one complete sequence of traffic signal indications

DELAY: The additional time experienced by a roadway user, typically motorists as a result of constrained movements and deviation from ideal or free flow speeds

DESIGN HOUR VOLUME (DHV): The hourly traffic volume used in the geometric design of highways. In Ohio, the DHV is the 30th highest hour vehicular volume experienced in a one-year period. See the Ohio Traffic Forecasting Manual for the methodology to determine DHV.

DESIGN SPEED: A selected speed used to determine the various geometric features of the roadway. The assumed design speed should be a logical one with respect to the topography, anticipated operating speed, the adjacent land use, and the functional classification of the highway. for the purposes of the State Highway Access Management Manual should equal the posted speed plus 5 mph.

DESIGN YEAR: This is the year in which the forecasts are targeted. The design year is typically 10 or 20 years after the opening year.

DIRECTIONAL DISTRIBUTION: The allocation of the site-generated traffic among all possible approach and departure routes, commonly expressed as a percentage in the peak flow directions.

8TH HIGHEST HOUR: The 8th highest hour of the day factor, expressed as a percentage, is used for traffic signal warrants. The default value for 8th highest hour is 0.056. More specific values can be determined by reviewing the hourly distribution of traffic reports by functional class.

FEDERAL HIGHWAY ADMINISTRATION (FHWA): A division of the United States Department of Transportation that specializes in highway transportation. The agency's major activities are grouped into two programs, the Federal-aid Highway Program and the Federal Lands Highway Program.

GENERATOR: A land use that attracts vehicle, pedestrian, or other modes of traffic

HIGHWAY CAPACITY MANUAL (HCM): A publication of the National Academy of Sciences Transportation Research Board that provides a collection of the state-of-the-art techniques for estimating the capacity and determining the level of service for transportation facilities; first published in the 1950s and most recently published in 2016.

INSTITUTE OF TRANSPORTATION ENGINEERS (ITE): An international educational and scientific association of transportation professionals. ITE facilitates the application of technology and scientific principles to research, planning, functional design, implementation, operation, policy development, and management for all transportation modes (McRae, Bloomberg and Muldoon).

INTERNALLY CAPTURED TRIP: A trip originating and destined for different land uses within the same development but not traveling on a public street.

INTERSECTION SIGHT DISTANCE: The distance at which a motorist attempting to enter or cross a highway should be able to observe traffic in order to make his desired movement. The required distance varies with the speed of the traffic on the main highway.

LANE: The portion of a roadway for the movement of a single line of vehicles. It does not include the gutter or shoulder of the roadway.

LEVEL-OF-SERVICE (LOS): A qualitative measure describing a range of traffic operating conditions such as travel speed and time, freedom to maneuver, traffic interruptions, and comfort and convenience as experienced and perceived by motorists and passengers. Six levels are defined from A to F, with A representing the best range of conditions and F the worst.

LOCAL ROADS (Classification 07): The largest percentage of all roadways in terms of mileage. They are not intended for use in long distance travel due to their provision of direct access to abutting land. They are often designed to discourage through traffic. Local Roads are often classified by default. In other words, once all Arterial and Collector roadways have been identified, all remaining roadways are classified as Local Roads (Ohio Department of Transportation).

MEDIAN: The portion of a highway separating the opposing traffic flows.

MEDIAN ISLAND: A curbed island which prevents egress traffic from encroaching upon the side of the drive used by ingress traffic. The island ensures that ingress traffic has the necessary maneuvering space.

MINOR ARTERIAL (Classification 04): Roadways that provide service for trips of moderate length and offer connectivity to the higher Principal Arterial system. In an urban context, they interconnect and augment the higher Principal Arterial system and provide intra-community continuity (Ohio Department of Transportation).

MILES PER HOUR (MPH): A rate of speed measured in miles per hour.

NO-BUILD: The future year scenario traffic volumes without the addition of the site generated traffic. The geometric conditions remain unchanged from today unless specifically detailed.

OHIO DEPARTMENT OF TRANSPORTATION (ODOT): The administrative department of the Ohio state government responsible for developing and maintaining all state and federal roadways in the state of Ohio with exception of the Ohio Turnpike. In addition to highways, the department also helps develop public transportation and public aviation programs.

OHIO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (OMUTCD): The Ohio Manual of Uniform Traffic Control Devices (OMUTCD) establishes statewide standards for the design and use of traffic control devices on any street, highway, bikeway or private roads open to public travel in Ohio. The current OMUTCD is the 2012 Edition published January 13, 2012, effective April 12, 2012.

OPENING YEAR: The year when the Build scenario opens. Typically refers to the year construction is completed and the project is open.

PASS-BY TRIPS: Trips that would have traveled on a street adjacent to a retail land use even if the retail land use was not present.

PEAK HOUR VOLUME: The highest traffic volume in 60 consecutive minutes in one (or both) of the two traditional peak periods of traffic, typically the weekday morning peak is between 7 a.m. and 9 a.m. and/or the evening peak is between 4 p.m. and 6 p.m. This volume is generally based on 60-minute, 30-minute, or 15-minute periods. While traffic may peak near the noon hour, trip generation rates do not usually exist for this period.

PHASE: A portion of a traffic signal cycle allocated to any traffic movement or combination of traffic movements.

PRINCIPAL ARTERIAL (Classification 03): These roadways usually serve cities and metropolitan areas, but also can provide a high degree of mobility to and throughout rural areas. Unlike Interstates, Freeways, and Expressways, Principal Arterials can directly service abutting land uses via driveways and at-grade intersections. (Ohio Department of Transportation)

QUEUING: A stacking of vehicles waiting to be serviced and/or processed.

RIGHT-OF-WAY (ROW): A general term denoting land, property, or the interest therein, usually in the configuration of a strip acquired for or devoted to transportation purposes. When used in this context, right-of-way includes the roadway, shoulders or berm, ditch, and slopes extending to the right-of-way limits under the control of the state or local authority. [Chapter 4511.01(UU), O.R.C.]

ROADWAY: The portion of a highway improved, designed or ordinarily used for vehicular travel except the berm or shoulder. If a highway includes two or more separate roadways, the term "roadway" means any such roadway separately but not to all such roadways collectively. [Chapter 4511.01 (EE), O.R.C.]

RURAL: The areas outside the boundaries of urban areas. See the definition for Urban.

SHIFT (Simplified Highway Forecasting Tool): A front-end software application used by ODOT for reporting simplified traffic forecasts for highway design purposes; used to prepare Low Risk Design Traffic for projects on State highways or to check other forecasts.

SIGNAL PROGRESSION: The progressive movement of traffic at a planned rate of speed without stopping through adjacent signalized locations within a traffic control system.

SIGNAL: Refers to a traffic control signal.

SIGNALIZATION: Refers to installing or modifying a traffic control signal.

SIMPLE FORECAST: A traffic forecast relying on trend line analysis for future year volume calculation and/or without intersection turning movements.

SITE GENERATED TRAFFIC: Traffic volumes that are generated by the development under study.

STOPPING SIGHT DISTANCE (SSD): The distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the roadway becomes visible. It includes the distance traveled during driver perception and reaction times and the vehicle braking distance.

STORAGE LENGTH: The additional lane length added to a deceleration lane to store the maximum number of vehicles likely to accumulate in the lane during a peak hour period to prevent stored vehicles from interfering with the function of the deceleration lane or the through travel lanes.

STUDY AREA: The portion(s) of the transportation system, which is directly affected by the planned development, to be included within the scope of the traffic study analysis

TOTAL TRIPS: The total of all trips entering plus all trips exiting during a designated time.

TRIPS: A single or one-direction vehicle movement with either the origin or the destination (exiting or entering) inside a generator site.

TRAFFIC IMPACT: The effect of site generated traffic on roadway operations and safety.

TRIP GENERATION: The estimation of the number of origins from and destinations to a site resulting from the land-use activity on that site.

TURN LANE WARRANT ANALYSIS: A methodology used in determining if turn lanes are required due to the proposed/existing traffic volumes.

URBAN: (1) places with a population of 5,000 or more, that are incorporated as cities, villages, and towns but excluding the rural portions of extended cities; (2) census designated places with 5,000 or more persons; and (3) other territory, incorporated or unincorporated, included in urbanized areas. Extended cities are those cities whose boundaries include territory that is essentially rural in character (e.g., uncurbed pavement with open drainage, where a rural typical section would be more consistent with the existing roadway). Urbanized areas consist of one or more places (central places) and the adjacent densely populated surrounding territory (urban fringe) that together have a minimum population of 50,000. The urban fringe generally consists of contiguous territory having a density of at least 1,000 persons per square mile. Rural areas are those outside of the boundaries of urban areas.

WARRANT: The criteria by which the need for a treatment or improvement can be determined.

Chapter 1
Introduction

1.1 Purpose of Report

This traffic impact study has been prepared at the request of the City of Hudson for the proposed Hudson Downtown Phase 2 Project. The project site is located within the downtown core in the City of Hudson, Summit County, Ohio. **Figure 1.1, Page 2** shows the proposed location of the development.

The proposed project consists of a mixed-use development with residential, office, and commercial land uses. The development parcels can be seen in **Figure 1.2, Page 3**.

The proposed development is expected to consist of three development components comprised of the following land uses:

Residential	**Office/Commercial**
63 Low-Rise Units	125,804 Square Feet - Office
80 Mid-Rise Units	6,000 Square Feet - Retail
	6,000 Square Feet - Restaurant
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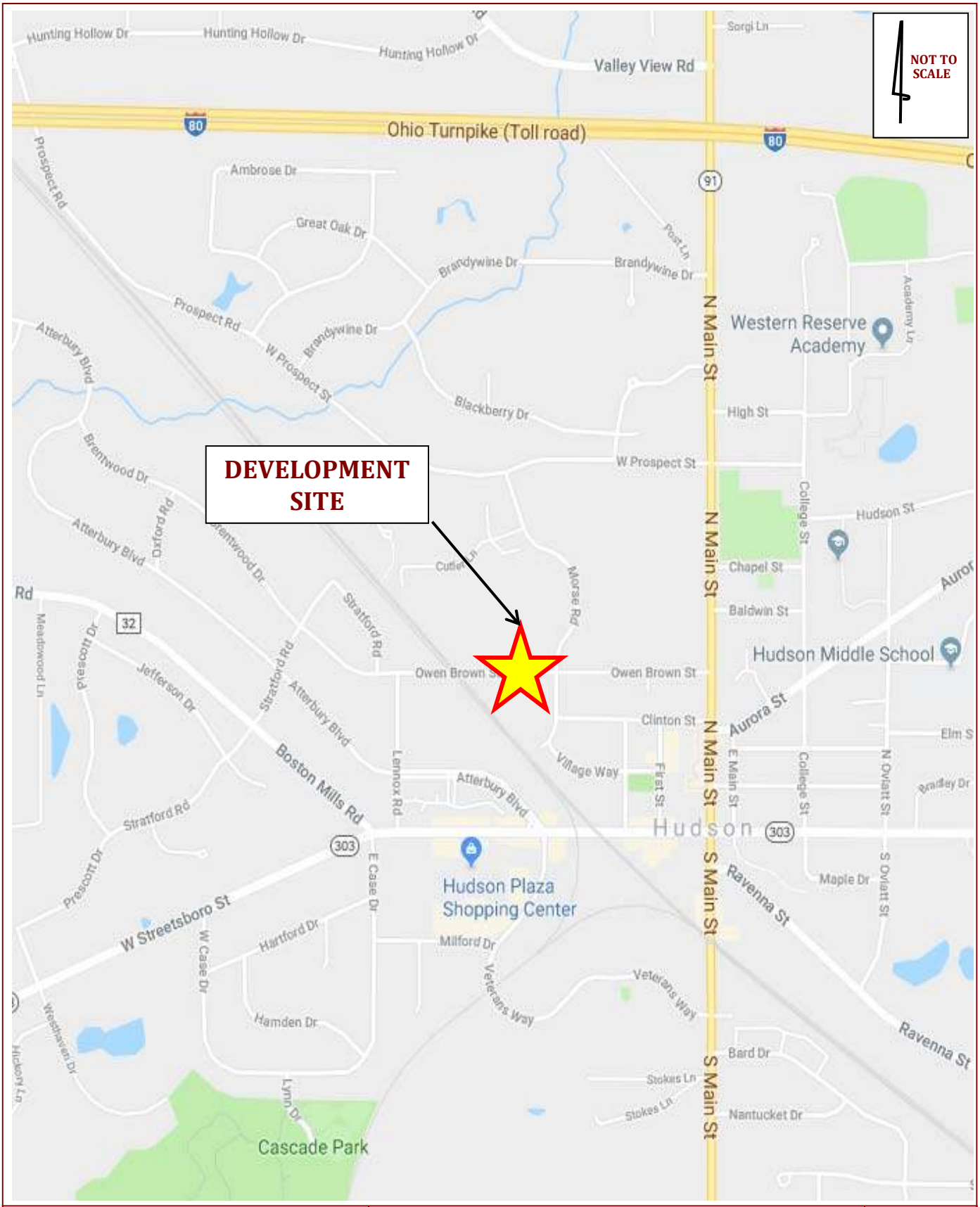
TOTAL : 143 Units	**TOTAL: 137,804 Square Feet***

***The 137,804 square feet of office/commercial space is anticipated to include approximately 12,000 square feet of first floor business service/restaurant/personal services uses.**

The year 2021 will be analyzed for the full build out of the development. The year 2041 will be analyzed as the design year for the twenty year analysis.

Access to the development site will be considered along the roadways of Morse Road to the north, Owen Brown Street to the west, Clinton Street to the east, and Village Way to the south. The site plan for the Hudson Downtown Phase 2 project can be seen in **Figure 1.3, Page 4**.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	**Downtown Phase II Hudson, Ohio Traffic Impact Study**	**Study Area Roadway Network**	**Figure 1.1** **Page 2**

TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	**Downtown Phase II Hudson, Ohio Traffic Impact Study**	**Development Area Parcel Map**	**Figure 1.2** **Page 3**

NOT TO SCALE

TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Downtown Phase II Hudson, Ohio Traffic Impact Study	Site Plan	Figure: 1.3 Page: 4

1.2 Study Objectives

This study is structured for the following purposes;

- to adequately assess the traffic impacts associated with the proposed development and to identify the level of off-site access and traffic,
- to provide a comprehensive study which evaluates and documents the traffic impacts and off-site improvements, where warranted,
- and to provide a technically sound basis to identify mitigation requirements to off-site traffic impacts.

This study documents the methodologies, findings and conclusions of the analysis, including the basis for all assumptions, traffic parameters utilized and conclusions reached.

The traffic impacts will be determined by comparing the existing intersection levels-of-service before the proposed development to the anticipated levels-of-service after the development is completed. Levels-of-service for the study area and access driveway will be calculated using the computerized software program **Synchro plus SimTraffic Signal Timing & Analysis Software**.

The Land Development Code of the City Hudson can be found in Part Twelve of the Code of Ordinances. The Code (1207.11.3) details that the TIS for a proposed development shall demonstrate compliance with the following transportation level-of-service standards:

- Existing peak hour levels-of-service are maintained within one-fourth (1/4) mile of the site or that such levels-of-service shall not fall below LOS C.
- The peak hour level-of-service shall not fall below the current level at locations within one-quarter (1/4) mile of the site where the existing level-of-service is below a LOS C.

The justification for any changes in the intersections will be determined by comparing data collected of the existing traffic conditions to the criteria established by the **Ohio Manual of Uniform Traffic Control Devices** and professional engineering judgment from an on-site field review.

Intersection geometric design guidelines will be based in the information and procedures found in the Ohio Department of Transportation's **Location & Design Manual, Volume 1**.

Chapter 2
Area Conditions

2.1 Functional Classification

The Ohio Department of Transportation (ODOT) and the Akron Metropolitan Area Transportation Study (AMATS) functionally classifies roadways to help define a roadway's characteristics as well as identify roadways that are eligible for federal funds. Functional classification is the grouping of roads, streets, and highways in a hierarchy based on the type of highway service they provide. Generally, streets and highways perform two types of service. They provide either traffic mobility or land access and can be ranked in terms of the proportion of service they provide.

The functional classification as determined by ODOT and AMATS will also be used to apply growth and design hour factors to the study area roadways for use in forecasting future traffic volumes in the study area. These factors are determined using data, guidelines, and methodology supplied by ODOT. These methods and the corresponding data are based on the roadways assigned functional classification. The ODOT methods for forecasting future traffic volumes are a recognized traffic engineering standard.

It should be noted that several roadways within the study area are functionally classified as collectors (Morse Road, Prospect Street, and Hines Hill Road) by the City of Hudson. In order to apply the applicable traffic data supplied by ODOT for use in their methodology for the future traffic forecasts the ODOT/AMATS functional classifications will be used in this report.

The following table lists the study area roadways that have an assigned functional classification as determined by ODOT and AMATS. Roadways that are not listed as having a functional classification can be assigned into one of two categories. The first category is a local roadway and the second category is that of an access drive. Table 2.1 only details roadways with a functional classification higher than local roadways.

Table 2.1 Functional Classification

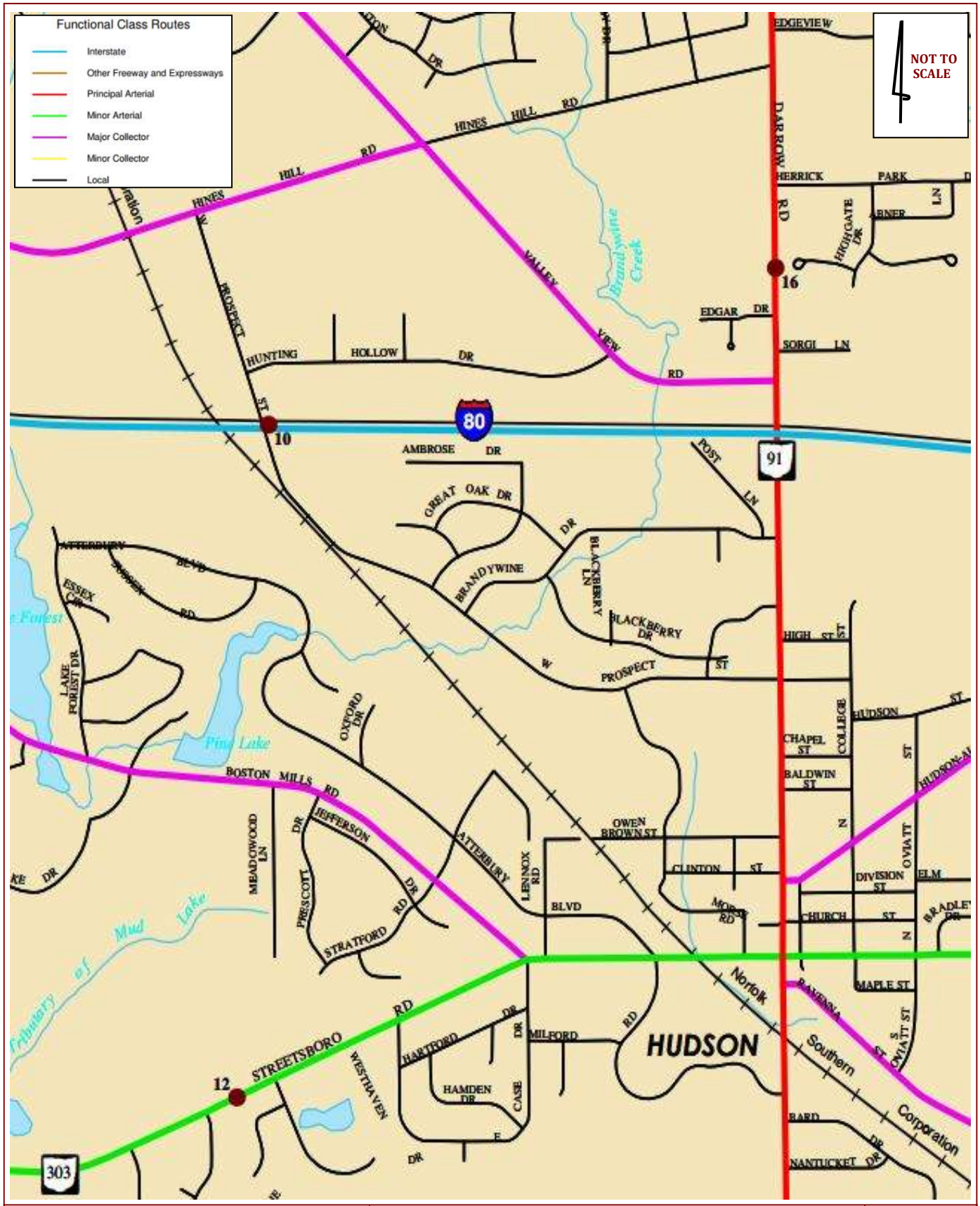
ROADWAY	AREA	FC #	CLASSIFICATION
North/South Main Street (SR 91)	Urban	3	Principal Arterial
East/West Streetsboro Road (SR 303)	Urban	4	Minor Arterial
Hines Hill Road	Urban	5	Major Collector
Valley View Road	Urban	5	Major Collector
Boston Mills Road	Urban	5	Major Collector
Aurora Road	Urban	5	Major Collector
Ravenna Street	Urban	5	Major Collector

The functional classification maps for the study area can currently be found online at the following ODOT and AMATS web addresses:

http://www.dot.state.oh.us/Divisions/Planning/ProgramManagement/MajorPrograms/MapRoom/Forms/AllItems.aspx

http://amatsplanning.org/wp-content/uploads/October-2013-FFC-Map.pdf

Figure 2.1, Page 8 details the section of the functional classification map for the City of Hudson and the study area.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	**Downtown Phase II Hudson, Ohio Traffic Impact Study**	**Functional Classification**	**Figure 2.1** **Page 8**

2.2 Transportation Network Study Area

The following 36 intersections are under study for this report:

1.	North Main Street (SR 91)	&	Brandywine Drive
2.	North Main Street (SR 91)	&	Morning Song Lane
3.	North Main Street (SR 91)	&	West Prospect Street
4.	North Main Street (SR 91)	&	Owen Brown Street
5.	North Main Street (SR 91)	&	Clinton Street/Aurora Street
6.	North Main Street (SR 91)	&	Church Street
7.	North Main Street (SR 91)	&	West Streetsboro Road (SR 303)
8.	South Main Street (SR 91)	&	Veterans Way
9.	Prospect Road	&	East Hines Hill Road
10.	West Prospect Street	&	Hunting Hollow Drive
11.	West Prospect Street	&	Brandywine Drive
12.	West Prospect Street	&	Morse Road
13.	West Prospect Street	&	Morning Song Lane
14.	West Streetsboro Road (SR 303)	&	Boston Mills Road/East Case Drive
15.	West Streetsboro Road (SR 303)	&	Milford Drive/Atterbury Boulevard
16.	West Streetsboro Road (SR 303)	&	Library Street
17.	West Streetsboro Road (SR 303)	&	First Street
18.	Valley View Road	&	East Hines Hill Road
19.	Valley View Road	&	Hunting Hollow Drive
20.	Owen Brown Street	&	Lennox Road
21.	Owen Brown Street	&	Morse Road
22.	Morse Road	&	Clinton Street
23.	Clinton Street	&	Library Street
24.	First Street	&	Village Way
25.	Atterbury Boulevard	&	Stratford Drive
26.	Atterbury Boulevard	&	Lennox Road
27.	East Case Drive	&	Milford Road
28.	Milford Road	&	Veterans Way
29.	East Main Street	&	Aurora Street
30.	East Main Street	&	Division Street
31.	East Main Street	&	Church Street
32.	College Street	&	Division Street
33.	College Street	&	Church Street
34.	Ravenna Street	&	South Oviatt Street
35.	East Streetsboro Road (SR 303)	&	North/South Oviatt Street
36.	South Main Street (SR 91)	&	Ravenna Street

The following table details the existing characteristics for the primary roadways in the study area.

Table 2.2 Existing Roadway Conditions

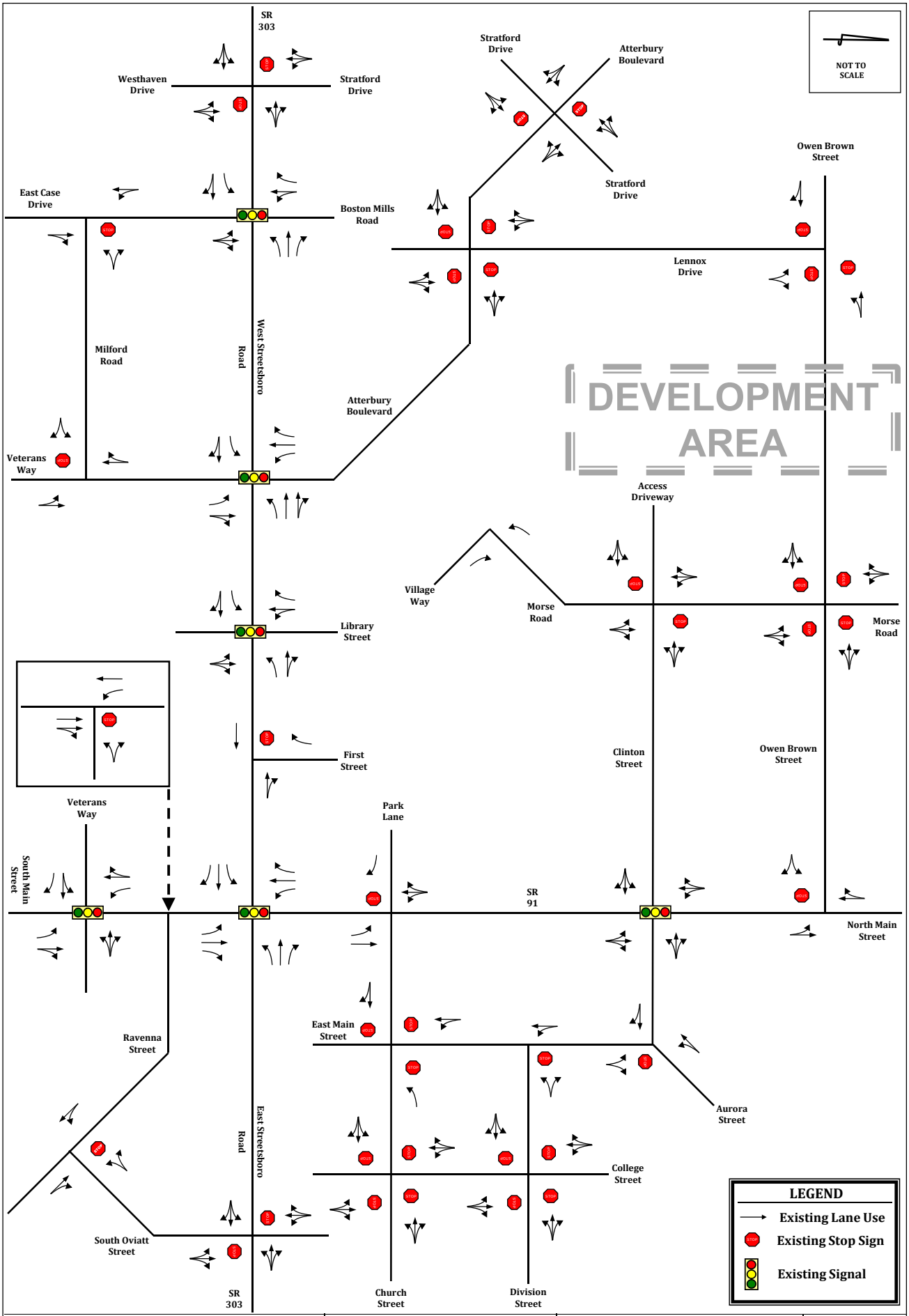
ROADWAY	# OF LANES	ORIENTATION	SPEED LIMIT (MPH)	ADT* (VPD)
SR 91	2	North-South	25	17,200
SR 303	2	East-West	25	15,190
Hines Hill Road	2	East -West	35	3,720
Valley View Road	2	Northwest-Southeast	45	2,740
Prospect Street	2	East-West	25/35	1,910
Boston Mills Road	2	East-West	35	5,970
Aurora Road	2	Southwest-Northeast	25	5,320
Ravenna Street	2	Northwest-Southeast	25	3,010
Morse Road	2	North-South	25	3,930
Owen Brown Street	2	East-West	25	2,070
Clinton Street	2	East-West	25	2,050
Village Way	2	East-West	25	370

The following study area intersections are under traffic signal control:

1. North Main Street (SR 91) & East/West Prospect Street
2. North Main Street (SR 91) & Clinton Street/Aurora Street
3. North/South Main Street (SR 91) & East/West Streetsboro Street (SR 303)
4. South Main Street (SR 91) & Veterans Way
5. West Streetsboro Street (SR 303) & Boston Mills Road/East Case Drive
6. West Streetsboro Street (SR 303) & Atterbury Boulevard/Milford Drive
7. West Streetsboro Street (SR 303) & Library Street

Figure 2.2, Page 11 shows the lane use and traffic control conditions based upon the existing conditions in the study area.

Figure 2.3 Page 12 shows an aerial view of the downtown core and development site area.



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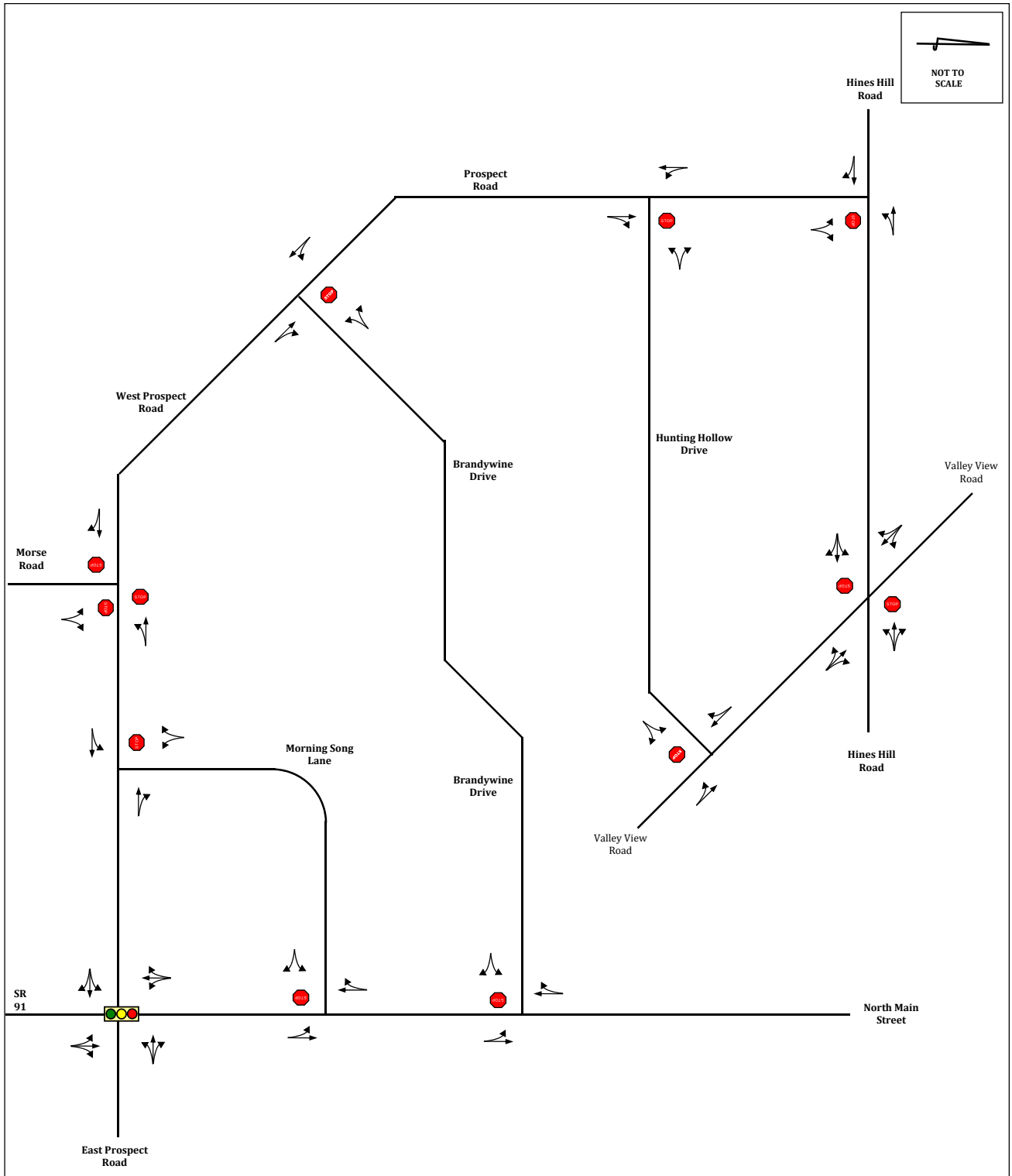
Traffic Impact Study

Existing
Lane Use & Traffic Control
(South Section)

Figure: 2.2b



LEGEND

- Existing Lane Use
- Existing Stop Sign
- Existing Signal

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TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Downtown Phase II Hudson, Ohio Traffic Impact Study	Aerial View Downtown Core Development Site	Figure: 2.3 Page: 12

2.3 Traffic

Traffic data was collected at 34 intersection locations in the City of Hudson. The weekday traffic counts were conducted in fifteen (15) minute intervals between the hours of 7 AM - 10 AM, 11 AM - 2 PM, and 3 PM - 6 PM, then hourly totals were calculated.

Weekday nine hour turning movement counts were performed at the following locations in of 2017/2018:

1.	North Main Street (SR 91)	&	Brandywine Drive
2.	North Main Street (SR 91)	&	Morning Song Lane
3.	North Main Street (SR 91)	&	West Prospect Street
4.	North Main Street (SR 91)	&	Owen Brown Street
5.	North Main Street (SR 91)	&	Clinton Street/Aurora Street
6.	North Main Street (SR 91)	&	Church Street
7.	North Main Street (SR 91)	&	West Streetsboro Road (SR 303)
8.	South Main Street (SR 91)	&	Veterans Way
9.	Prospect Road	&	East Hines Hill Road
10.	West Prospect Street	&	Hunting Hollow Drive
11.	West Prospect Street	&	Brandywine Drive
12.	West Prospect Street	&	Morse Road
13.	West Prospect Street	&	Morning Song Lane
14.	West Streetsboro Road (SR 303)	&	Boston Mills Road/East Case Drive
15.	West Streetsboro Road (SR 303)	&	Milford Drive/Atterbury Boulevard
16.	West Streetsboro Road (SR 303)	&	Library Street
17.	West Streetsboro Road (SR 303)	&	First Street
18.	Valley View Road	&	East Hines Hill Road
19.	Valley View Road	&	Hunting Hollow Drive
20.	East Streetsboro Road (SR 303)	&	North/South Oviatt Street
21.	South Main Street (SR 91)	&	Ravenna Street

A copy of the 2017 intersection turn movement counts are included in **Appendix A**.

