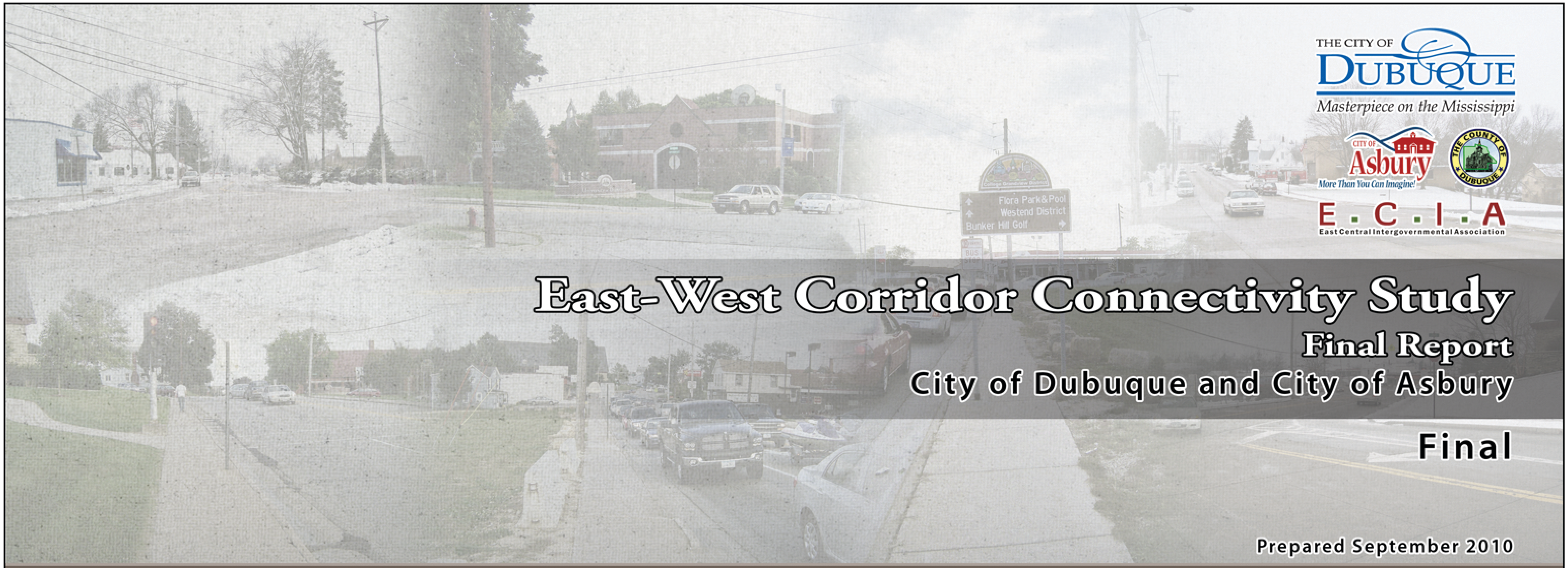

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East-West Corridor Connectivity Study

Final Report

City of Dubuque and City of Asbury

Final

Prepared September 2010

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EAST-WEST CORRIDOR CONNECTIVITY STUDY

Roadway Concept and Traffic Operations Study

Prepared For
City of Dubuque
City of Asbury

By
HDR Engineering, Inc
September 2010

WILLIAM H.
SHARP, JR.
15011

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

William H. Sharp, Jr. (date)

My license renewal date is December 31, 2010.

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CHAPTER 1: INTRODUCTION

REPORT PURPOSE AND FORMAT

The U.S. 20 corridor in Dubuque, Iowa is the primary east-west route in the City. Future traffic projections indicate that U.S. 20 alone will not provide sufficient capacity for east-west travel in the City. Capacity along alternate east-west corridors will need to be improved to provide connectivity between the western growth areas and the downtown. The purpose of this study was to analyze east-west traffic flow in the City and identify corridor improvements or modifications needed to support growing traffic demands. Additionally, consideration was given to transit needs, pedestrian needs and sustainability.

In addition to reviewing the east-west corridor needs for the City of Dubuque, Asbury Road west of the Northwest Arterial, including Asbury Road within the City of Asbury, was reviewed to determine recommended improvements for the corridor.

The remainder of this chapter provides a description of the Phase 1 study corridors.

Chapter 2 provides a detailed discussion of the corridor screening process and analysis. Additionally, the Phase 2 study corridors are identified and a discussion of four travel demand management strategies is provided as noted below:

- Aggressive Land Use/Urban Design
- Trip Reduction Ordinance
- Transportation Management Association (TMA)
- Updated Transit System

Chapter 3 includes a review of the existing conditions of the Phase 2 corridors. Data Collection, geometric conditions and traffic operations are discussed in Chapter 3.

The year 2031 vehicular volume development process and traffic operational analysis is discussed in Chapter 4.

Chapter 5 provides a review of several components of the concept development process including a discussion of Complete Streets and pedestrian accommodations, the preferred concept, probable construction costs and project sequencing.

University Avenue Signalized Pedestrian Crossing West of Loras Boulevard

Chapter 6 includes a summary of the public involvement activities that have occurred for the study including:

- 2 Dubuque Public Information Meetings
- 3 Dubuque City Council Work Sessions
- Dubuque Agency Coordination and Stakeholder Meetings
- 1 Asbury Public Information Meeting

Chapter 7 provides summary of the findings and recommendations for the study.

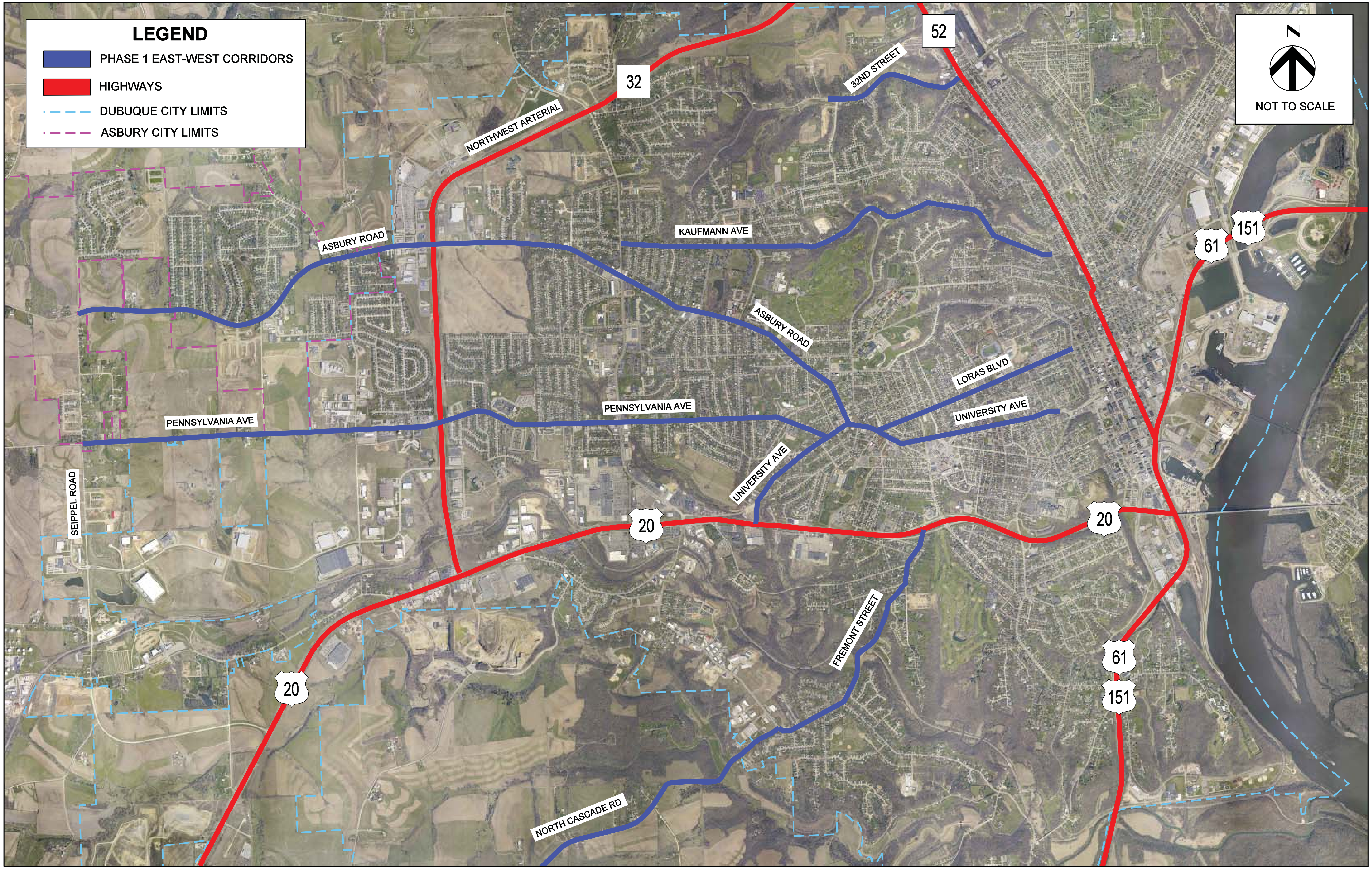
PHASE 1 STUDY CORRIDORS

Several primary east-west corridors were included in a screening analysis to determine which corridors were the most influential to east-west travel within the City of Dubuque. A future year planning-level analysis for a various improvement alternatives was performed for these Phase 1 study corridors. The corridors included in the analysis were:

- Asbury Road
- Pennsylvania Avenue
- University Avenue
- Loras Boulevard
- Fremont Avenue
- Kaufmann Avenue
- 32nd Street
- North Cascade Road

These Phase 1 study corridors are shown in ***Figure 1-1***.

Figure 1-1. Dubuque East-West Connectivity Study Corridors



CHAPTER 2. CORRIDOR SCREENING

A corridor screening analysis was conducted to test transportation improvement alternatives and determine their impact on travel patterns in the Dubuque metropolitan area. A key evaluation criterion of the corridor screening was the traffic volume diversion potential from U.S. 20 and other heavily travelled east-west roadways. The alternatives were tested using the volume forecasts for year 2031 from the East Center Intergovernmental Association (ECIA) travel demand model. Evaluation of various capacity improvement scenarios helped identify which improvements would be studied in further detail.

Twenty-two corridor improvement scenarios were evaluated. These scenarios were approved by the City of Dubuque and presented to the City Council. Based on input from City Council, study improvements that would require major right of way acquisition along any of the study corridors were removed from further consideration except along the University Avenue Overlap section (Pennsylvania Avenue through Loras Boulevard). Additionally, the City Council suggested Complete Streets amenities, specifically bicycle accommodations, be considered along the study corridors.

The 22 corridor screening scenarios are summarized in this chapter. Figures illustrating the corridor screening scenarios are shown in the appendix, and are based on the roadway network used in the travel demand model. The volumes shown are raw travel demand model assignments, and should be used for comparison purposes only. The figures show daily traffic volumes as compared to the capacity of the roadway. The relationship between the daily volume and the capacity is illustrated by color, with green depicting roadways where the daily traffic volume is 'under' the daily capacity, or, a volume-to-capacity (v/c) ratio below 0.9. Yellow segments of roadway represent those with a daily traffic volume 'at' the daily capacity, or a v/c between 0.9 and 1.1. The roadway segments shown in red are projected as 'over' capacity, or a v/c above 1.1. The thickness of the roadway segment corresponds to the number of lanes for the roadway segment in the given scenario.

For comparison purposes, the existing conditions (year 2005) base scenario is shown with daily v/c ratios. It should be noted that the v/c is representative of the capacity levels on a daily basis (24-hour aggregate). Therefore, peaking conditions, such as heavy travel in one direction during high commute times, are not characterized.

The horizon year for all future traffic forecasts is year 2031. The future base scenario is representative of only future improvements included in the Transportation 2031 Long-Range Transportation Plan (LRTP), published by the Dubuque Metropolitan Area Transportation Study (DMATS). For example, the Grandview Avenue extension and the Southwest Arterial are included as new roadway facilities in the future base scenario. Several segments of the east-west corridors, including U.S. 20, are projected to be over capacity in the future year 2031 but are not over capacity in the existing conditions year 2005.

The 22 corridor screening scenarios for year 2031 include the 2031 LRTP improvements as well as specific improvements that are listed in each scenario. It should be noted that similar capacities were used for 2-lane undivided with left-turn lanes and 3-lane corridors based on capacities provided by ECIA, thus more capacity may be realized for a 3-lane cross section given the high number of driveways along the study corridors.

The following listing contains a brief description of each screening scenario.

SCENARIO 1

Improvements:

- 5-lane along Asbury Road from Springreen Drive, along the University Avenue Overlap section and along University Avenue to Locust Street

Despite capacity improvements on Asbury Road, major portions of the Asbury Road corridor were still projected to be at or over capacity. The Asbury Road daily traffic volume in Scenario 1 approximately doubled compared to the future base scenario, as an additional 13,000 to 17,000 daily trips were projected to be attracted to this corridor. The University Avenue corridor would attract nearly 9,000 more daily trips than the future base scenario, but the additional lanes in this scenario would allow University Avenue to remain under capacity.

SCENARIO 2

Improvements:

- 5-lane along Asbury Road from Springreen Drive, along the University Avenue Overlap section and along Loras Boulevard to Locust Street

Similar to Scenario 1, despite improving capacity on Asbury Road to a 5-lane section major portions of this corridor were still projected to be at or over capacity as an additional 13,000 to 17,000 daily trips were attracted to these segments. The Loras Boulevard corridor would attract nearly 12,000 more daily trips than the future base scenario, but the additional lanes in this scenario would allow Loras Boulevard to shift from segments over capacity in the future base, to segments either under or at capacity in Scenario 2.

SCENARIO 3

Improvements:

- 5-lane along Asbury Road from Springreen Drive, along the University Avenue Overlap section
- 3-lane along Loras Boulevard from University Avenue to Locust Street
- 3-lane along University Avenue from Loras Boulevard to Locust Street

Despite capacity improvements on Asbury Road, major portions of the Asbury Road corridor would be at or over capacity as an additional 13,000 to 17,000 daily trips were projected to be attracted to this corridor. With Loras Boulevard and University Avenue each improved to 3-lane cross sections, they each would attract on the order of 2,000 more daily trips. The v/c classifications on Loras Boulevard and University Avenue would not improve over those shown in the future base scenario, and sections of Loras Boulevard would still be over capacity.

SCENARIO 4

Improvements:

- 5-lane along Asbury Road from Springreen Drive to the University Avenue Overlap section

The results of Scenario 4 were similar to Scenario 3, but there was not as much additional traffic projected to be attracted to the University Avenue Overlap section without capacity improvements on Loras Boulevard or University Avenue. Despite improving capacity on Asbury Road, major portions of the Asbury Road corridor were still projected to be at or over capacity as an additional 13,000 to 16,000 daily trips were attracted to this corridor.

SCENARIO 5

Improvements:

- 3-lane along Asbury Road from Springreen Drive to the University Avenue Overlap section
- 5-lane along the University Avenue Overlap section (Asbury Road to Loras Boulevard)

Improving Asbury Road to a 3-lane cross section would attract approximately 20 percent more traffic volume to the corridor (projected to be less than an additional 3,000 daily trips). This scenario would not improve daily operations for the majority of the Asbury Road corridor. Without capacity improvements east of the University Avenue Overlap section, the increase in traffic volume would be less than 3,000 trips resulting in improved v/c on the University Avenue Overlap section compared to the future base scenario.

SCENARIO 6

Improvements:

- 5-lane along Pennsylvania Avenue from Seippel Road, along the University Avenue Overlap section to Loras Boulevard
- 3-lane along Loras Boulevard from University Avenue to Locust Street
- 3-lane along University Avenue from Loras Boulevard to Locust Street

The added capacity on Pennsylvania Avenue in Scenario 6 would attract up to an additional 12,000 daily trips to the corridor. The v/c ratios on Pennsylvania Avenue would improve compared to the future base scenario. However, Pennsylvania Avenue would not divert enough traffic volume from major portions of U.S. 20 and Asbury Road, since these streets would remain over capacity. Loras Boulevard and University Avenue would each attract in the range of 1,000 to 3,000 daily trips over the traffic volume forecast for the future base scenario. No improvement to the v/c ratios on Loras Boulevard and University Avenue were realized with Scenario 6 compared to the future base scenario.

SCENARIO 7

Improvements:

- 5-lane along Pennsylvania Avenue from Seippel Road to just east of Northwest Arterial (Hempstead High School)
- 5-lane University Avenue Overlap section

In Scenario 7, the capacity improvement to Pennsylvania Avenue would not extend east past Hempstead High School, and therefore the projected changes to the traffic volume forecasts would be minimal when compared to the future base scenario. Modifying the University Avenue Overlap section to 5 lanes would attract an additional 2,000 daily trips to this segment, and would improve the v/c ratio such that the volume forecast would be relatively equal to the daily capacity.

SCENARIO 8

Improvements:

- 5-lane Asbury Road from Springreen Drive to the University Avenue Overlap section
- 7-lane University Avenue Overlap section (Asbury Road to Loras Boulevard)
- 5-lane Loras Boulevard from University Avenue to Locust Street

Scenario 8 is most similar to Scenario 2, except that Scenario 8 would improve the University Avenue Overlap section capacity to 7 lanes instead of 5. In Scenario 8, Asbury Road was projected to attract as much as 17,000 additional daily trips above the future base scenario. With a 7-lane cross section and an average daily traffic volume of nearly 45,000, the University Avenue Overlap section v/c ratio was projected to be below capacity. However, a major portion of Asbury Road would remain over capacity. Increasing the capacity on Loras Boulevard to a 5-lane section would reduce the University Avenue forecast by 2,300 daily trips compared to the future base scenario, and would add 10,000 daily trips to Loras Boulevard. With these improvements, the Loras Boulevard and University Avenue v/c ratios would be under capacity.

SCENARIO 9

Improvements:

- 3-lane Asbury Road from Springreen Drive to the University Avenue Overlap section
- 5-lane University Avenue Overlap section
- 3-lane Loras Boulevard from University Avenue to Locust Street
- 3-lane University Avenue from Loras Boulevard to Locust Street

Improving Asbury Road to a 3-lane cross section would increase traffic volume forecasts up to 3,000 daily trips compared to the future base scenario. Asbury Road was projected to be over capacity with the 3-lane improvement. The University Avenue Overlap section was also projected to be over capacity. As in previously discussed scenarios, 3-lane improvements to Loras Boulevard and University Avenue would attract additional traffic to these corridors, yet the v/c ratios in these areas would not change compared to the future base scenario.

SCENARIO 10

Improvements:

- 5-lane Asbury Road from Spring Green drive to the University Avenue Overlap section
- 7-lane University Avenue Overlap section
- 5-lane Loras Boulevard from University Avenue to Locust Street
- 3-lane University Avenue from Loras Boulevard to Locust Street

Scenario 10 is similar to Scenario 8, but Scenario 10 improvements include a 3-lane section along University Avenue. The results of this analysis are also similar to Scenario 8, with projected increases in daily trips on the improved corridors. Although many segments of the improved corridors would result in improved v/c ratios compared to the future base scenario, a significant portion of Asbury Road would remain over capacity.

SCENARIO 11

Improvements:

- 3-lane Asbury Road from Springreen Drive to Rosedale Avenue
- 3-lane Rosedale Avenue (Clarke Drive in model) to Grandview Avenue
- 3-lane Grandview Avenue from Rosedale Avenue to Loras Boulevard
- 3-lane Loras Boulevard from Grandview Avenue to Locust Street
- 3-lane University Avenue from Loras Boulevard to Locust Street

The improvements in Scenario 11 were intended to provide an alternative route from Asbury Road to the west, via Rosedale Avenue and Grandview Avenue, to Loras Boulevard and the downtown area. The difference in traffic volume forecasts between Scenario 11 and the future base scenario would be minor and the overall v/c ratios would not change significantly compared to the future base scenario.

SCENARIO 12

Improvements:

- 3-lane Asbury Road from Springreen Drive to Clarke Drive
- 3-lane Clarke Drive/ Locust Street to Loras Boulevard
- 3-lane University Avenue from Loras Boulevard to Locust Street

The improvements in Scenario 12 were intended to provide an alternative route from Asbury Road to the west, via Clarke Drive and Locust Street, to Loras Boulevard and the downtown area. The traffic volume forecast on Locust Street would increase by nearly 5,000 daily trips over the future base scenario due to the additional capacity on this route. However, the overall v/c ratios would not change significantly compared to the future base scenario.

SCENARIO 13

Improvements:

- 3-lane Asbury Road from Springreen Drive to Bonson Road
- 3-lane Kaufmann Avenue from Bonson Road to Central Avenue (U.S. 52)

In Scenario 13, the Kaufmann Avenue improvements would add approximately 3,000 to 4,000 daily trips to this corridor and would result in a v/c ratio under capacity. The v/c ratios for other east-west corridors would not significantly change compared to the future base scenario.

SCENARIO 14

Improvements:

- 3-lane W. 32nd Street from Grandview Avenue to Central Avenue (U.S. 52).
- 3-lane Grandview Avenue extension from W. 32nd Street to Northwest Arterial (2-lane in Base)

In Scenario 14, approximately 2,000 more daily trips would be added to W. 32nd Street compared to the future base scenario. With these cross section improvements, the Grandview Avenue extension would still be over capacity. The traffic volume diverted from other east-west corridors would be minor, and therefore the v/c ratios for these corridors would not significantly change compared to the future base scenario.

SCENARIO 15

Improvements:

- 3-lane Fremont Avenue/ N. Cascade Road from U.S. 20 to SW Arterial

The improvement to Fremont Avenue and N. Cascade Road would not significantly change the volumes or v/c ratios on the east-west corridors. The improved route would draw an additional daily traffic volume ranging from 500 to 2,600.

SCENARIO 16

Improvements:

- 5-lane along Asbury Road from Springreen Drive, along the University Avenue overlap section and along University Avenue to Locust Street
- 6-lane Northwest Arterial from U.S. 20 to Plaza Drive

Scenario 16 is similar to Scenario 1, with the addition of upgrading Northwest Arterial to a 6-lane facility for a majority of the corridor. With the additional Northwest Arterial capacity, an additional daily traffic volume ranging from 1,000 to 3,00 was projected between U.S. 20 and Plaza Drive with v/c ratios that would be under capacity. Although daily traffic volume forecasts would be reduced along Pennsylvania Avenue compared to the future base scenario, additional traffic volume would be attracted to the Asbury Road corridor (higher than the additional volume realized in Scenario 1).

SCENARIO 17

Improvements:

- 3-lane Asbury Road from Springreen Drive to the University Avenue Overlap section
- 5-lane University Avenue Overlap section (Asbury Road to Loras Boulevard)
- 3-lane University Avenue from Loras Boulevard to Locust Street
- 6-lane Northwest Arterial from U.S. 20 to Plaza Drive

Scenario 17 is similar to Scenario 5, with the addition of improving a portion of University Avenue, as well as Northwest Arterial. Compared to Scenario 5, Scenario 17 would reduce the traffic volume on U.S. 20, and add more traffic volume to Asbury Road and University Avenue. In this scenario, the v/c ratio on Northwest Arterial would improve such that the corridor would be under capacity, yet other east-west corridors would remain similar to those shown in the future base scenario.

SCENARIO 18

Improvements:

- 8-lane U.S. 20 from Old Highway Road to Devon Drive

Widening U.S. 20 would attract additional daily trips, ranging from 2,000 to 7,000, to this corridor. The improvements would allow some segments of U.S. 20 to achieve v/c ratios that would be under capacity. However, there would not be a significant reduction in volumes on east-west roadways such as Asbury Road and University Avenue, which would be over capacity.

SCENARIO 19

Improvements:

- Southwest Arterial removed

Scenario 19 was assessed for comparison purposes to the future base scenario, to determine the impacts of the Southwest Arterial on the roadway network. Without the Southwest Arterial coded into the year 2031 travel demand model network, most segments of the east-west corridors would have an increase in daily traffic volumes. The U.S. 20 corridor would attract additional daily traffic volume ranging from 2,000 to 3,000 east of Northwest Arterial. Traffic volume forecasts would be reduced on U.S. 20 west of Northwest Arterial, as more trips were projected to travel on roadways south of U.S. 20, such as N. Cascade Road, English Mill Road, Kelly Lane and Cedar Cross Road. It was found that without the Southwest Arterial in the future, the travel demand for the local streets south of U.S. 20 would increase.

SCENARIO 20

Scenario 20 incorporated land use modifications, by intensifying the downtown land use. This scenario contains no transportation roadway network improvements beyond those assumed in the future base scenario. The land use data was modified such that population and employment growth that was previously allocated to western Dubuque were reallocated to the downtown area.

Land Use Data Adjustments:

- ECIA and City Planning staff adjusted the land use data with migration of population and employment to the downtown area as follows:
    - Traffic Analysis Zones (TAZs) that fall outside the 6-mile downtown radius had 16 percent of their population and 21 percent of Non-Retail Employment moving to downtown.
    - TAZs that fall within the 6- to 4-mile downtown radius had 6 percent of their population and 12 percent of Non-Retail Employment moving to downtown.
    - TAZs that fall within the 4- to 2- mile downtown radius had 2 percent of their population and 6 percent of Non-Retail Employment moving to downtown.

Over all it was assumed that 5,977 people and 3,259 jobs would move into the downtown area.

Land use modifications presented in this scenario would result in traffic volume reductions on many of the study corridors. The land use modifications in this scenario include population and employment densifications in the downtown area. Given this assumption, the downtown area would be a more attractive destination. Traffic volume would increase, up to as much as 6,000 daily trips, on U.S. 20, which can be attributed to the migration of population and employment centers. Traffic volume forecasts were projected to slightly decrease on Asbury Road compared to the future base scenario, but the v/c ratios on this corridor would still be over capacity along some major segments. A reduction in daily traffic volume by as much as 9,000 daily trips was projected along the University Avenue Overlap section. Projected volumes on Loras Boulevard and University Avenue east of the Overlap section would decrease by 4,000 to 6,000 daily trips.