Weekday nine hour turning movement counts were performed at the following locations in September of 2015:

22.	Owen Brown Street	&	Lennox Road
23.	Owen Brown Street	&	Morse Road
24.	Morse Road	&	Clinton Street
25.	Clinton Street	&	Library Street
26.	First Street	&	Village Way
27.	Atterbury Boulevard	&	Stratford Drive
28.	Atterbury Boulevard	&	Lennox Road
29.	East Case Drive	&	Milford Road
30.	Milford Road	&	Veterans Way
31.	East Main Street	&	Aurora Street
32.	East Main Street	&	Division Street
33.	East Main Street	&	Church Street
34.	College Street	&	Division Street
35.	College Street	&	Church Street
36.	Ravenna Street	&	South Oviatt Street

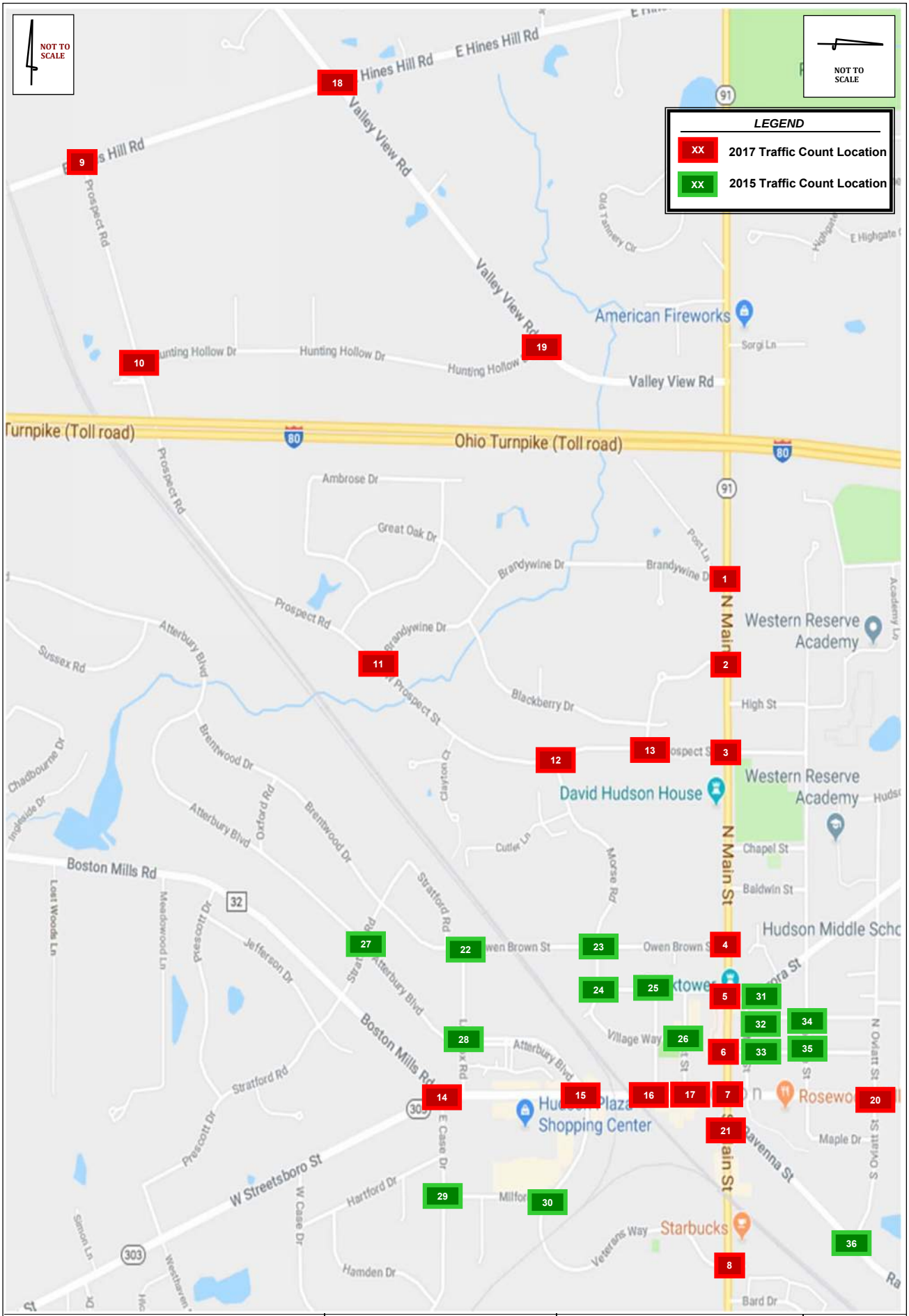
A copy of the 2015 intersection turn movement counts are included in **Appendix A**.

Figure 2.4, Page 15 details the 36 locations where traffic count data was collected in 2015 and 2017/2018.

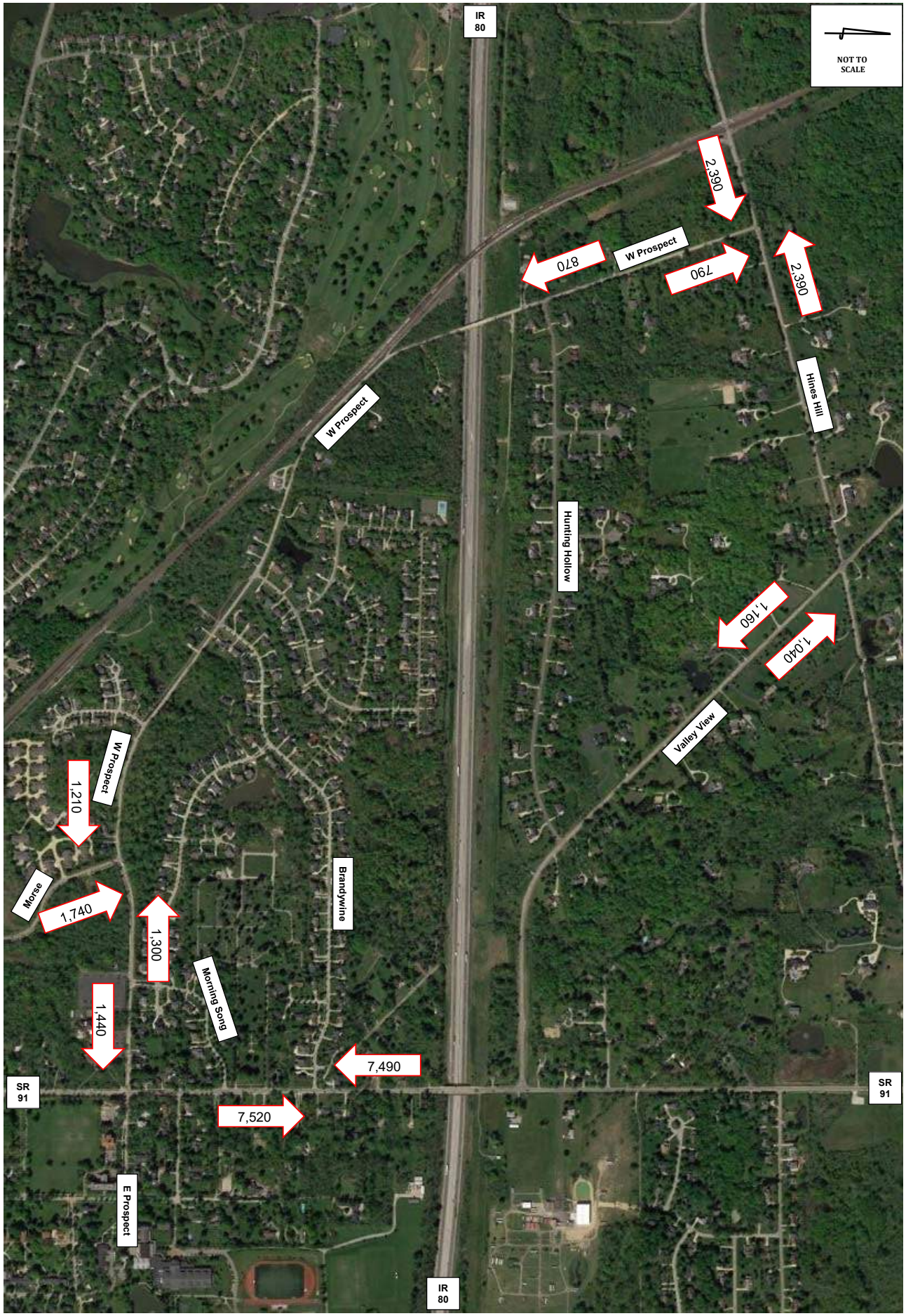
Average daily traffic was calculated for roadway using expansion factors to account for daily and seasonal variations according to the recommendations and latest data from the Ohio Department of Transportation.

From the data, the weekday AM peak hour of traffic was determined to be 7:00 AM to 8:00 AM. The weekday PM peak hour of traffic was found to be 5:00 PM to 6:00 PM. The traffic data includes traffic being generated from the development parcels at the time of the traffic counts. These parcels include the bus garage, HPP, and Windstream. The collected traffic data from these periods will be analyzed since they reflect the period of the highest volume of traffic flow for the roadways. It will provide a worst case scenario for future traffic.

The existing Average Daily Traffic (ADT) volumes for the study area can be seen in **Figure 2.5, Page 16**. The existing weekday AM and PM peak hour traffic volumes can be seen in **Figure 2.6, Page 17**.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Downtown Phase II Hudson, Ohio Traffic Impact Study	Traffic Count Locations	Figure: 2.4 Page: 15



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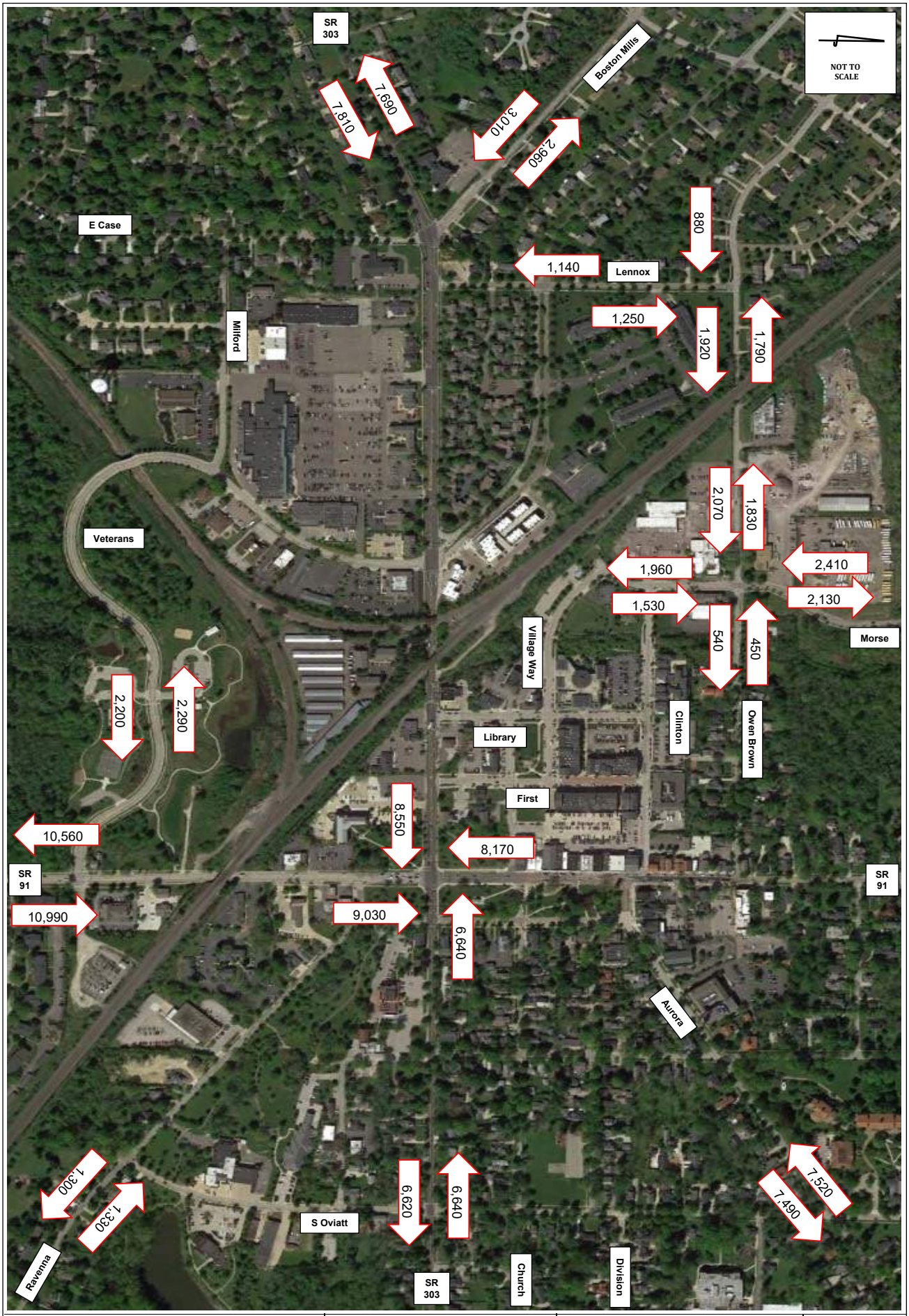

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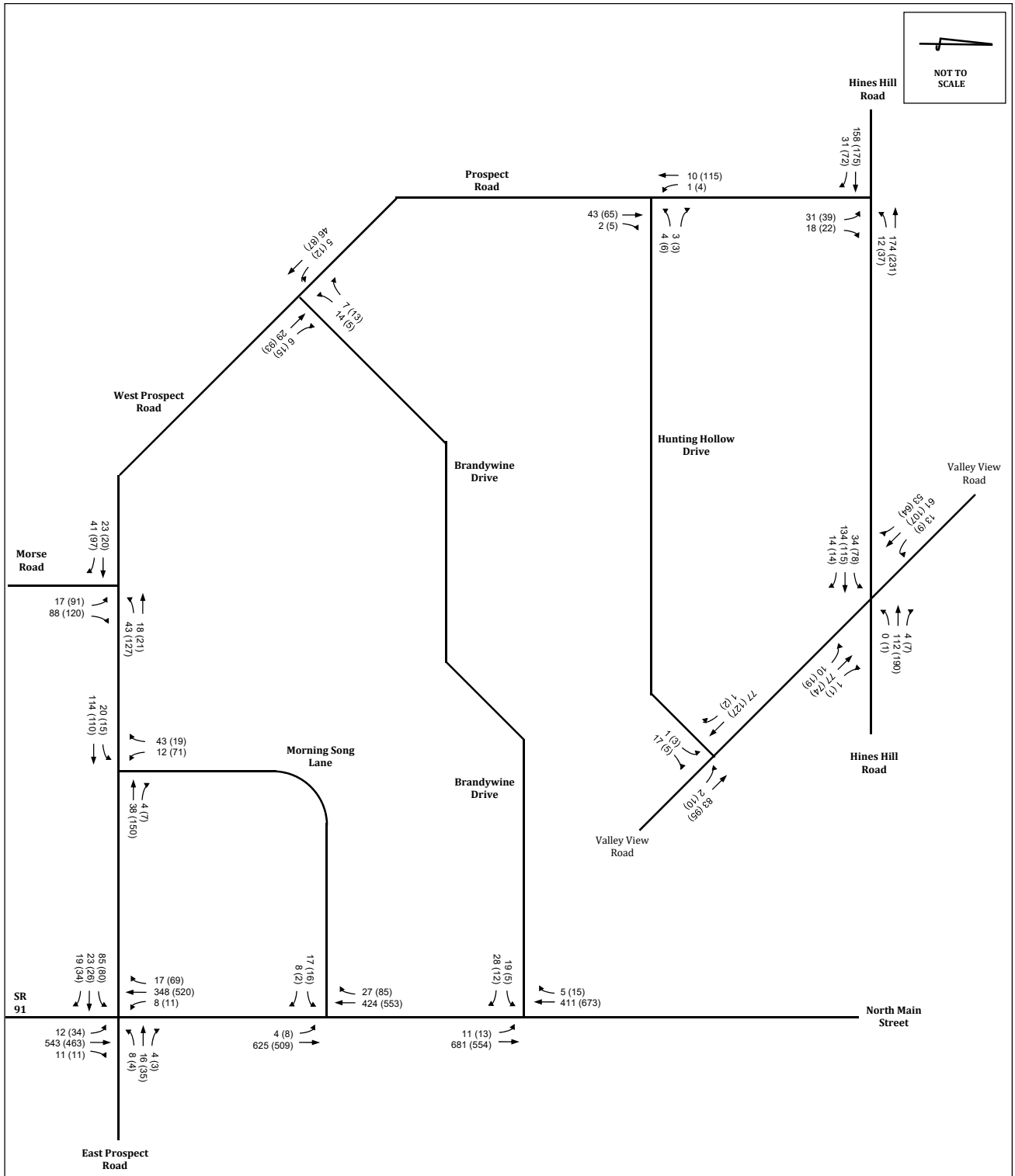

LEGEND	
XX	AM Peak Hour Traffic
(XX)	PM Peak Hour Traffic

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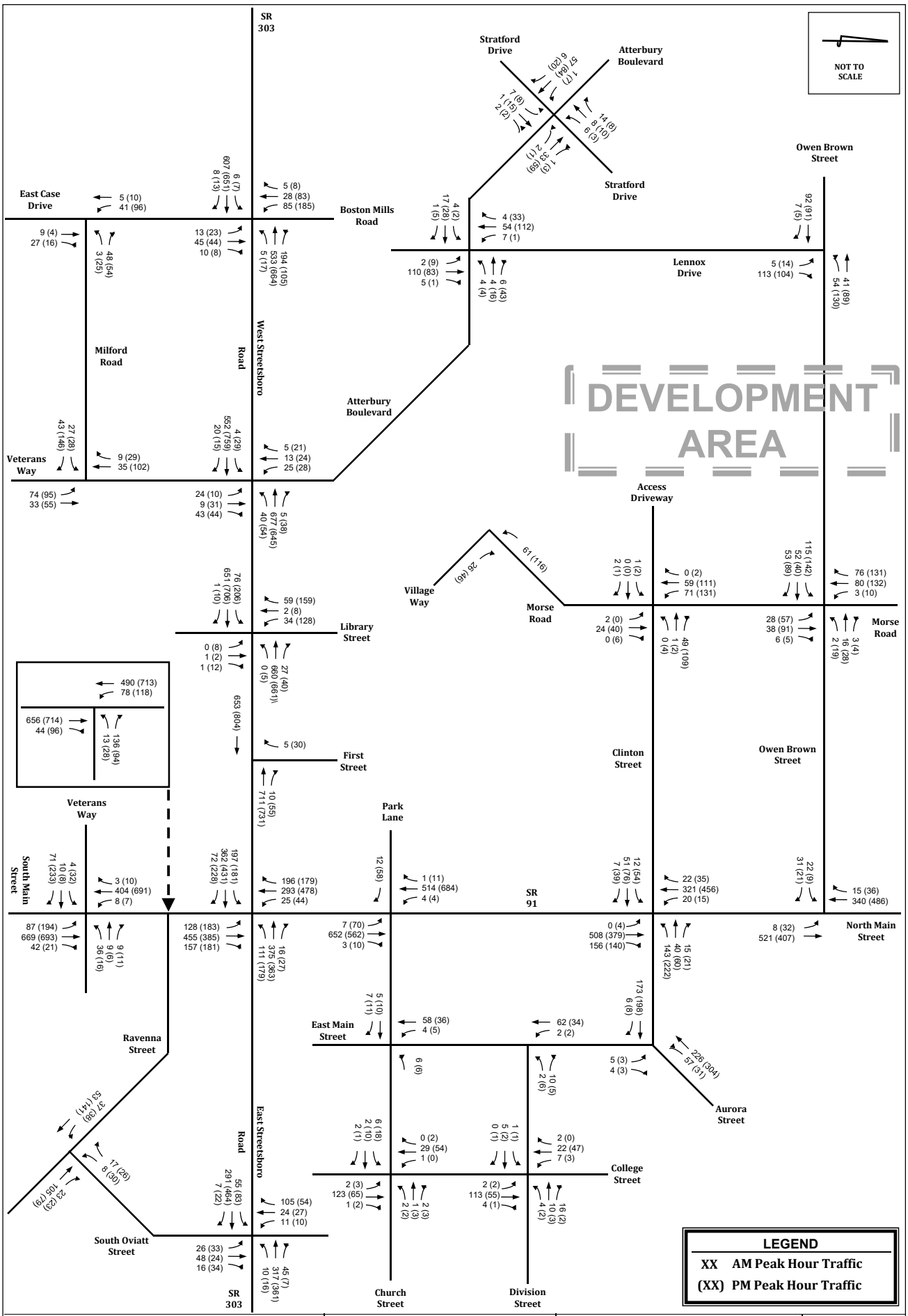
Traffic Impact Study

2015/2017 Existing
Peak Hour Traffic Volumes
(North Section)

Figure: 2.6a



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Downtown Phase II Hudson, Ohio Traffic Impact Study	2015/2017 Existing Peak Hour Traffic Volumes (South Section)	Figure: 2.6b Page: 17b

2.4 Crash Data

The Ohio Department of Transportation provides a tool to retrieve crash data. The ODOT GIS Crash Analysis Tool (GCAT) was used to collect crash information at the study area intersections. The ODOT GIS Crash Analysis Tool can currently be found at the following web address:

https://gis.dot.state.oh.us/tims/

The years 2014 through 2016 at the 36 study area intersections in the City of Hudson were reviewed using the ODOT GCAT portal. Crash data summaries for each study area intersection with reported crash data can be found in **Appendix B**.

The crashes were tabulated by intersection and crash type in order to address probable causes and corrective measures at each intersection based on the dominate crash type. The tables detailing the intersection crash patterns and possible corrective measures can be seen on the following pages:

Table 2.3 Intersection Crash Patterns

INTERSECTION	TOTAL CRASHES (INJURY)	CRASH RATE (MEV*)	MAJOR CRASH PATTERN	PROBABLE CAUSE
SR 91 & Brandywine Drive	3 (0)	0.18	Right Turn (1) Sideswipe Passing (1) Rear End (1)	Driver unaware of intersection Slippery Surface Large Turning Volumes
SR 91 & Morning Song Ln	3 (0)	0.19	Rear End (2) Left Turn (1)	Driver unaware of intersection Slippery Surface Large Turning Volumes
SR 91 & West Prospect St	12 (2)	0.71	Rear End (9)	Large Turning Volumes Poor device visibility Traffic signal timing
SR 91 & Owen Brown St	6 (0)	0.42	Rear End (3) Left Turn (3)	Driver unaware of intersection Slippery Surface Large Turning Volumes
SR 91 & Clinton/Aurora St	17 (3)	0.85	Rear End (10) Left Turn (2) Sideswipe Passing (2)	Large Turning Volumes Poor device visibility Traffic signal timing Crossing pedestrians
SR 91 & Church St	13 (1)	0.72	Rear End (11) Angle (1) Right Turn (1)	Driver unaware of intersection Slippery Surface Large Turning Volumes Crossing pedestrians
SR 91 & SR 303	45 (7)	1.30	Rear End (25) Left Turn (9) Sideswipe Passing (5)	Large Turning Volumes Poor device visibility Traffic signal timing Inadequate roadway design
SR 91 & Veterans Way	14 (2)	0.56	Rear End (11) Pedestrian (1)	Large Turning Volumes Poor device visibility Traffic signal timing
Prospect Rd & Hines Hill Rd	1 (1)	0.16	Left Turn (1)	Restricted sight distance Excessive speed
West Prospect St & Hunting Hollow Dr	0 (0)	0.00	NA	NA

*** Crash Rate Per Million Vehicles Entering the Intersection**

Table 2.3 Intersection Crash Patterns

INTERSECTION	TOTAL CRASHES (INJURY)	CRASH RATE (MEV*)	MAJOR CRASH PATTERN	PROBABLE CAUSE
West Prospect St & Brandywine Dr	1	0.41	Fixed Object (1)	Excessive speed Slippery surface FO too close to roadway
West Prospect St & Morse Rd	0 (0)	0.00	NA	NA
West Prospect St & Morning Song Ln	0 (0)	0.00	NA	NA
SR 303 & Boston Mills Rd	22 (4)	0.93	Rear End (15)	Large turning volumes Poor device visibility Traffic signal timing
SR 303 & Atterbury Blvd	15 (3)	0.65	Rear End (11) Angle (2) Sideswipe Passing (2)	Large turning volumes Poor device visibility Traffic signal timing
SR 303 & Library Street	13 (2)	0.53	Rear End (6) Sideswipe Passing (4)	Large turning volumes Traffic signal timing Driveway Spacing Inadequate signing
SR 303 & First Street	4 (0)	0.18	Angle (1) Rear End (1) Sideswipe Meeting (1) Pedestrian (1)	Driveway spacing Large turning volumes Inadequate signing
Valley View Rd & Hines Hill Rd	8 (2)	1.13	Angle (6) Left Turn (1)	Restricted sight distance Excessive speed Inadequate advance warning Inadequate TCD
Valley View Rd & Hunting Hollow Dr	0 (0)	0.00	NA	NA
Owen Brown St & Lennox Rd	0 (0)	0.00	NA	NA

*** Crash Rate Per Million Vehicles Entering the Intersection**

Table 2.3 Intersection Crash Patterns

INTERSECTION	TOTAL CRASHES (INJURY)	CRASH RATE (MEV*)	MAJOR CRASH PATTERN	PROBABLE CAUSES
Owen Brown St & Morse Rd	3 (1)	0.43	Rear End (1) Angle (1) Left Turn (1)	Restricted sight distance Excessive speed Driver inattention
Morse Rd & Clinton St	0 (0)	0.00	NA	NA
Clinton St & Library St	1 (0)	0.19	Right Turn (1)	Restricted sight distance Excessive speed Driver inattention
First St & Village Way	0 (0)	0.00	NA	NA
Atterbury Blvd & Stratford Rd	0 (0)	0.00	NA	NA
Atterbury Blvd & Lennox Rd	0 (0)	0.00	NA	NA
East Case Dr & Milford Rd	0 (0)	0.00	NA	NA
Milford Rd & Veterans Way	1 (0)	0.20	Left Turn (1)	Larger turning volumes Excessive speed Driver inattention
East Main St & Aurora St	0 (0)	0.00	NA	NA
East Main St & Division St	0 (0)	0.00	NA	NA
East Main St & Church St	0 (0)	0.00	NA	NA

*** Crash Rate Per Million Vehicles Entering the Intersection**

Table 2.3 Intersection Crash Patterns

INTERSECTION	TOTAL CRASHES (INJURY)	CRASH RATE (MEV*)	MAJOR CRASH PATTERN	PROBABLE CAUSES
College St & Division St	0 (0)	0.00	NA	NA
College St & Church St	0 (0)	0.00	NA	NA
Ravenna St & South Oviatt St	1 (0)	0.25	Rear End (1)	Excessive Speed Slippery Surface Driver inattention
SR 303 & Oviatt Street	14 (3)	0.96	Angle (7) Rear End (5)	Restricted sight distance Excessive speed Driver inattention
SR 91 & Ravenna Street	14 (3)	0.61	Angle (9) Rear End (5)	Restricted Sight Distance Large Turning Volumes Excessive speed Driver inattention

*** Crash Rate Per Million Vehicles Entering the Intersection**

2.5 Crash Diagram

An intersection crash diagram was prepared for the each intersection based on the results from the previous tables and the summary in **Appendix B**.

A crash diagram is a schematic drawing that has been compiled from a series of individual crash reports relative to a specific location (intersection). The diagram includes the vehicles direction of travel prior to contact, and the presence of any pedestrians or bicycles whose presence contributed to a collision or were involved directly in the crash. The crash diagrams can be used as a visual reference in analyzing possible crash patterns at an intersection.

The crash diagrams include the following information:

- Title block with project and study area description.
- Schematic of the location with the approaches labeled and directional arrow indicating north.
- A legend key to denote the symbols and abbreviations used in the diagram.
- Each crash includes the date and time in the following format: DDMMYEAR - HHMM
- Each crash also includes the road conditions and the lighting conditions. RC - LC

The crash data from the years 2014 through 2016 was used to create a crash diagram for each intersection under study. The intersection crash diagrams can be seen in **Appendix B**.

Chapter 3
Traffic Signal Warrant Analysis

All of the data collected for this study was analyzed and compared to the traffic signal warrant criteria established by the **OMUTCD** for the study area intersections. The following sections explain the criteria and results of the analyses.

3.1 Traffic Signal Control

A properly placed traffic signal can improve the safety and efficiency of flow through an intersection. An unnecessary signal can be the source of danger and annoyance to all who use the intersection including pedestrians, bicyclists, and motorists. It can also increase air pollution and cause driver frustration if there is not much traffic on the major street.

When determining whether or not a traffic signal is necessary at a specific location, an evaluation of the candidate location (called a signal warrant study) is conducted to determine the answers to the following questions:

1. How much traffic is there on the intersecting streets?
2. Are high levels of traffic consistent throughout the day or just during a few hours?
3. Is there a significant amount of pedestrian traffic?
4. Is the street a wide, high speed, and busy thoroughfare?
5. Are school children crossing the street?
6. Will a signal improve the flow of traffic or cause gridlock with other nearby signals?

The signal warrant study collects all of the relevant data at a location that is under study. Once the data is collected, it is compared to criteria that has been established by extensive research and experience and documented in the latest edition of the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**. The Ohio Revised Code requires that an engineering signal warrant study must be performed to determine whether installation of a traffic signal is justified at a particular location.

It should be noted that traffic signals do not prevent motor vehicle crashes. Engineering studies have shown that in many instances, total intersection crashes increase after a traffic signal is installed. Certain types of crashes are susceptible to correction by installation of traffic signals, however, overall the number of crashes generally increase.

3.2 Traffic Signal Warrants

The OMUTCD provides nine (9) sets of criteria, called warrants. The warrants are;

Warrant 1 - Eight Hour Vehicular Volume
This warrant has three conditions. The Minimum Vehicular Volume, Condition A, is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic signal. The Interruption of Continuous Traffic, Condition B, is intended for application where the traffic volume of a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. The third condition is a combination of Condition A and Condition B in which 80% of each condition must be satisfied.

Warrant 2 - Four Hour Vehicular Volume
This warrant addresses the need for signalization based on situations existing for less than eight hours and is based upon a sliding scale or combined volume. Four hours of volume must be met.

Warrant 3 - Peak Hour Vehicular Volume
This warrant is intended for use at a location where traffic conditions are such for a minimum of one hour of an average day, the minor street suffers undue delay when entering or crossing the major street. This warrant is only applied in unusual cases. Such cases include, but are not limited to, office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.

It should be noted that if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, or the speed limit exceeds 40 miles per hour the minimum volume thresholds may be reduced to 70% levels.

Warrant 4 - Pedestrian Volume
This warrant is intended for applications where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Warrant 5 - School Crossing

This warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic signal.

Warrant 6 - Coordinated Signal System

This warrant is used when progressive movement of traffic in a coordinated signal system sometimes necessitates installing a traffic signal at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Warrant 7 - Crash Experience

This warrant is intended for application where the severity and frequency of crashes are the principal reason to consider installing a traffic signal.

Warrant 8 - Roadway Network

This warrant is used at the intersection of two major routes where installing a traffic signal may encourage concentration and organization of traffic flow on a roadway network.

Warrant 9 - Intersection Near a Grade Crossing

This warrant is used at an intersection where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing an intersection approach controlled by a stop or yield sign is the principal reason to consider installing traffic signal control.

3.3 Traffic Signal Warrant Analysis

The existing traffic conditions at study area intersections were analyzed and compared to the criteria established by the **Ohio Manual of Uniform Traffic Control Devices** and professional engineering judgement in order to determine if traffic signal control is justified. This is required by the Ohio Revised Code. All of the data collected and determined for this study was analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for the existing conditions. The warrant analyses worksheets for each intersection can be found in **Appendix C**.

The following intersections were determined to warrant traffic signal control:

1. North Main Street (SR 91) & East/West Prospect Street
2. North Main Street (SR 91) & Clinton Street/Aurora Street
3. North Main Street (SR 91) & East/West Streetsboro Road (SR 303)
4. North Main Street (SR 91) & Veterans Way
5. West Streetsboro Road (SR 303) & Boston Mills Road/East Case Drive
6. West Streetsboro Road (SR 303) & Milford Drive/Atterbury Boulevard
7. West Streetsboro Road (SR 303) & Library Street

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is justified as required by the Ohio Revised Code based upon the 2017 existing conditions at the seven intersections listed above.

The above mentioned intersections are currently operating under traffic signal control.

The remaining intersections under study were determined to not warrant traffic signal control based on the existing conditions. These intersections are currently operating under stop sign control.

Chapter 4
Projected Traffic Conditions

4.1 Site Traffic

Trip Generation

Calculating future total driveway trips requires an estimate of the traffic generated by the proposed development. The most widely accepted method of determining the amount of traffic that the proposed development will generate is to compare the proposed land use with existing facilities of the same use. The Institute of Transportation Engineers (ITE) has prepared a manual titled **"Trip Generation Manual"**, which is a compilation of similar traffic generation studies to aide in making such a comparison. The most recent update of this manual is the 10TH edition and was utilized for this study.

The following table details the development land uses and the corresponding ITE land uses that will be used to forecast the site generated traffic volumes for the Build conditions:

Table 4.1 ITE Land Use Codes

BLOCK	SITE PLAN LAND USE	ITE CODE	ITE DESCRIPTION
D - E - F - H	Townhome	220	Multi-Family Housing (Low-Rise)
A - C - G	Multifamily	221	Multi-Family Housing (Mid-Rise)
A - B - C	Commercial	710	General Office Building

It should be noted that the available data from ITE for the general office building land use #710 includes sites where the office buildings include a mixture of tenants and tenant services, such as banks, restaurants, and service retail facilities. The inclusion of these sites in the available trip generation data is expected to account for the varying peak hours of operations for retail and restaurant components that are located within an office/commercial building. The expected 12,000 square feet of retail and restaurant space will be included in the total office/commercial space square footage.

A summary detailing the development components, sizes, and phasing that will be used to determined the expected site generated traffic can be seen in **Appendix D**.

Pass-by Trips

It should be noted that retail and service land uses generate a different mixture of traffic than land uses such as residential homes and office facilities, which add all of the "new" traffic to the adjacent roadway system. Retail and service land uses also attract motorists from the existing passing flow of traffic. A portion of the estimated total generated trips are actually vehicles that are currently using the adjacent roadway system (i.e. motorists who are already on the road and stop by the drugstore on the way home from work). These vehicles are referred to as "Pass-by" trips and require direct access from roadways directly adjacent to the development site.

The development is not expected to generate pass-by trips as direct access to the development is only available along functionally classified local roadways.

Diverted Link Trips

It should be noted that retail and service land uses generate a different mixture of traffic than land uses such as residential homes and office facilities, which add all of the "new" traffic to the adjacent roadway system. Retail and service land uses also attract motorists from roadways within the vicinity of the development. A portion of the estimated total generated trips are vehicles that would require a diversion from another roadway to a site adjacent roadway to gain access (i.e. motorists who are who are on the interstate and exit to get gas and then re-enter the interstate). These vehicles are referred to as "Diverted Link" trips. It should be noted that diverted link trips add traffic to the roadways adjacent to the site, but may not add traffic to the study area's major travel routes.

The first floor business portion of the office/commercial buildings may generate diverted link trips from North Main Street (SR 91) and West Streetsboro Road (SR 303). In order to provide a conservative estimate of the expected site generated traffic no diverted link trips will be assumed for the approximate 12,000 square feet of first floor uses at the commercial/office buildings.

Internal Capture

The proposed Downtown Phase 2 development can be classified as a multi-use development where trips can be made between two on site land uses without using the off-site road system. Because of the nature of these developments, the trip making characteristics are interrelated, and some trips are made among on-site uses. This capture of trips internal to the site has the net effect of reducing vehicle trip generation between the overall development site and the external street system (compared to the total number of trips generated by comparable land uses developed individually on stand-alone sites). It will be assumed that internal connections will be available within the development during Phase 1 and full build out of the development.

Internal trips between residents who live and work within the development are also likely to occur and could be considered part of the internal capture for the development. In order to provide a conservative estimate of the site generated trips Internal trips between the residential and office land uses will not be included in the internal capture calculations.

Trip generation calculations for the development were performed utilizing data contained in the **Trip Generation Manual** and the methods outlined in the (ITE) **Trip Generation Handbook** that have been discussed previously. Copies of the trip generation detail worksheets can be found in **Appendix D**.

The office/commercial (125,804 SF), retail (6,000 SF), and restaurant (6,000 SF) components were analyzed as 137,804 square feet of general office building land use #710 based on the ITE land use definition and to account for the varying peak hours of operation for the expected building components.

The development was also analyzed with 30 less multifamliy units and an additional 10 townhome units.

The following tables detail the expected site generated traffic for each portion of the development under the development plan as detailed in Figure 1.3 and the alternative residential scenario previously described:

Table 4.2 Net Trip Generation
Hudson Phase 2 Development - Full Build

ITE TRIP GENERATION		SIZE	TRIP ENDS			
ITE Code	Description		Weekday AM Peak Hour of Generator (Enter/Exit)		Weekday PM Peak Hour of Generator (Enter/Exit)	
220	Multifamily Housing (Low-Rise)	63 Units	10	26	25	18
221	Multifamily Housing (Mid-Rise)	80 Units	8	21	22	14
710	General Office Building*	137,804 SF	194	26	39	178
TOTAL NEW TRIPS			**212**	**73**	**86**	**210**
			285		**296**	

***The 137,804 square feet of office/commercial space is anticipated to include approximately 12,000 square feet of first floor business service/restaurant/personal services uses.**

Table 4.3 Net Trip Generation
Hudson Phase 2 Development - Alternate Residential Scenario

ITE TRIP GENERATION		SIZE	TRIP ENDS			
ITE Code	Description		Weekday AM Peak Hour of Generator (Enter/Exit)		Weekday PM Peak Hour of Generator (Enter/Exit)	
220	Multifamily Housing (Low-Rise)	73 Units	12	30	29	20
221	Multifamily Housing (Mid-Rise)	50 Units	5	14	15	10
710	General Office Building*	137,804 SF	194	26	39	178
TOTAL NEW TRIPS			**211**	**70**	**83**	**208**
			281		**291**	

***The 137,804 square feet of office/commercial space is anticipated to include approximately 12,000 square feet of first floor business service/restaurant/personal services uses.**

Table 4.3 indicates the change in residential units results in 4 fewer trips in the AM peak hour and 5 fewer trips in the PM peak hour. It is our opinion that the difference in total site generated trips at this level is insignificant and would not have an impact of the calculations and results in this report. The study and all analysis found in it will be based on the site generated trips found in Table 4.2.

Development Average Daily Traffic

The trip generation calculation methods also provide the expected amount of daily trips to be generated by a land use. This is the expected volume traffic generated by a land use throughout the course of an entire day or 24 hour period.

Trip generation calculations for the average daily site generated development traffic were performed utilizing data contained in the **Trip Generation Manual** and the methods outlined in the (ITE) **Trip Generation Handbook** that have been discussed previously. Copies of the trip generation detail worksheets can be found in **Appendix D**. The following tables detail the expected average daily site generated traffic for each portion of the development on a weekday and a Saturday:

Table 4.4 Net Trip Generation
Hudson Phase 2 Development

ITE TRIP GENERATION		SIZE	TRIP ENDS			
ITE Code	Description		Weekday Average Daily Traffic (Enter/Exit)		Saturday Average Daily Traffic (Enter/Exit)	
220	Multifamily Housing (Low-Rise)	63 Units	218	218	181	181
221	Multifamily Housing (Mid-Rise)	80 Units	217	217	330	330
710	General Office Building	137,804 SF	724	724	153	153
TOTAL NEW TRIPS			**1159**	**1159**	**664**	**664**
			2318		**1328**	

Figure 4.1A on the following pages details the additional daily traffic on the study area roadways due to the site generated traffic volumes.

Distribution of Generated Traffic

The directional distribution for the new generated traffic is a function of several variables including size and type of the proposed development, the prevailing operating conditions on the existing roadways, population distribution within the defined area of influence and current land uses.

The distribution of traffic for the analysis contained in this report also included a review of available data from the following organizations that can currently be found at the following web addresses:

AMATS:	http://amatsplanning.org/
Summit County:	https://co.summitoh.net/
ODOT TIMS:	http://odot.ms2soft.com/tcds/tsearch.asp?loc=Odot&mod=
On The Map:	https://onthemap.ces.census.gov/

The Akron Metropolitan Area Transporation Study (AMATS) is the metropolitan planning organization (MPO) for Summit, Portage, and a portion of Wayne counties. A MPO is a federally mandated and funded transportation policy-making organization made up of local government and transportation officials.

The ODOT TIMS website is a web-mapping portal that provides a variety of data regarding the transportation system in Ohio.

On The Map is a web-based mapping and reporting application that shows where workers are employed and where they live. The application also provides a variety of additional census data.

The distribution pattern based on the existing peak hour traffic volumes can be seen in the following tables.:

Table 4.5 Trip Origins and Destinations
AM Peak Hour

ORIGIN/ DESTINATION	ROUTE	FROM	% TOTAL	TO	% TOTAL
NORTH	SR 91	416	14%	700	22%
NORTH	Valley View	127	4%	115	4%
SOUTH	SR 91	798	26%	511	16%
SOUTH	Ravenna	128	4%	61	2%
WEST	Hines Hill	189	6%	205	7%
WEST	Boston Mills	118	4%	245	8%
WEST	SR 303	621	20%	551	17%
EAST	Aurora	198	6%	227	7%
EAST	SR 303	502	16%	544	17%
	TOTALS	**3097**	**100%**	**3159**	**100%**

Table 4.6 Trip Origins and Destinations
PM Peak Hour

ORIGIN/ DESTINATION	ROUTE	FROM	% TOTAL	TO	% TOTAL
NORTH	SR 91	688	17%	559	15%
NORTH	Valley View	180	5%	159	4%
SOUTH	SR 91	908	23%	940	25%
SOUTH	Ravenna	102	3%	171	4%
WEST	Hines Hill	247	6%	270	7%
WEST	Boston Mills	276	7%	156	4%
WEST	SR 303	671	17%	695	18%
EAST	Aurora	303	8%	231	6%
EAST	SR 303	569	14%	656	17%
	TOTALS	**3944**	**100%**	**3837**	**100%**

The collected traffic data for this report was compared to the available data from ODOT and AMATS.

The On The Map application was used to create a series of maps detailing where residents of Hudson are going to work and where people working in Hudson are coming from. These maps can be seen in **Appendix E**.

The distribution patterns for the site generated traffic are based upon engineering judgment of the previously discussed variables and data shown in Tables 4.5 and Table 4.6. These distribution patterns should provide a conservative estimate of where traffic is originating from and where traffic is destined for.

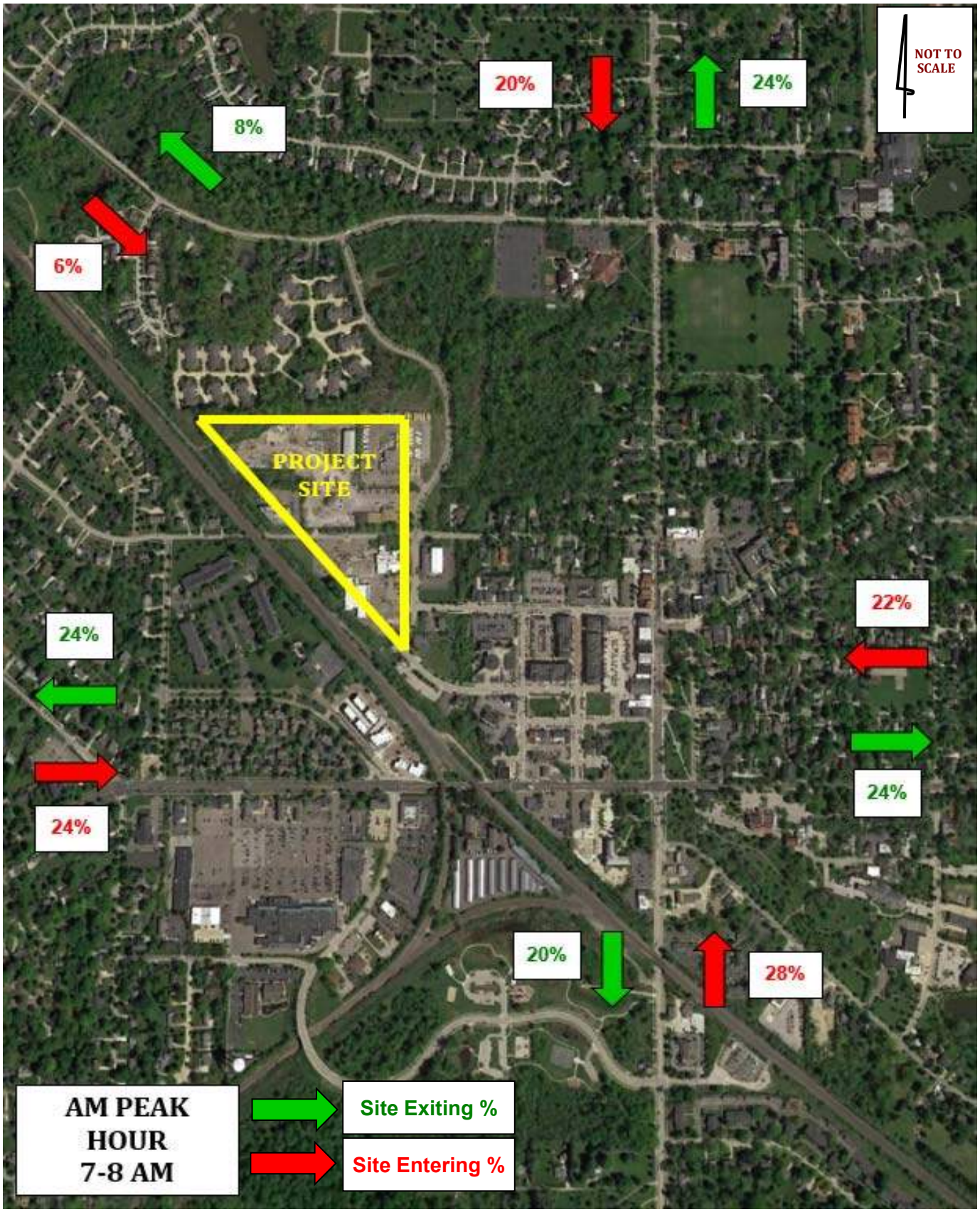
The peak hour distribution pattern that will be used to distribute the site generated traffic in the study area is shown in **Figures 4.1 and 4.2, Page 36 and 37** for the AM and PM peak hours, respectively.

The directional distribution for the new AM and PM peak hour generated traffic volumes are shown graphically in **Figure 4.3, Page 38.**

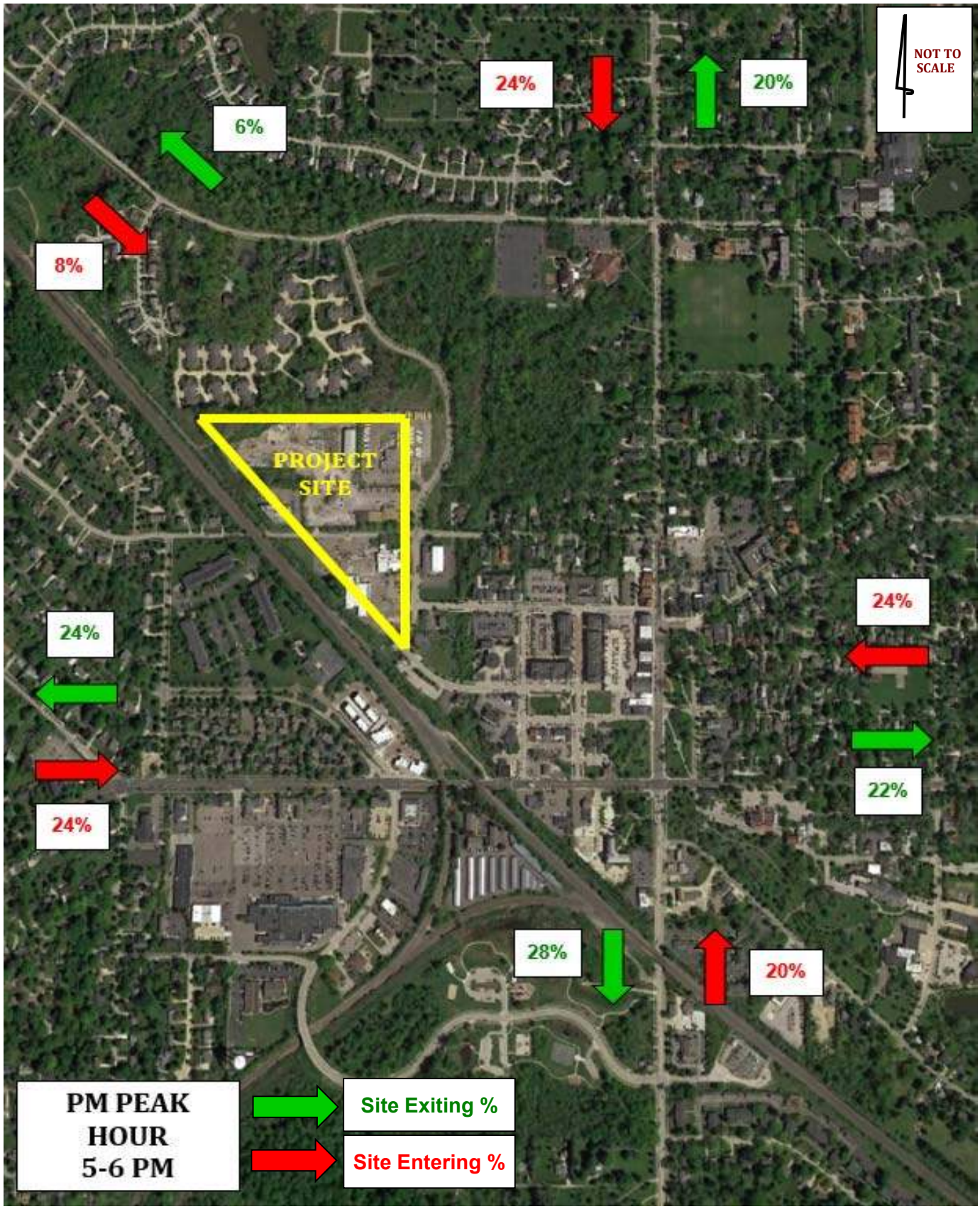
It should be noted that the Street Closure Evaluation was prepared to analyze impact of closing of College Street between Hudson Street to the north and Chapel Street to the south. The study was prepared by TMS Engineers, Inc. and dated February 23, 2018. A closure of College Street in this section is not expected to significantly impact the distribution of the site generated traffic due to the location of the ingress and egress locations for the proposed development as compared to the location of the street closure.

Assignment of Generated Traffic

Based upon the distribution pattern shown in **Figure 4.3**, the new AM and PM peak generated traffic were assigned to the study intersections for the full build out of the development. **Figure 4.4, Page 39** details the full build site generated traffic volumes.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Downtown Phase II Hudson, Ohio Traffic Impact Study	AM Peak Hour Traffic Distribution Percentages	Figure 4.1 Page 36



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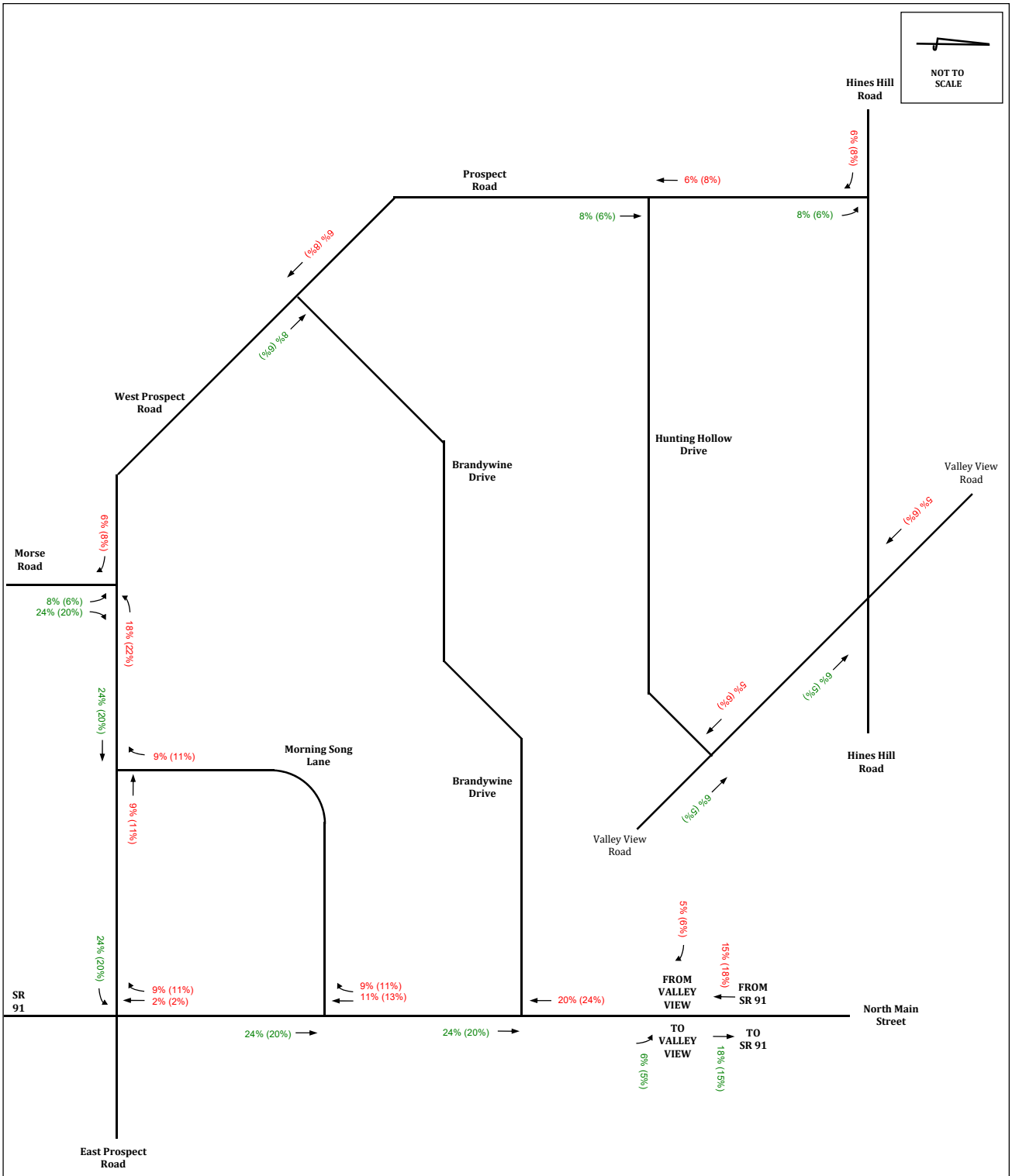

LEGEND
XX% AM Peak Hour Distribution
(XX%) PM Peak Hour Distribution
RED = Entering Volumes
GREEN = Exiting Volumes

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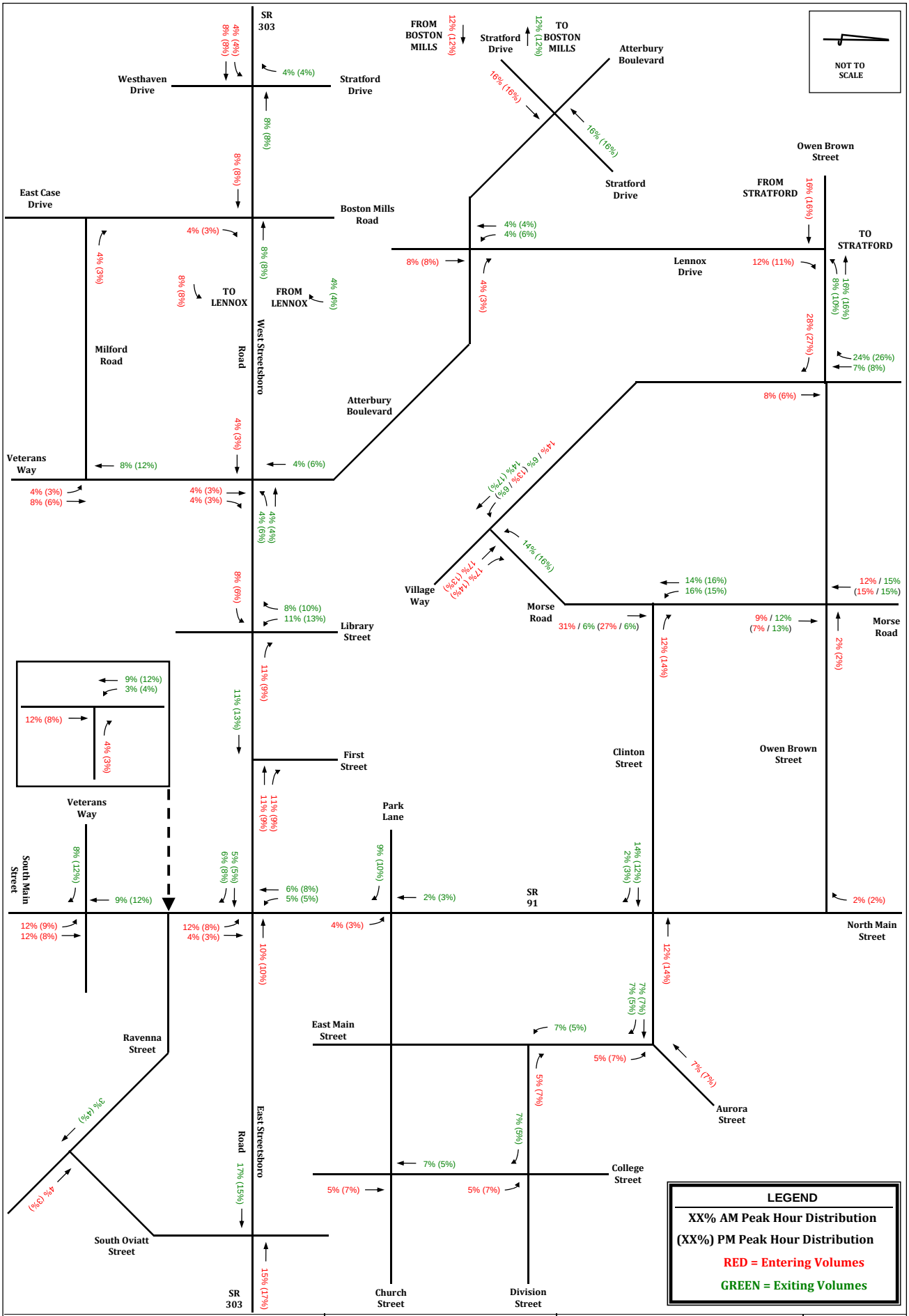
Directional Distribution
New Trips
(North Section)

Figure: 4.3a



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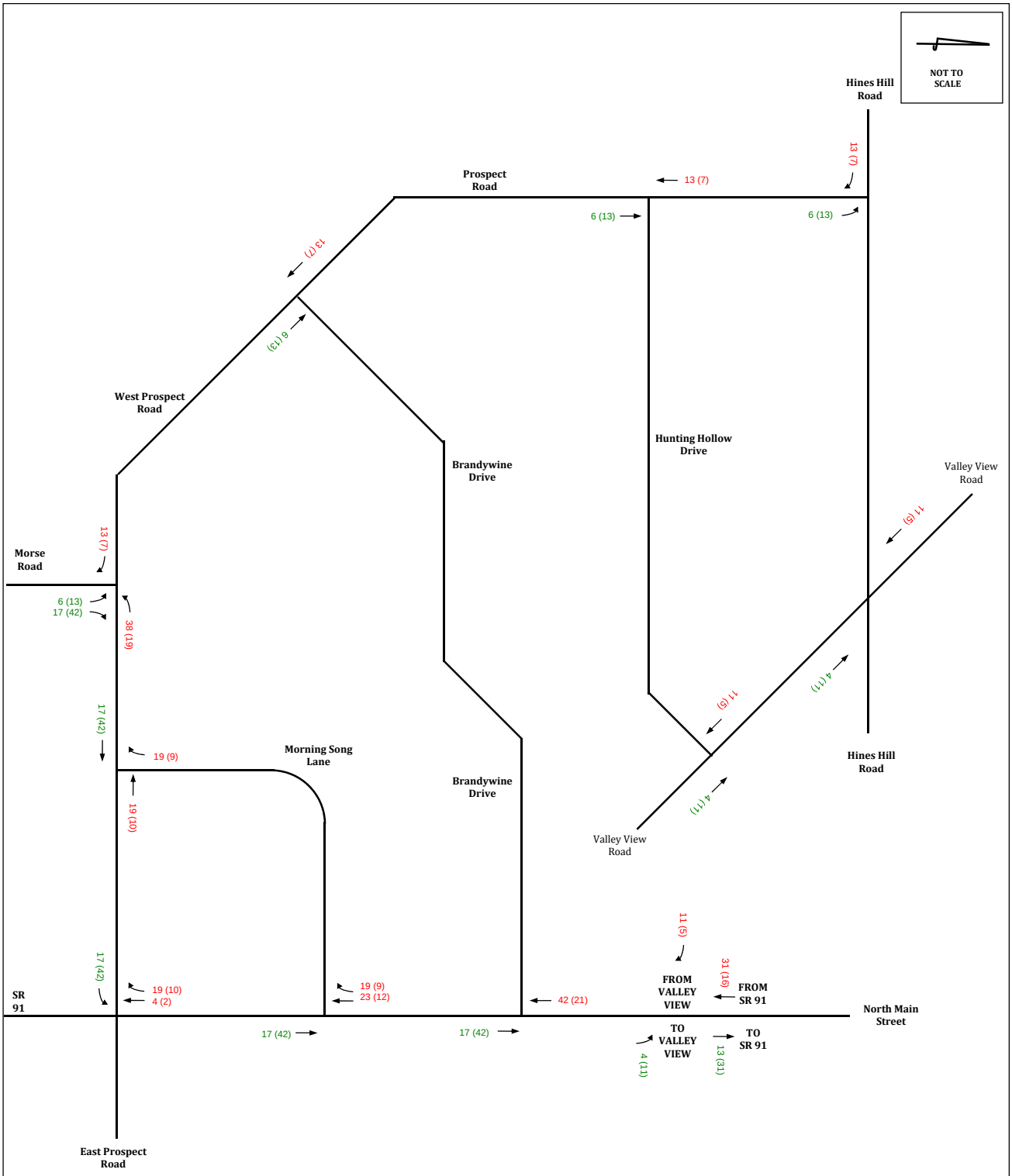
Directional Distribution
New Trips
(South Section)

Figure: 4.3b



NEW GENERATED TRAFFIC	AM	PM
TOTAL TRIPS	285	296
ENTER	212	86
EXIT	73	210

LEGEND	
XX	AM Peak Hour Trips
(XX)	PM Peak Hour Trips
	RED = Entering Volumes
	GREEN = Exiting Volumes

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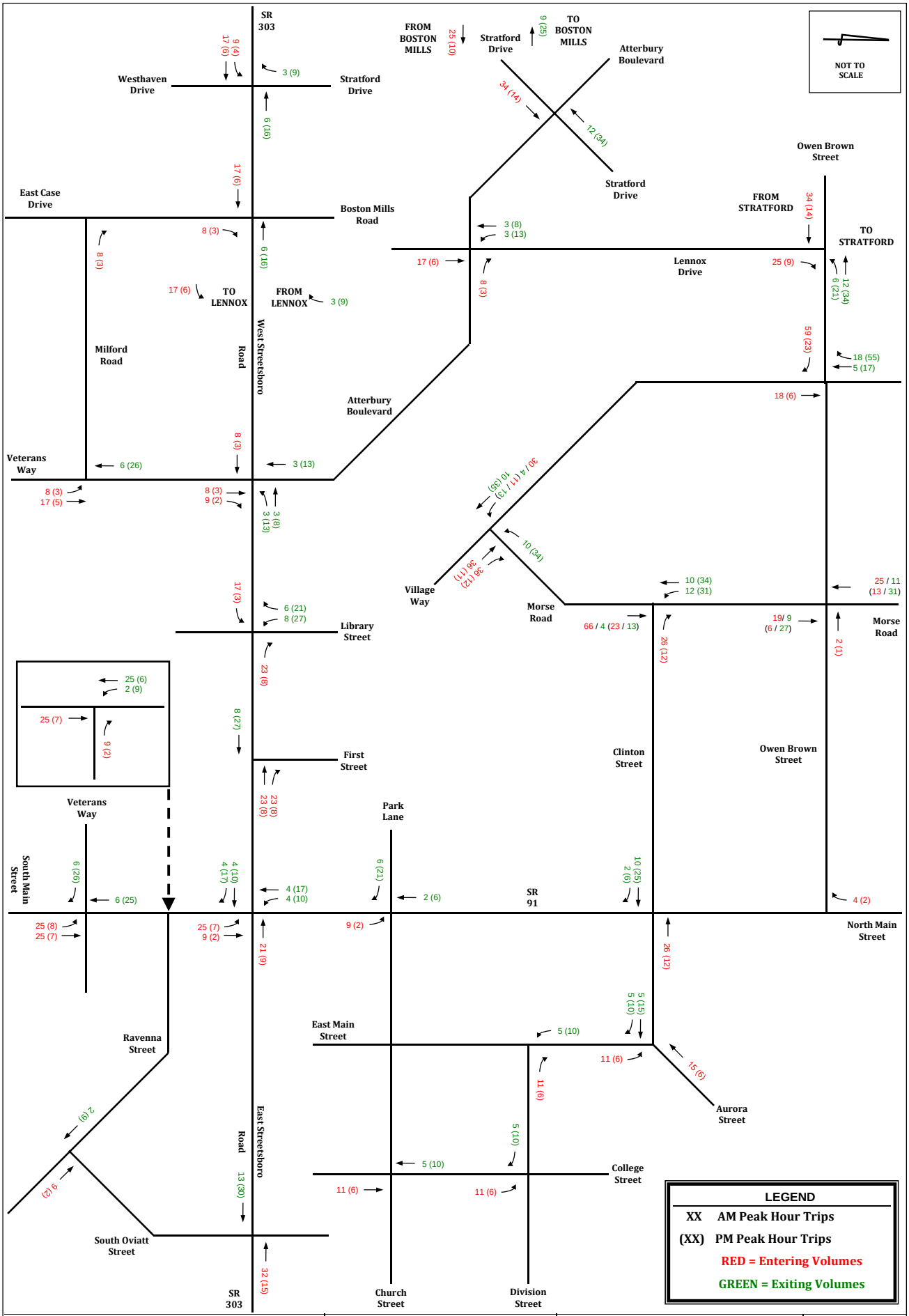
New Generated Trips
Full Build
(North Section)

Figure: 4.4a



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New Generated Trips
Full Build
(South Section)

Figure: 4.4b

4.2 Non-Site Traffic

Background Traffic Growth

Design of new roadways or improvements to existing roadways should not usually be based on current traffic volumes alone, but should consider future traffic volumes expected to make use of the facilities. Roadways should be designed to accommodate the traffic volume that is likely to occur within the design life of the facility. In a practical sense, this design volume should be a value that can be estimated with reasonable accuracy. It is believed that the maximum design period is in the range of 15 to 24 years. Therefore, a period of twenty years is widely used as a basis for design. Traffic cannot usually be forecasted accurately beyond this period on a specific facility because of probable changes in the general regional economy, population, and land development along the roadway. The ODOT **Access Management Manual** requires that opening year and twenty year design hour traffic volumes be analyzed for a proposed development.

Roadways like those found in the study area carry a significant amount of through traffic due to their functional characteristics. This through traffic component generally increases as regional growth occurs. Therefore, it is anticipated that existing traffic on the study area roadways will increase in future years.

The years 2021 and 2041 (design year) will be analyzed for the proposed development. Therefore, it is necessary to estimate historical growth rates in order to establish the future traffic on the study area roadways due to non-site related conditions.

The ODOT Traffic Management Monitoring System (TMMS) was consulted to determine past historical trends along the roadways in the vicinity of the study area. This historical traffic data was used to determine the study area growth rates. The TMMS can be seen and accessed at the following web address:

http://odot.ms2soft.com/tcds/tsearch.asp?loc=Odot&mod=

Data for locations along State Route 91 south of Prospect Street and north of Barlow Road can be seen in **Appendix F**.

Data for locations along State Route 303 east of Boston Mills Road and west of Stow Road can be seen in **Appendix F**.

Based on the historical traffic data from ODOT's TMMS, the functional characteristics due to the roadway functional classification, and in order to provide a conservative analysis of the study area, linear growth rates will be used to determine the anticipated study area volumes under the 2021 and 2041 No-Build conditions. The growth rate and factors for the study area roadways based on their functional classification can be seen in the following table:

Table 4.7 - Growth Rates & Factors
2017 Traffic Count Data

ROADWAY FUNCTIONAL CLASSIFICATION	GROWTH RATE (Annual Growth)	2021 GROWTH FACTOR	2041 GROWTH FACTOR
Principal Arterial	1.00%	1.04	1.24
Minor Arterial	0.75%	1.03	1.18
Major Collector	0.50%	1.02	1.12
Local Roadway	0.00%	1.00	1.00

Table 4.8 - Growth Rates & Factors
2015 Traffic Count Data

ROADWAY FUNCTIONAL CLASSIFICATION	GROWTH RATE (Annual Growth)	2021 GROWTH FACTOR	2041 GROWTH FACTOR
Principal Arterial	1.00%	1.06	1.26
Minor Arterial	0.75%	1.045	1.195
Major Collector	0.50%	1.03	1.13
Local Roadway	0.00%	1.00	1.00

Design Hour Traffic

The traffic patterns on any roadway typically show considerable variation in the traffic volumes experienced during the various hours of the day and in the hourly volumes experienced throughout the year. A key decision in the design process involves determining which of these hourly traffic volumes should be used as the basis for the design. It would be wasteful to predicate a design on the maximum peak hour traffic that occurs during the year and the use of the average hourly traffic would result in an inadequate design. The hourly traffic volumes used in a design should not be exceeded very often or by very much. On the other side of the spectrum, the hourly traffic volumes should not be so high that traffic would rarely be sufficient to make full use of the designed facility. Normal design policy in the State of Ohio is based upon a review of curves that depict the variation in hourly traffic volumes during the year. The Ohio Department of Transportation recommends using the 30^{TH} highest hour as a design control for urban streets. There is typically very little difference between the volumes in this range. The Ohio Department of Transportation provides factors or a methodology to determine factors that are applied to counted daily traffic volumes to determine appropriate design hour traffic volumes.

Following guidelines set forth in the **ODOT Access Management Manual**, all analyses are required to examine the design hour volume for the adjacent roadway and peak hour traffic volume of the proposed development.

The ODOT Peak Hour to Design Hour charts will be used to determine the deign hour factors for the study area roadways. These charts are based on the functional classification of the roadway, the day of the week and the month that the traffic data was collected. A copy of the ODOT Peak Hour to Design Hour Charts can be seen in **Appendix G**.

4.3 Future Traffic

No-Build Traffic Volumes

In order to estimate the future traffic considering non-project traffic conditions, the previously discussed historical growth rates and design hour factors were applied to the traffic data collected for this report. The estimated 2021 and 2041 No-Build traffic volumes for the study area are shown graphically in the following figures:

Figure 4.5, Page 44 - 2021 No-Build Traffic Volumes
Figure 4.6, Page 45 - 2041 No-Build Traffic Volumes

This traffic is the expected traffic if the proposed development **is not** constructed, the "No-Build" condition. It should be noted that existing traffic from the development parcels was not removed or re-distributed from the study area roadways.