SCENARIO 21

Improvements:

- University Avenue converted to a one-way (2 lanes eastbound) between the University Avenue Overlap section and Locust Street
- Loras Boulevard converted to a one-way (2 lanes westbound) between the University Avenue Overlap section and Locust Street
- 5-lane University Avenue Overlap section

Scenario 21 includes the conversion of Loras Boulevard and University Avenue into one-way pairs. Creating one-way pairs on Loras Boulevard and University Avenue would result in a minor increase in traffic volume along both of the corridors, of approximately 1,000 to 2,000 daily trips. Minimal traffic volume changes would occur on Pennsylvania Avenue, Asbury Road and U.S. 20. This scenario would be politically challenging given the potential concerns of business owners (lack of access) and residents (issues with cut-through traffic within the neighborhood).

SCENARIO 22

Improvements:

- University Avenue 2 lanes eastbound and 1 lane westbound between the University Avenue Overlap section and Locust Street
- Loras Boulevard 1 lane eastbound and 2 lanes westbound between the University Avenue Overlap section and Locust Street
- 5-lane University Avenue Overlap section

Scenario 22 reflects imbalanced capacity along Loras Boulevard and University Avenue with two lanes in one direction and one lane in the other direction. Increasing capacity on Loras Boulevard to two lanes westbound and one lane eastbound would add about 6,000 daily trips on this corridor. Increasing capacity on University Avenue to two lanes eastbound and one lane westbound would increase the daily traffic volume by approximately 2,000 to 3,000. More traffic would be attracted to these two corridors compared to Scenario 21; however this scenario would not result in any significant volume reductions on Asbury Road and Pennsylvania Avenue. U.S. 20 volumes would decrease minimally with this scenario. This scenario would be challenging to implement given the need to eliminate of on-street parking.

SELECTED CORRIDORS

A series of figures summarizing the volume differences and capacities of the Scenario 1 through 22 corridor improvements are provided in the appendix.

Table 2-1 provides a general comparison of the scenarios. Traffic operations for key east-west corridors including U.S. 20, Asbury Road, Pennsylvania Avenue, Loras Boulevard and University Avenue, are classified for each scenario. Public acceptance and impacts, probable costs and additional lane-miles of capacity are also listed for each of the corridor screening scenarios. This table shows that none of the corridor screening scenarios solve all of the issues.

Based on the findings of the corridor screening process and through discussions with City Council and technical

staff, Phase 2 corridors were identified for further detailed study. These corridors include Asbury Road, Pennsylvania Avenue, University Avenue and Loras Boulevard.

As noted previously, none of the improvement scenarios fully met future capacity needs for the east-west corridors. Travel Demand Management strategies were reviewed and utilized to develop future volumes (as discussed in Chapter 4) for the study corridors. ECIA and City Planning staff reviewed and revised the future land use data to represent more dense development in the downtown area. This change was consistent with new development including IBM and the proposed Millwork district in the downtown area. Scenario 20 in the corridor screening exercise proved the beneficial impacts of land use modifications on the transportation system. These land use changes were necessary to provide acceptable future year operations.

TRAVEL DEMAND MANAGEMENT INITIATIVES

Given the direction of City Council to minimize right of way impacts, Travel Demand Management (TDM) strategies were investigated to accommodate future travel demand. TDM strategies are designed to reduce the demand for transportation and thus reduce the number of vehicles using the system. TDM strategies accomplish their goals by effectively changing people's travel behavior and focus on reducing the number of single occupant vehicle (SOV) work-trips during peak periods. TDM can be geared towards the general population (transit), those living in the same neighborhood (carpool/vanpool) and to individuals (telecommuting, flex-time).

TDM strategies that the City of Dubuque may consider would offset the need for infrastructure improvements. There are several reasons that the Dubuque area may benefit from TDM initiatives:

- **Solving Transportation Problems.** Improved transportation options can help reduce traffic congestion, facility costs, road risk, environmental impacts and consumer costs.
- **Efficiency.** Consumer choice is necessary for economic efficiency. Improved transportation options allow consumers to choose the most efficient option for each trip.
- **Equity.** Inadequate transport options often limit the personal and economic opportunities available to people who are physically, economically or socially disadvantaged. Increasing transportation options can help achieve equity objectives.
- **Livability.** Many people value living in or visiting a community where walking and cycling are safe, pleasant and common. There are also public health benefits from increased walking and cycling. As a result, transportation options can help communities become more "livable," resulting in increased property values and commercial activity.
- **Security and Resilience.** Improved transportation options results in a more diverse and flexible transportation system that can accommodate variable and unpredictable conditions. Even people who do not currently use a particular form of transport may value the availability of other forms as insurance to accommodate future needs.

Four TDM strategies were assessed during this study. These strategies are:

- **Strategy 1: Aggressive Land Use/ Urban Design.** Land use patterns and urban design will have significant effects on how much demand is put on the transportation network. Where people live, work, shop and recreate generate the need for transportation. Components to this strategy include higher densities near transit, programs to reduce parking, streetscape improvements, rezoning to allow for mixed use environment, master planning growth areas to ensure connectivity and decreased dependence on the single occupant automobile.

- **Strategy 2: Create Trip Reduction Ordinance.** Establishing a city-wide Trip Reduction Ordinance (TRO) is a regulatory approach that would influence new development to reduce vehicular trips in the community. A TRO would be tied to the unified development code, and the City would oversee and enforce the ordinance to ensure that a trip reduction goal is achieved. The goal would be achieved through employer-based programs such as accommodating bicycle parking, setting caps on vehicular parking and design guidelines. The TRO may be presented with a menu of options and include flexibility on how trip reduction would be achieved.

- **Strategy 3: Create Transportation Management Association (TMA).** A Transportation Management Association (TMA) is a public/private partnership formed so that employers, developers, building owners, and government entities can work collectively to establish policies, programs and services to address local transportation problems. The TMA may be made up of a non-profit entity / public-private partnership (employers, developers, government). TMA's are incentive based, and may include programs such as ride home programs, incentives for carpools, transit subsidy program, bicycle program, flex-time and staggered work shifts.

- **Strategy 4: Update Transit System.** An improved transit system could potentially reduce vehicular trips in the community. A transit study is currently underway, which will evaluate the existing transit service and assess new concepts for the Keyline transit system, including which corridors Keyline can best serve east-west travel in the metro area.

These four strategies were discussed with City staff and the City Council. Through these discussions, many potential benefits of a TMA were identified.

A TMA could be developed that would strongly encourage membership from employers within Dubuque. Funding could be secured for important programs and services that support a successful initiative and increase the use of mobility options such as taking transit and walking to work. Programs that should be considered for a future TMA include:

- Guaranteed Ride Home Program
- Personalized Carpool Matching
- Vanpool Creation
- Transit Pass Subsidy Program
- Employee Commute Programs
- Car Share Program
- City-wide Bicycle Sharing Program
- Flextime
- Compressed Workweek
- Staggered Shifts

Many rideshare programs and groups already exist within and near Dubuque. Recommended elements of a Dubuque TMA would also include identifying these resources and coordinating efforts with organizations such as bicycle groups and carpooling databases.

TABLE 2-1. CORRIDOR SCREENING SCENARIO COMPARISON TABLE

Scenario	Traffic Operations					Public Acceptance/ Impacts	Cost	Additional Capacity (Lane-miles)
	U.S. 20	Asbury Rd	Pennsylvania Ave	Loras Blvd	University Ave			
Base Existing	○	●	◒	●	◒	N/A	N/A	N/A
Base 2031	●	●	●	●	●	N/A	N/A	N/A
Scenario 1	●	●	●	●	◒	● Requires purchase of numerous homes/ businesses and right-of-way along Asbury Rd, the Asbury/ University overlap section and University Ave	●	11.4
Scenario 2	●	●	●	◒	◒	● Requires purchase of numerous homes/ businesses and right-of-way along Asbury Rd, the Asbury/ University overlap section and Loras Blvd	●	11.4
Scenario 3	●	●	●	●	◒	● Requires purchase of numerous homes and right-of-way along Asbury Rd; some business/ right-of-way purchases required in the Asbury/ University overlap section; eliminates most or all on-street parking along Loras Blvd and University Ave	●	10.0
Scenario 4	●	●	●	●	◒	● Requires purchase of numerous homes and right-of-way along Asbury Rd; some business/ right-of-way purchases required in the Asbury/ University overlap section	●	7.7
Scenario 5	●	●	●	●	◒	○ Minimal impacts to Asbury Rd; some business/ right-of-way purchases required in the Asbury/ University overlap section	○	2.2
Scenario 6	●	●	◒	●	◒	● Requires purchase of numerous homes and right-of-way along Pennsylvania Ave; some business/ right-of-way purchases required in the Asbury/ University overlap section; eliminates most or all on-street parking along Loras Blvd and University Ave	●	12.1
Scenario 7	●	●	●	●	◒	● Minimal impacts to Pennsylvania Ave; some business/ right-of-way purchases required in the Asbury/ University overlap section	◒	6.5
Scenario 8	●	●	●	◒	○	● Requires purchase of numerous homes/ businesses and right-of-way along Asbury Rd, the Asbury/ University overlap section and Loras Blvd	●	11.7
Scenario 9	●	●	●	●	◒	○ Minimal impacts to Asbury Rd; some business/ right-of-way purchases required in the Asbury/ University overlap section; eliminates most or all on-street parking along Loras Blvd and University Ave	○	4.6
Scenario 10	●	●	●	◒	○	● Requires purchase of numerous homes/ businesses and right-of-way along Asbury Rd, the Asbury/ University overlap section and Loras Blvd; eliminates most or all on-street parking along University Ave	●	13.2
Scenario 11	●	●	●	●	●	○ Minimal impacts to Asbury Rd; requires purchase of several homes/ businesses and right-of-way along Rosedale Ave and Grandview Ave; eliminates most or all on-street parking along Loras Blvd	○	3.4
Scenario 12	●	●	●	●	◒	○ Minimal impacts to Asbury Rd; requires purchase of some homes and right-of-way along Clarke Dr and Locust St; eliminates most or all on-street parking along University Ave	○	4.4
Scenario 13	●	●	●	●	◒	○ Minor home and right-of-way impacts along Asbury Rd and Kaufmann Ave, eliminates on-street parking along Asbury Rd and Kaufmann Ave	○	3.5
Scenario 14	●	●	●	●	◒	○ Minimal impacts to W 32nd St; no impacts to the Grandview Ave extension since it has not been built yet	○	1.4
Scenario 15	●	●	●	●	◒	○ Minimal impacts to Freemont Ave; eliminates most or all on-street parking along Freemont Ave; would require new bridges over the Middle and South Forks of Catfish Creek	◒	3.0
Scenario 16	●	●	●	●	◒	● Requires purchase of numerous homes/ businesses and right-of-way along Asbury Rd and University Ave; minimal impacts along NW Arterial	●	15.9
Scenario 17	●	●	●	●	◒	○ Minimal impacts to Asbury Rd; some business/ right-of-way purchases required in the Asbury/ University overlap section; eliminates most or all on-street parking along University Ave; minimal impacts along NW Arterial	●	7.8
Scenario 18	◒	●	●	●	◒	◒ Moderate right-of-way purchases and impacts to businesses along U.S. 20	●	9.6
Scenario 19	●	●	●	●	◒	N/A	○	0.0
Scenario 20	●	●	●	○	○	○ No right-of-way purchases or capacity improvements to the roadway network. Growth assumed in the downtown area	○	0.0
Scenario 21	●	●	●	●	○	○ Minimal impacts to University & Loras; some business/ right-of-way purchases required in the Asbury/ University overlap section	○	0.2
Scenario 22	●	●	●	●	○	◒ Requires removal of on-street parking along University Ave and Loras Blvd. Some business/ right-of-way purchases required in the Asbury/ University overlap section	○	0.2

Symbol Key:

●	Operations - Over Capacity; Public Acceptance/Impacts - Extremely Challenging; Cost - High
◒	Operations - At Capacity; Public Acceptance/Impacts - Challenging; Cost - Moderate
○	Operations - Under Capacity; Public Acceptance/Impacts - Fair; Cost - Low

CHAPTER 3: REVIEW OF EXISTING CONDITIONS

DATA COLLECTION

Data collection included gathering ground-level site photos, site videos along study corridors, travel time runs, gathering existing intersection turning movement counts and obtaining existing signal timings from the City. Travel time runs were conducted by the consultant from the middle of September through the first week of October 2008. Information gathered included east/west travel time between major intersections, stop duration and observed queues on all approaches. The travel time runs were conducted to help identify bottleneck areas. A summary of the data collection is provided in the ECIA model review and screening analysis memorandum, which is provided in the appendix.

EXISTING CONDITIONS

Existing conditions of Phase 2 corridors were reviewed to identify roadway cross sections including number of driving lanes, on-street parking and adjacent sidewalks. This information was used to determine locations that may be available for capacity improvements. A summary of the existing conditions review is shown in ***Figure 3-1***.

TRAFFIC OPERATIONS

Traffic capacity analysis was performed for the existing conditions using simulation for the Phase 2 corridors. The following details the methodologies utilized for the analysis and the analysis results.

ANALYSIS DESCRIPTION

Observations of traffic volumes provide an understanding of the general nature of traffic, but are insufficient to indicate either the ability of the street network to carry additional traffic or the quality of service provided by the street system. For this reason the concept of level of service (LOS) was developed to correlate numerical traffic operational data to subjective descriptions of traffic performance at intersections. Each lane of traffic has delay associated with it and therefore a correlating LOS. The weighted average delay for each of these lanes of traffic for a signalized intersection is the intersection LOS. Stop-controlled intersections are analyzed by identifying the amount of delay for each movement that conflict with other intersection movements (i.e. all movements except the free flow through lanes). The LOS for unsignalized intersections is typically determined from either the delay of the worst case stop-controlled approach or the delay of a specific movement. LOS categories range from LOS "A" (best) to "F" (worst) as shown in ***Table 3-1***.

The intersection capacity analyses were completed with CORSIM software. CORSIM is a microscopic simulation tool that models individual vehicle behavior to emulate realistic operations and gather realistic delays and queues.

LOS 'C' has generally been established as the standard for planning of transportation facilities for peak hour traffic conditions in urban areas. For this study, LOS 'C' for the overall intersection was used as the minimum standard for acceptable operations; however it should be noted that in highly developed urban areas LOS 'D' is often considered acceptable. A review of the analyses for existing volumes and geometrics is provided in the next section. It should be noted that existing conditions analysis was performed for the year 2008 whereas the corridor screening analysis described in Chapter 2 was performed utilizing the existing base model (year 2005).

Table 3-1. Level of Service Description

Level of Service	Signalized Intersection Control Delay (seconds)	Unsignalized Intersection Control Delay (seconds)	Traffic Flow Characteristics
A	< 10.0	< 10.0	Free flow, insignificant delays.
B	10.01-20.0	10.01-15.0	Stable operation, minimal delays.
C	20.01-35.0	15.01-25.0	Stable operation, acceptable delays.
D	35.01-55.0	25.01-35.0	Restricted flow, regular delays.
E	55.01-80.0	35.01-50.0	Maximum capacity, extended delays. Volumes at or near capacity. Long queues form upstream from intersection.
F	> 80.0	> 50.0	Forced flow, excessive delays. Represents jammed conditions. Queues may block upstream intersections.

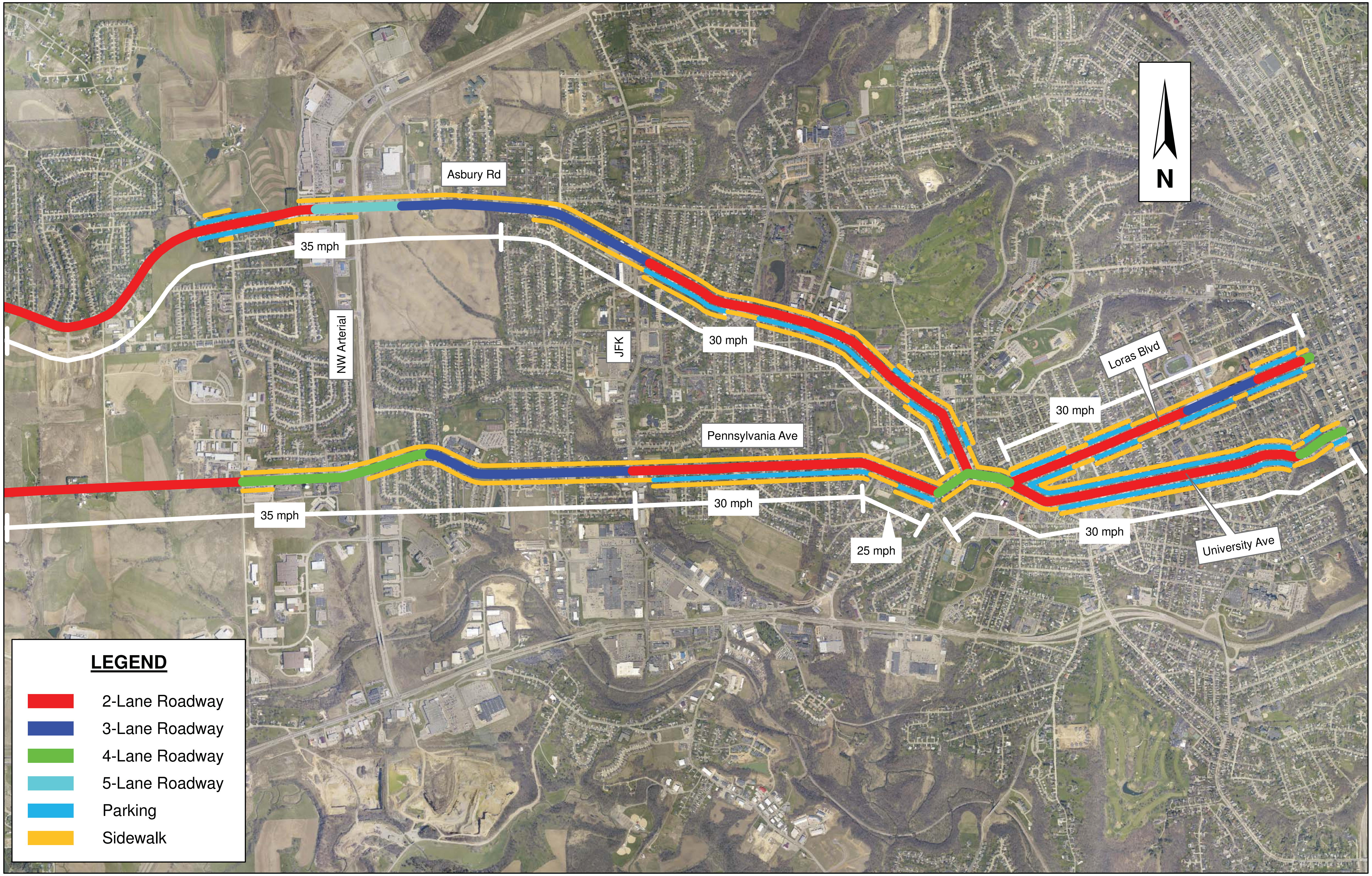
Source: Highway Capacity Manual, Transportation Research Board, 2000

STUDY INTERSECTIONS

Not all intersections along the Phase 2 corridors were analyzed in detail. The intersections included in the analysis were:

- Asbury Road/Lore Mound Road
- Asbury Road/Seippel Road
- Asbury Road/Springreen Road
- Asbury Road/Radford Road
- Asbury Road/JFK Road
- Asbury Road/Carter Road
- Asbury Road/Chaney Road
- Asbury Road/Poplar Street
- Asbury Road/Hillcrest Road
- Asbury Road/Clarke Drive
- Pennsylvania Avenue/Hempstead High School Entrance
- Pennsylvania Avenue/JFK Road
- Pennsylvania Avenue/University Avenue
- Loras Boulevard/University Avenue
- Loras Boulevard/Grandview Avenue
- Asbury Road/University Avenue
- Delhi Street/University Avenue
- Grandview Avenue/University Avenue
- Nevada Street/University Avenue
- Booth Street/University Avenue

Figure 3-1. Existing Conditions for Phase 2 Corridors



EXISTING CONDITIONS ANALYSIS RESULTS

Delay and the maximum queue lengths were reviewed for the study intersections. All intersections currently operate at LOS 'C' or better except at the following locations:

PM Peak

- Asbury Road/JFK Road (LOS 'D')
- University Avenue/Asbury Road (LOS 'D')

The majority of queue lengths at the study area intersections were minor (less than 10 vehicles in length). Queues in excess of 15 vehicles were recorded at the following locations:

AM Peak

- Eastbound and westbound approaches of Asbury Road/JFK Road
- Eastbound approach of Asbury Road/Carter Road
- Westbound approach of Pennsylvania Avenue/Hempstead High School Drive
- Eastbound and westbound approaches of Pennsylvania Avenue/JFK Road
- Eastbound approach of Pennsylvania of University Avenue
- Southbound approach of University Avenue/Asbury Road

PM Peak

- Westbound approach of Asbury Road/Radford Road
- Eastbound, westbound and northbound approaches of Asbury Road/JFK Road
- Eastbound approach of Asbury Road/Carter Road
- Eastbound approach of Asbury Road/Chaney Road
- Westbound approach of Pennsylvania Avenue/Hempstead High School Drive
- Eastbound and westbound approaches of Pennsylvania Avenue/JFK Road
- Eastbound approach of Pennsylvania Avenue/University Avenue
- Southbound approach of University Avenue/Asbury Road

Detailed simulation results are shown in *TABLE 3-2*. A summary of the simulation results as well as the existing geometrics and volumes are shown for the study intersections in *FIGURE 3-2* and *FIGURE 3-3*. Simulation output including recorded queues is provided in the appendix.

TABLE 3-2. EXISTING CONDITIONS ANALYSIS RESULTS

INTERSECTION [1]	TRAFFIC CONTROL [2]	AM PEAK HOUR		PM PEAK HOUR	
		LOS	AVE. DELAY (SEC)	LOS	AVE. DELAY (SEC)
Asbury Road/Lore Mound Road	Unsignalized	n/a	-	n/a	-
SB Approach		A	3.1	A	3.0
Asbury Road/Seippel Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	4.7	A	5.1
SB Approach		A	5.0	A	5.5
Asbury Road/Springreen Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	4.6	A	4.7
SB Approach		A	5.3	A	5.4
EB Approach		A	8.2	A	7.2
WB Approach		A	6.4	B	12.3
Asbury Road/Radford Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	8.7	A	8.3
Asbury Road/JFK	Signalized	B	18.7	D	37.2
NB Approach		B	18.9	C	28.7
SB Approach		B	18.7	C	29.1
EB Approach		B	19.2	C	27.5
WB Approach		B	18.1	E	55.9
Asbury Road/Carter Road	Signalized	A	8.8	B	10.7
NB Approach		C	32.6	D	35.3
SB Approach		C	23.6	C	26.4
EB Approach		A	4.1	A	7.3
WB Approach		A	2.5	A	4.1
Asbury Road/Chaney Road	Signalized	A	5.0	A	7.0
NB Approach		B	12.2	B	12.7
SB Approach		A	9.1	A	6.2
EB Approach		A	3.7	A	7.2
WB Approach		A	4.2	A	6.6
Asbury Road/Hillcrest Road	Unsignalized	n/a	-	n/a	-
NB Approach		B	14.7	B	13.2
Asbury Road/Clarke Drive	Unsignalized	n/a	-	n/a	-
SB Approach		A	9.4	C	19.2
Asbury Road/Poplar Street	Unsignalized	n/a	-	n/a	-
NB Approach		A	6.1	A	5.4

Table 3-2. Existing Conditions Analysis Results (Continued)

Intersection [1]	Traffic Control [2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
Asbury Road/St. Ambrose Street	Signalized	A	4.8	A	5.1
SB Approach		A	6.8	A	6.6
EB Approach		A	4.5	A	5.5
WB Approach		A	4.5	A	4.5
Pennsylvania Avenue/Hempstead High School Drive	Signalized	B	11.0	A	6.3
SB Approach		C	22.2	C	22.8
EB Approach		A	6.0	A	3.6
WB Approach		B	11.2	A	6.0
Pennsylvania Avenue/JFK	Signalized	C	21.1	C	29.0
NB Approach		B	18.0	C	25.9
SB Approach		C	20.3	C	27.2
EB Approach		C	21.4	C	32.8
WB Approach		C	27.0	C	30.8
University Avenue/Pennsylvania Avenue	Signalized	A	9.6	A	9.3
SB Approach		B	17.4	B	17.6
EB Approach		A	6.0	A	8.1
WB Approach		A	4.3	A	4.9
University Avenue/Asbury Road	Unsignalized	n/a	-	n/a	-
SB Approach		C	20.0	D	34.9
EB Approach		A	9.7	B	14.4
WB Approach		A	8.8	C	17.4
University Avenue/Loras Boulevard	Unsignalized	n/a	-	n/a	-
SB Approach		A	5.9	A	7.7
University Avenue/McCormick Street	Unsignalized	n/a	-	n/a	-
NB Approach		A	6.5	A	5.5
University Avenue/Delhi Street	Unsignalized	n/a	-	n/a	-
NB Approach		A	7.9	B	13.1
University Avenue/Grandview Avenue	Unsignalized	n/a	-	n/a	-
NB Approach		B	10.5	B	12.3
SB Approach		B	10.3	A	8.3
EB Approach		A	8.4	A	8.5
WB Approach		A	8.3	A	6.9

Table 3-2. Existing Conditions Analysis Results (Continued)