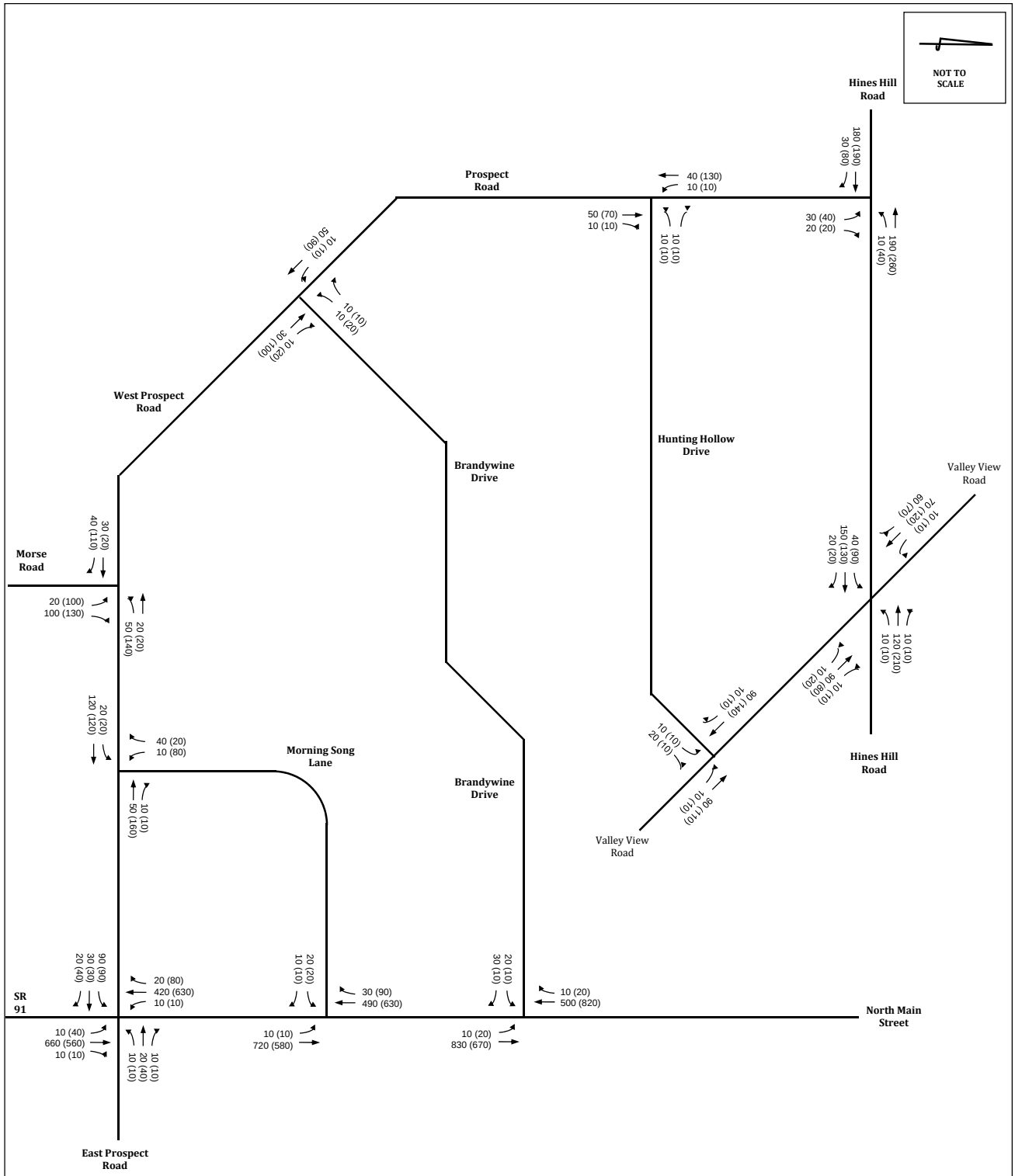
The No-Build traffic volumes have been rounded to the nearest 10 to adhere to preferred ODOT practices.

Build Condition Traffic Volumes

In order to estimate the future traffic considering project traffic conditions, the sum of the No-Build volumes, shown in **Figures 4.5** and **4.6**, were added to the new generated traffic to equal the future Build peak hour volumes. The estimated 2021 and 2041 Build traffic volumes for the study area are shown graphically in the following figures:

Figure 4.7, Page 46 - 2021 Build Traffic Volumes
Figure 4.8, Page 47 - 2041 Build Traffic Volumes

It should be noted that existing traffic from the development parcels was from the study area roadways in close proximity to the development area. These traffic volumes are the expected volumes if the proposed development **is** constructed, or the "Build" condition.



LEGEND	
XX	AM Peak Hour Traffic
(XX)	PM Peak Hour Traffic

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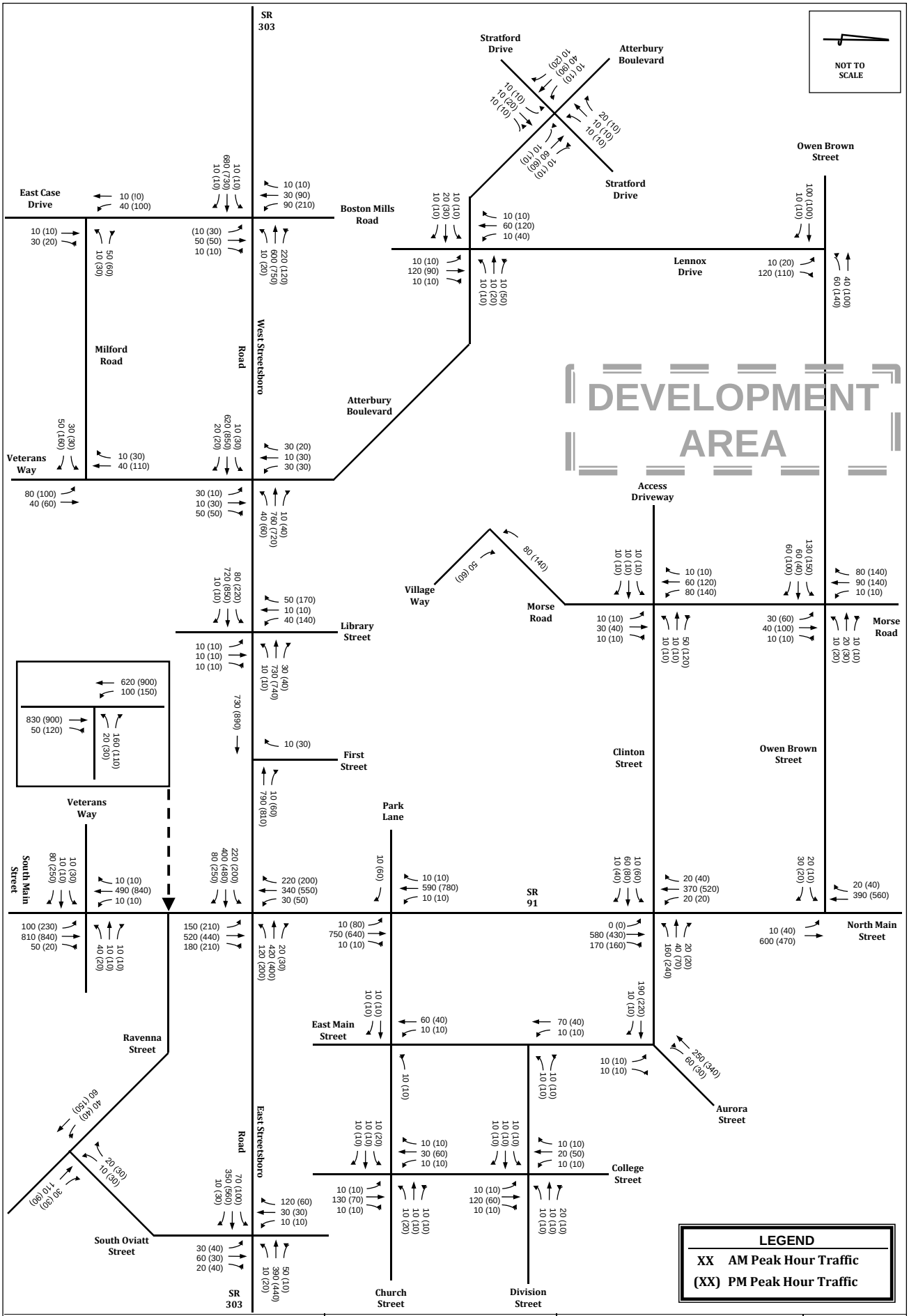
2021 No-Build
Peak Hour Traffic Volumes
(North Section)

Figure: 4.5a



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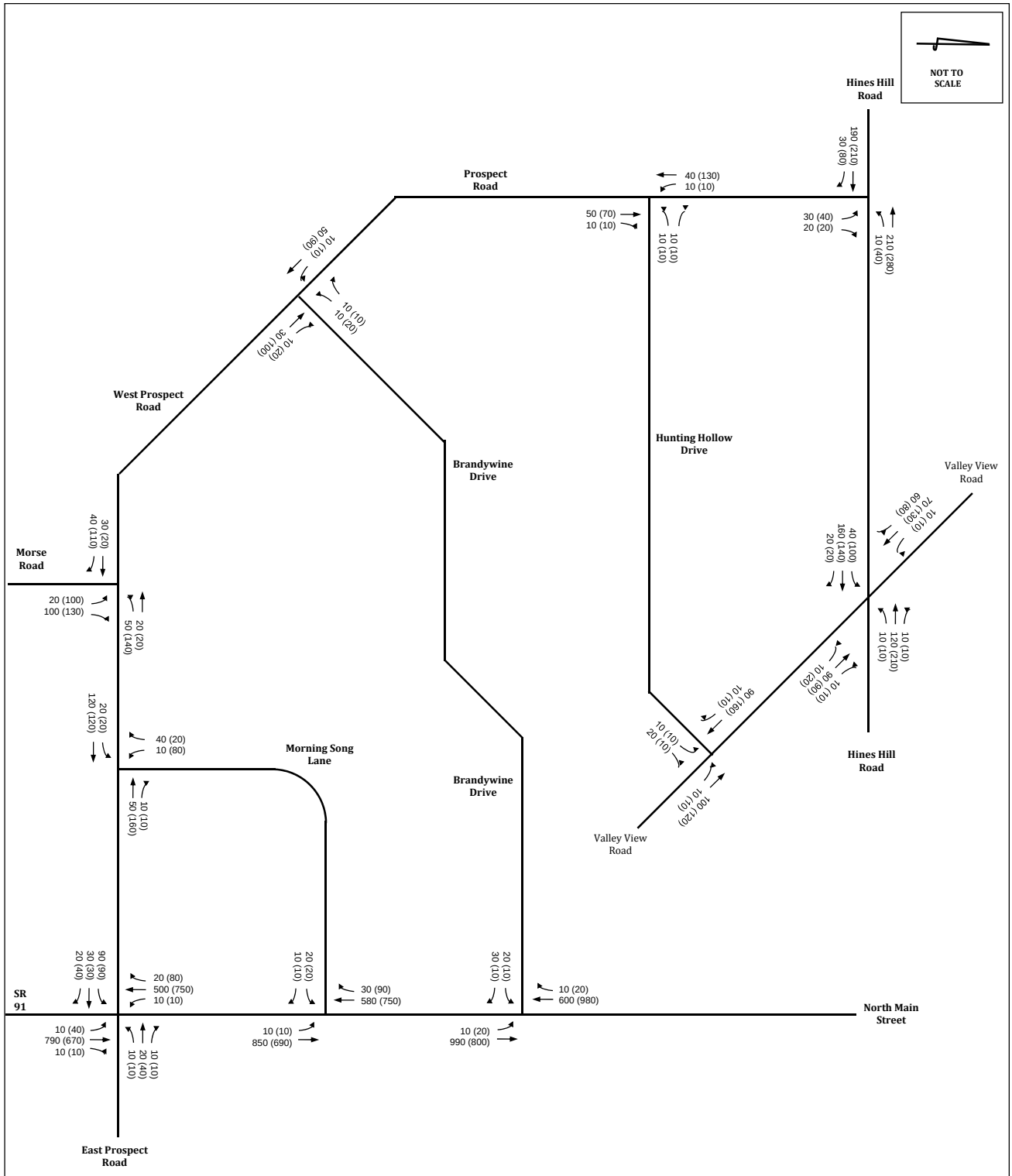

LEGEND	
XX	AM Peak Hour Traffic
(XX)	PM Peak Hour Traffic

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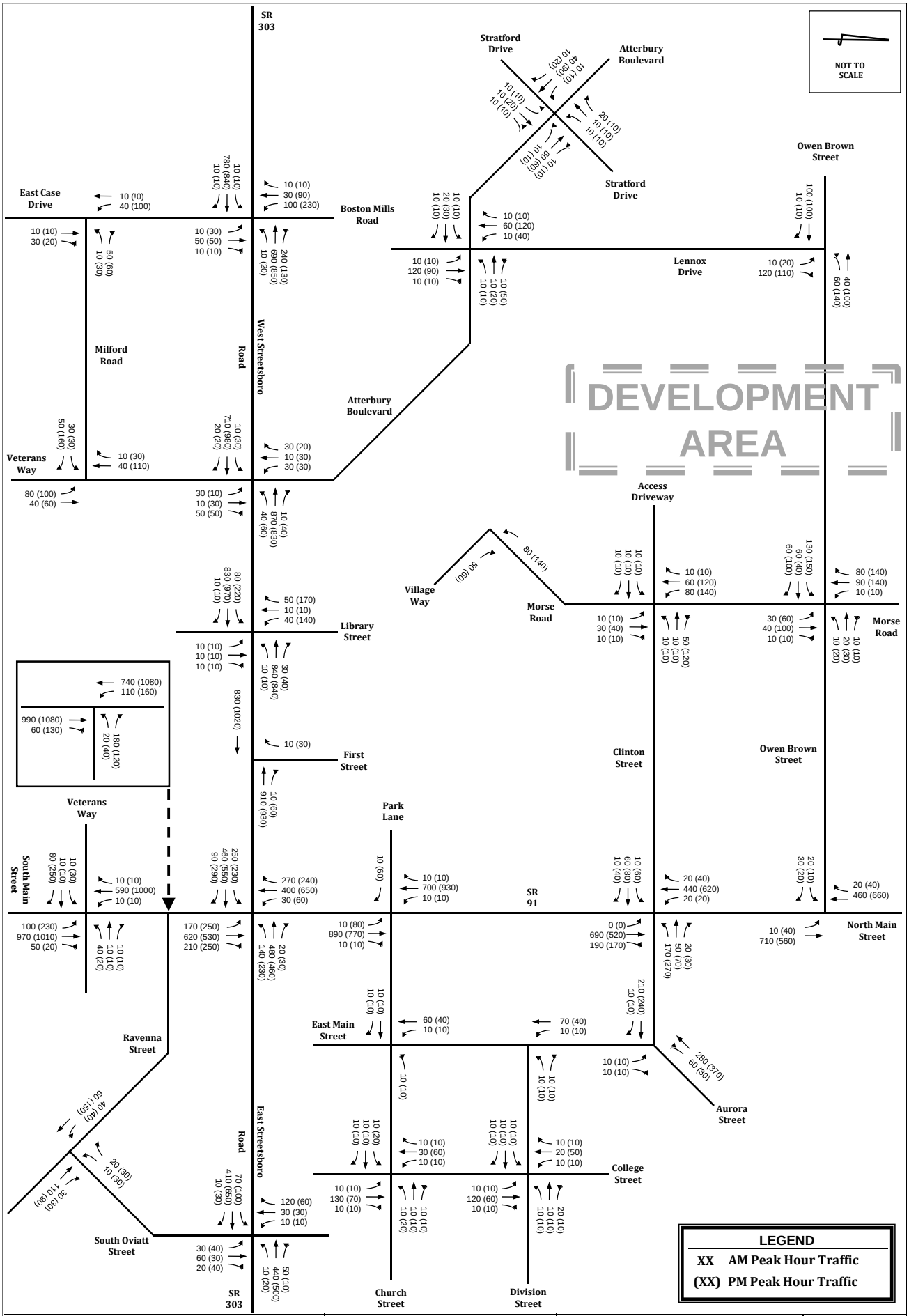
2041 No-Build
Peak Hour Traffic Volumes
(North Section)

Figure: 4.6a



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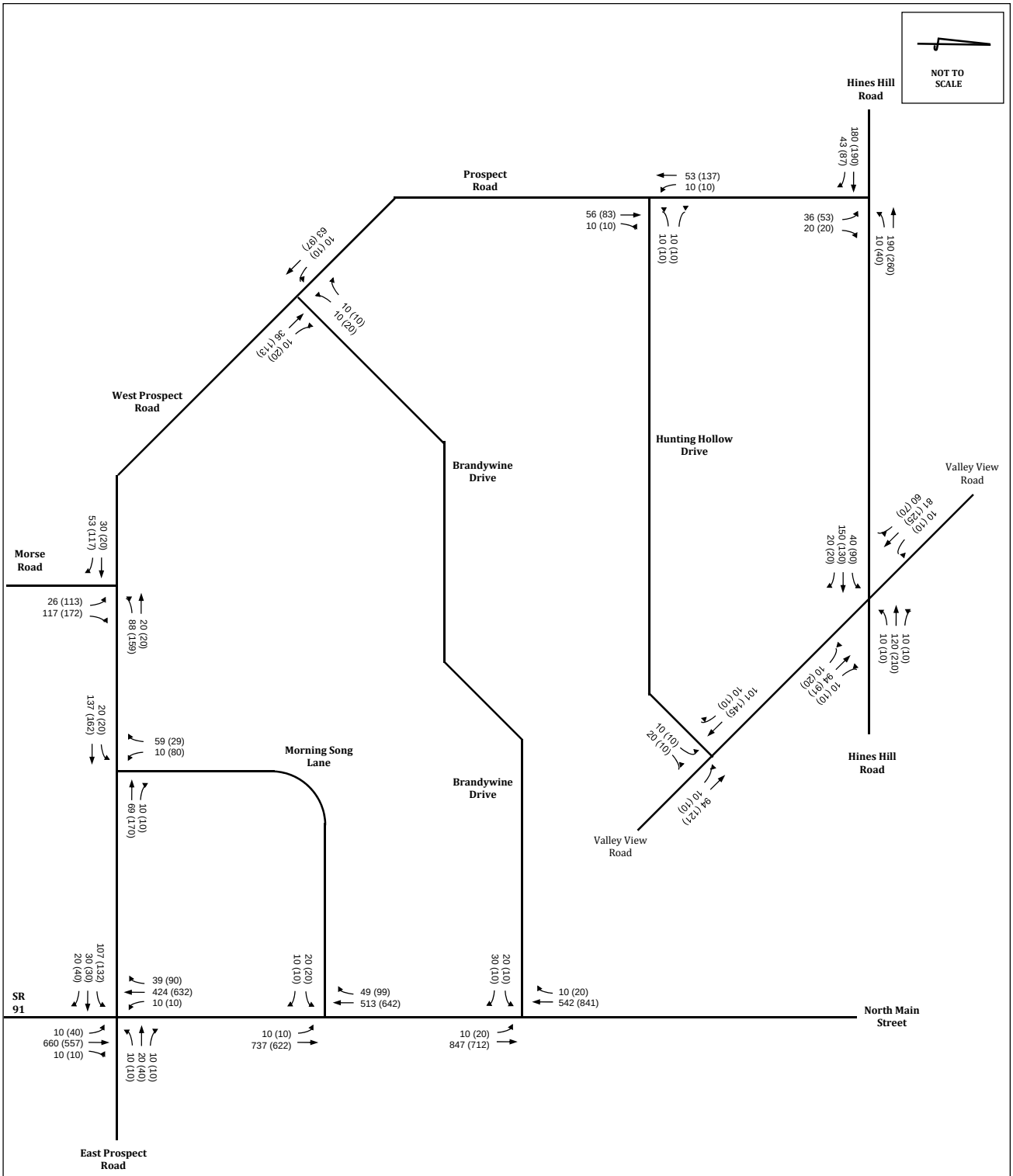
2041 No-Build
Peak Hour Traffic Volumes
(South Section)

Figure: 4.6b



LEGEND	
XX	AM Peak Hour Traffic
(XX)	PM Peak Hour Traffic

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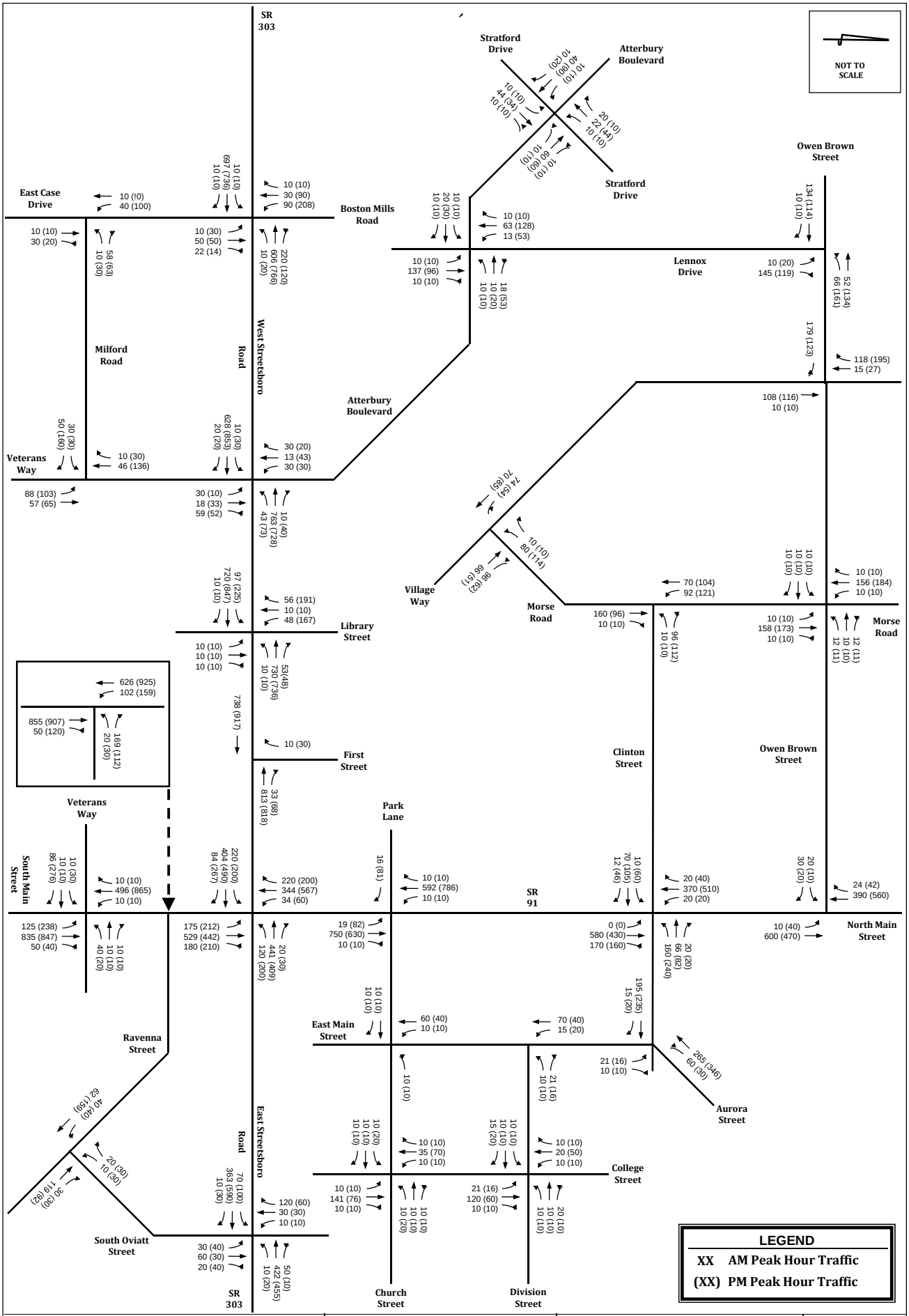
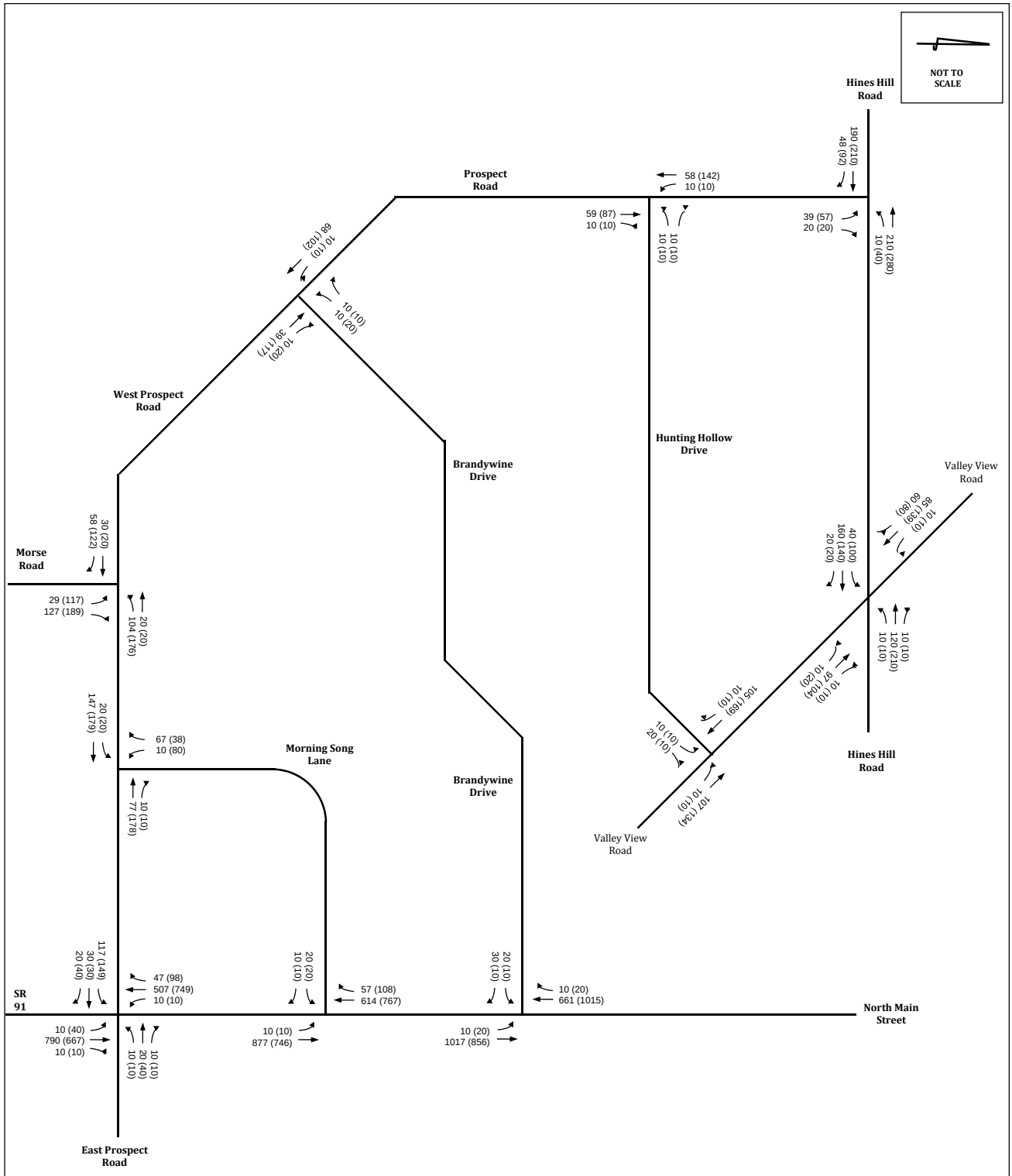
Peak Hour Traffic Volumes
(North Section)

Figure: 4.7a


SR 303
Stratford Drive
Atterbury Boulevard
Stratford Drive
NOT TO SCALE
Owen Brown Street
East Case Drive
Boston Mills Road
Lennox Drive
Milford Road
West Streetsboro Road
Atterbury Boulevard
Veterans Way
Village Way
Morse Road
Library Street
Morse Road
First Street
Clinton Street
Owen Brown Street
Veterans Way
Park Lane
South Main Street
SR 91
North Main Street
Ravenna Street
East Main Street
Aurora Street
East Streetsboro Road
College Street
South Oviatt Street
Church Street
Division Street
SR 303
LEGEND
XX AM Peak Hour Traffic
(XX) PM Peak Hour Traffic



LEGEND	
XX	AM Peak Hour Traffic
(XX)	PM Peak Hour Traffic

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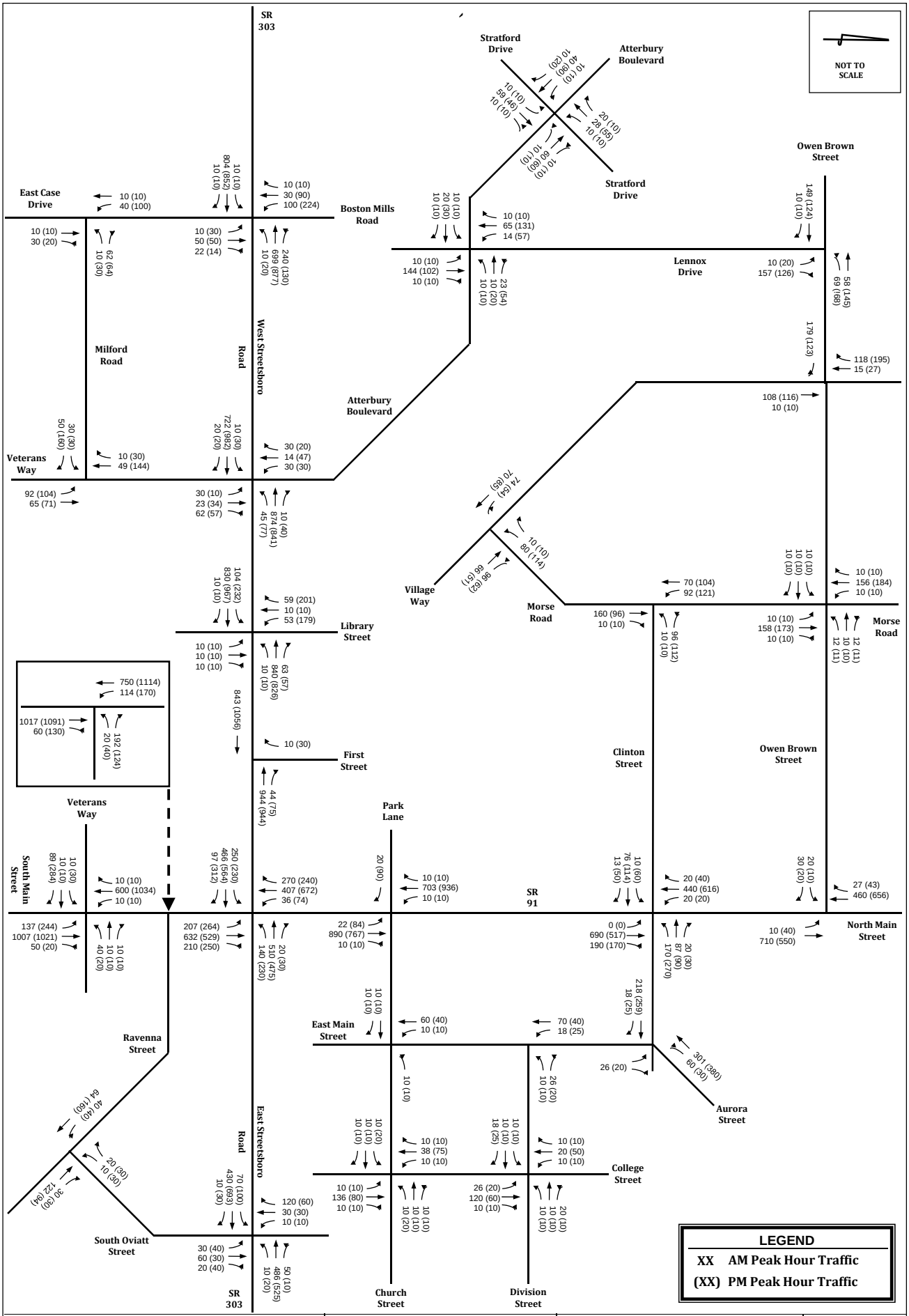
2041 Build
Peak Hour Traffic Volumes
(North Section)

Figure: 4.8a


SR 303
Stratford Drive
Atterbury Boulevard
Stratford Drive
NOT TO SCALE
Owen Brown Street
East Case Drive
Boston Mills Road
Lennox Drive
Milford Road
West Streetsboro Road
Atterbury Boulevard
Veterans Way
Village Way
Morse Road
Library Street
First Street
Clinton Street
Owen Brown Street
Morse Road
Veterans Way
Park Lane
South Main Street
SR 91
North Main Street
Ravenna Street
East Main Street
Aurora Street
East Streetsboro Road
College Street
South Oviatt Street
Church Street
Division Street
SR 303
LEGEND
XX AM Peak Hour Traffic
(XX) PM Peak Hour Traffic

Chapter 5
Traffic Analysis

5.1 Capacity and LOS at Study Area Intersections

Intersection capacity analyses were performed at the study area intersections using the computerized version of Synchro plus SimTraffic, Traffic Signal Coordination Software. The capacity analyses were performed in order to estimate the maximum amount of traffic that can be accommodated by a roadway facility while maintaining recommended operational qualities. Existing, No-Build, and Build peak hour traffic volumes were analyzed to determine the level-of-service (LOS) at the study area intersections.

The capacity analysis procedures provide a calculated "average vehicle delay", which is based on traffic volumes, number of lanes, type of traffic control, channelization, grade, and percentage of large vehicles in the traffic stream at each intersection. The average delay calculated at an intersection is then assigned a "grade" or level of service (LOS) ranging from LOS A, the best, to LOS F, the worst based upon driver expectation. The intersection LOS "grades" as defined by the Transportation Research Board are as follows:

Table 5.1 Intersection LOS

LOS	UNSIGNALIZED AVERAGE DELAY/VEHICLE (Seconds/Vehicle)	SIGNALIZED AVERAGE DELAY/VEHICLE (Seconds/Vehicle)	ROUNDABOUT AVERAGE DELAY/VEHICLE (Seconds/Vehicle)
A	≤ 10.0	≤ 10.0	≤ 10.0
B	10.1 to 15.0	10.1 to 20.0	10.1 to 20.0
C	15.1 to 25.0	20.1 to 35.0	20.1 to 35.0
D	25.1 to 35.0	35.1 to 55.0	35.1 to 55.0
E	35.1 to 50.0	55.1 to 80.0	55.1 to 80.0
F	> 50	> 80	> 80

The capacity analysis procedures and the resulting level of service grades and delays are a recognized traffic engineering standard for measuring the efficiency of intersection operations by such organizations as the Institute of Transportation Engineers, American Association of State Highway and Transportation Officials, and the Ohio Department of Transportation.

Existing Conditions - Capacity Analysis

Analyses were performed for the current conditions under the Existing scenario. These analyses will be used to identify existing capacity and/or operational deficiencies. The analysis assumed that the signal timing would be optimized at the signalized intersections. The traffic volumes used in this analysis can be seen in **Figure 2.6**. Copies of the Synchro capacity worksheets are included in **Appendix H**.