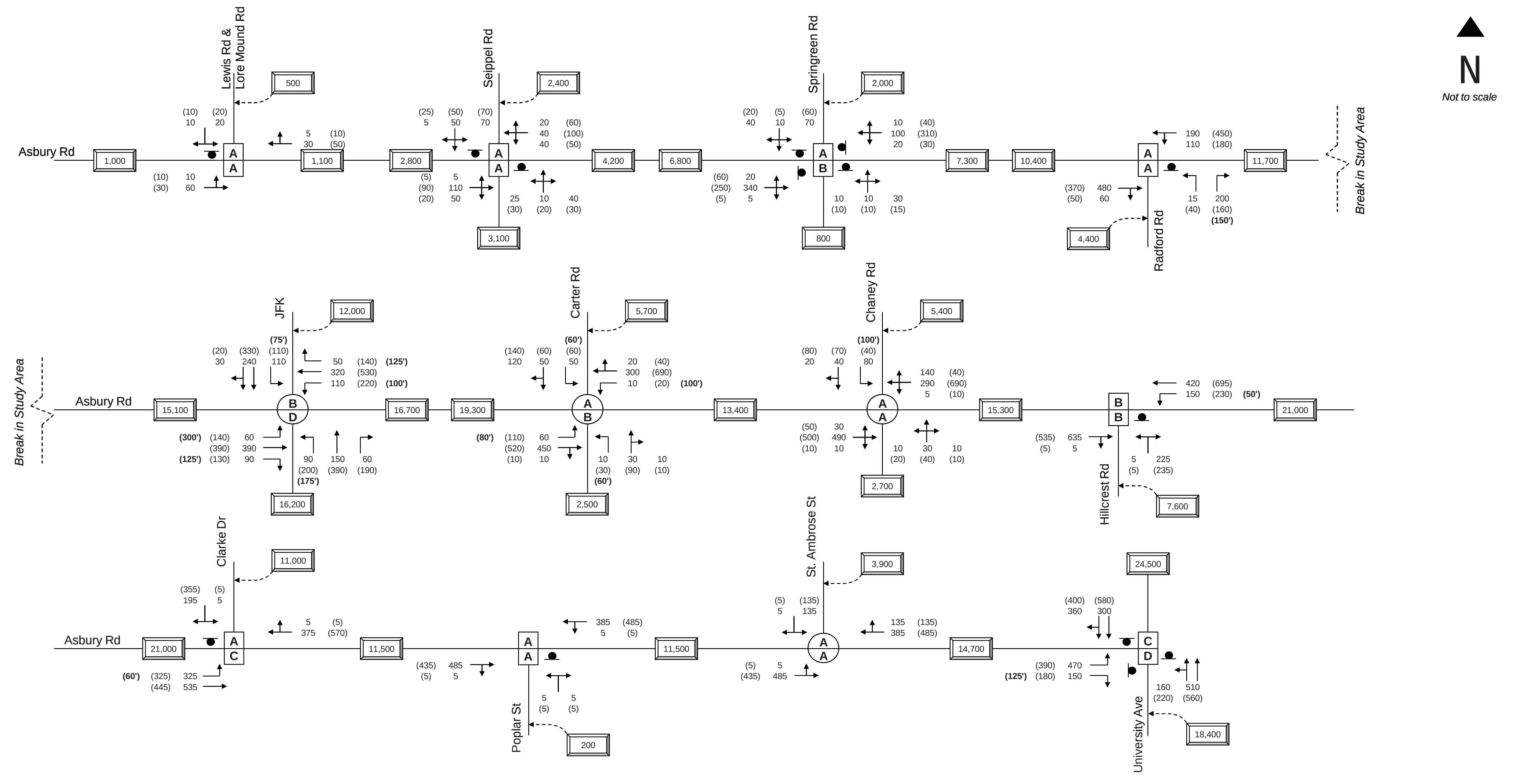
Intersection [1]	Traffic Control [2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
University Avenue/Booth Street	Unsignalized	n/a	-	n/a	-
NB Approach		A	5.9	A	6.2
SB Approach		A	5.1	A	6.5
University Avenue/Nevada Street	Signalized	A	3.0	A	3.6
NB Approach		A	3.2	A	3.0
SB Approach		A	3.3	A	2.7
EB Approach		A	2.2	A	3.8
WB Approach		A	4.1	A	3.7
Loras Boulevard/Grandview Avenue	Signalized	B	12.2	B	10.8
NB Approach		A	9.3	B	12.3
SB Approach		B	12.9	B	10.5
EB Approach		B	13.2	B	11.6
WB Approach		B	13.2	A	9.3

Notes:

1. All streets listed first in the 'Intersection' column are assumed to have EB/WB orientation at the intersection

2. Only stop-controlled approaches are shown for unsignalized intersections

FIGURE 3-2. EXISTING VOLUMES, GEOMETRICS, AND LEVELS OF SERVICE ALONG ASBURY ROAD



LEGEND

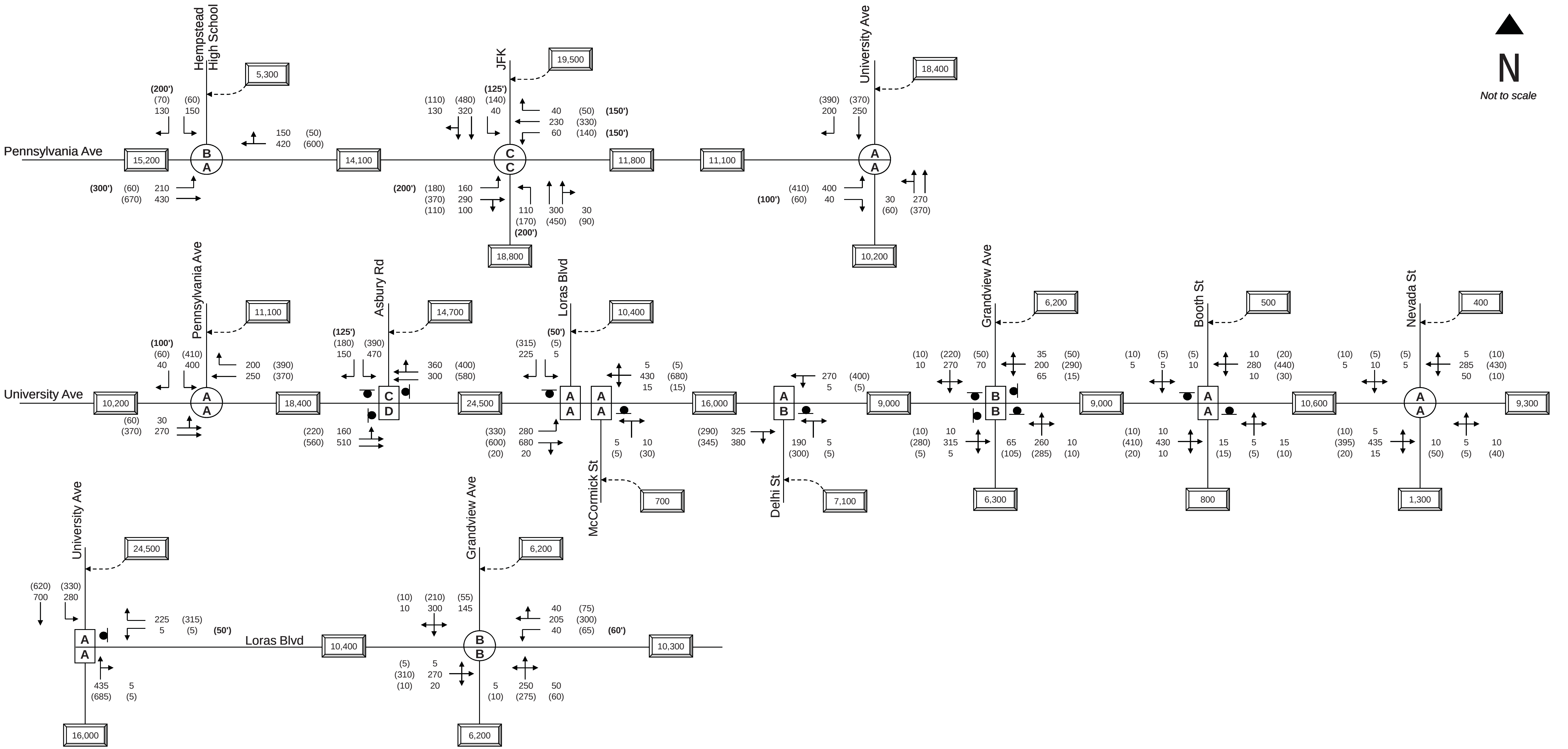
XXX 2008 AM Peak Hour Volume
(XXX) 2008 PM Peak Hour Volume
XXX 2008 Annual Daily Traffic
→ 2008 Geometrics
(XXX') 2008 Storage Length

● Stop Sign
X/X AM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
PM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
X/X AM Peak Hour Signalized Intersection Level of Service
PM Peak Hour Signalized Intersection Level of Service

Note:
1. Asbury Road is assumed to run east-west for the purpose of this figure. It is recognized that Asbury Road is more north-south at the east end of the corridor.

Sources:
1. Existing Volumes - HDR, November 2008 (based on counts received from IDOT, IIW and City of Dubuque).
2. Traffic Capacity Analysis (CORSIM Simulation Software) - HDR Engineering, September 2009.

Figure 3-3. Existing Conditions Volumes, Geometrics, and Levels of Service along Pennsylvania Avenue, University Avenue, and Loras Boulevard



LEGEND

XXX	2008 AM Peak Hour Volume
(XXX)	2008 PM Peak Hour Volume
XXX	2008 Annual Daily Traffic
→	2008 Geometrics
(XXX')	2008 Storage Length
●	Stop Sign
X / X	AM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service PM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
ⓧ	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service

Notes:
1. On the Pennsylvania Avenue corridor, University Avenue is shown as a north/south street; however, it is recognized that University Avenue is a northeast/southwest street at this location and was depicted as shown for ease of presentation on this figure.
2. On the University Avenue corridor, Pennsylvania Avenue is shown as a north/south street; however, it is recognized that Pennsylvania Avenue is an east/west street at this location and was depicted as shown for ease of presentation on this figure.
3. On the University Avenue corridor, Loras Boulevard is shown as a north/south street; however, it is recognized that Loras Boulevard is a northeast/southwest street at this location and was depicted as shown for ease of presentation on this figure.
4. On the University Avenue corridor, Delhi Street is shown as a north/south street; however, it is recognized that Delhi Street is a southeast/northwest street at this location and was depicted as shown for ease of presentation on this figure.
5. On the Loras Boulevard corridor, McCormick Street is shown as an east/west street; however, it is recognized that McCormick Street is a north/south street at this location and was depicted as shown for ease of presentation on this figure.
6. On the Loras Boulevard corridor, University Avenue is shown as an east/west street; however, it is recognized that University Avenue is a southeast/northwest street at this location and was depicted as shown for ease of presentation on this figure.

Sources:
1. Existing Volumes - HDR, November 2008 (based on counts received from IDOT, IIW and City of Dubuque).
2. Traffic Capacity Analysis (CORSIM Simulation Software) - HDR Engineering, September 2009.

CHAPTER 4: YEAR 2031 VOLUME DEVELOPMENT AND ANALYSIS

YEAR 2031 VOLUME DEVELOPMENT

From the corridor screening analysis, Phase 2 corridors were identified. Volume development and analysis was only completed for Phase 2 corridors. Detailed information about the corridor screening analysis is presented in Chapter 2. Phase 2 corridors include Asbury Road, Pennsylvania Avenue, University Avenue and Loras Boulevard.

In Phase 2, year 2031 daily and peak hour traffic volume forecasts were developed in close coordination with ECIA. Several steps were taken to forecast 2031 daily traffic volumes for the study area. The volume development methodology included utilization of the 2005 and 2031 travel demand model assignments, 2005 count data, 2008 peak hour data and engineering judgment.

2031 NO-BUILD

The 2031 No-Build scenario was based on a travel demand model network similar to the future base scenario assessed in Phase 1; however an increased population and employment control total were used reflective of IBM locating in downtown Dubuque. Additionally, socioeconomic data was reallocated to reflect the IBM development. The DMATS 2031 LRTP improvements were included in the network, however no additional roadway capacity improvements were assumed for the No-Build condition.

Average daily traffic (ADT) volumes were developed through a post-processing exercise where base year (2005) count data was available. Deviation between the calibrated 2005 model volume and a 2005 count volume was measured on an absolute basis and a percentage basis, and applied to the year 2031 assignments. These 2031 “corrected assignments” were used as the 2031 No-Build forecasts at most locations. For locations where 2005 counts were not available, year 2031 ADT’s were estimated using engineering judgment and a combination of calculations including annual growth rates from 2005 counts to the 2031 “corrected assignments” from adjacent areas.

The 2031 “corrected assignment” at some locations resulted in less volume than the 2005 count or showed nearly no growth into the future, based on reductions in the model assignments. In some areas, a minimum annual growth rate was applied.

2031 BUILD

Based on the findings of the corridor screening analysis and City Council and technical staff input, the 2031 Build scenario included a capacity improvement to the University Avenue Overlap section from Pennsylvania Avenue to Loras Boulevard. In the Build scenario, the University Avenue Overlap section was coded as a 5-lane section. For locations where 2031 No-Build and Build model assignments were available, a ratio of the 2031 No-Build model assignment to 2031 No-Build “corrected assignment” was applied to the 2031 Build model assignment to generate a 2031 Build “corrected assignment”. This methodology was applied at most locations. For locations where the 2031 Build model assignment was lower than the 2031 No-Build model assignment, the 2031 Build “corrected assignment” was adjusted to match the 2031 No-Build “corrected assignment”.