The following intersections are currently operating with a level-of-service D or lower under the existing conditions:

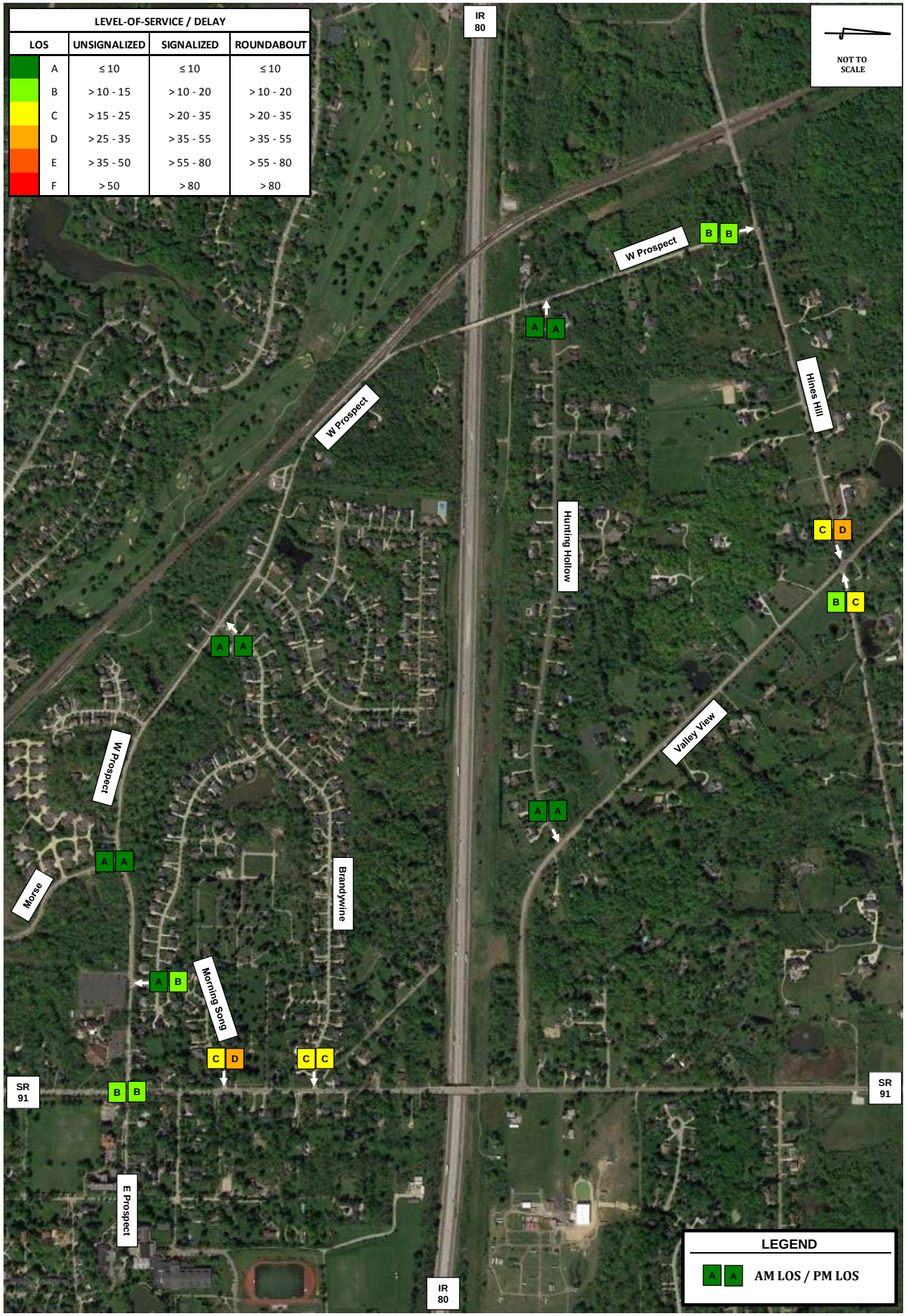
2. North Main Street (SR 91) & Morning Song Lane
5. SR 91 & Clinton Street/Aurora Street
7. North/South Main Street (SR 91) & East/West Streetsboro Street (SR 303)
16. Hines Hill Road & Valley View Road
35. East Streetsboro Road (SR 303) & North/South Oviatt Street

The remaining study area intersections are operating with acceptable levels-of-service under the existing peak hour conditions.

Figure 5.1, Page 50 visually details the intersection level-of-service for traffic signal and all-way stop controlled intersections and the minor street approach levels-of-service at the minor street stop controlled intersections. AM and PM peak hour charts can be found in **Appendix H** detailing a summary of the capacity analysis results for the study area intersections.

In order to determine what mitigation would be necessary to improve the levels-of-service at these intersections, certain improvements were tested with further capacity analyses. It should be noted that traffic signal was determined to not be warranted at the unsignalized intersections as detailed in Section 3.3. Therefore, alternatives to traffic signal control were considered to improve the minor street levels-of-service.

The following improvements were determined to mitigate the poor levels-of-service under the existing conditions:



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Existing Conditions
Levels-of-Service

Figure: 5.1a

Page: 50a

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Figure: 5.1b

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

The intersections of SR 91/Aurora Street/Clinton Street and SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make these types of improvements unfeasible.

It should also be noted that the implementation of geometric improvements at the intersection of SR 91 and SR 303 would be high cost due to the railroad bridges west and south of the intersection, available right-of-way, and the impact to adjacent intersections.

The following recommendations are made for consideration for future improvements at the following intersections:

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

No-Build Conditions - 2021 Capacity Analysis

Analyses were performed for the projected year 2021 conditions under the No-Build scenario using the design hour volumes. These analyses will be used to compare to the conditions expected under the Build scenario. All analyses assumed that the signal timing would be optimized. The traffic volumes used in this analysis can be seen in **Figure 4.5**. Copies of the Synchro capacity worksheets are included in **Appendix J**.

The following intersections are expected to operate with levels-of-service D or lower under the anticipated 2021 No-Build conditions:

1. SR 91 & Brandywine Drive
2. SR 91 & Morning Song Lane
5. SR 91 & Clinton Street/Aurora Street
7. SR 91 & SR 303
14. SR 303 & Boston Mills Road
18. Valley View Road & East Hines Hill Road
35. East Streetsboro Road (SR 303) & North/South Oviatt Street
36. SR 91 & Ravenna Street

The remaining study area intersections are expected to continue operating with acceptable levels-of-service under the anticipated 2021 No-Build peak hour conditions.

Figure 5.2, Page 53 visually details the intersection level-of-service for traffic signal and all-way stop controlled intersections and the minor street approach levels-of-service at the minor street stop controlled intersections. AM and PM peak hour charts can be found in **Appendix J** detailing a summary of the capacity analysis results for the study area intersections.

The intersections of SR 91/Aurora Street/Clinton Street and SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make these types of improvement unfeasible.
Copies of the capacity worksheets for the improved intersections using traditional geometric and traffic control improvements are in included in **Appendix K**.

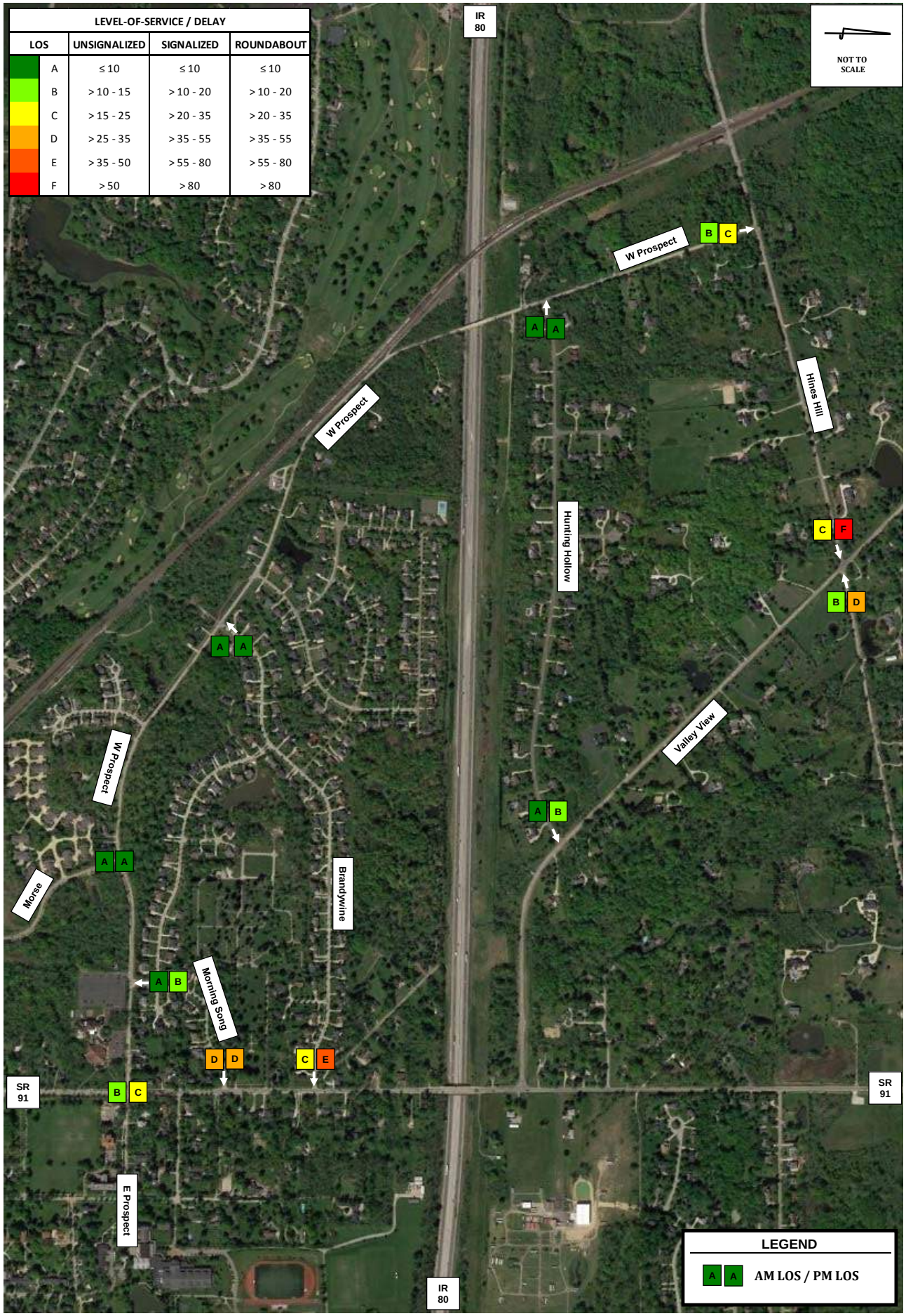

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Figure: 5.2a

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Figure: 5.2b

In order to determine what mitigation would be necessary to improve the levels of service at these intersections, certain improvements were tested with further capacity analyses. The following improvements are recommended to mitigate the poor levels-of-service under the No-Build conditions:

1. North Main Street (SR 91) & Brandywine Drive

- Construct a center two-way left turn lane.

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

The eastbound minor street approaches of Brandywine Drive and Morning Song Lane at North Main Street are expected to operate with a poor levels-of-service during the peak hours due to the lack of adequate gaps in the North Main Street north-south through traffic stream for vehicles turning left from the minor street onto North Main Street. The addition of turn lanes at the intersections is not expected to improve the LOS. The use of a single lane roundabout at the intersections is also not expected to improve the LOS.

Traffic signal control north of the intersections at Valley View Road and Herrick Park Drive should be analyzed to determine if traffic signal control is warranted and would be able to produce additional gaps in the southbound traffic flow for the minor street traffic.

It was determined that traffic signal control at the intersections could improve the intersection levels-of-service. The intersections however do not meet the criteria for warranting a traffic signal as the minor street (Brandywine Drive & Morning Song Lane) volumes do not meet the required minimum volume thresholds for traffic signal control. Therefore traffic signal control will not be considered for mitigating the levels-of-service at the intersections.

It is our opinion that a closure or turn restriction for Brandywine Drive is not a viable consideration due to the likely increase in traffic at the North Main Street and Prospect Street intersection.

An alternative option for improving the minor street level-of-service at the intersections of North Main Street at Brandywine Drive and Morning Song Lane would be to consider the use of a center two-way left turn lane.

The use of an auxiliary lane would allow the left-turning vehicles from the minor road to turn into the center lane before merging into the through lane. **Figure 5.3, Page 56** details an example of a left-turn acceleration lane.

18. Valley View Road & East Hines Hill Road
- Construct a single lane roundabout.

36. SR 91 & Ravenna Street
- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

The following recommendations are made for consideration for future improvements at the following intersections:

5. SR 91 & Clinton Street/Aurora Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

14. SR 303 & Boston Mills Road
- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street
- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

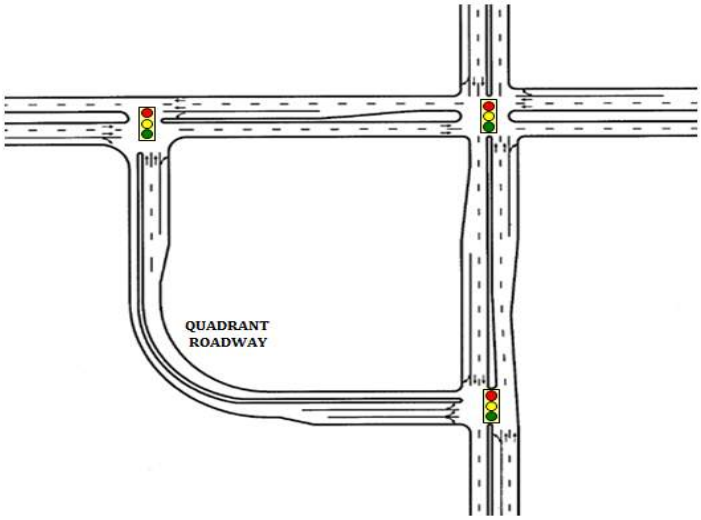
It should be noted that the downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for the State Route 91 and SR 303 including intersection improvements, operational improvements, and adding a by-pass. It would be recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.


CENTER
LEFT TURN LANE
CENTER
LEFT TURN LANE

It should be noted that reducing traffic through the intersection of State Route 91 and State Route 303 could also improve the intersection levels-of-service. Providing by-pass roadways would provide an alternative route for through traffic that is passing east-west or north-south through the City of Hudson.

A Quadrant Roadway (QR) intersection would be an alternative by-pass type scenario for consideration at State Route 91 and State Route 303 instead of geometric improvements at the intersection itself.

A Quadrant Roadway (QR) intersection is an alternative design for an intersection of two high volume roadways. The intersection works by rerouting all four left–turn movements at a four–legged intersection onto a road that connects the two intersecting roads. This design prohibits all left turns at the main intersection and therefore allows a simple two–phase signal to process the remaining through and right–turn movements. Both junctions of the connector road are typically signalized. The location of the connector road depends on traffic flow and availability of right–of–way.



A QR intersection typically needs three sets of signal controlled intersections. The main intersection with two signal phases and two secondary intersections at the ends of the connecting roadway with three signal phases each typically comprise the QR intersection treatment. A typical intersection configuration with the quadrant roadway intersections can be seen below:

The implementation of by-pass routes or QR intersections would require additional analysis of potential routes and locations for implementation to determine the feasibility and impact of creating a by-pass scenario for the intersection of State Route 91 and State Route 303.

No-Build Conditions - 2041 Capacity Analysis

Analyses were performed for the projected year 2041 conditions under the No-Build scenario using the design hour volumes. These analyses will be used to compare to the conditions expected under the Build scenario. All analyses assumed that the signal timing would be optimized. The traffic volumes used in this analysis can be seen in **Figure 4.6**. Copies of the Synchro capacity worksheets are included in **Appendix L**.

The following intersections are expected to operate with levels-of-service D or lower under the anticipated 2041 No-Build conditions:

1. SR 91 & Brandywine Drive
2. SR 91 & Morning Song Lane
5. SR 91 & Clinton Street/Aurora Street
7. SR 91 & SR 303
8. SR 91 & Veterans Way
14. SR 303 & Boston Mills Road
18. Valley View Road & East Hines Hill Road
35. East Streetsboro Road (SR 303) & North/South Oviatt Street
36. SR 91 & Ravenna Street

The remaining study area intersections are expected to continue operating with acceptable levels-of-service under the anticipated 2041 No-Build peak hour conditions.

Figure 5.4, Page 59 visually details the intersection level-of-service for traffic signal and all-way stop controlled intersections and the minor street approach levels-of-service at the minor street stop controlled intersections. AM and PM peak hour charts can be found in **Appendix L** detailing a summary of the capacity analysis results for the study area intersections.

The intersections of SR 91/Aurora Street/Clinton Street and SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make these types of improvement unfeasible.

Copies of the capacity worksheets for the improved intersections using traditional geometric and traffic control improvements are in included in **Appendix M**.

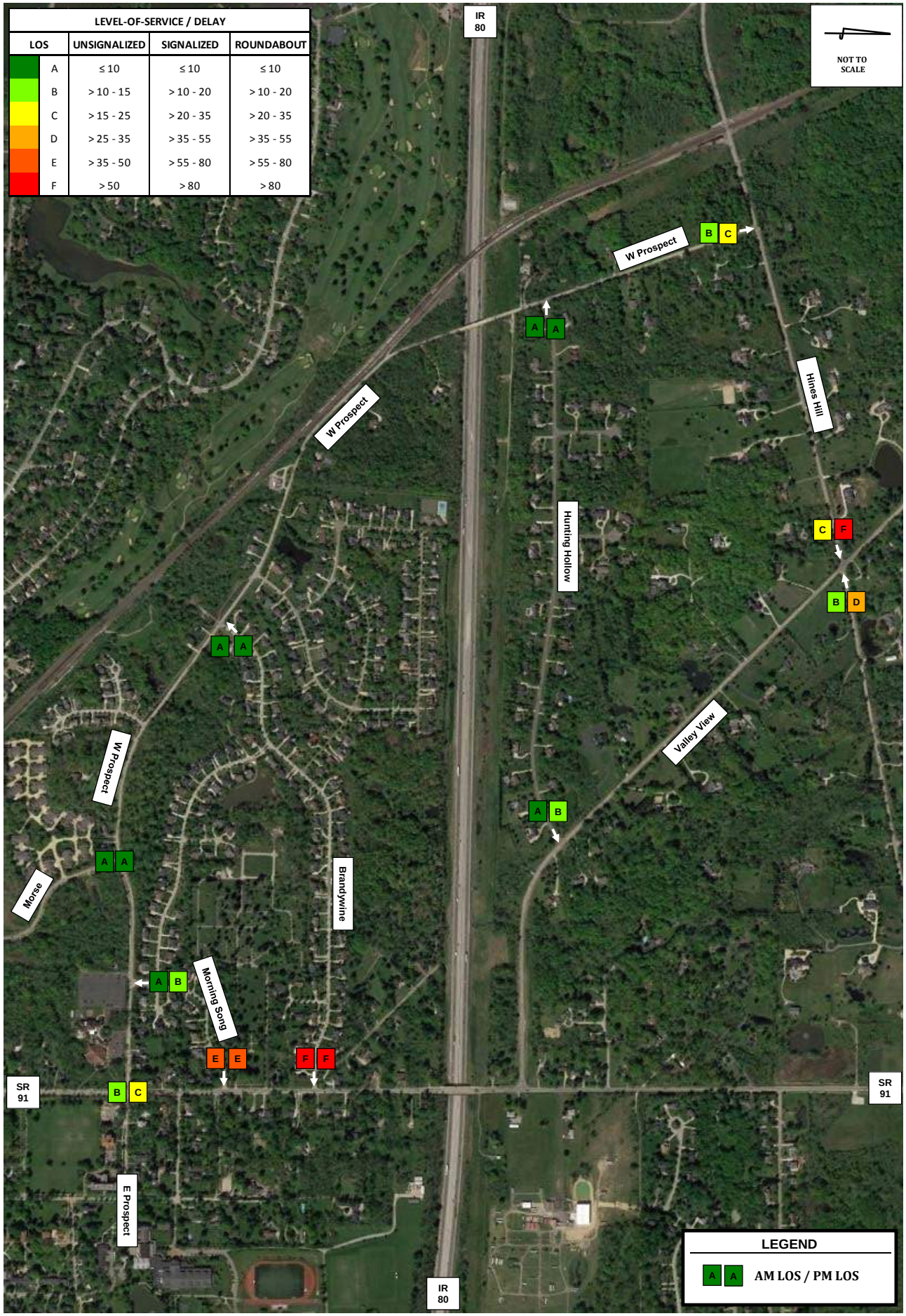


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Figure: 5.4a

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Figure: 5.4b

The eastbound minor street approaches of Brandywine Drive and Morning Song Lane at North Main Street are expected to operate with a poor level-of-service during the peak hours due to the lack of adequate gaps in the North Main Street north-south through traffic stream for vehicles turning left from the minor street approaches onto North Main Street. It was determined that traffic signal control at the intersections could improve the intersection levels-of-service. The intersections however do not meet the criteria for warranting a traffic signal as the minor street (Brandywine Drive and Morning Song Lane) volumes do not meet the required minimum volume thresholds for traffic signal control. Therefore traffic signal control will not be considered for mitigating the levels-of-service at the intersections of Brandywine Drive and Morning Song Lane at North Main Street.

In order to determine what mitigation would be necessary to improve the levels of service at these intersections, certain improvements were tested with further capacity analyses. The following improvements were determined to mitigate the poor levels-of-service under the 2041 No-Build conditions:

1. North Main Street (SR 91) & Brandywine Drive
- Construct a center two-way left turn lane.

2. North Main Street (SR 91) & Morning Song Lane
- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

Traffic signal control north of the intersections at Valley View Road and Herrick Park Drive should be analyzed to determine if traffic signal control is warranted and would be able to produce additional gaps in the southbound traffic flow for the minor street traffic.

18. Valley View Road & East Hines Hill Road
- Construct a single lane roundabout.

36. South Main Street (SR 91) & Ravenna Street
- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

The following recommendations are made for consideration for future improvements at the following intersections:

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303

8. SR 91 & Veterans Way

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct a westbound left turn lane.

14. SR 303 & Boston Mills Road

- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

It should be noted that the downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for the State Route 91 and SR 303 including intersection improvements, operational improvements, and adding a by-pass. It would be recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.

The levels-of-service at the intersection of SR 91 and SR 303 were determined to deteriorate during the No-Build conditions with the growth of the background traffic. These roadways carry a significant amount of through traffic due to their functional characteristics. The through traffic on these roadways is traffic not destined for or originating from the downtown core area but traffic passing through the City of Hudson. An alternative to implementing improvements directly at the intersection of SR 91 and SR 303 would be to create by-passes that would provide an alternative route for traffic to traverse through the City while avoiding the downtown core area. This would help to reduce the traffic volumes at the intersection of SR 91 and SR 303. By-passes are typically created through the construction of new roadways or providing signage and way-finding directing the through traffic around the intended by-pass area. Further analysis and review of potential by-pass options for the downtown core area should be considered as a potential option to reduce traffic and congestion at the intersection of SR 91 and SR 303 by relocating through traffic to other areas of the City.

Geometric and traffic control improvements at the intersection of South Main Street and Ravenna Street were determined to not improve the minor street levels-of-service. The use of by-passes as described at the intersection of SR 91 and SR 303 would impact the intersection through a potential reduction of through traffic volumes along SR 91.

The table on the following page shows the capacity analysis results of implementing the proposed improvements. Copies of the capacity worksheets for the improved intersections are in included in **Appendix M**.

Table 5.2 - 2041 Levels-of-Service
(No-Build Conditions - Recommended Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
SR 91 & Brandywine	Stop Sign	Northbound Left	A (9.2)	B (11.9)
		Eastbound	C (21.6)	D (30.2)
SR 91 & Morning Song	Stop Sign	Northbound Left	A (9.0)	B (10.4)
		Eastbound	C (20.0)	C (21.9)
Valley View & Hines Hill	Roundabout	Intersection	A (6.7)	A (8.8)
		Eastbound	A (7.8)	A (8.6)
		Westbound	A (5.5)	A (8.5)
		Northbound	A (5.3)	B (10.2)
		Southbound	A (6.9)	A (6.9)
SR 91 & Clinton/Aurora	Traffic Signal	Intersection	C (26.2)	C (29.6)
(No Through & Right Turns)		Eastbound	C (20.9)	B (17.0)
		Westbound	C (31.2)	C (30.8)
		Northbound	C (30.6)	C (31.8)
		Southbound	B (16.3)	C (27.9)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection of State Route 91 and Clinton Street/Aurora Street would require appropriate signs, pavements markings, and a physical re-construction to give notice and prevent right turns from being made illegally and conflicting with the permitted eastbound and westbound left turn movements.

The consideration of by-pass roadways or QR intersections would also be a consideration for improvements at the intersections of State Route 91 at State Route 303 and Ravenna Street instead of geometric improvements at the intersections.

Build Condition - 2021 Capacity Analysis

Analyses were performed for the projected 2021 conditions under the Build scenario. This analysis will be used to determine the expected levels-of-service at the study intersections under the anticipated build conditions of the proposed development. All analyses assumed that the signal timing would be optimized. The traffic volumes used in this analysis can be seen in **Figure 4.7**. The 2021 Build analysis includes the site generated traffic from the proposed development but does not include recommended improvements from the No-Build conditions. Copies of the Synchro capacity worksheets are included in **Appendix N**.

The following intersections are expected to operate with levels-of-service D or lower under the anticipated 2021 Build conditions:

3. SR 91 & Prospect Street
5. SR 91 & Clinton Street/Aurora Street
7. SR 91 & SR 303
14. SR 303 & Boston Mills Road
35. SR 303 & Oviatt Street
36. SR 91 & Ravenna Street

The intersections were previously determined to operate with levels-of-service D or lower under the 2021 No-Build conditions with the exception of SR 91 and Prospect Street. The remaining study area intersections are expected to continue operating with acceptable levels-of-service under the anticipated 2021 Build peak hour conditions with the recommended improvements from the 2021 No-Build analyses.

Figure 5.5, Page 65 visually details the intersection level-of-service for traffic signal and all-way stop controlled intersections and the minor street approach levels-of-service at the minor street stop controlled intersections. AM and PM peak hour charts can be found in **Appendix N** detailing a summary of the capacity analysis results for the study area intersections.

The intersections of SR 91/Aurora Street/Clinton Street and SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make these types of improvement unfeasible.

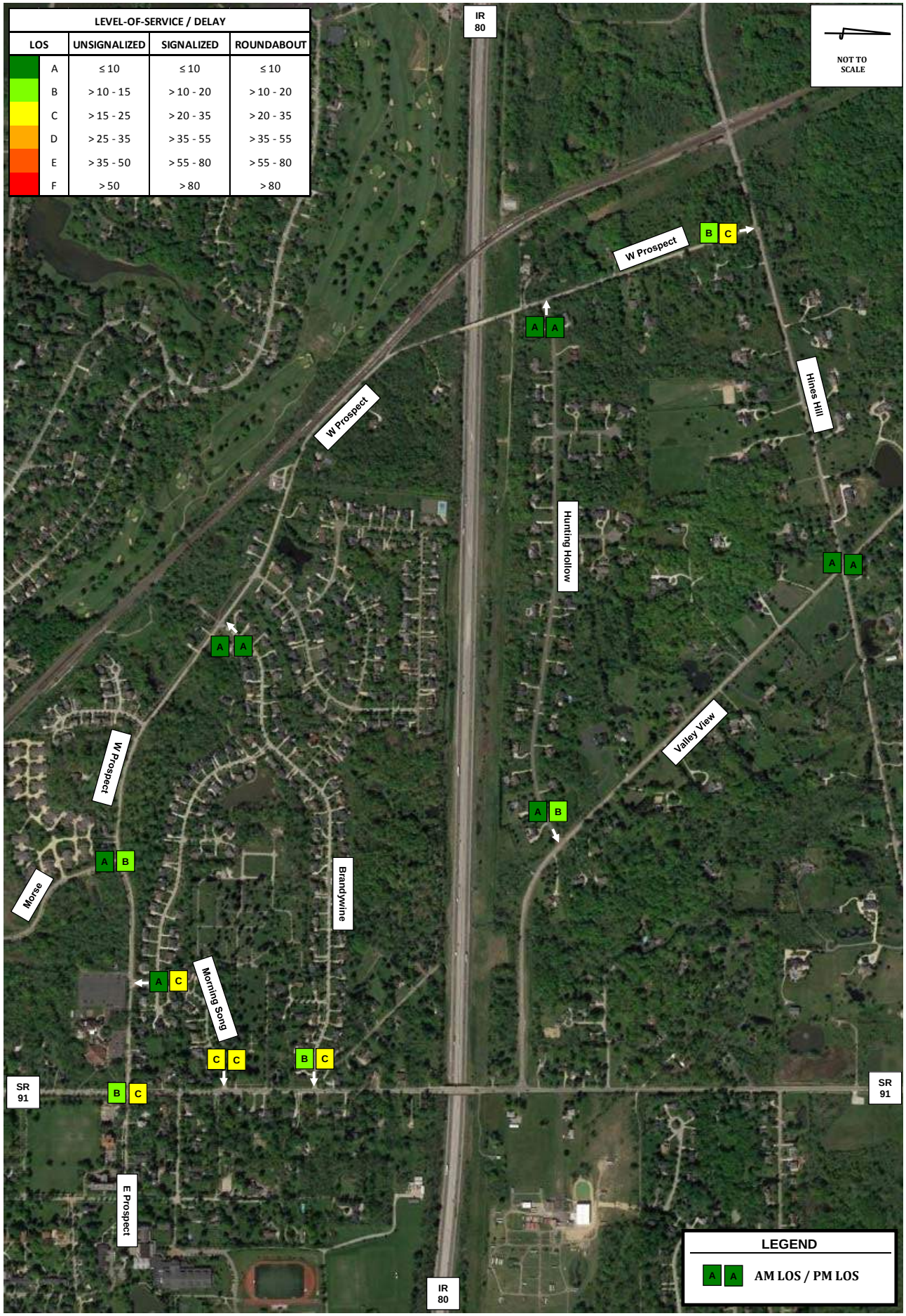
LEVEL-OF-SERVICE / DELAY
LOS
UNSIGNALIZED
SIGNALIZED
ROUNDABOUT
A ≤ 10 ≤ 10 ≤ 10
B > 10 - 15 > 10 - 20 > 10 - 20
C > 15 - 25 > 20 - 35 > 20 - 35
D > 25 - 35 > 35 - 55 > 35 - 55
E > 35 - 50 > 55 - 80 > 55 - 80
F > 50 > 80 > 80
NOT TO SCALE
IR 80
W Prospect
Hines Hill
Hunting Hollow
Valley View
Brandywine
Morning Song
Morse
E Prospect
SR 91
LEGEND
AM LOS / PM LOS

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Figure: 5.5b

The intersection of Owen Brown Street and Morse Road was analyzed as roundabout as an alternative form of traffic control as compared to an all-way stop sign controlled intersection. **Figure 5.6, Page 67** details the approximate amount of land that would be necessary to install a single lane roundabout at the intersection of Morse Road and Owen Brown Street. The dimensions shown are the inscribed circle diameter (ICD). The ICD of a roundabout is the basic parameter used to define the size of a roundabout. The ICD is measured between the outer edges of the circulatory roadway.

The guidelines and recommendations found in the **"Roundabouts: An Informational Guide, NCHRP Report 672,"** publication put forth by the National Cooperative Highway Research Program in cooperation with the U.S. Department of Transportation and the Federal Highway Administration recommends an inscribed circle diameter of 90 feet to 180 feet for an urban single lane roundabout (Exhibit 1-9). Larger diameter roundabouts are required for larger design vehicles.

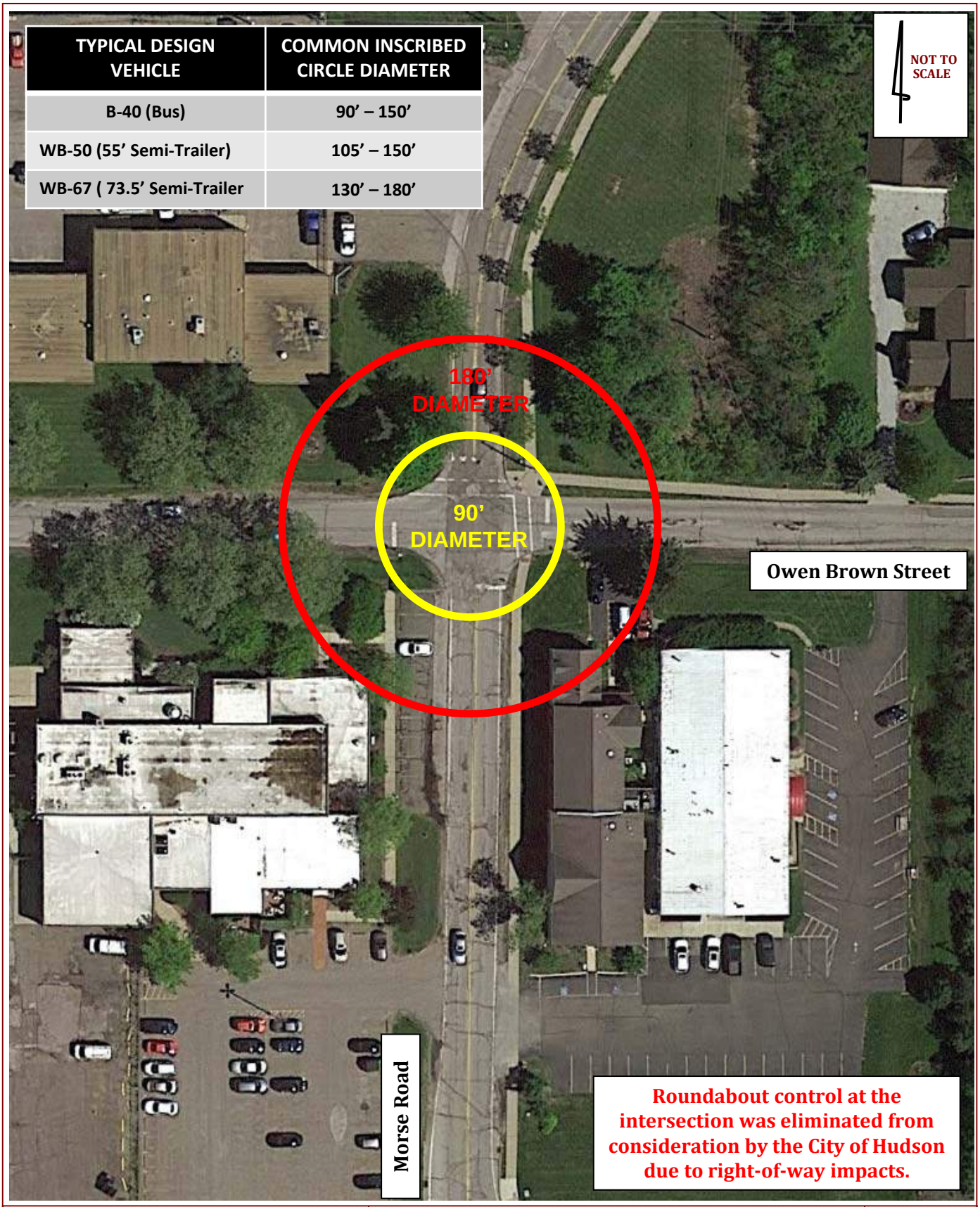
The following table shows the capacity analysis results of using roundabout control at the intersection of Morse Road and Owen Brown Street. Copies of the capacity worksheets for the intersection are in included in **Appendix O**.

Table 5.3 - 2021 Levels-of-Service
(Build Conditions - Recommended Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Morse & Owen Brown	Roundabout	Intersection	A (6.6)	A (6.4)
		Eastbound	A (5.1)	A (6.0)
		Westbound	A (5.7)	A (4.9)
		Northbound	A (7.2)	A (6.4)
		Southbound	A (6.6)	A (6.7)

(XX.X) = Average vehicle delay in seconds per vehicle

It should be noted that roundabout control at the intersection of Morse Road and Owen Brown Street has been eliminated from consideration by the City due to concerns regarding the availability and impact to the right-of-way in the study area.


TYPICAL DESIGN VEHICLE
COMMON INSCRIBED CIRCLE DIAMETER
B-40 (Bus)
90' – 150'
WB-50 (55' Semi-Trailer)
105' – 150'
WB-67 (73.5' Semi-Trailer
130' – 180'
NOT TO SCALE
180' DIAMETER
90' DIAMETER
Owen Brown Street
Morse Road
Roundabout control at the intersection was eliminated from consideration by the City of Hudson due to right-of-way impacts.

The following recommendations are made for consideration for future improvements at the following intersections:

3. SR 91 & Prospect Street
- Construct eastbound left turn lane.

5. SR 91 & Clinton Street/Aurora Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

14. SR 303 & Boston Mills Road
- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. SR 303 & North/South Oviatt Street
- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street
- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

It should be noted that the intersection of North Main Street (SR 91) and Prospect Street was previously analyzed in prior studies and was determined to not require any additional improvements. The primary difference between studies can be attributed to the application of design hour factors and higher trip generation results for the proposed development due to differences in the development site plans under review for each analysis.

Based on the trip generation results and capacity analysis it is recommended that the need for an eastbound left turn lane on West Prospect Street at North Main Street (SR 91) be re-analyzed in a post-construction analysis after the development has reached full build conditions and installed if warranted.

It should be noted that the downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for the State Route 91 and SR 303 including intersection improvements, operational improvements, and adding a by-pass. It would be recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.

Build Condition - 2041 Capacity Analysis

Analyses were performed for the projected 2041 design year conditions under the Build scenario. This analysis will be used to determine the expected levels-of-service at the study intersections under the anticipated build conditions for the twenty year conditions. All analyses assumed that the signal timing would be optimized. The traffic volumes used in this analysis can be seen in **Figure 4.8**. Copies of the Synchro capacity worksheets are included in **Appendix P.**

The following intersections are expected to operate with levels-of-service D or lower under the anticipated 2041 Build conditions:

3. SR 91 & Prospect Street
5. SR 91 & Clinton Street/Aurora Street
7. SR 91 & SR 303
8. SR 91 & Veterans Way
14. SR 303 & Boston Mills Road
35. East Streetsboro Road (SR 303) & North/South Oviatt Street
36. SR 91 & Ravenna Street

Figure 5.7, Page 71 visually details the intersection level-of-service for traffic signal and all-way stop controlled intersections and the minor street approach levels-of-service at the minor street stop controlled intersections. AM and PM peak hour charts can be found in **Appendix P** detailing a summary of the capacity analysis results for the study area intersections.

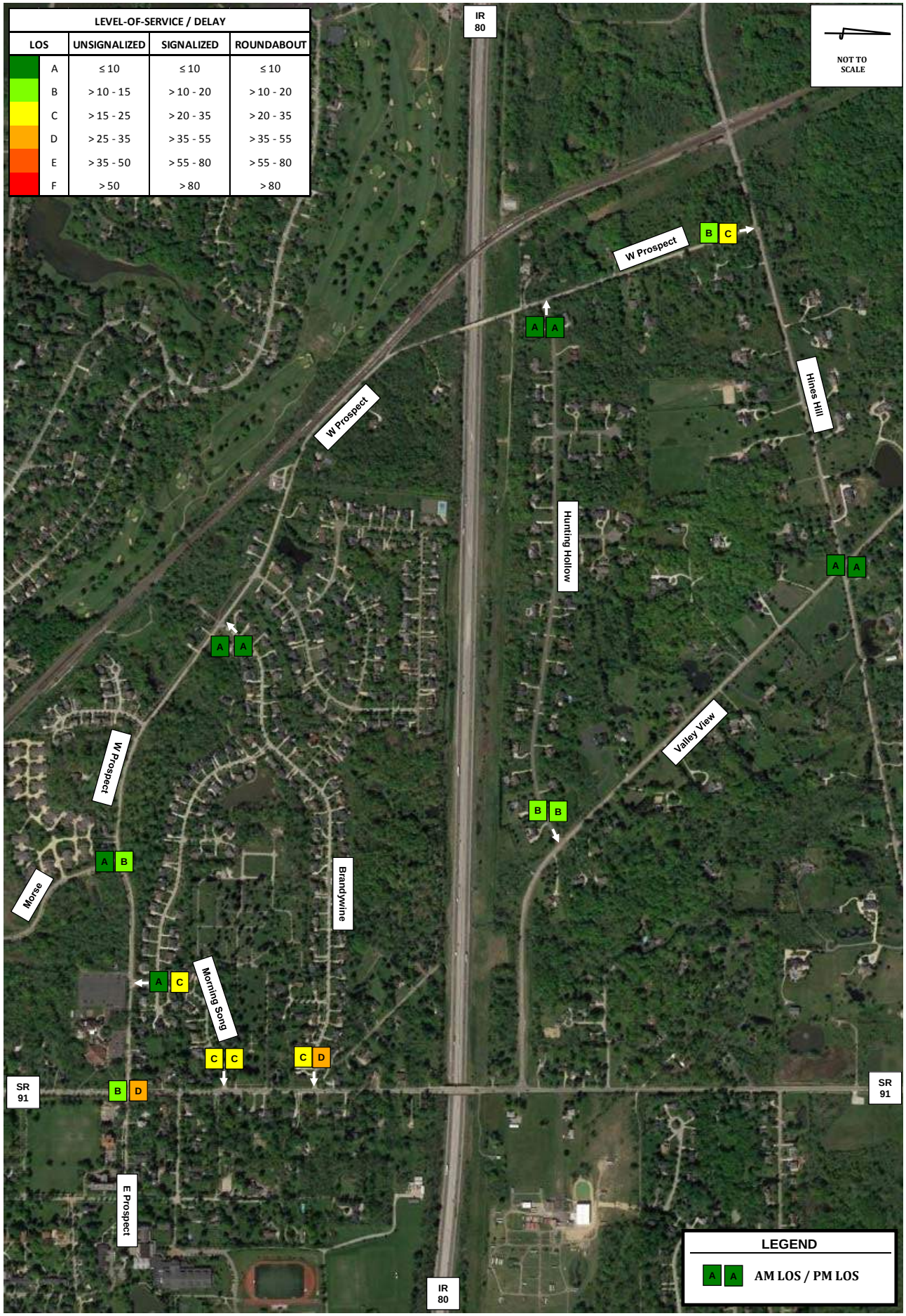


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Figure: 5.7a

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The following recommendations are made for consideration for future improvements at the following intersections:

3. SR 91 & Prospect Street

- Construct an exclusive eastbound left turn lane.

It should be noted that the intersection of North Main Street (SR 91) and Prospect Street was previously analyzed in prior studies and was determined to not require any additional improvements. The primary difference between studies can be attributed to the application of design hour factors and higher trip generation results for the proposed development due to differences in the development site plans under review for each analysis.

Based on the trip generation results and capacity analysis it is recommended that the need for an eastbound left turn lane on West Prospect Street at North Main Street (SR 91) be re-analyzed in a post-construction analysis after the development has reached full build conditions.

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

8. SR 91 & Veterans Way

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct a westbound left turn lane.

14. SR 303 & Boston Mills Road

- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street (AM & PM Peak)

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street

- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

It should be noted that the downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for the State Route 91 including intersection improvements, operational improvements, and adding a by-pass. It would be recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.

The following table shows the capacity analysis results of implementing the recommended improvements. Copies of the capacity worksheets for the improved intersection are in included in **Appendix Q**.

Table 5.4 - 2041 Levels-of-Service
(Build Conditions - Recommended Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
SR 91 & Prospect Street	Traffic Signal	Intersection	B (17.0)	C (33.8)
		Eastbound	C (20.7)	D (40.2)
		Westbound	B (13.7)	C (23.6)
		Northbound	B (19.6)	C (22.5)
		Southbound	B (12.9)	D (41.3)
SR 91 & Veterans Way	Traffic Signal	Intersection	B (12.0)	D (39.1)
		Eastbound	C (22.0)	D (48.8)
		Westbound	D (53.9)	D (46.2)
		Northbound	B (10.8)	C (26.2)
		Southbound	A (8.6)	D (50.4)

(XX.X) = Average vehicle delay in seconds per vehicle

5.2 Turn Lane Length Analysis

An analysis was performed to determine the necessary turn lane storage length in order to accommodate the proposed turn lanes at the following intersections:

3. North Main Street & Prospect Street
8. South Main Street & Veterans Way

The analysis was performed in accordance with the procedure recommended by the Ohio Department of Transportation in their **Location and Design Manual, Volume 1, Section 401**. The ODOT criteria and procedures are furnished in **Appendix G**. The recommended maximum left turn lane length is 600 feet and 800 feet for a right turn lane. The maximum turn lane length will not be applicable if calculated turn lane length is lower than these values. The following tables show the results of the analysis based upon the highest anticipated movement volumes at the intersections.

Table 5.5 - Turn Lane Length Analysis
#3 - North Main Street (SR 91) & Prospect Street

Movement Direction	DHV	No. of Lanes	Cycles / Hour	Average Veh/ Cycle/ Lane	Design Speed (mph)	Fig. 401-10 Storage Length (ft)	Fig. 401-9 Condition			Backup Length (ft)	Turn Lane Length* (ft)
							A*	B*	C*		
EB LT	132	1	40	3.3	30	175	225	--	--	--	**225***
EB T/RT	70	1	40	1.8	30	100	--	--	--	100	--

*** Includes 50' taper**

Table 5.6 - Turn Lane Length Analysis
#8 - South Main Street (SR 91) & Veterans Way

Movement Direction	DHV	No. of Lanes	Cycles / Hour	Average Veh/ Cycle/ Lane	Design Speed (mph)	Fig. 401-10 Storage Length (ft)	Fig. 401-9 Condition			Backup Length (ft)	Turn Lane Length* (ft)
							A*	B*	C*		
WB LT	40	1	30	1.3	30	100	150	--	--	--	**150***
WB T/RT	20	1	30	0.7	30	50	--	--	--	50	--

*** Includes 50' taper**

5.3 Development Site Plan

The site plan shown in **Figure 1.3, Page 4** proposes to use Morse Road and Owen Brown Street and an extension of Village Way to provide access to and throughout the development. The development also proposes several new local roadways throughout the development as well.

The existing and proposed roadways throughout the development site are shown as two-lane roadways. Two-lane local roadways throughout the development should be sufficient to accommodate the movement of vehicular traffic through and within the development. These local roadways should have a minimum lane width of 11 feet in the commercial areas of the development and 10 feet in the residential areas based on Table 301-4 from the ODOT **Location and Design Manual, Volume 1**.

The roadways within the residential portions of the development are shown with available on-street parking. A parking lane width of 7 to 9 feet is recommended for parallel on-street parking. There is also pull in angled parking available within the development. We suggest the consideration of back-in angle parking as an alternative in these areas.

Back-in angle provides motorists with better vision of bicycles, pedestrians, and other vehicles as they exit the parking space and enter moving traffic. A backed in vehicle also provides ease of loading and unloading cargo and helping children maneuver in and out of the vehicle as the open door directs children away from the street. The use of back-in angled parking will require signage indicating its intended use and proper entry into the space. A public education campaign can also be beneficial in educating the public on the purpose and use of back-in angle parking.

The intersections within the development with the exception of Owen Brown Street at Morse Road and at Morse Road and Village Way. It is our recommendation that the Morse Road, Owen Brown Street, and Village Way approaches operate under free flow conditions with the left turn movements yielding the right-of-way to the opposing traffic. The proposed development roadways that intersect these roadways are then recommended to be under stop sign control.

The intersection of Owen Brown Street at Morse Road should be operated under all-way stop sign control due the offset lanes and pedestrian crossing locations. The intersection of Morse Road at Village Way should be operated under all-way stop sign control due the non-perpendicular alignment of the roadways at the intersection.

The section of Owen Brown Street between Village Way and Morse Road is proposed on the site plan as a boulevard type section with a median between the eastbound and westbound travel lanes. Medians alone are not considered a traffic calming feature as they may increase vehicle speeds by reducing the "friction" between opposing directions of traffic. The traffic calming benefit of medians is typically related to the ability to provide space to locate pedestrian safety enhancements and traffic control devices. It is our opinion that the boulevard as shown on the site plan is not a traffic calming feature for the study area.

It should also be noted that the boulevard layout causes the east-west lanes to be mis-aligned at the east end of the boulevard as the two-lane section of Owen Brown Street on the other side of Morse Road does not have any median separation. This intersection layout can often be confusing to motorists as they enter the median section of the roadway.

The north-south section of Village Way is proposed on the site plan with a median that would prohibit the east-west through movement on Owen Brown Street. It is our recommendation the some method of restricting the through movement along Owen Brown Street be maintained in order to minimize the impact to the residential portion of Owen Brown Street between Morse Road and State Route 91.

The site plan as proposed would maintain this recommended restriction. The following alternatives could also be used as opposed to a median along Village Way.:

1. Construct a median island at just the intersection of Owen Brown Street and Village Way.

2. Construct a cul-de-sac type end cap at the east edge of the Owen Brown Street median to the west of Morse Road.

3. The use of bump-outs and channelized lanes at the intersection of Owen Brown Street and Village Way to allow only turn movements and restrict the through movement.

The development area to the south of Owen Brown Street between the Village Way to the west and Morse Road to the west includes a proposed parking garage. The parking garage is proposed with access along the east side of Village Way and the west side of Morse Road. These proposed intersections should include stop sign control the parking garage approaches. The Village Way access is located between horizontal curves on Village Way. The driveway and approach should be constructed so the exiting vehicle does not have an obstructed view of oncoming traffic due to landscaping or signs.

The proposed street layout and connectivity as shown in the site plan in **Figure 1.3** shows no significant problems in relation to the safety and efficiency of vehicular traffic throughout the site based on the recommendations for traffic control within this section and the report.

5.4 One-Way Streets

The use of one-way streets was reviewed in order to determine if the operation at the signalized intersection of North Main Street (SR 91) and Clinton Street/Aurora Street could be improved.

The previous intersection capacity analyses determined that the intersection operates with a poor level-of-service and high delay due to the split phasing of the side streets. The offset of the intersections requires that Clinton Street and Aurora Street approaches have their own protected phase in the signal operation due to the conflicting turning paths through the intersection.

The use of one-way streets was based on creating a couplet between Clinton Street and Park Lane. The streets would be paired so that one would provide ingress to the downtown core and the other would provide egress from the downtown core.

In order to improve the intersection it was previously shown that the split phasing of the side street approaches needs to be eliminated. The elimination of the split phasing with one-way streets would require that Clinton Street would be a one-way roadway westbound for the ingress movement to the downtown core. Clinton Street as the egress street in the one-way couplet would still require the side streets to be split phased.

The couplet of Clinton Street and Park Lane would then require Park Lane to be the egress street. Currently only right turns are permitted from Park Lane to North Main Street. This configuration would require vehicles to use the signalized intersections along West Streetsboro Street (SR 303) to exit the core area via a left turn and then turn left at the intersection of SR 91 and SR 303 to go north on SR 91. The alternative would be to permit the left turns from Park Lane to northbound SR 91. The left turns would however experience poor levels-of-service and high delay making the left turn at an unsignalized intersection. The use of traffic signal control at this location is not recommended due to the close proximity of the SR 91 and SR 303 intersection.

We do not recommend the use of a one-way couplet between Clinton Street and Park Lane as traffic signal control is not recommended at Park Lane to accommodate left turns and using the West Streetsboro Street (SR 303) intersection would add additional traffic to the westbound left turn movement at the intersection of SR 91 and SR 303.

5.5 Owen Brown Street

Owen Brown Street is a two-way roadway with a posted speed limit of 25 miles per hour between Morse Road to the west and North Main Street to the east. The roadway is approximately 20 feet wide and permits on-street parking along the south side of the roadway. Vehicles can not pass side by side when vehicles are parked along the roadway.

It is our opinion that the development traffic will not have a significant impact on the residential portion of Owen Brown Street between Morse Road and North Main Street. Owen Brown Street is not expected to serve as a significant ingress and egress route for the proposed development based on the following conclusions:

1. Less than 25% of the site generated traffic is expected to originate or be destined for the north along SR 91 (**Figures 4.1 & 4.2**).

2. The multiple access locations for the development is expected to further distribute and dilute the sit generated traffic throughout the adjacent street network

3. The roadway is located near the beginning of the downtown core area where congestion in the North Main Street corridor occurs during the peak hours and has been observed to block the intersection of Owen Brown Street and North Main Street on occasion.

4. Owen Brown Street is approximately 20 feet wide and permits on-street parking making it impossible for eastbound and westbound vehicles to pass side by side where vehicles are parked.

5. There is an all-way stop intersection located approximately half-way between Morse Road and North Main Street.

6. The Owen Brown Street at North Main Street only has stop sign control on the Owen Brown Street approach. Left turn vehicles from Owen Brown Street to northbound North Main Street must wait for an adequate gap in the north-south through traffic stream.

Owen Brown Street was reviewed under various access scenarios to determine the existing conditions and potential impacts to the segment of roadway between Morse Road to the west and North Main Street (State Route 91) to the east.

The following scenarios were analyzed and reviewed:

1. Existing & No-Build Conditions w/out the proposed development
2. Build Conditions with the proposed development as detailed in Figure 1.3
3. Right In & Right Out at North Main Street (SR 91)
4. Hammerhead at North Main Street (SR 91)
5. Hammerhead Near the Creek
6. Elongated Roundabout at Morse Road & Owen Brown Street Intersection

The traffic volumes and capacity analysis for **Scenario 1 & 2** were analyzed in Section 5.1. These scenarios are based on the existing roadway conditions on Owen Brown Street and North Main Street.

Scenario 3 would restrict access at North Main Street by preventing left turns between Owen Brown Street and North Main Street. Northbound vehicles that wished to turn left onto Owen Brown Street would have to use an alternate travel route likely involving access locations and roadways to the south along North Main Street or those along State Route 303. Vehicles turning left from Owen Brown Street to northbound North Main Street would likely use an alternate route involving Morse Road and Prospect Street.

The restriction of left turn movements at the intersection of North Main Street and Owen Brown Street would require the construction of a channelizing island to direct traffic and the appropriate signage indicating the restricted turn movements. A properly designed island will designate the correct turning path. The geometry of the approach and the channelizing island shall physically define the permitted movements and block the prohibited movements. The island design should accommodate the largest design vehicle likely to use the driveway. Channelizing islands should be constructed per the ODOT requirements and guidelines for a channelized restricted access driveway with the appropriate pavement markings and signs as detailed in the ODOT Access Management Manual. A copy of the design guidelines are included in **Appendix G**.

Scenario 4 was the closure of Owen Brown Street at the east end of the roadway near North Main Street. The closure would redirect all traffic using the North Main Street (SR 91) and Owen Brown Street intersection to alternative routes primarily through Morse Road and the adjacent roadways. This closure would impact traffic both originating and destined to the north and south of Owen Brown Street. The west end of Owen Brown Street would need to be configured to allow for vehicles such as school buses, snow plows, and emergency vehicles to turn around. It may also be necessary that any closure of Owen Brown at North Main Street be constructed so as to still allow emergency vehicles access as needed in the event of an emergency situation.

It was assumed that vehicles from the north turning right onto Owen Brown Street from North Main Street would use West Prospect Street and Morse Road. The vehicles turning left onto Owen Brown Street from North Main Street were assumed to use Park Lane and the access locations along West Streetsboro Street (SR 303). The vehicles turning left from Owen Brown Street to North Main Street (SR 91) were assumed to use Morse Road and West Prospect Street. The vehicles turning right from Owen Brown Street to North Main Street (SR 91) are expected to use Morse Road and the downtown core area roadways to travel south.

It was also considered to reroute Owen Brown Street east of Morse Road to connect to Clinton Street as part of the closure at the east end of Owen Brown Street. The most likely location would be at Old First Street. The connection would require the ability to bring the roadway through an existing parking lot along the north side of Clinton Street. Any connection from Owen Brown Street to Clinton Street east of the culvert is likely to require significant costs associated with acquiring the necessary right-of-way. Additional connection locations east and west of Old First Street are likely to be even high cost with more right-of-way issues. It is our opinion that the benefit of connecting Owen Brown Street to Clinton Street east of Morse Road as part of any planned changes to Owen Brown Street is minimal.

Scenario 5 was the closure of Owen Brown Street at the Brandywine Creek Tributary culvert approximately 280 feet east Morse Road. The closure would eliminate access to the downtown core area using the internal roadways for the Owen Brown Street residents.

A closure of the roadway at the west end of the residential units at the culvert location would still allow access to the Owen Brown Street residential area at North Main Street but would eliminate access to the downtown core area through the intersection with Morse Road. The intersection was previously shown to operate with adequate levels-of-service under the No-Build conditions. The intersection would be expected to maintain these levels-of-service as through access to North Main Street would be restricted further reducing the Owen Brown Street volumes at North Main Street.

It was also considered to reroute Owen Brown Street east of Morse Road to connect to Clinton Street as part of the closure at the west end of Owen Brown Street. The most likely locations would be at Old First Street. The connection would require the ability to bring the roadway through an existing parking lot along the north side of Clinton Street. Any connection from Owen Brown Street to Clinton Street east of the culvert is likely to require significant costs associated with acquiring the necessary right-of-way. The connection would provide an access for the local residents to access the internal areas of the downtown core without having to travel on North Main Street. It is likely however that residents will still prefer to use the intersection of Owen Brown Street and North Main Street especially outside the peak hours for North Main Street.

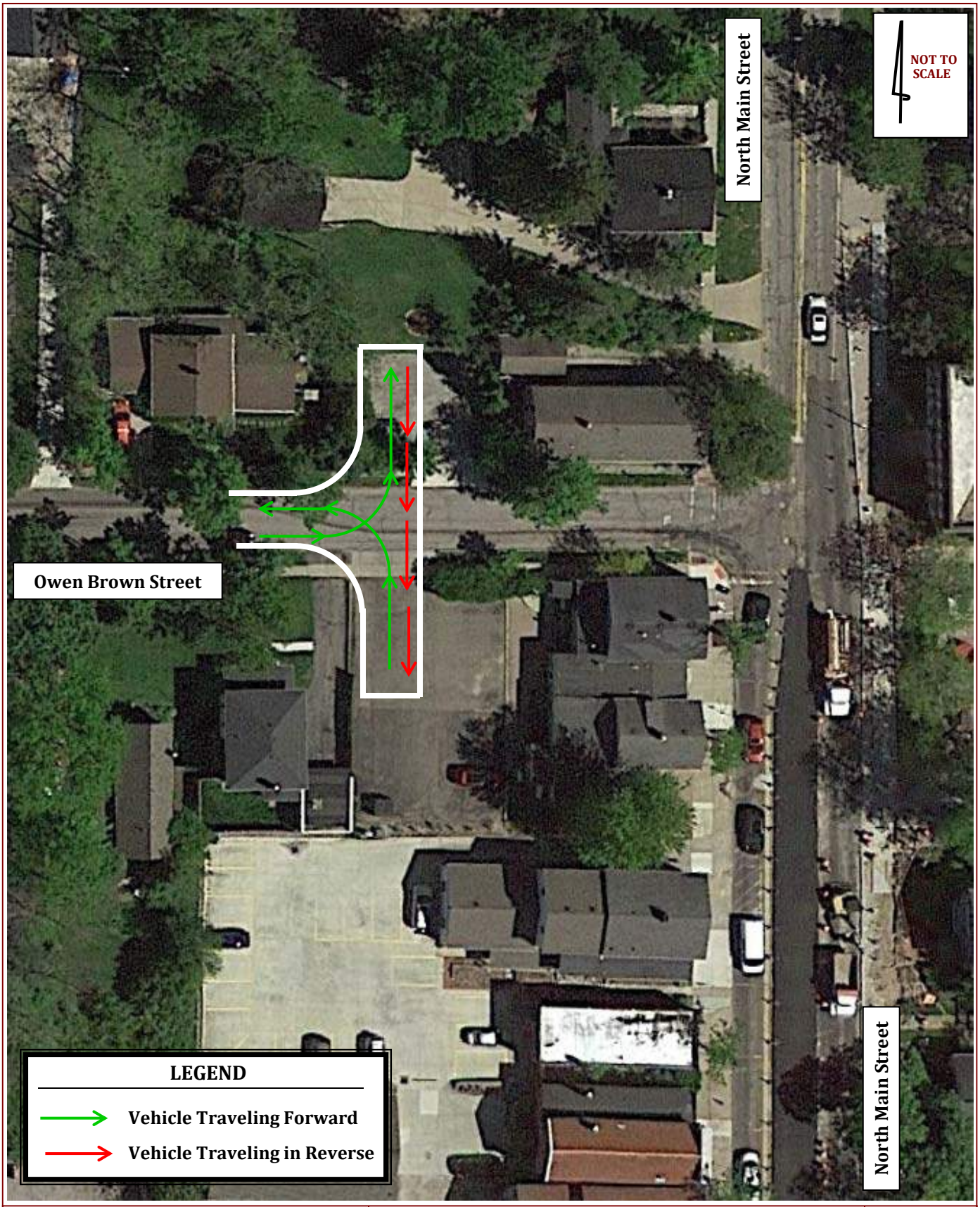
A closure of Owen Brown Street at the east or west end without a connection to Clinton Street would require the placement of signs to indicate Owen Brown Street is not a through street at the intersection with Morse Road or North Main Street (SR 91). The use of a NO OUTLET (W14-2 and/or W14-2a) sign is recommended. The W14-2a may be used in conjunction with street name signs to warn turning traffic the cross street ends in the direction indicated by the arrow.

The recommended signs can be seen below:

Figures 5.8 and 5.9, Pages 83 and 84 detail possible configurations for a hammerhead style turnaround at the east end of Owen Brown Street.

Figures 5.10 and 5.11, Pages 85 and 86 detail possible configurations for a hammerhead style turnaround at the west end of Owen Brown Street.

It should be noted that a typical hammerhead turnaround is 120 feet long at 60 feet in direction from the centerline of the roadway. The hammerhead should however be designed to accommodate any expected school bus traffic, emergency vehicles, or city service vehicles that would need the ability to access the local street and turnaround.



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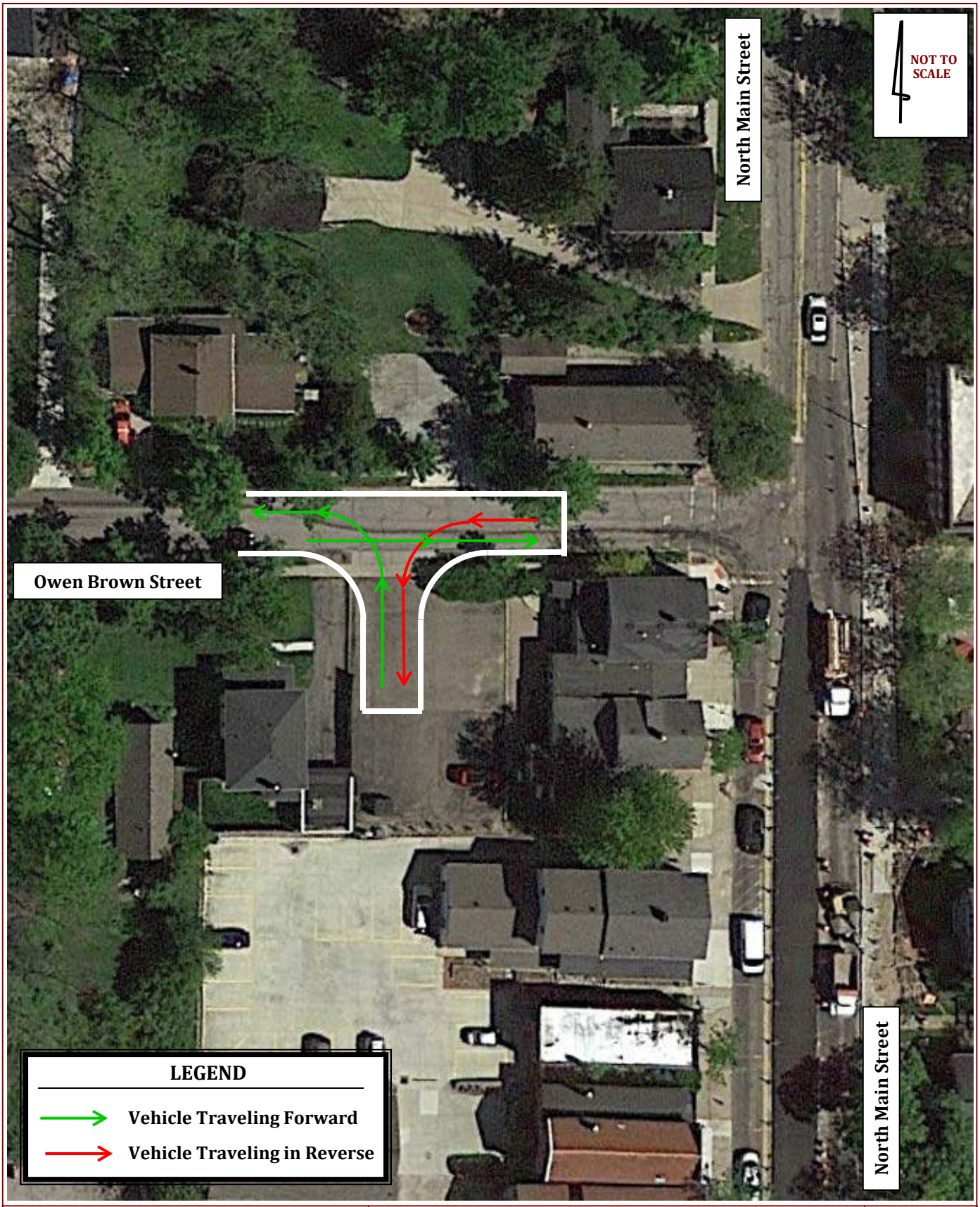
Downtown Phase II
Hudson, Ohio
Traffic Impact Study

Hammerhead
Configuration
East Alternative 1

Figure 5.8



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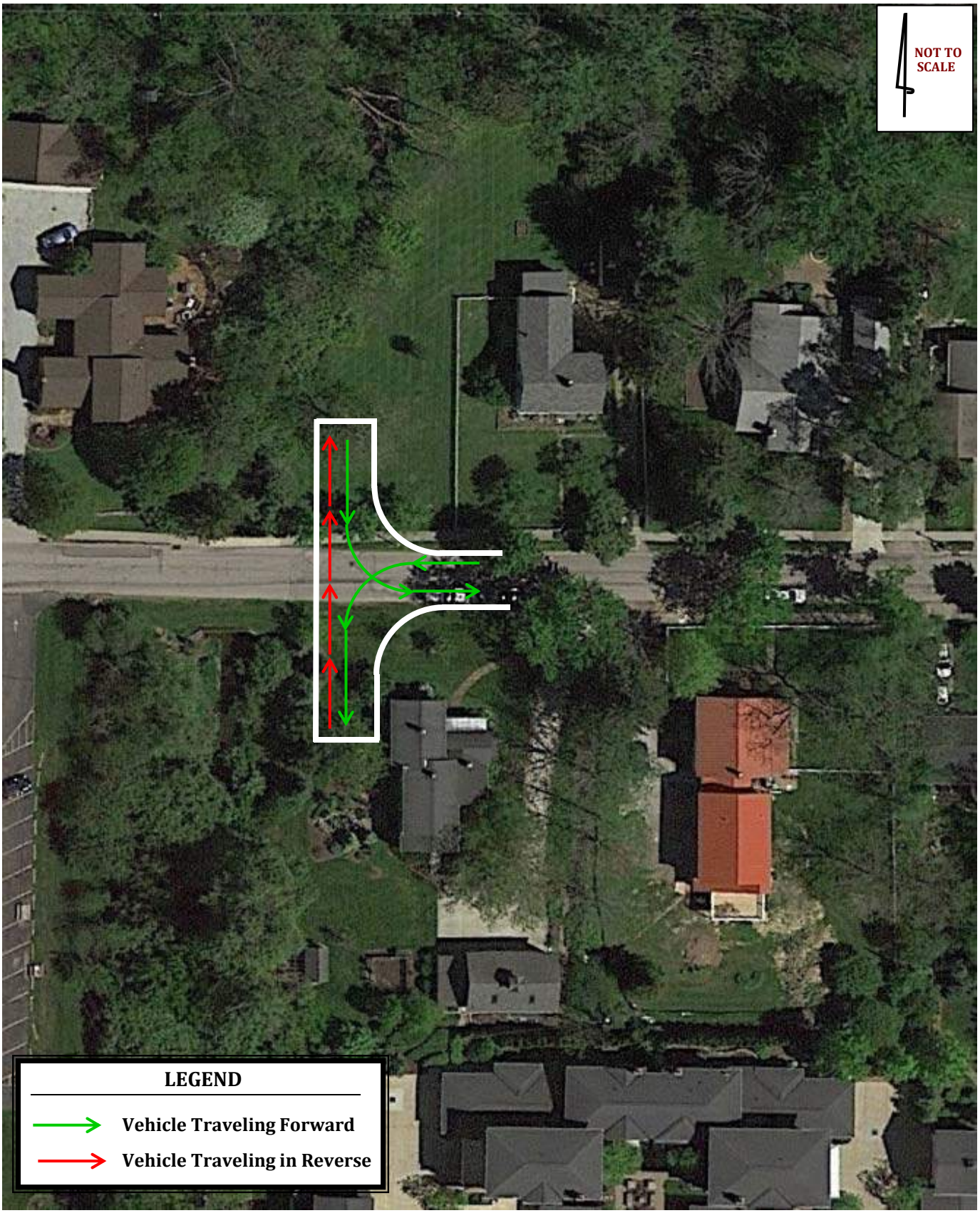
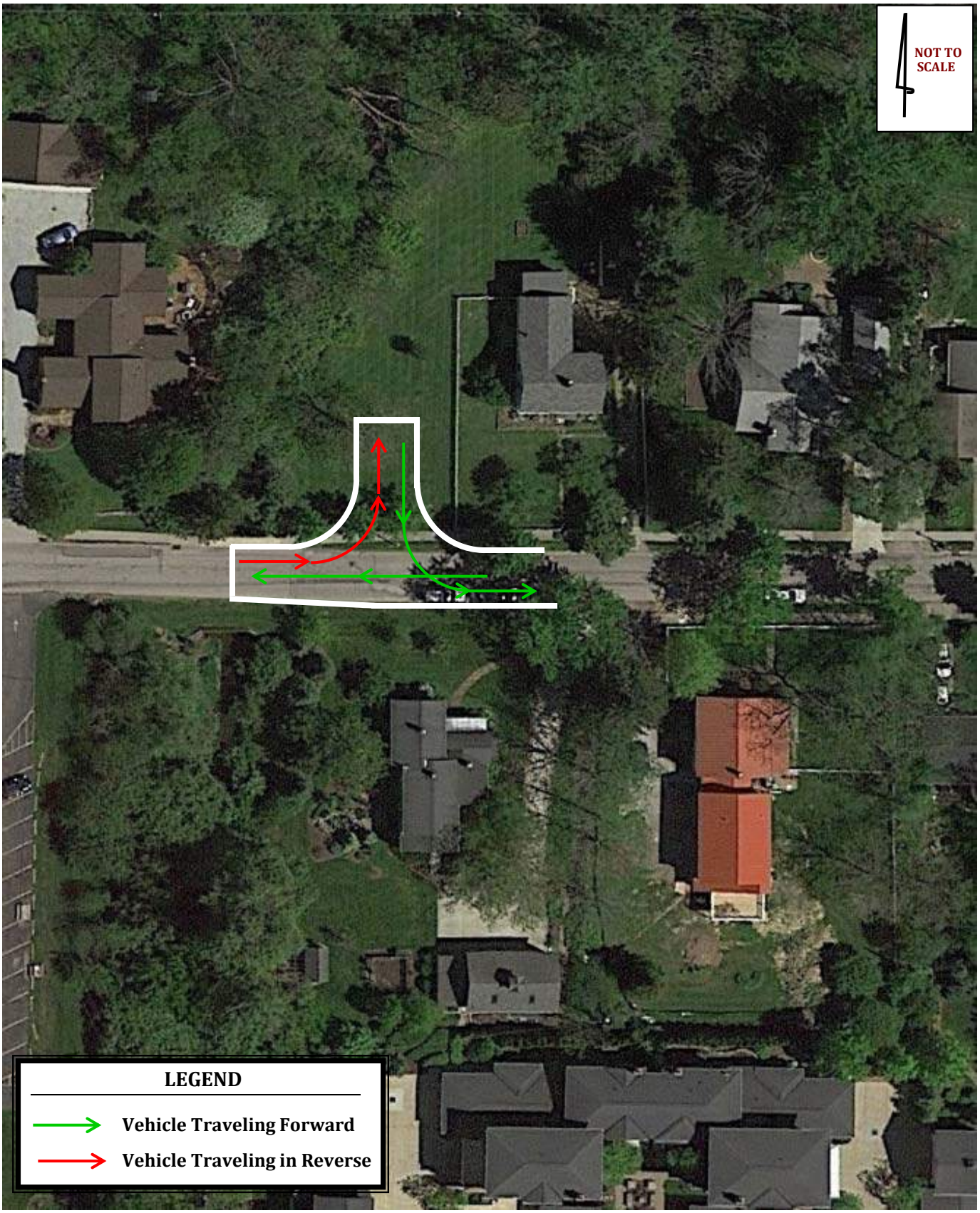


TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Downtown Phase II Hudson, Ohio Traffic Impact Study	Hammerhead Configuration West Alternate 1	Figure 5.10 Page 85



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Scenario 6 involved the use of a median island on Morse Road at the intersection with Owen Brown Street to prevent the east-west through movements and all left turns at the intersection.