For locations where 2031 Build model assignments where not available, ratios of the 2031 No-Build model assignment to 2031 No-Build “corrected assignment” from adjacent areas were used to generate 2031 Build ADTs.

YEAR 2031 TRAFFIC OPERATIONS

Traffic capacity analysis was conducted for Phase 2 corridors for year 2031 No-Build and Build conditions using CORSIM and VISSIM simulation. CORSIM software was originally utilized for the simulation analysis; however VISSIM software was utilized to analyze the recommended roundabouts due to its ability to replicate more realistic vehicular behavior associated with roundabouts compared to CORSIM. The following presents the assumptions and results for each condition.

2031 NO-BUILD

Future 2031 No-Build analysis was conducted utilizing existing geometrics conditions with the addition of planned improvements at Pennsylvania Avenue/Hempstead High School Drive and Pennsylvania Avenue/Northwest Arterial. No traffic control changes were made for the 2031 No-Build analysis compared to existing conditions other than signal timing optimization.

Base on the operational analysis, the following locations would operate outside of the LOS ‘C’ criteria under 2031 No-Build conditions:

AM Peak
- University Avenue/Asbury Road (LOS ‘F’)

PM Peak
- Asbury Road/Springreen Drive (LOS ‘D’)
- Asbury Road/Radford Road (LOS ‘F’)
- Asbury Road/JFK Road (LOS ‘D’)
- Asbury Road/Hillcrest Road (LOS ‘D’)
- Asbury Road/Clarke Drive (LOS ‘F’)
- Asbury Road/Poplar Street (LOS ‘F’)
- Asbury Road/St. Ambrose Street (LOS ‘D’)
- Pennsylvania Avenue/JFK Road(LOS ‘D’)
- University Avenue/Asbury Road (LOS ‘F’)
- University Avenue/Loras Boulevard (LOS ‘F’)
- University Avenue/McCormick Street (LOS ‘D’)
- University Avenue/Delhi Street (LOS ‘D’)

Observations of the CORSIM simulation showed that there would be excessive queuing at the University Avenue/Asbury Road intersection causing traffic to spill back to adjacent intersections, resulting in excessive delays. Additionally, long queues would occur at most of the study area intersections. Detailed simulation results are shown in *Table 4-1*. A summary of the simulation results as well as the 2031 No-Build geometrics and volumes are shown for the study intersections in *Figure 4-1* and *Figure 4-2*. Simulation output including recorded queues is provided in the appendix.

Table 4-1. Year 2031 No-Build Analysis Results

Intersection [1]	Traffic Control [2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
Asbury Road/Lore Mound Road	Unsignalized	n/a	-	n/a	-
SB Approach		A	3.4	A	3.3
Asbury Road/Seippel Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	8.9	B	10.3
SB Approach		B	10.1	B	10.3
Asbury Road/Springreen Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	6.7	A	6.1
SB Approach		A	8.0	A	7.3
EB Approach		C	15.6	B	12.4
WB Approach		A	8.2	D	27.5
Asbury Road/Radford Road	Unsignalized	n/a	-	n/a	-
NB Approach		B	14.6	F	94.7
Asbury Road/JFK	Signalized	B	17.7	D	37.2
NB Approach		B	16.2	C	31.2
SB Approach		B	19.8	D	36.1
EB Approach		B	16.8	C	24.9
WB Approach		B	18.4	D	55.0
Asbury Road/Carter Road	Signalized	A	8.6	B	11.4
NB Approach		C	31.8	D	35.7
SB Approach		C	23.1	C	27.3
EB Approach		A	4.8	A	8.7
WB Approach		A	2.3	A	4.5
Asbury Road/Chaney Road	Signalized	A	5.9	A	8.5
NB Approach		A	9.4	B	15.5
SB Approach		A	7.0	A	8.1
EB Approach		A	3.8	A	8.3
WB Approach		A	7.7	A	7.9
Asbury Road/Hillcrest Road	Unsignalized	n/a	-	n/a	-
NB Approach		C	19.5	D	28.4
Asbury Road/Clarke Drive [3]	Unsignalized	n/a	-	n/a	-
SB Approach		C	16.2	F	> 150
Asbury Road/Poplar Street [3]	Unsignalized	n/a	-	n/a	-
NB Approach		A	7.9	F	> 150

Table 4-1. Year 2031 No-Build Analysis Results (Continued)

Intersection [1]	Traffic Control [2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
Asbury Road/St. Ambrose Street [3]	Signalized	A	7.2	D	51.2
SB Approach		B	18.9	F	121.1
EB Approach		A	6.0	F	91.9
WB Approach		A	4.9	A	4.7
Pennsylvania Avenue/Hempstead High School Drive	Signalized	B	11.8	A	7.8
SB Approach		C	20.7	C	22.8
EB Approach		A	8.0	A	5.5
WB Approach		B	12.2	A	7.6
Pennsylvania Avenue/JFK	Signalized	C	24.2	D	36.6
NB Approach		C	21.6	D	35.4
SB Approach		C	25.3	D	37.4
EB Approach		C	25.4	D	41.4
WB Approach		C	24.1	C	30.1
University Avenue/Pennsylvania Avenue	Signalized	B	12.4	B	14.2
SB Approach		B	17.4	B	16.7
EB Approach		B	12.8	C	22.6
WB Approach		A	6.5	A	6.9
University Avenue/Asbury Road	Unsignalized	n/a	-	n/a	-
SB Approach		F	97.9	F	> 150
EB Approach		B	12.3	C	23.8
WB Approach		B	11.7	F	86.6
University Avenue/Loras Boulevard [3]	Unsignalized	n/a	-	n/a	-
SB Approach		B	11.9	F	> 150
University Avenue/McCormick Street [3]	Unsignalized	n/a	-	n/a	-
NB Approach		A	8.8	D	27.0
University Avenue/Delhi Street	Unsignalized	n/a	-	n/a	-
NB Approach		B	12.0	D	33.3
University Avenue/Grandview Avenue	Unsignalized	n/a	-	n/a	-
NB Approach		C	18.0	C	23.8
SB Approach		C	24.3	B	13.4
EB Approach		C	16.4	B	14.0
WB Approach		C	16.0	B	14.5

TABLE 4-1. YEAR 2031 NO-BUILD ANALYSIS RESULTS (CONTINUED)

INTERSECTION [1]	TRAFFIC CONTROL [2]	AM PEAK HOUR		PM PEAK HOUR	
		LOS	AVE. DELAY (SEC)	LOS	AVE. DELAY (SEC)
University Avenue/Booth Street	Unsignalized	n/a	-	n/a	-
NB Approach		A	9.0	B	11.1
SB Approach		A	6.8	A	9.3
University Avenue/Nevada Street	Signalized	A	4.1	A	4.5
NB Approach		A	3.8	A	4.1
SB Approach		A	4.0	A	3.8
EB Approach		A	3.2	A	5.3
WB Approach		A	5.3	A	3.9
Loras Boulevard/Grandview Avenue	Signalized	B	15.4	C	31.4
NB Approach		A	8.9	C	22.9
SB Approach		B	16.1	C	24.3
EB Approach		B	18.6	B	13.8
WB Approach		B	18.2	E	59.5

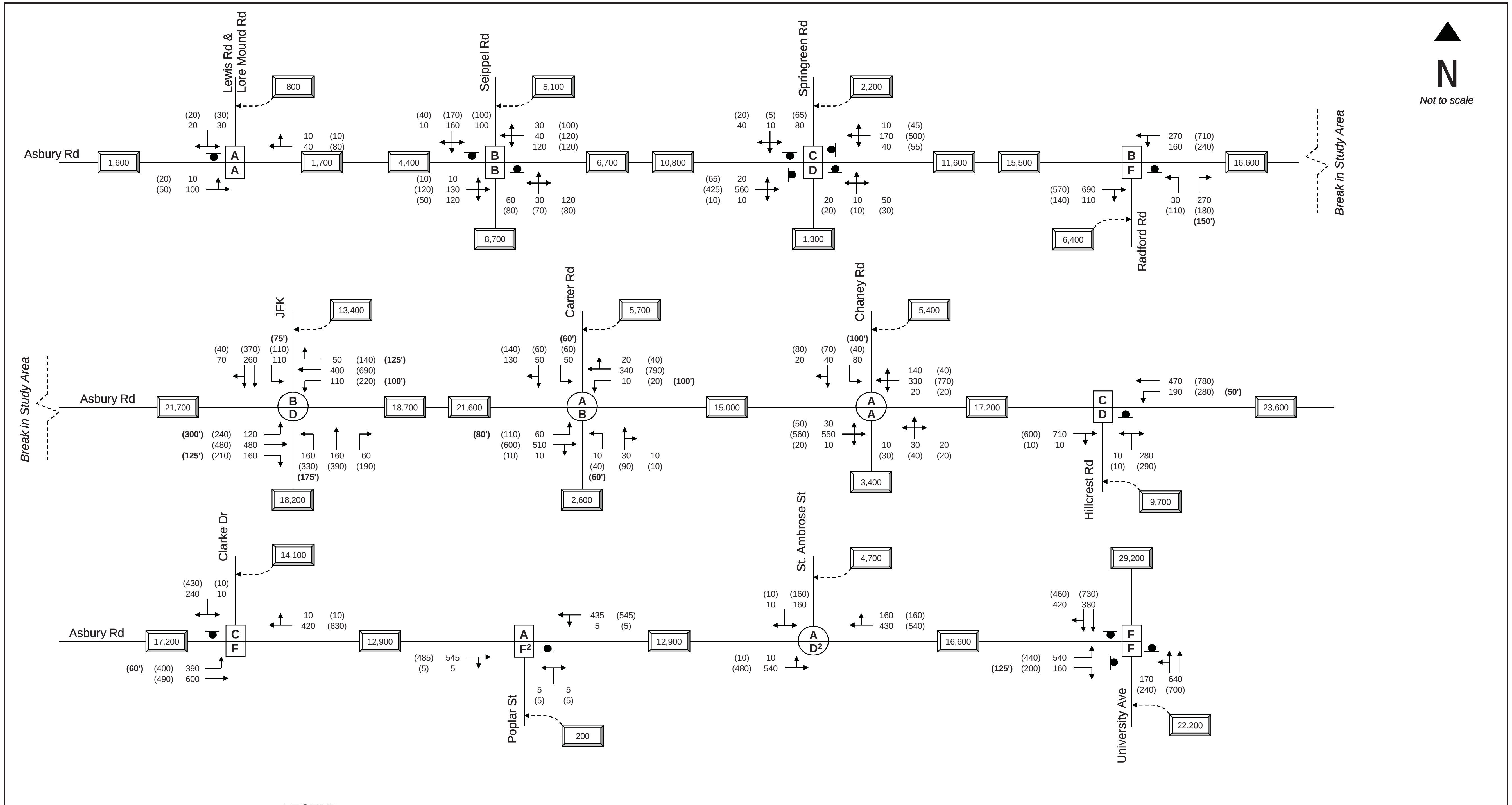
Notes:

1. All streets listed first in the 'Intersection' column are assumed to have EB/WB orientation at the intersection

2. Only stop-controlled approaches are shown for unsignalized intersections

3. Traffic queued at the southbound and westbound approaches of the University Avenue/Asbury Road intersection would spill back to adjacent upstream intersections during the PM peak hour causing excessive delays