The median would provide a break between the continuous stretch of Owen Brown Street between SR 91 to the east and Lennox Road to the west. Traffic entering and exiting the development site to the north and south would not have a direct access to Owen Brown Street. The closure is not expected to have an impact on traffic entering and exiting the site to west from Owen Brown Street.

The median would still allow local Owen Brown residents to have an internal connection to the Morse Road but would not permit a left turn to head south in to the downtown core area. Residents would have to turn right onto Morse Road and then use the development roadways to navigate back to the south. Local residents would likely instead SR 91 to access the downtown core by making a right turn at SR 91 and then entering the downtown core through Clinton Street or Park Lane.

A comparison chart was created to list the advantages of each scenario versus the disadvantages of each scenario. The comparison chart can be seen on the following page.

Table 5.7 Advantages vs Disadvantages
Owen Brown Street Options

ADVANTAGES	DISADVANTAGES
Scenario #2 - Build Option (2021)	
No access restriction to local residents.	Available connection between Morse Road & SR 91 for through traffic.
Emergency access maintained	Maximum intersection conflict points.
No construction required.	No impact to existing vehicular speeds.
No cost.	Development may increase through traffic.
Sceanario #3 - Right In & Right Out @ North Main Street (SR 91)	
Limit volume of through traffic to and from Morse Road.	No direct access for locals coming from the south or going to the north.
Emergency access can be maintained.	May require redirection of bus and maintenance vehicle routes.
Reduces conflict points at the intersection.	Require reconstruction of intersection approach to accommodate channelizing island.
	May require enforcement by police department.
	Increase travel time for local residents.
Scenario #4 - Hammerhead @ North Main Street (SR 91)	
Eliminates access location along SR 91 reducing total conflict points in corridor.	Accomodations necessary for emergency access from SR 91.
May decrease vehicular speeds.	Potential impact to parcels to create turnaround.
Eliminates through traffic between SR 91 and Morse Road.	Increase travel time for local residents.
Scenario #5 - Hammerhead Near the Creek	
Removal of culvert and impact to culvert maintenance.	No internal access to downtown core area for locals. All must use SR 91.
Restrict volume on Owen Brown and at intersection with SR 91 to local traffic only.	Potential impact to parcels to create turnaround.
May decrease vehicular speeds.	Removal of culvert would sever pedestrian and bicycle connections.
Eliminates through traffic between SR 91 and Morse Road.	Increase travel time for local residents.
	May impact emergency response from the west.
Option #6 - Elongated Roundabout @ Morse Road & Owen Brown Street Intersection	
Limit volume of through traffic to and from Morse Road.	No direct access for locals coming from the north or going south.
Emergency access from SR 91 can be maintained.	May require redirection of bus and maintenance routes.
Reduces conflict points at the intersection of OB & Morse.	May increase resident travel time.

The six scenarios were evaluated based on various criteria to consider a range of impacts. A matrix was prepared, which provides a comparative assessment of the six scenarios. Information gathered for this report and the analysis contained within it were used to complete the matrix seen **Figure 5.12, Page 90**.

The six scenarios can be seen visually represented in the following exhibits that were prepared by the City of Hudson:

Figure 5.13, Page 91: Scenario #1 - Study Area Traffic Conditions w/out the proposed development
Figure 5.14, Page 92: Scenario #2 - Study Area Traffic Conditions w/ the proposed development
Figure 5.15, Page 93: Scenario #3 - Right In & Right Out at North Main Street
Figure 5.16, Page 94: Scenario #4 - Hammerhead at North Main Street
Figure 5.17, Page 95: Scenario #5 - Hammerhead Near the Creek
Figure 5.18, Page 96: Scenario #6 - Elongated Roundabout at Morse Road & Owen Brown Street

Based on the development site plan shown in **Figure 1.3** and the matrix shown in **Figure 5.12** our recommendation would be to start with implement Scenario 2 with the proposed development and continue to provide full access to SR 91 to the east and to the downtown interior core to the west for the residents of Owen Brown Street between Morse Road and SR 91.

The traffic patterns on Owen Brown Street should then be re-evaluated after the opening of the development to determine if additional traffic calming measures for Owen Brown Street between Morse Road to the west and SR 91 to the east should be implemented.

It is our opinion that the measures previously detailed should then be considered and implemented if necessary in a progressive manner of the least impact to access for the Owen Brown residents to the greatest impact. The preferred sequencing of the traffic calming measures for Owen Brown Street between Morse Road and SR 91 is shown below.

1. Scenario #2 - Full access at Morse Road & SR 91
2. Scenario #3 - Limited access at SR 91 & full access at Morse Road
3. Scenario #6 - Full access at SR 91 & limited access at Morse Road
4. Scenario #4 - No access at SR 91 & full access at Morse Road
5. Scenario #5 - Full access at SR 91 & no access at Morse Road

EVALUATION CRITERIA	Scenario #1 Existing Option	Scenario #2 Build Option (2021)	Scenario #3 Right In & Right Out @ North Main Street (SR 91)	Scenario #4 Hammerhead @ North Main Street (SR 91)	Scenario #5 Hammerhead Near The Creek	Scenario #6 Elongated Roundabout @ Morse Rd. & Owen Brown St. Intersection
Intersection Operation	Four-way intersection under all-way stop sign control.	OB & Morse requires stop sign control.	OB & Morse requires stop sign control.	OB & Morse requires stop sign control.	OB & Morse requires stop sign control.	OB & Morse requires stop sign control.
Owen Brown Vehicular Volumes	990 Vehicles Per Day	580 Vehicles Per Day	290 Vehicles Per Day	260 Vehicles Per Day	260 Vehicles Per Day	370 Vehicles Per Day
Emergency Access	Access available from Morse & SR 91.	No Change	Physical left turn restriction would need to be mountable or response routes would likely be altered.	Physical barrier would need to be mountable or response from 91 would be impacted.	If culvert were removed only access would be via SR 91	No Change
School Bus/Service/Maintenance Access	Access available from Morse & SR 91.	No Change	Routes would likely be altered.	Routes would likely be altered.	If culvert were removed only access would be via SR 91.	No Change
Right-of-Way	-----	Possible ROW impact to accommodate proposed OB median.	Possible ROW impact to widen approach to construct island to prohibit left turns at OB & 91.	ROW would be needed at OB & 91 to provide vehicle turnaround.	ROW would be needed to provide a vehicle turn around east and west of the creek.	Possible ROW impact to widen Morse to accommodate center island.
Local Access	No access restriction to local residents.	No access restriction to local residents.	Local access impacted at SR 91 by left turn restrictions.	Local residents would have no direct access to 91.	Local residents would have to use 91 to access downtown core area to the west.	Local access impacted by turn restrictions due to island.
Intersection Safety	SR 91 & Morse has 9 conflict points. Morse & OB has 32 conflict points.	No change at 91 & OB. No change at Morse & OB.	Vehicular conflicts at 91 & OB are reduced. No change at Morse & OB.	Vehicular conflicts at 91 & OB are eliminated. No change at Morse & OB.	No change at 91 & OB. No change at Morse & OB.	No change at 91 & OB. Vehicular conflicts at Morse & OB reduced.
Travel Time - Local Residents	-----	No Change	Increased travel time for residents that make left turns at 91.	Increased travel time for residents that use intersection of 91 & OB.	Increased travel time for residents that use intersection of Morse & OB.	Increase travel time for residents that that travel west or make a left turn at Morse.

Owen Brown Street Alternatives Matrix

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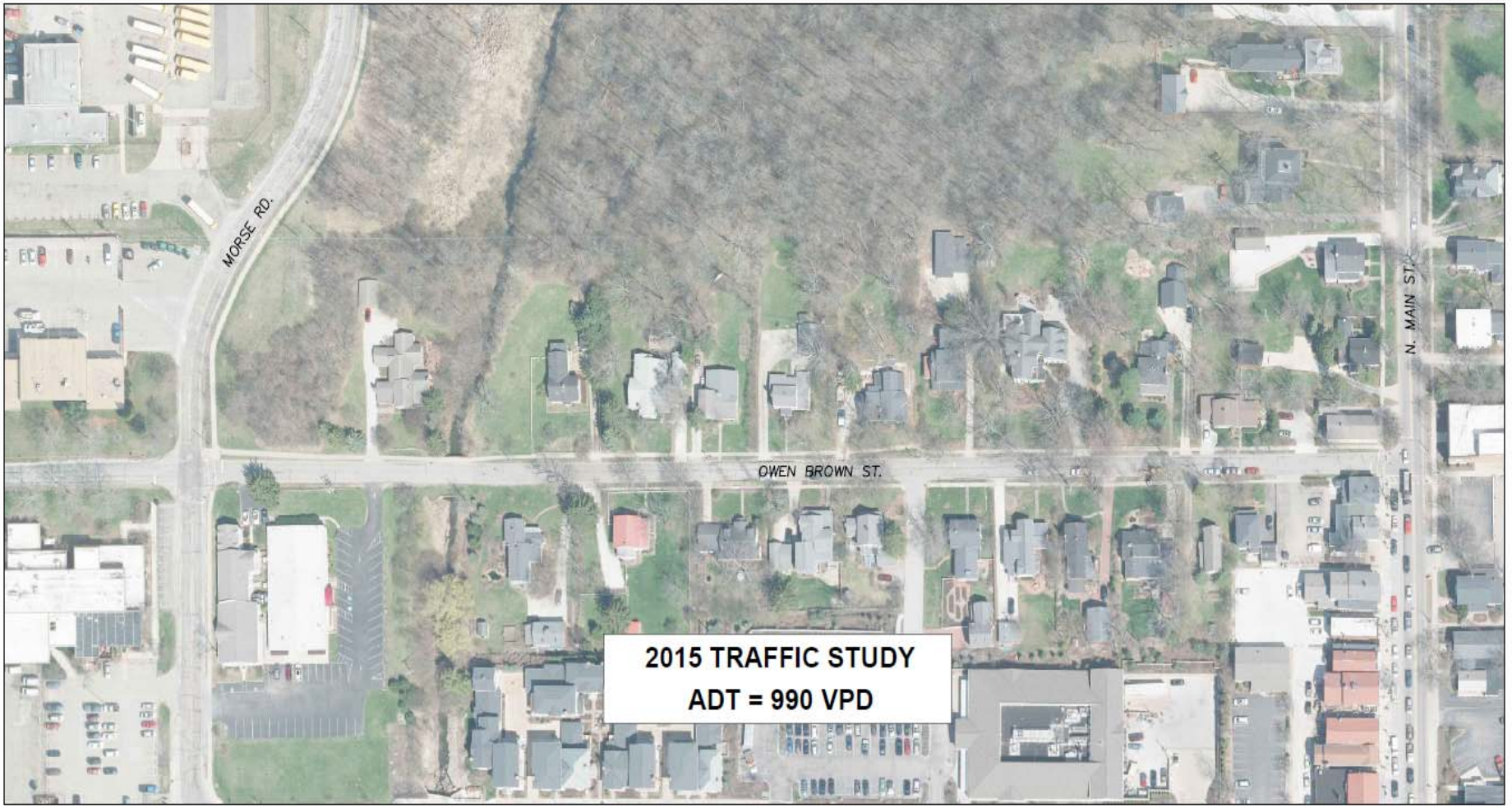

SCENARIO # 1

LEGEND:

ADT= AVERAGE DAILY TRAFFIC

VPD= VEHICLES PER DAY

NOTE:

THIS TRAFFIC INCLUDED THE HUDSON PUBLIC POWER, WINDSTREAM, AND THE BUS GARAGE TRAFFIC IN FULL OPERATION.

N

0 50 100

SCALE IN FEET

OHIO HUDSON
115 Executive Parkway, Suite 400
Hudson, Ohio 44236
(330) 342-1770

TRAFFIC IMPACT DESIGN

EXISTING OPTION (2015)

Drawn:	Checked:	Date:
JVG	TJS	5/03/2018
Scale: 1"=100'	Drawing No: Figure 1	

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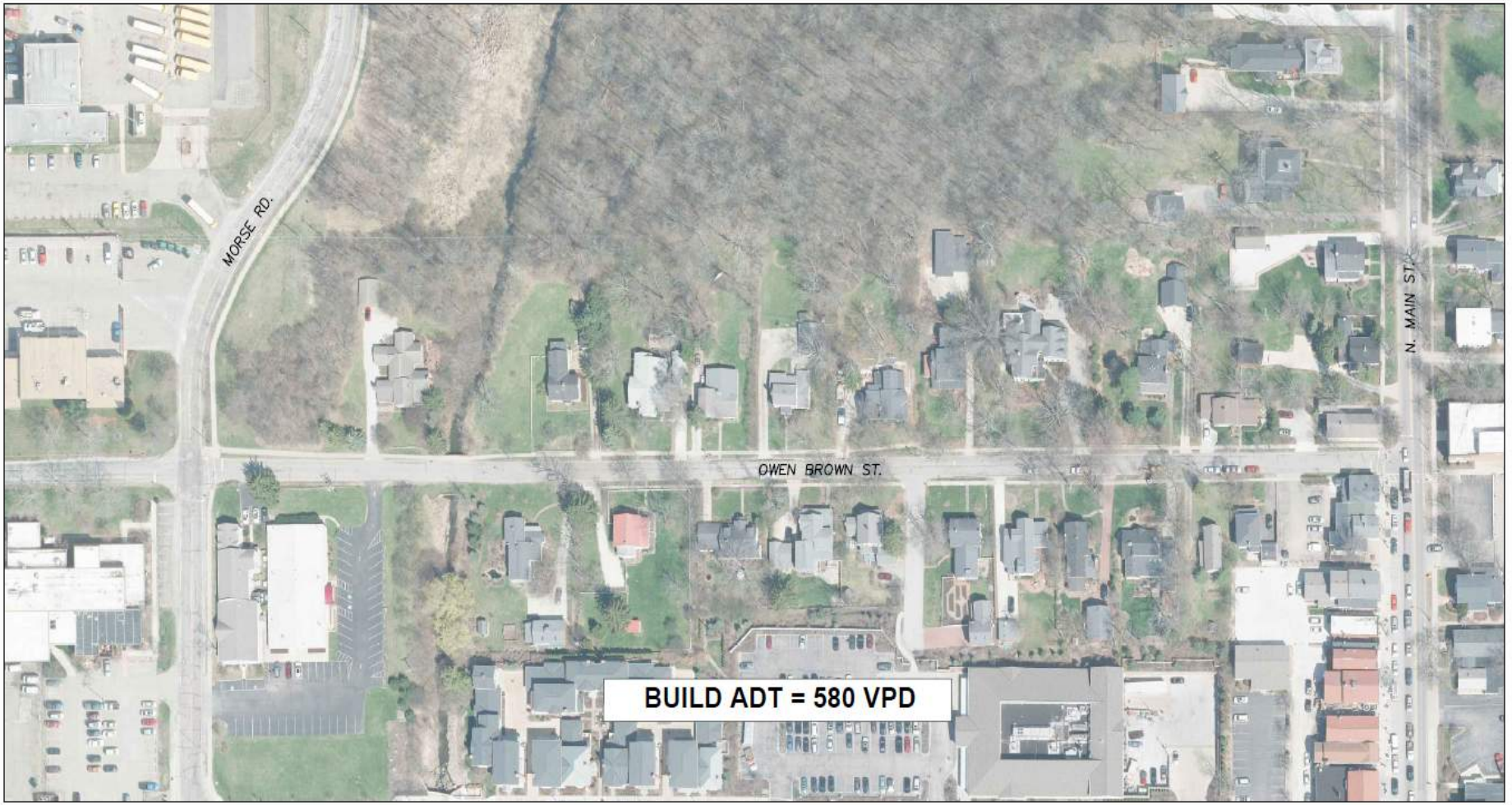

LEGEND:

ADT= AVERAGE DAILY TRAFFIC

VPD= VEHICLES PER DAY

NOTE:

THIS ESTIMATE IS FOLLOWING THE FINAL BUILD-OUT OF DOWNTOWN PHASE 2 WITH THE "GREEN" THAT WILL BE CLOSING OWEN BROWN NEAR THE RAILROAD UNDERPASS AS PART OF THE TESTA DEVELOPMENT.

SCENARIO # 2

N

0 50 100

SCALE IN FEET

OHIO HUDSON

115 Executive Parkway, Suite 400
Hudson, Ohio 44236
(330) 342-1770

TRAFFIC IMPACT DESIGN

BUILD OPTION (2021)

Drawn:	Checked:	Date:
JVG	TJS	5/03/2018
Scale: 1" = 100'	Drawing No: Figure 1	

Figure: 5.14

Page: 92

Scenario #2

Downtown Phase II
Hudson, Ohio
Traffic Impact Study

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SCENARIO # 3

LEGEND:

ADT= AVERAGE DAILY TRAFFIC

VPD= VEHICLES PER DAY

NOTE:

THIS ESTIMATED TRAFFIC IS FOLLOWING A RIGHT-IN AND RIGHT-OUT AT SR 91.

N

0 50 100

SCALE IN FEET

OHIO HUDSON

115 Executive Parkway, Suite 400
Hudson, Ohio 44236
(330) 342-1770

TRAFFIC IMPACT DESIGN

RIGHT IN AND RIGHT OUT AT N. MAIN ST.

Drawn:	Checked:	Date:
JVG	TJS	5/03/2018
Scale: 1" = 100'	Drawing No: Figure 1	

Figure: 5.15

Page: 93

Scenario #3

Downtown Phase II
Hudson, Ohio
Traffic Impact Study

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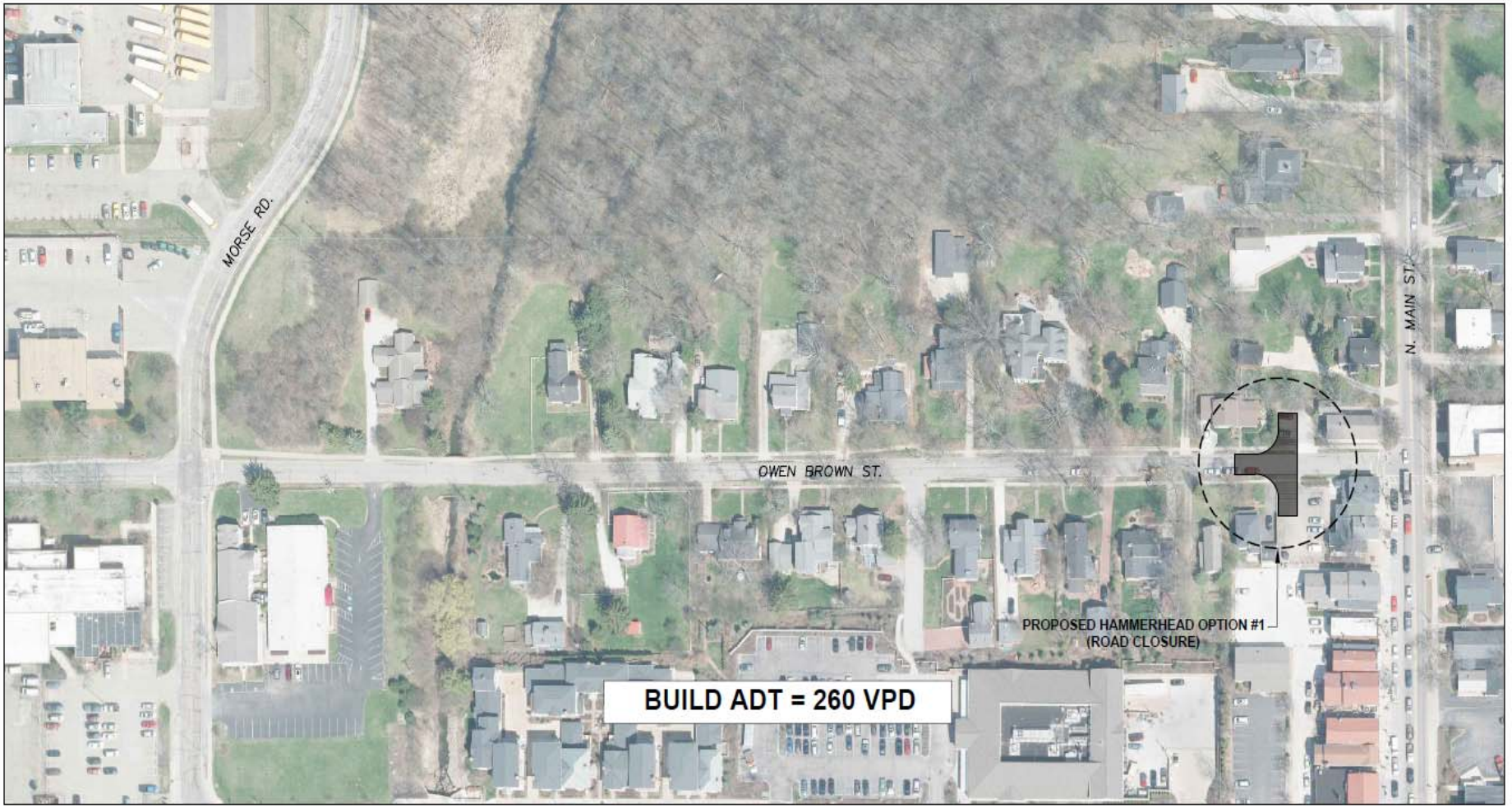

LEGEND:

ADT= AVERAGE DAILY TRAFFIC

VPD= VEHICLES PER DAY

NOTE:

THIS ESTIMATED TRAFFIC IS FOLLOWING A COMPLETE CLOSURE NEAR SR 91 ON OWEN BROWN ST.

SCENARIO # 4

N

0 50 100

SCALE IN FEET

OHIO HUDSON
115 Executive Parkway, Suite 400
Hudson, Ohio 44236
(330) 342-1770

TRAFFIC IMPACT DESIGN

HAMMERHEAD AT N. MAIN ST.

Drawn:	Checked:	Date:
JVG	TJS	5/03/2018
Scale: 1" = 100'	Drawing No: Figure 1	

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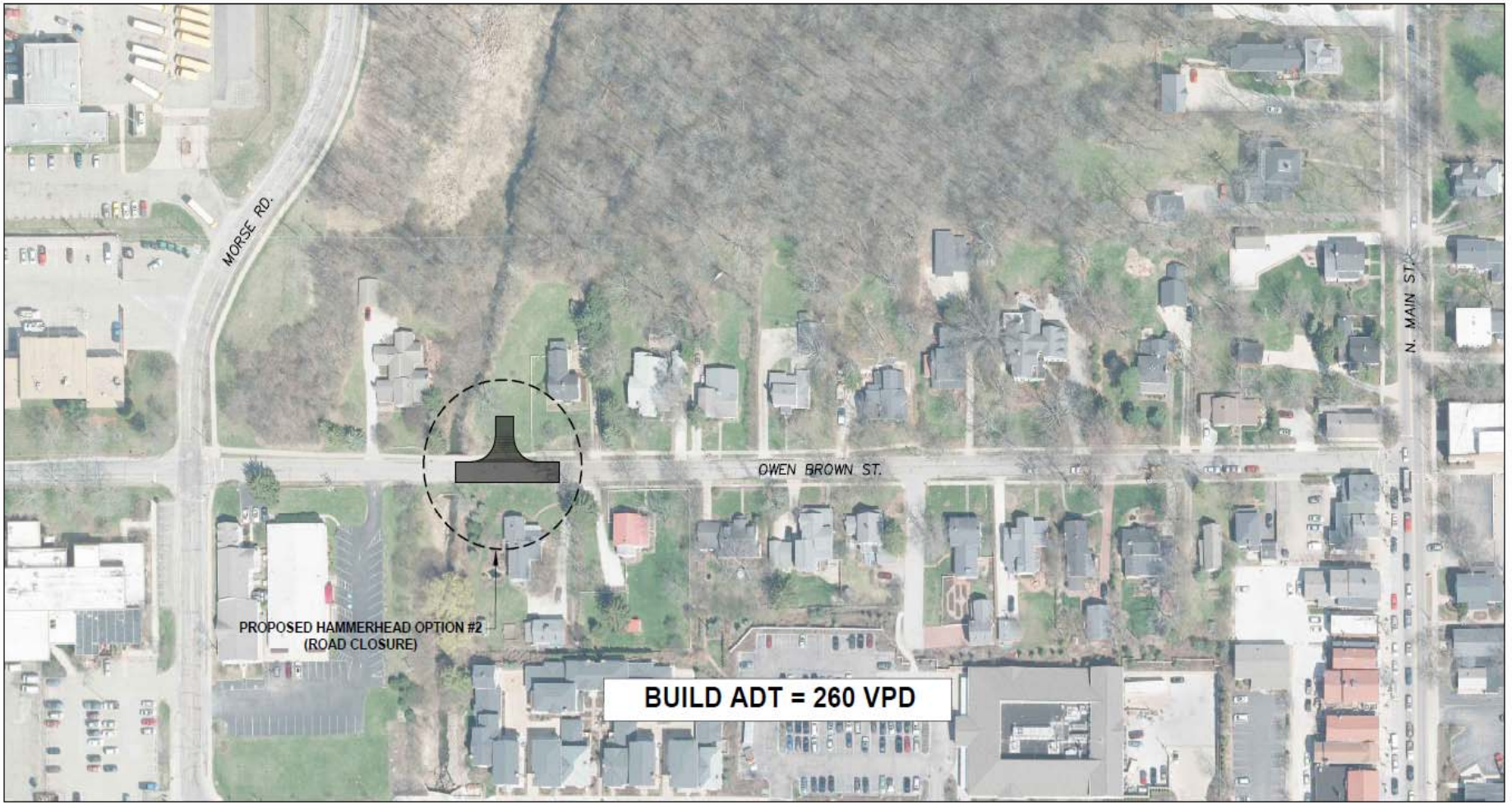

LEGEND:

ADT= AVERAGE DAILY TRAFFIC

VPD= VEHICLES PER DAY

NOTE:

THIS ESTIMATED TRAFFIC IS FOLLOWING A COMPLETE CLOSURE NEAR THE BRANDYWINE CREEK TRIBUTARY CROSSING ON OWEN BROWN ST.

SCENARIO # 5

N

0 50 100

SCALE IN FEET

OHIO HUDSON

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Hudson, Ohio 44236
(330) 342-1770

TRAFFIC IMPACT DESIGN

HAMMERHEAD NEAR THE CREEK

Drawn:	Checked:	Date:
JVG	TJS	5/03/2018
Scale: 1" = 100'	Drawing No: Figure 1	

Figure: 5.17

Page: 95

Scenario #5

Downtown Phase II
Hudson, Ohio
Traffic Impact Study

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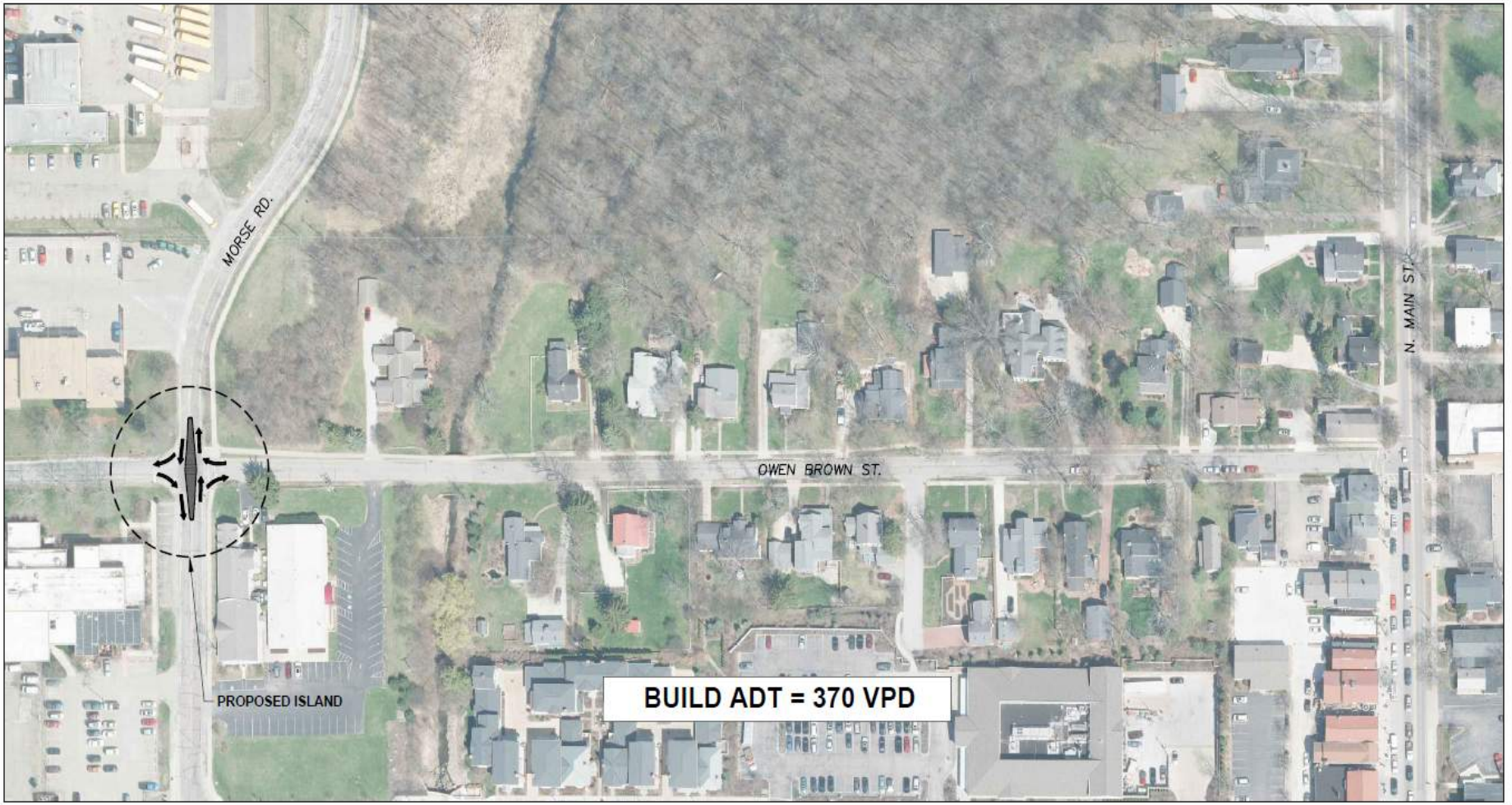

SCENARIO #6

LEGEND:

ADT= AVERAGE DAILY TRAFFIC

VPD= VEHICLES PER DAY

NOTE:

THIS ESTIMATED TRAFFIC IS AFTER AN ISLAND INSTALLED ON MORSE RD/OWEN BROWN ST. OWEN BROWN ST. WILL ONLY BE A RIGHT-IN AND RIGHT-OUT TO THE EAST OF THE INTERSECTION AT MORSE ROAD.

N

0 50 100

SCALE IN FEET

OHIO HUDSON

115 Executive Parkway, Suite 400
Hudson, Ohio 44236
(330) 342-1770

TRAFFIC IMPACT DESIGN

ELONGATED ROUNDABOUT AT MORSE RD AND OWEN BROWN ST INTERSECTION

Drawn:	Checked:	Date:
JVG	TJS	5/03/2018
Scale: 1" = 100'	Drawing No: Figure 1	

Figure: 5.18

Page: 96

Scenario #6

Downtown Phase II
Hudson, Ohio
Traffic Impact Study

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5.6 Owen Brown Street & Norfolk Southern Overpass

Owen Brown Street is a two-lane roadway that has an east to west orientation which starts at North Main Street (SR 91) and terminates in the west at Lennox Road. There is a rail overpass operated by Norfolk Southern that crosses Owen Brown Street. It is located 480 feet east of Lennox Road and 860 feet west of Morse Road.

The overpass has advance "low clearance" warning signs installed at Morse Road and Lennox Road which are the nearest intersecting roadways where a vehicle can detour or turn around. The advance signs are marked with a 10'-7" clearance. Measurements taken found the clearance height to be 11'-1". There are no supplemental distance plaques mounted under the low clearance warning signs.

To the west of the railroad overpass, the abutting property is generally residential. To the east of the overpass the land use is currently commercial with one property devoted to City services and school bus transportation services. Owen Brown Street serves as a connection between the west side residential areas to the east side down town retail / commercial area. There are no sidewalks on either side of the street between Morse Road and Lennox Road, therefore pedestrians and bicyclists must share the roadway with motor vehicles.

The pavement width of Owen Brown Street is nominally 19 feet from face to face of curb where curb is present. It reduces in width as it approaches the Norfolk Southern rail overpass and under the bridge to 15 feet from face of gutter plate to face of gutter plate. Curbs are present along both sides of the street from Lennox Road to approximately 250 feet east of the rail overpass. The curb east and west of the overpass is a straight 6" curb without gutter plate. This curb transitions to an integral curb and gutter plate under the overpass. There is no curb from 250 feet east of the rail overpass to Morse Road.

Owen Brown Street has an average daily traffic (ADT) volume of approximately 3,400 vehicles per day based on a 2016 traffic count collected at the railroad overpass. A copy of the count data can be seen in **Appendix A**. The table below shows a breakdown of the classifications of road users for a weekday and a Saturday.

Table 5.8 - Roadway Users

	Weekday	Saturday
ADT (24 Hr Vehicular Volume)*	3352	2670
9 Hr. Vehicular Volume	2215	1517
Cars (9 Hours)	2182 (98.5%)	1513 (99.7%)
Trucks (9 Hours)	27 (1.2%)	4 (0.3%)
Buses (9 Hours)	6 (0.3%)	0 (0%)
Pedestrians (9 Hours)	18	20
Bicyclists (9 Hours)	22	13

* Calculated by multiplying ODOT expansion factors for local streets and 9 hour vehicular volume

Motor vehicle, pedestrian and bicycle crash records were reviewed for Owen Brown Street. There were 6 total crashes that have occurred since 2011. There were no reports of crashes involving either pedestrians or bicyclists. The following table shows a breakdown of the crashes by year.

Table 5.9- Crashes

Year	Total Crashes	Type
2011	0	
2102	1	1 - Backing (truck too tall so stopped before bridge & while backing hit vehicle in his blind spot)
2103	0	
2014	3	2 - Hit fixed object (too tall, hit bridge) 1 - Sideswipe (vehicles passing one another under bridge)
2015	1	1 - Hit fixed object (too tall, hit bridge)
2016	1	1 - Hit fixed object (too tall, hit bridge)

A roadway segment analysis of underpass section of Owen Brown Street was analyzed to determine the existing levels-of service for the roadway under the existing conditions. The following table details the results of that analysis. Copies of the analysis worksheets can be seen in **Appendix V**.