FIGURE 4-1. YEAR 2031 NO-BUILD VOLUMES, GEOMETRICS, AND LEVELS OF SERVICE ALONG ASBURY ROAD



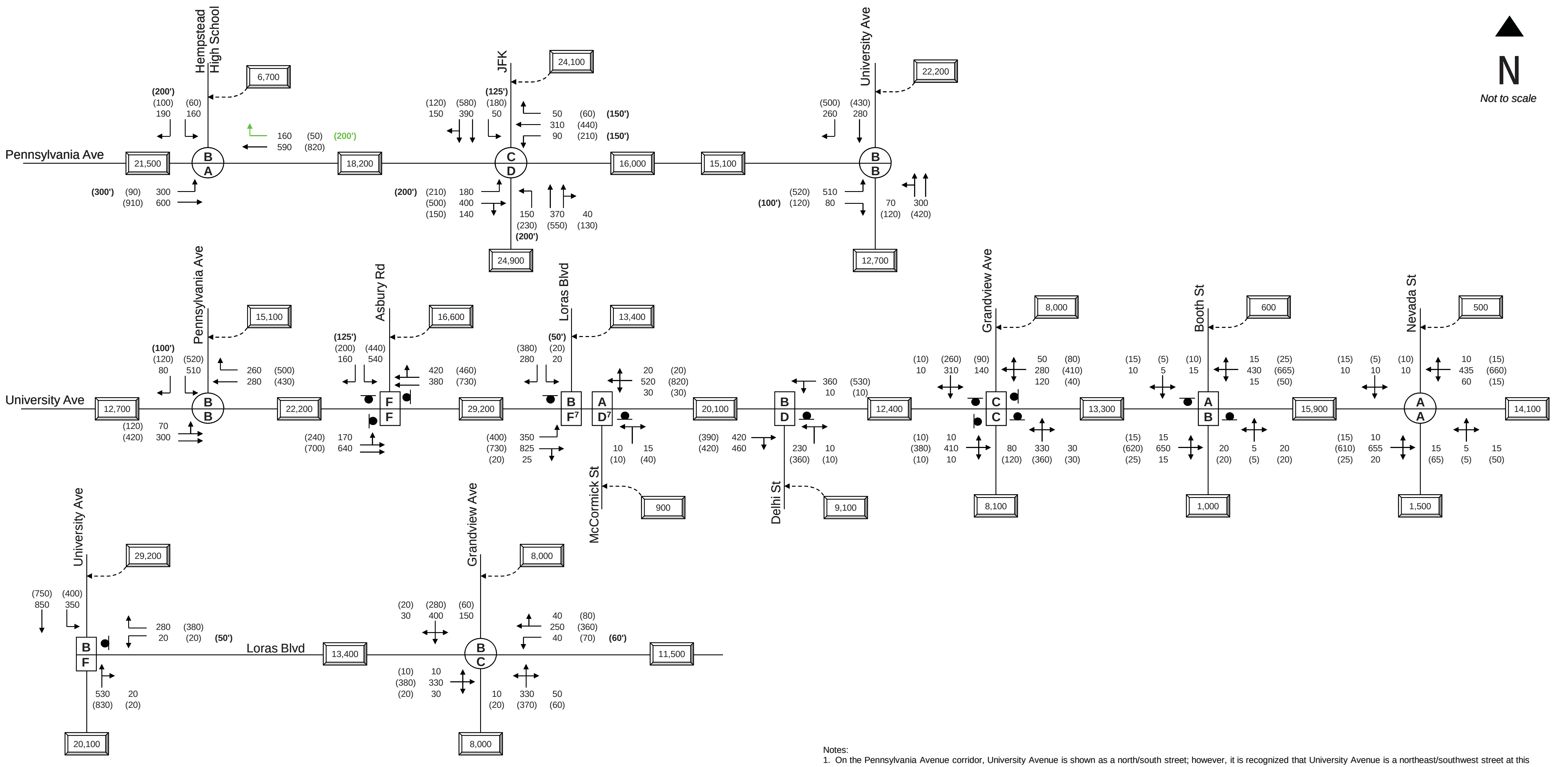
LEGEND

XXX	2031 No-Build AM Peak Hour Volume
(XXX)	2031 No-Build PM Peak Hour Volume
XXX	2031 Annual Daily Traffic
→	Existing Geometrics
(XXX')	Existing Storage Length
●	Stop Sign
X X	AM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service PM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
X X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service

Note:
1. Asbury Road is assumed to run east-west for the purpose of this figure. It is recognized that Asbury Road is more north-south at the east end of the corridor.
2. Traffic queued at the southbound and westbound approaches of the University Ave/Asbury Rd intersection would spill back to adjacent upstream intersections during the PM peak hour causing excessive delays. Intersections affected by spillback include: Asbury Rd/Poplar St, Asbury Rd/St. Ambrose St, University Ave/Loras Blvd and University Ave/McCormick St. This also resulted in a metering of traffic to downstream signals and would therefore result in better operations at downstream signals since the total demand of traffic was unable to be served.

Sources:
1. 2031 Volume Forecasts - HDR Engineering, June 2009.
2. Traffic Capacity Analysis (CORSIM Simulation Software) - HDR Engineering, September 2009.

Figure 4-2. Year 2031 No-Build Volumes, Geometrics, and Levels of Service along Pennsylvania Avenue, University Avenue, and Loras Boulevard



LEGEND

XXX 2031 No-Build AM Peak Hour Volume
(XXX) 2031 No-Build PM Peak Hour Volume
XXX 2031 Annual Daily Traffic
→ Existing Geometrics
→ Planned Improvements Completed by Year 2031
(XXX') Existing Storage Length
(XXX') Storage Length for Planned Improvements
● Stop Sign
X / X AM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service / PM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
X / X AM Peak Hour Signalized Intersection Level of Service / PM Peak Hour Signalized Intersection Level of Service

Notes:
1. On the Pennsylvania Avenue corridor, University Avenue is shown as a north/south street; however, it is recognized that University Avenue is a northeast/southwest street at this location and was depicted as shown for ease of presentation on this figure.
2. On the University Avenue corridor, Pennsylvania Avenue is shown as a north/south street; however, it is recognized that Pennsylvania Avenue is an east/west street at this location and was depicted as shown for ease of presentation on this figure.
3. On the University Avenue corridor, Loras Boulevard is shown as a north/south street; however, it is recognized that Loras Boulevard is a northeast/southwest street at this location and was depicted as shown for ease of presentation on this figure.
4. On the University Avenue corridor, Delhi Street is shown as a north/south street; however, it is recognized that Delhi Street is a southeast/northwest street at this location and was depicted as shown for ease of presentation on this figure.
5. On the Loras Boulevard corridor, McCormick Street is shown as an east/west street; however, it is recognized that McCormick Street is a north/south street at this location and was depicted as shown for ease of presentation on this figure.
6. On the Loras Boulevard corridor, University Avenue is shown as an east/west street; however, it is recognized that University Avenue is a southeast/northwest street at this location and was depicted as shown for ease of presentation on this figure.
7. Traffic queued at the southbound and westbound approaches of the University Ave/Asbury Rd intersection spilled back to adjacent upstream intersections during the PM peak hour causing excessive delays. Intersections affected by spillback include: Asbury Rd/Poplar St, Asbury Rd/St. Ambrose St, University Ave/Loras Blvd and University Ave/McCormick St. This also resulted in a metering of traffic to downstream signals and would therefore result in better operations at downstream signals since the total demand of traffic was unable to be served.

Sources:
1. 2031 Volume Forecasts - HDR, June 2009.
2. Traffic Capacity Analysis (CORSIM Simulation Software) - HDR Engineering, September 2009.

2031 BUILD

Future 2031 Build conditions include recommended improvements to existing geometry and traffic control, which is documented in detail in Chapter 5 of this report. These improvements are recommended based on safety and operational benefits. A summary of the changes to existing conditions for future 2031 Build conditions include:

- Roundabouts on University Avenue at the intersections of Pennsylvania Avenue, Asbury Road and Loras Boulevard
- Realignment of Hillcrest Road at Asbury Road to create a four-legged intersection with the drive on the opposite side of Asbury Road
- Realignment of Clarke Drive and Wilbricht Lane at Asbury Road to a four-legged intersection and the installation of a traffic signal
- Realignment of St. Ambrose Street at Asbury Road
- Removal of access to Poplar Street from Asbury Road
- Conversion of Asbury Road to a three-lane section east of the entrance to Sam's Club
- Installation of northbound, southbound and eastbound right-turn lanes at Pennsylvania Avenue/JFK Road
- Conversion of Pennsylvania Avenue to a five-lane section east of NW Arterial to Hempstead High School and a three-lane section east of Hempstead High School to University Avenue
- Realignment of Delhi Street at University Avenue
- Installation of left-turn lanes on all four approaches of University Avenue/Grandview Avenue and the installation of a traffic signal
- Installation of northbound, southbound and eastbound left-turn lanes at Loras Boulevard/Grandview Avenue

Existing signal timings were modified to minimize delay under the 2031 Build conditions. Additional coordination of signals from existing conditions was not necessary to meet operational criteria and not considered given the signal spacing and number of driveways between signals; however coordination could be considered in the future if needed and deemed reasonable to improve capacity. CORSIM software was originally utilized for the simulation analysis; however VISSIM software was utilized to analyze the recommended roundabouts due to its ability to replicate more realistic vehicular behavior associated with roundabouts compared to CORSIM. The VISSIM simulation analysis of the University Avenue Overlap section roundabouts shows:

- Future queues would be "moving queues" that would have minimal effect on delay within the roundabout, but would affect vehicles using upstream driveways
- During peak times, queues on the eastbound and westbound approaches of the University Avenue/Asbury Road roundabout would not extend into the adjacent upstream roundabouts at Pennsylvania Avenue and Loras Boulevard
- Queues on the University Avenue/Loras Boulevard roundabout westbound approach would occasionally extend into the University Avenue/Delhi Street intersection impacting operations at the intersection

Operational analysis of 2031 Build conditions determined that the recommended geometric improvements would alleviate the congested conditions identified in the 2031 No-Build analysis. The future 2031 Build analysis showed that all study intersections would operate within the LOS 'C' criteria. Detailed simulation results are shown in *Table 4-2*. A summary of the simulation results as well as the recommended 2031 Build geometrics and volumes are shown for the study intersections in *Figure 4-3* and *Figure 4-4*. Simulation output including recorded queues is provided in the appendix.

Table 4-2. Year 2031 Build Analysis Results

Intersection [1]	Traffic Control [2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
Asbury Road/Lore Mound Road	Unsignalized	n/a	-	n/a	-
SB Approach		A	3.3	A	3.2
Asbury Road/Seippel Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	9.0	B	10.7
SB Approach		B	10.9	B	11.0
Asbury Road/Springreen Road	Unsignalized	n/a	-	n/a	-
NB Approach		A	6.7	A	6.2
SB Approach		A	7.6	A	7.3
EB Approach		B	14.3	A	9.9
WB Approach		A	7.0	C	20.1
Asbury Road/Radford Road	Signalized	A	6.8	A	7.0
NB Approach		A	9.3	B	10.0
EB Approach		A	4.7	A	3.4
WB Approach		A	8.7	A	8.4
Asbury Road/JFK	Signalized	B	17.1	C	27.2
NB Approach		B	16.3	C	27.9
SB Approach		B	19.9	C	32.9
EB Approach		B	15.6	C	24.2
WB Approach		B	17.4	C	26.5
Asbury Road/Carter Road	Signalized	A	8.4	B	12.0
NB Approach		C	32.5	D	36.3
SB Approach		C	23.2	C	28.1
EB Approach		A	4.5	A	9.3
WB Approach		A	2.1	A	5.7
Asbury Road/Chaney Road	Signalized	A	4.1	A	6.6
NB Approach		A	8.5	B	15.0
SB Approach		A	7.4	A	8.6
EB Approach		A	2.7	A	2.9
WB Approach		A	4.4	A	8.1
Asbury Road/Hillcrest Road	Unsignalized	n/a	-	n/a	-
NB Approach		C	24.8	C	21.2
SB Approach		B	12.8	A	8.5

Table 4-2. Year 2031 Build Analysis Results (Continued)

Intersection[1]	Traffic Control[2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
Asbury Road/Clarke Drive	Signalized	A	8.8	B	12.4
NB Approach		B	15.4	C	27.4
SB Approach		A	8.1	B	16.9
EB Approach		A	6.6	B	10.0
WB Approach		B	14.2	B	12.3
Asbury Road/St. Ambrose Street	Signalized	A	9.2	A	8.3
SB Approach		B	19.8	B	17.9
EB Approach		A	5.5	A	7.1
WB Approach		A	9.5	A	6.8
Pennsylvania Avenue/Hempstead High School Drive	Signalized	A	9.3	A	4.4
SB Approach		B	18.4	B	18.2
EB Approach		A	6.2	A	3.0
WB Approach		A	8.8	A	3.5
Pennsylvania Avenue/JFK	Signalized	C	22.0	C	30.0
NB Approach		C	20.3	C	26.8
SB Approach		B	20.0	C	26.3
EB Approach		B	15.4	C	26.1
WB Approach		D	39.8	D	44.2
University Avenue/Pennsylvania Avenue	Roundabout	A	5.6	B	11.1
SB Approach		A	8.5	C	22.9
EB Approach		A	7.6	B	10.3
WB Approach		A	1.4	A	3.8
University Avenue/Asbury Road	Roundabout	B	11.5	C	16.7
SB Approach		B	12.5	D	30.0
EB Approach		C	18.5	B	10.7
WB Approach		A	4.0	B	14.6
University Avenue/Loras Boulevard/ McCormick Street	Roundabout	A	5.2	B	10.7
NB Approach		D	25.1	C	22.8
SB Approach		A	5.1	B	12.3
EB Approach		A	3.8	A	3.8
WB Approach		A	7.3	C	18.5

Table 4-2. Year 2031 Build Analysis Results (Continued)