Table 5.10 - Existing Levels-of-Service
(No Traffic Control)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS	PM PEAK LOS (DELAY)
Owen Brown & NS Underpass	None	Eastbound	E	E
		Westbound	E	E

(XX.X) = Average vehicle delay in seconds per vehicle

Table 5.11 - 2021 Levels-of-Service
(No Traffic Control)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS	PM PEAK LOS (DELAY)
Owen Brown & NS Underpass	None	Eastbound	E	E
		Westbound	E	E

(XX.X) = Average vehicle delay in seconds per vehicle

Table 5.12 - 2041 Levels-of-Service
(No Traffic Control)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS	PM PEAK LOS (DELAY)
Owen Brown & NS Underpass	None	Eastbound	E	E
		Westbound	E	E

(XX.X) = Average vehicle delay in seconds per vehicle

It should be noted that HCM guidelines do not allow for a lane width less than 9 feet in the analysis. The results provided above likely represent a best-case scenario for the underpass under existing conditions with no traffic control. The results however do indicate that widening the underpass to accommodate two 9 foot travel lanes would not be sufficient to allow the roadway segment to operate with a levels-of-service D or better.

The use of traffic control signals were analyzed to determine their impact to traffic along Owen Brown Street at the rail overpass. Copies of the analysis worksheets for a traffic signal controlled under pass can be seen in **Appendix T**. The following table details the results of the analysis based in the 2041 design year conditions:

Table 5.13 - Existing Levels-of-Service
(Traffic Signal Control)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Owen Brown & NS Underpass	Traffic Signal	Eastbound	D (35.8)	C (34.2)
		Westbound	C (24.8)	C (32.8)

(XX.X) = Average vehicle delay in seconds per vehicle

Table 5.14 - 2021 Levels-of-Service
(Traffic Signal Control)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Owen Brown & NS Underpass	Traffic Signal	Eastbound	D (41.2)	D (35.1)
		Westbound	C (24.5)	D (37.6)

(XX.X) = Average vehicle delay in seconds per vehicle

Table 5.15 - 2041 Levels-of-Service
(Traffic Signal Control)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Owen Brown & NS Underpass	Traffic Signal	Eastbound	D (44.8)	D (37.4)
		Westbound	C (25.7)	D (40.6)

(XX.X) = Average vehicle delay in seconds per vehicle

The table indicates that using traffic signal control on each side of the rail overpass at Owen Brown Street to control right-of-way through the tunnel would be expected to operate with level-of service D or better.

A queue analysis was performed using the Synchro analysis software to determine the expected length of westbound queued traffic. The analysis determined the 95TH percentile queue lengths to be 94 feet in the AM peak hour and 148 feet in the PM peak hour with the use of traffic signals to control traffic through the underpass. The available space between the underpass and Village Way should be sufficient to store vehicles without restricting movement at the intersection of Owen Brown Street and Village Way.

Further improvement in the roadway level-of service for vehicular traffic would require widening the underpass to accommodate a two-lane roadway width of at least 11 feet based on Table 301-4 from Section 300 of the ODOT **Location and Design Manual, Volume 1**. A copy of Table 301-4 can be seen in **Appendix G**.

There are four (4) ways in which pedestrians can be accommodated in the public right of way. These include:

1. Sidewalks
2. Off-Road Paths
3. Shared-Use Paths
4. Shared Streets

If the Owen Brown Street roadway were to be reconstructed to have a sidewalk under the overpass, the narrowest pedestrian area would require that a minimum four (4) foot sidewalk with a minimum two (2) foot buffer area to be constructed. A nine (9) foot paved area for motor vehicles would be left in the existing cross section. Nine foot travel lane is not recommended unless the ADT is less than 250 vehicles per day. Since the current ADT exceeds this value it would be expected that operational and safety issues could be a concern. This narrow design does not have adequate width to allow two persons, each in wheel chairs, to pass one another and therefore may not meet ADA requirements for accessibility. The construction of sidewalks under the overpass would require a widening of the under pass to accommodate the necessary width of the sidewalks facilities and vehicular travel lanes.

The construction of an off-road path would require a separate facility that would require tunneling under the rail overpass.

Shared use paths, path where pedestrians and bicyclists share the same travel area and is marked accordingly, has the same difficulty as constructing a sidewalk under the overpass. There is not enough space for the path and a travel lane for vehicles. Shared use paths require a minimum of 10 feet in width and a 5 foot buffer area between the path and the travel lane. There is currently only 15 feet of width available which would not allow a travel lane for motor vehicles. The construction of a shared use path would require either a separate facility that would require tunneling under the rail overpass or a widening of the existing underpass.

The last method of accommodating pedestrians, "shared street", is precisely what is currently being used along Owen Brown Street, under the overpass and along the street. Pedestrian activity has been recorded using Owen Brown Street. No pavement markings indicating a pedestrian path way is required nor recommended.

The widening or the Owen Brown Street underpass or the tunneling of a separate facility would be a high cost improvement that would require significant coordination with the Norfolk Southern to maintain rail traffic over Owen Brown Street.

Based on information currently found at the Pedestrian and Bicycle Information Center the cost to create a pedestrian underpass (excluding bridges) can vary greatly based on site conditions and materials. The presence of the rail line and maintaining rail traffic will likely increase the cost of any underpass project. The site details an approximate cost of $1,609,000 to $10,733,00 at approximately $120 per square foot. The underpass information at the Pedestrian and Bicycle Information Center website can currently be found at the following web address:

http://www.pedbikeinfo.org/planning/facilities_crossings_over-underpasses.cfm

The following factors should also be considered with the possible construction of a separate underpass or widening of the existing underpass to accommodate pedestrians and bicycles:

- People will not use the structure if a more direct route is available.
- Lighting, drainage, graffiti removal, and security are also major concerns with underpasses.
- Must be wheelchair accessible, which may result in long ramps on either end of the underpass.
- AASHTO recommends a railing height of at least 42 inches.

- When bicyclist space is provided near railings or near motorized traffic, extra horizontal width or a buffer of at least two feet is recommended to protect bicyclists in the event of a crash or wind blast.

It is our recommendation to install stop signs on each side of the underpass for traffic control with the intention to re-evaluate the need for traffic signal control after the construction and opening of the proposed development. It is recommended to consider the "bonding" of traffic signal cost so funds are in place and available if it is determined that traffic signal control is necessary at the under pass after the opening of the development.

5.7 Improvements to Accommodate Study Area Traffic

The following improvements were determined to mitigate the poor levels-of-service under the existing conditions:

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

  OR
- Restrict intersection to right in and right out at North Main Street.

  OR
- Close intersection at North Main Street.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

The intersections of SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make these types of improvements unfeasible.

The following recommendations are made for consideration for future improvements at the following intersections:

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.\
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

No additional improvements were recommended to accommodate the existing traffic at the study area intersections.

The following improvements were determined to mitigate the poor levels-of-service under the forecasted 2021 traffic conditions without the development site generated traffic:

1. North Main Street (SR 91) & Brandywine Drive
- Construct a center two-way left turn lane.

2. North Main Street (SR 91) & Morning Song Lane
- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

Traffic signal control north of the intersections at Valley View Road and Herrick Park Drive should be analyzed to determine if traffic signal control is warranted and would be able to produce additional gaps in the southbound traffic flow for the minor street traffic.

18. Valley View Road & East Hines Hill Road
- Construct a single lane roundabout.

The following recommendations are made for consideration for future improvements at the following intersections:

5. SR 91 & Clinton Street/Aurora Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

14. SR 303 & Boston Mills Road
- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street

- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

No additional improvements were recommended to accommodate the forecasted 2021 traffic conditions without the development site generated traffic at the study area intersections.

The following improvements were determined to mitigate the poor levels-of-service under the forecasted 2041 traffic conditions without the development site generated traffic :

1. North Main Street (SR 91) & Brandywine Drive

- Construct a center two-way left turn lane.

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street

OR

- Close intersection at North Main Street.

Traffic signal control north of the intersections at Valley View Road and Herrick Park Drive should be analyzed to determine if traffic signal control is warranted and would be able to produce additional gaps in the southbound traffic flow for the minor street traffic.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

36. South Main Street (SR 91) & Ravenna Street

- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

The following recommendations are made for consideration for future improvements at the following intersections:

5. SR 91 & Clinton Street/Aurora Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

8. SR 91 & Veterans Way
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct a westbound left turn lane

14. SR 303 & Boston Mills Road
- Upgrade traffic control signal to operate under an adaptive traffic control system.

15. SR 303 & Atterbury Boulevard/Milford Drive
- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street
- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted

The following lane use and traffic control are recommended to accommodate the 2021 site generated (Build) traffic:

21. Morse Road & Owen Brown Street
- Maintain stop sign control on all intersection approaches.
- Maintain existing intersection lane use of one lane in each direction for two-way traffic flow.

The following recommendations are made for consideration for future improvements at the following intersections:

3. SR 91 & Prospect Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct eastbound left turn lane.

It should be noted that the intersection of North Main Street (SR 91) and Prospect Street was previously analyzed in prior studies and was determined to not require any additional improvements. The primary difference between studies can be attributed to the application of design hour factors and higher trip generation results for the proposed development due to differences in the development site plans under review for each analysis.

Based on the trip generation results and capacity analysis it is recommended that the need for an eastbound left turn lane on West Prospect Street at North Main Street (SR 91) be re-analyzed in a post-construction analysis after the development has reached full build conditions and installed if warranted.

5. SR 91 & Clinton Street/Aurora Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

14. SR 303 & Boston Mills Road
- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. SR 303 & North/South Oviatt Street
- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street

- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

The following recommendations are made for consideration for future improvements at the following intersections under the 2041 Build conditions:

3. SR 91 & Prospect Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct an exclusive eastbound left turn lane.

It should be noted that the intersection of North Main Street (SR 91) and Prospect Street was previously analyzed in prior studies and was determined to not require any additional improvements. The primary difference between studies can be attributed to the application of design hour factors and higher trip generation results for the proposed development due to differences in the development site plans under review for each analysis.

Based on the trip generation results and capacity analysis it is recommended that the need for an eastbound left turn lane on West Prospect Street at North Main Street (SR 91) be re-analyzed in a post-construction analysis after the development has reached full build conditions.

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

8. SR 91 & Veterans Way

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct a westbound left turn lane

14. SR 303 & Boston Mills Road

- Upgrade traffic control signal to operate under an adaptive traffic control system.

15. SR 303 & Atterbury Boulevard/Milford Drive

- Upgrade traffic control signal to operate under an adaptive traffic control system.

16. SR 303 & Library Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street

- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

It should be noted that the downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for State Route 91 and SR 303 including intersection improvements, operational improvements, and adding a by-pass. It would be recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.

A summary of the intersection improvements can be seen on **Figure 5.19, Page 111.**

The recommended lane use and traffic control for the study area intersections to accommodate the proposed development under the expected No-Build and Build conditions can be seen in **Figure 5.20, Page 112**.

INT #	YEAR	CONDITION	PEAK	LOS	APPROACH
1	2021	No-Build	PM	E	Eastbound
Center Left Turn Lane / Traffic Signal Control @ Valley View/Herrick Park					
2	2021	No-Build	AM/PM	D	Eastbound
Center Left Turn Lane / Traffic Signal Control @ Valley View/Herrick Park Turn Movement Restriction/Closure					
3	2021	Build	PM	D	EB & SB
Eastbound Left Turn Lane/Adaptive Signal Control					
5	2021	No-Build	AM/PM	D	EB & WB
Prohibit Minor Street Right Turns/Adaptive Signal Control Additional Study (AMATS)					
7	2021	No-Build	PM	E	WB & SB
Re-Route Through Traffic / Adaptive Signal Control/Additional Study (AMATS)					
8	2041	No-Build	PM	D	NB
Westbound Left Turn Lane / Adaptive Signal Control					
18	2021	No-Build	PM	F	Eastbound
Single Lane Roundabout					
35	2018	Existing	PM	E	Northbound
Monitor Traffic Volumes for Signal Warrant / Additional Study (AMATS)					
36	2021	No-Build	PM	D	Westbound
Restrict Left Turn Movement During Peak Periods/Additional Study (AMATS)					
6	2041	Build	PM	C	Eastbound
Do Not Block the Box Pavement Markings & Signs /Additional Study (AMATS)					
14	2021	No-Build	PM	E	Southbound
Adaptive Signal Control/Additional Study (AMATS)					
15	2041	No-Build	PM	D	Southbound
Adaptive Signal Control/Additional Study (AMATS)					
16	2041	No-Build	PM	D	WB & SB
Adaptive Signal Control/Additional Study (AMATS)					

Figure: 5.19

Page: 111

Intersection Improvement Summary

Downtown Phase II
Hudson, Ohio
Traffic Impact Study

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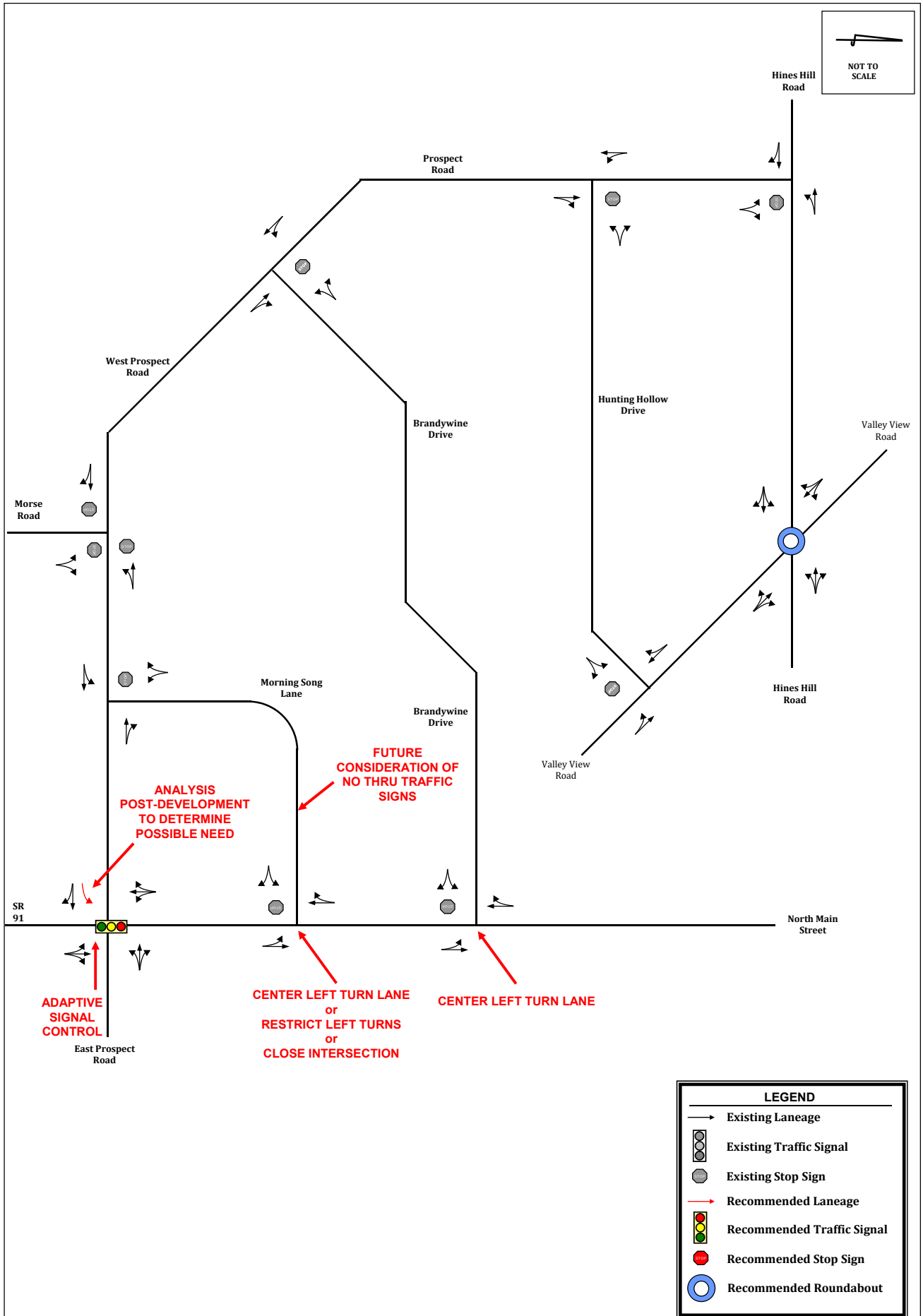

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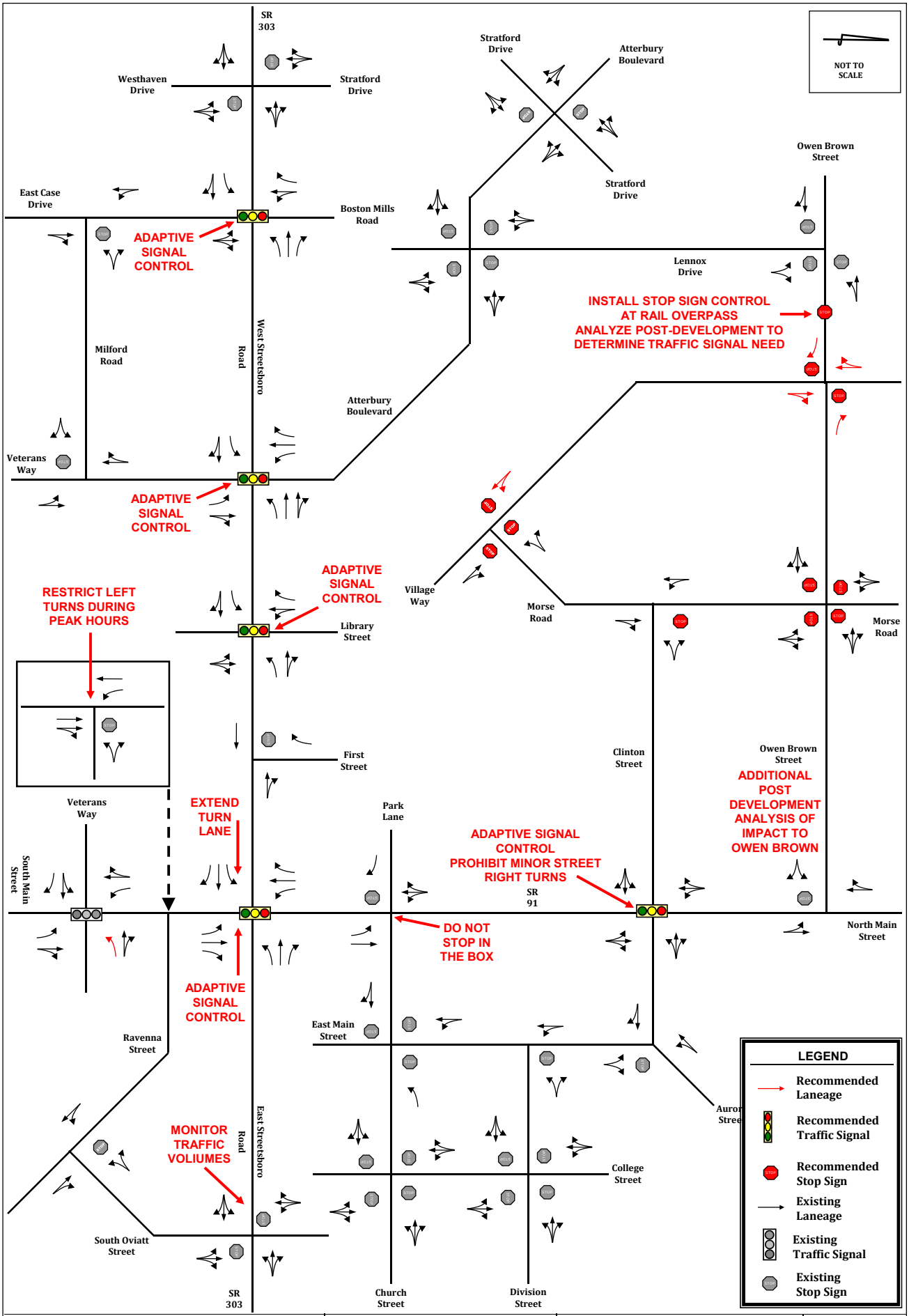
Hudson, Ohio
Traffic Impact Study

Recommended Intersection Improvements

Figure: 5.20a



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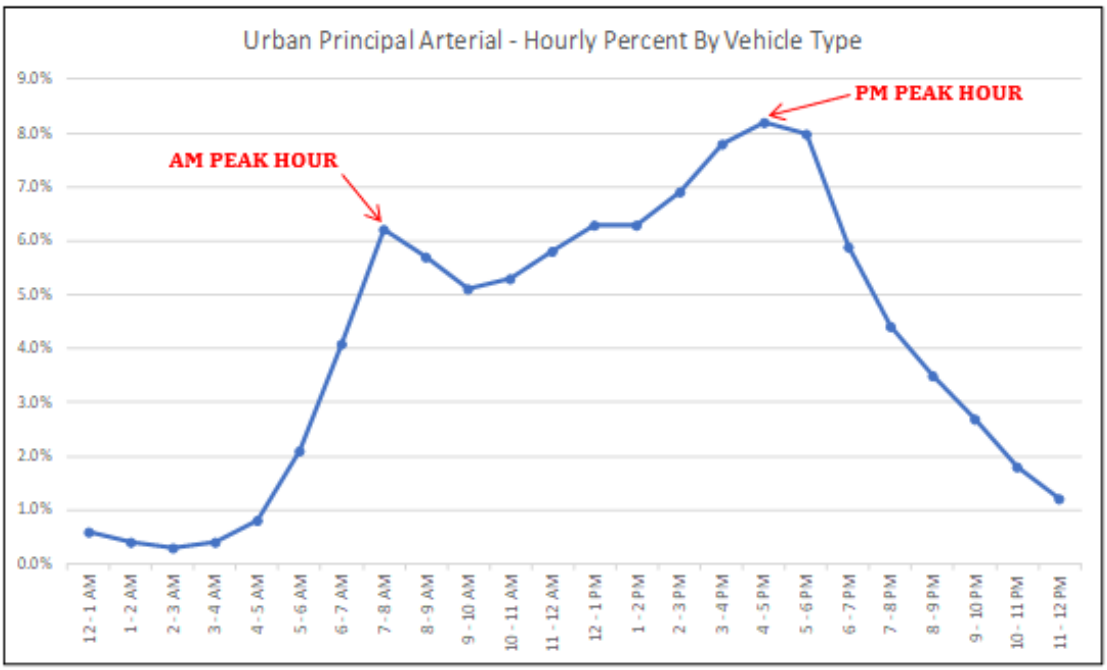
Hudson, Ohio
Traffic Impact Study

Recommended Intersection Improvements

Figure: 5.20b

The analysis used to determine the capacity of the study area intersections and the previously listed improvements were based on the AM and PM peak hours of the roadways. Based on these results the intersections are expected to be operating at this level or an improved level during the remaining hours of the day.

The following graph details the hourly variation in vehicular volumes for a typical urban principal arterial in the Ohio based on data collected by the Ohio Department of Transportation from various Automatic Traffic Counter statewide.



It is our opinion that the poorest levels-of-service and delay will typically correspond to the highest traffic volumes on the roadway. The delay is therefore expected to lessen and the level-of-service may improve as the traffic volumes lessen. The graph above provides a basic representation of how the level-of-service may vary throughout the day based on traffic volumes. For example the if the AM peak hour had an LOS C and the PM peak hour had an LOS D it could be assumed that any hours represented on the graph between the AM and PM peak hours would be either an LOS C or LOS D. The hours below the AM peak hour would be assumed to be LOS C or better with the LOS and delay continually improving as you move further below the AM peak hour level on the graph.

The precise LOS and delay at intersections outside the peak hours can not be determined without performing a detailed analysis like those found in Chapter 5.

The following recommendations and traffic calming measures are made for the Owen Brown Street corridor between North Main Street and Lennox Road in order to minimize the impacts of the development:

1. Maintain full access for Owen Brown Street at SR 91 and Morse Road.

2. Install traffic signal control at the Owen Brown underpass location to control traffic through the underpass.

3. Use raised pavement areas with a different surface texture than the roadway at crosswalk locations.

4. Consider the use of on-street parking along Owen Brown Street in the development area between Morse Road to the east and the railroad overpass to the west.

5. Minimize the corner radii at all development intersections to force vehicles to slow down to turn. Consideration should be given to the expected design vehicles on the roadways including but not limited to the City's emergency vehicles.

These recommended traffic calming measures are intended for implementation during the construction of the project so they are in place upon the opening of the development. Turn restrictions and roadways closures can also be temporarily put in place during construction periods to evaluate the impact to local traffic and adjacent roadways and intersection before permanent restriction or closure is enacted.

The traffic patterns on Owen Brown Street should then be re-evaluated after the opening of the development to determine if additional traffic calming measures for Owen Brown Street between Morse Road to the west and SR 91 to the east should be implemented. It is our opinion that the measures previously detailed in this report should then be considered and implemented if necessary in a progressive manner of the least impact to access for the Owen Brown residents to the greatest impact.

Chapter 6
Conclusions

Based on the results of the analyses, we offer the following conclusions and recommendations:

6.1 The weekday AM peak hour of traffic was determined to be 7:00 AM to 8:00 AM. The weekday PM peak hour of traffic was found to be 5:00 PM to 6:00 PM at the study intersections.

6.2 The proposed project is expected to consist of three development components comprised of the following land uses:

Residential	**Office/Commercial**
63 Low-Rise Units	125,804 Square Feet - Office
80 Mid-Rise Units	6,000 Square Feet - Retail
	6,000 Square Feet - Restaurant
TOTAL : 143 Units	**TOTAL: 137,804 Square Feet***

***The 137,804 square feet of office/commercial space is anticipated to include approximately 12,000 square feet of first floor business service/restaurant/personal services uses.**

6.3 The year 2021 will be analyzed as the opening year for the full build out of the development. The year 2041 will be analyzed as the design year for the twenty year analysis.

6.4 Access to the development site will be considered along the roadways of Morse Road to the north, Owen Brown Street to the west, Clinton Street to the east, and Village Way to the south. The site plan for the Hudson Downtown Phase 2 project can be seen in **Figure 1.3, Page 4**.

Site Generated Traffic

6.5 The proposed development is expected to generate the following average hourly traffic during the AM and PM peak periods based upon the rates established by studies from the Institute of Transportation Engineers.

Hudson - Downtown Phase II Project
Full Build

ITE TRIP GENERATION		SIZE	TRIP ENDS			
ITE Code	Description		Weekday AM Peak Hour of Generator (Enter/Exit)		Weekday PM Peak Hour of Generator (Enter/Exit)	
220	Multifamily Housing (Low-Rise)	63 Units	10	26	25	18
221	Multifamily Housing (Mid-Rise)	80 Units	8	21	22	14
710	General Office Building	137,804 SF	194	26	39	178
TOTAL NEW TRIPS			**212**	**73**	**86**	**210**
			285		**296**	

Existing Improvements to Serve Future Traffic Conditions without the Development

6.6 The following improvements were determined to mitigate the poor levels-of-service under the existing conditions at the study area intersections:

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

The intersections of SR 303 at SR 91 and North/South Oviatt Street are located in close proximity to areas of significant community and historical importance. While certain traditional geometric and traffic control improvements could be expected to improve the levels-of-service the impact to these areas would make this types of improvement unfeasible.

The following recommendations are made for consideration for future improvements at the following intersections:

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

No additional improvements were recommended to accommodate the existing traffic at the study area intersections.

6.7 The following improvements were determined to mitigate the poor levels-of-service under the 2021 No-Build conditions:

1. North Main Street (SR 91) & Brandywine Drive

- Construct a center two-way left turn lane.

2. North Main Street (SR 91) & Morning Song Lane

- Construct a center two-way left turn lane.

OR

- Restrict intersection to right in and right out at North Main Street.

OR

- Close intersection at North Main Street.

18. Valley View Road & East Hines Hill Road

- Construct a single lane roundabout.

6.8 Traffic signal control north of Brandywine Drive and Morning Song Lane at Valley View Road and Herrick Park Drive should be analyzed to determine if traffic signal control is warranted and would be able to produce additional gaps in the southbound traffic flow for the minor street traffic.

6.9 The following recommendations are made for consideration for future improvements at the following intersections under the expected 2021 No-Build conditions:

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303 (PM Peak)

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

14. SR 303 & Boston Mills Road

- Upgrade traffic control signal to operate under an adaptive traffic control system.

35. East Streetsboro Road (SR 303) & North/South Oviatt Street

- Periodically monitor intersection traffic volumes to determine if traffic signal control becomes warranted.

36. SR 91 & Ravenna Street

- Restrict left turns during the peak hours.
- Current study underway to analyze study area of SR 91 and SR 303.

6.10 The downtown area corridors of SR 91 and SR 303 are identified as congested locations by the Akron Metropolitan Area Transportation Study (AMATS) Final Congestion Management Process Report (January 12, 2017). The report includes recommendations for State Route 91 and State Route 303 including intersection improvements, operational improvements, and adding a by-pass. It is recommended to coordinate with AMATS regarding available opportunities for improvement funding as well as possible future corridor studies to identify additional improvements.

6.11 No additional improvements were recommended to accommodate the 2041 No-Build traffic conditions at the study area intersections as compared to the 2021 No-Build conditions.

Recommended Improvements fo Mitigate Traffic Associated with the Development

6.12 The following lane use and traffic control are recommended to accommodate the 2021 site generated (Build) traffic:

21. Morse Road & Owen Brown Street

- Maintain stop sign control on all intersection approaches.
- Maintain existing intersection lane use of one lane in each direction for two-way traffic flow.

3. SR 91 & Prospect Street

- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct eastbound left turn lane.

6.13 It should be noted that the intersection of North Main Street (SR 91) and Prospect Street was previously analyzed in prior studies and was determined to not require any additional improvements. The primary difference between studies can be attributed to the application of design hour factors and higher trip generation results for the proposed development due to differences in the development site plans under review for each analysis.

Based on the trip generation results and capacity analysis it is recommended that the need for an eastbound left turn lane on West Prospect Street at North Main Street (SR 91) be re-analyzed in a post-construction analysis after the development has reached full build conditions and installed if warranted.

6.14 The following recommendations are made for consideration for future improvements at the following intersections under the expected 2021 Build conditions:

5. SR 91 & Clinton Street/Aurora Street

- Upgrade traffic control signal to operate under an adaptive traffic control system
- Prohibit the minor street through and right turn movements and upgrade the traffic signal to allow the eastbound & westbound left turns at the same time.

7. SR 91 & SR 303

- Upgrade traffic control signal to operate under an adaptive traffic control system
- Extend the length of the exclusive eastbound left turn lane.
- Current study underway to analyze study area of SR 91 and SR 303.

6.15 The following recommendations are made for consideration for future improvements at the following intersections under the 2041 Build conditions:

8. SR 91 & Veterans Way
- Upgrade traffic control signal to operate under an adaptive traffic control system.
- Construct a westbound left turn lane

15. SR 303 & Atterbury Boulevard/Milford Drive
- Upgrade traffic control signal to operate under an adaptive traffic control system.

16. SR 303 & Library Street
- Upgrade traffic control signal to operate under an adaptive traffic control system.

Development Street Network

6.16 The site plan shown in **Figure 1.3** proposes to use Morse Road and Owen Brown Street and an extension of Village Way to provide access to and throughout the development. The development also proposes several new local roadways throughout the development as well.

6.17 The existing and proposed roadways throughout the development site are shown as two-lane roadways. Two-lane local roadways throughout the development should be sufficient to accommodate the movement of vehicular traffic through and within the development.

6.18 The intersections within the development with the exception of Owen Brown Street at Morse Road and at Morse Road and Village Way are recommended to have only minor street stop control. It is our recommendation that the Morse Road, Owen Brown Street, and Village Way approaches operate under free flow conditions with the left turn movements yielding the right-of-way to the opposing traffic at these proposed intersections.

6.19 The intersection of Owen Brown Street at Morse Road should be operated under all-way stop sign control due the offset lanes and pedestrian crossing locations. The intersection of Morse Road at Village Way should be operated under all-way stop sign control due the non-perpendicular alignment of the roadways at the intersection.

6.20 The development area to the south of Owen Brown Street between the Village Way to the west and Morse Road to the west includes a proposed parking garage. The parking garage is proposed with access along the east side of Village Way and the west side of Morse Road. These proposed intersections should include stop sign control the parking garage approaches. The Village Way access is located between horizontal curves on Village Way. The driveway and approach should be constructed so the exiting vehicle does not have an obstructed view of oncoming traffic due to landscaping or signs.

6.21 The proposed street layout and connectivity as shown in the site plan in **Figure 1.3** shows no significant problems in relation to the safety and efficiency of vehicular traffic throughout the site based on the recommendations for traffic control within this section and the report.

Owen Brown Street - Historic Block

6.22 Owen Brown Street was reviewed under various access scenarios to determine the existing conditions and potential impacts to the segment of roadway between Morse Road to the west and North Main Street to the east.

6.23 The following scenarios were analyzed and reviewed:

1. Study Area Traffic Conditions (Existing & 2021) w/out the proposed development
2. Study Area Traffic Conditions (2021) with the proposed development
3. Right In and Right Out at North Main Street
4. Hammerhead at North Main Street
5. Hammerhead Near the Creek
6. Elongated Roundabout at Morse Road & Owen Brown Street Intersection

6.24 Based on the development site plan shown in **Figure 1.3** and the matrix shown in **Figure 5.12** our recommendation would be to provide full access to SR 91 to the east and to the downtown interior core to the west for the residents of Owen Brown Street between Morse Road and SR 91.

6.25 The traffic patterns on Owen Brown Street should be re-evaluated after the opening of the development to determine if additional traffic calming measures for Owen Brown Street between Morse Road to the west and SR 91 to the east should be implemented.

6.26 It is our opinion that the measures previously detailed should then be considered and implemented if necessary in a progressive manner of the least impact to access for the Owen Brown residents to the greatest impact. The preferred sequencing of the traffic calming measures for Owen Brown Street between Morse Road and SR 91 is shown below.

1. Scenario #2 - Full access at Morse Road & SR 91
2. Scenario #3 - Limited access at SR 91 & full access at Morse Road
3. Scenario #6 - Full access at SR 91 & limited access at Morse Road
4. Scenario #4 - No access at SR 91 & full access at Morse Road
5. Scenario #5 - Full access at SR 91 & no access at Morse Road

Owen Brown Street Underpass at Norfolk Southern Railroad

6.27 A rail overpass operated by Norfolk Southern crosses Owen Brown Street approximately 480 feet east of Lennox Road and 860 feet west of Morse Road. To the west of the railroad overpass, the abutting property is generally residential. To the east of the overpass is the proposed Downtown Phase 2 development. Owen Brown Street serves as a connection between the west side residential areas to the east side down town retail / commercial area. There are no sidewalks on either side of the street between Morse Road and Lennox Road, therefore pedestrians and bicyclists must share the roadway with motor vehicles.

6.28 The distance between the underpass and the intersection of Owen Brown Street and Village Way should be adequate to store queued vehicles without impacting the intersection.

6.29 It is our recommendation to install stop signs on each side of the underpass for traffic control with the intention to re-evaluate the need for traffic signal control after the construction and opening of the proposed development. It is recommended to consider the "bonding" of traffic signal cost so funds are in place and available if it is determined that traffic signal control is necessary at the under pass after the opening of the development.

Conclusion

6.30 The proposed development is expected to increase traffic volumes on the adjacent street network. Based upon the results of the analysis in this study and the corresponding recommendations, it can be seen that the development traffic can be accommodated without adversely impacting the area roadway network.

TRAFFIC IMPACT STUDY

Downtown Phase 2 Project

Hudson, Ohio

MAY 25, 2018
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FEBRUARY 15, 2019
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MARCH 13, 2019

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