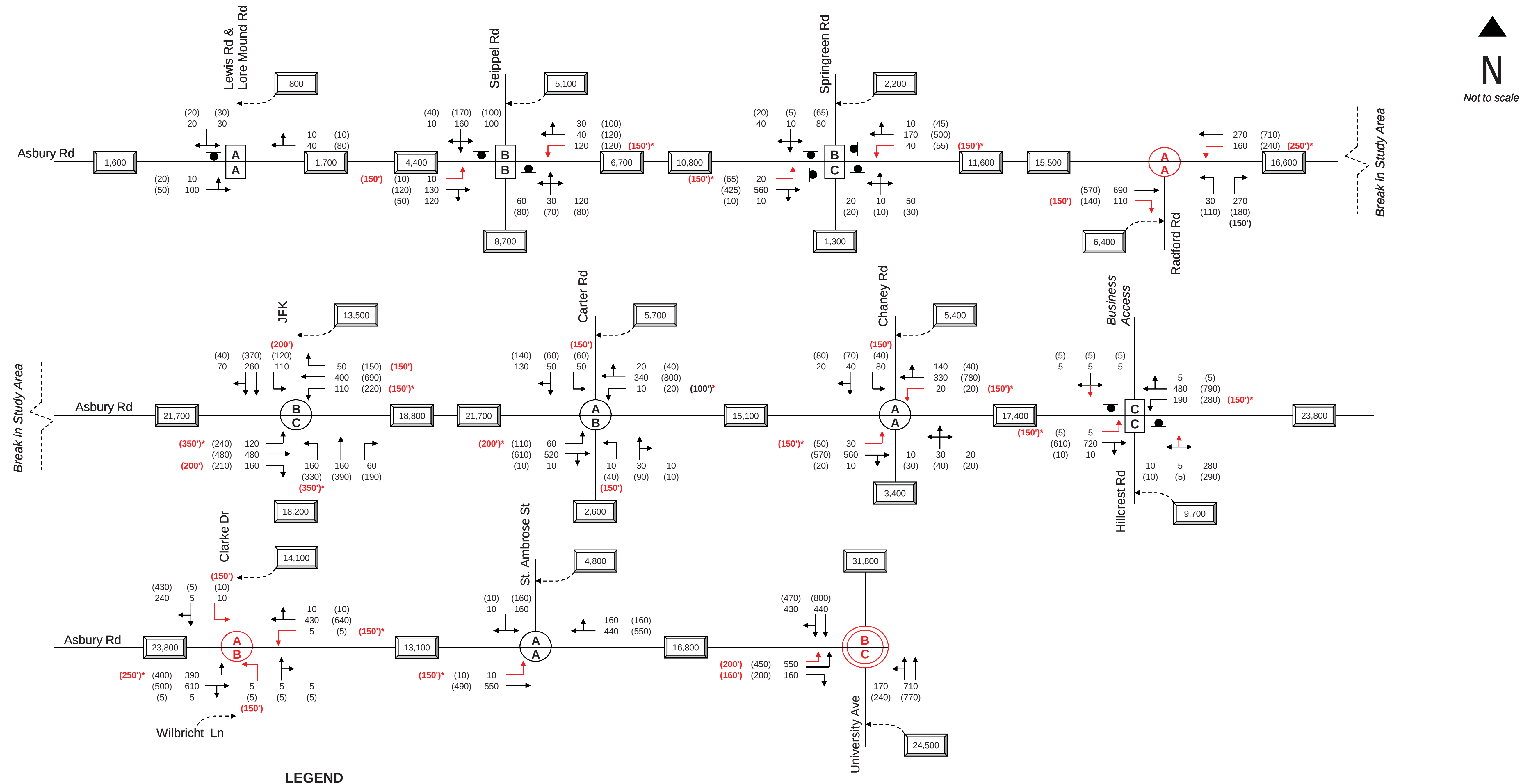
Intersection[1]	Traffic Control[2]	AM Peak Hour		PM Peak Hour	
		LOS	Ave. Delay (sec)	LOS	Ave. Delay (sec)
University Avenue/Delhi Street	Unsignalized	n/a	-	n/a	-
NB Approach		B	11.3	C	20.7
University Avenue/Grandview Avenue	Signalized	B	13.3	B	12.2
NB Approach		B	13.3	B	13.3
SB Approach		B	12.1	B	10.9
EB Approach		B	12.6	B	13.0
WB Approach		B	15.0	B	11.2
University Avenue/Booth Street	Unsignalized	n/a	-	n/a	-
NB Approach		A	8.4	B	12.0
SB Approach		A	8.6	A	8.9
University Avenue/Nevada Street	Signalized	A	3.8	A	5.8
NB Approach		A	5.4	A	6.2
SB Approach		A	5.1	A	5.3
EB Approach		A	2.8	A	6.5
WB Approach		A	4.8	A	5.0
Loras Boulevard/Grandview Avenue	Signalized	B	10.7	B	10.5
NB Approach		A	8.4	B	11.6
SB Approach		B	12.6	B	11.6
EB Approach		B	10.3	B	10.4
WB Approach		B	10.8	A	8.9

Notes:

1. All streets listed first in the 'Intersection' column are assumed to have EB/WB orientation at the intersection

2. Only stop-controlled approaches are shown for unsignalized intersections

Figure 4-3. Year 2031 Build Volumes, Geometrics, and Levels of Service along Asbury Road



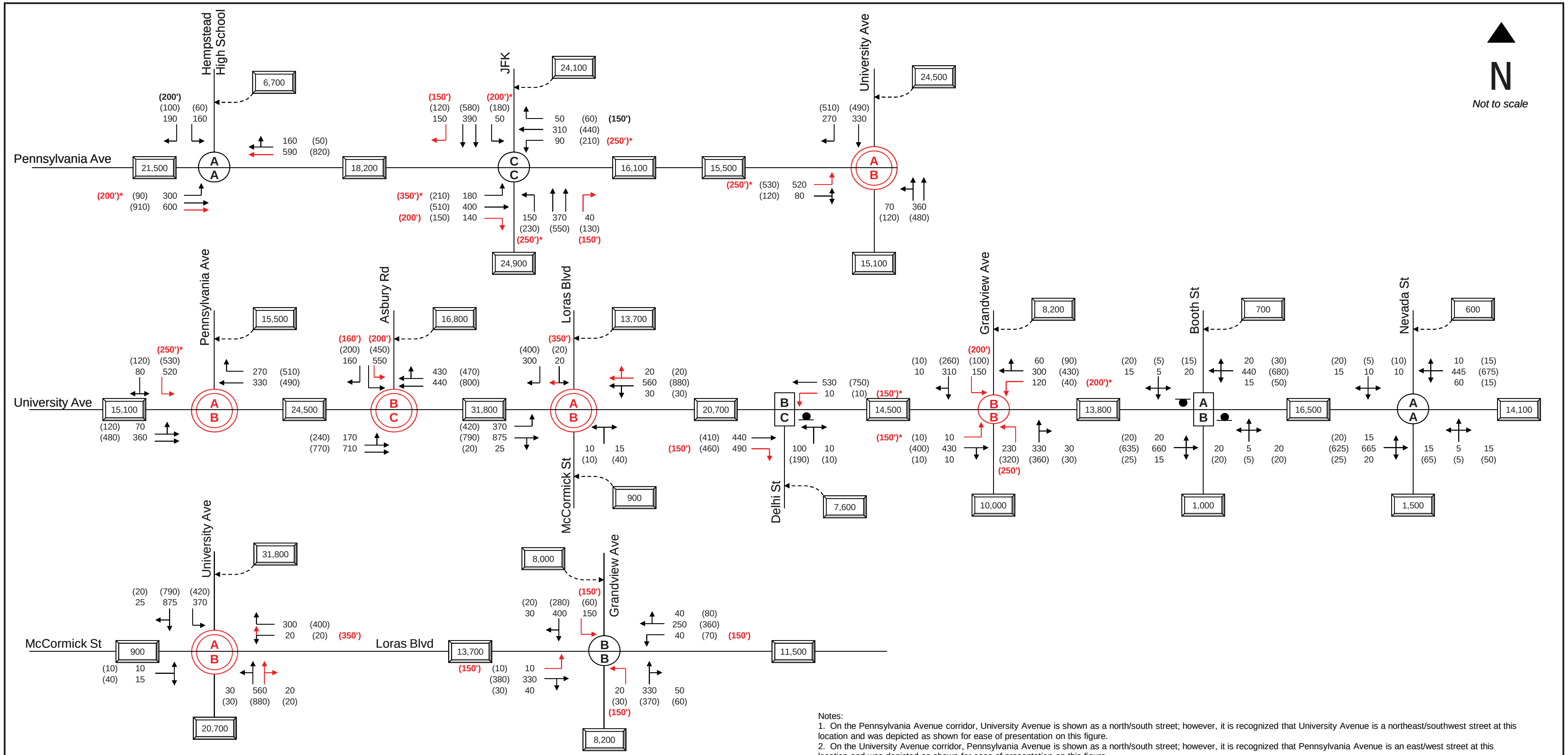
LEGEND

XXX	2031 Build AM Peak Hour Volume
(XXX)	2031 Build PM Peak Hour Volume
XXX	2031 Annual Daily Traffic
⟶	Existing Geometrics
⟶	Recommended Improvements for Year 2031
(XXX')	Existing Storage Length
(XXX')	Recommended Storage Length if Exceeds Existing Storage Length
*	Two-Way Left-Turn Lane
●	Stop Sign
X X	AM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service PM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
X X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X X	Recommended Signalization and AM/PM Level of Service
X X	Recommended Roundabout and Overall Roundabout AM/PM Level of Service

Notes:
1. Asbury Road is assumed to run east-west for the purpose of this figure. It is recognized that Asbury Road is more north-south at the east end of the corridor.
2. Two-way left-turn lanes will provide additional storage where applicable.
3. Recommended storage was based on traffic simulation results; however, geometric constraints governed the amount of storage available in select locations. Movements where the recommended storage was reduced based on geometric constraints are: WB Left at Asbury Rd/JFK, WB Left at Asbury Rd/Carter Rd, WB Left at Asbury Rd/Hillcrest Rd, EB Left at Asbury Rd/Clarke Dr, SB Left at University Ave/Asbury Rd, SB Right at University Ave/Asbury Rd, and EB Right at University Ave/Delhi St. Recommended storage based solely on the traffic simulation results can be found in the appendix.

Sources:
1. 2031 Volume Forecasts - HDR Engineering, June 2009.
2. Traffic Capacity Analysis for non-roundabout intersections (CORSIM Simulation Software) - HDR Engineering, September 2009.
3. Traffic Capacity Analysis for roundabout intersections (VISSIM Simulation Software) - HDR Engineering, October 2009.

FIGURE 4-4. YEAR 2031 BUILD VOLUMES, GEOMETRICS, AND LEVELS OF SERVICE ALONG PENNSYLVANIA AVENUE, UNIVERSITY AVENUE, AND LORAS BOULEVARD



LEGEND

XXX	2031 Build AM Peak Hour Volume
(XXX)	2031 Build PM Peak Hour Volume
XXX	2031 Annual Daily Traffic
→	Existing Geometrics
→	Recommended Improvements for Year 2031
(XXX')	Existing Storage Length
(XXX')	Recommended Storage Length if Exceeds Existing Storage Length
*	Two-Way Left-Turn Lane
●	Stop Sign
X X	AM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service PM Peak Hour Unsignalized Intersection Worst Case Stop-Controlled Approach Level of Service
X X	AM Peak Hour Signalized Intersection Level of Service PM Peak Hour Signalized Intersection Level of Service
X X	Recommended Signalization and AM/PM Level of Service
X X	Recommended Roundabout and Overall Roundabout AM/PM Level of Service

Notes:
1. On the Pennsylvania Avenue corridor, University Avenue is shown as a north/south street; however, it is recognized that University Avenue is a northeast/southwest street at this location and was depicted as shown for ease of presentation on this figure.
2. On the University Avenue corridor, Pennsylvania Avenue is shown as a north/south street; however, it is recognized that Pennsylvania Avenue is an east/west street at this location and was depicted as shown for ease of presentation on this figure.
3. On the University Avenue corridor, Loras Boulevard is shown as a north/south street; however, it is recognized that Loras Boulevard is a northeast/southwest street at this location and was depicted as shown for ease of presentation on this figure.
4. On the University Avenue corridor, Delhi Street is shown as a north/south street; however, it is recognized that Delhi Street is a southeast/northwest street at this location and was depicted as shown for ease of presentation on this figure.
5. On the Loras Boulevard corridor, McCormick Street is shown as an east/west street; however, it is recognized that McCormick Street is a north/south street at this location and was depicted as shown for ease of presentation on this figure.
6. On the Loras Boulevard corridor, University Avenue is shown as an east/west street; however, it is recognized that University Avenue is a southeast/northwest street at this location and was depicted as shown for ease of presentation on this figure.
7. Two-way left-turn lanes will provide additional storage where applicable.
8. Recommended storage was based on traffic simulation results; however, geometric constraints governed the amount of storage available in select locations. Movements where the recommended storage was reduced based on geometric constraints are: WB Left at Asbury Rd/JFK, WB Left at Asbury Rd/Carter Rd, WB Left at Asbury Rd/Hillcrest Rd, and EB Left at Asbury Rd/Clarke Dr, SB Left at University Ave/Asbury Rd, SB Right at University Ave/Asbury Rd, and EB Right at University Ave/Delhi St. Recommended storage based solely on the traffic simulation results can be found in the appendix.

Sources:
1. 2031 Volume Forecasts - HDR Engineering, June 2009.
2. Traffic Capacity Analysis for non-roundabout intersections (CORSIM Simulation Software) - HDR Engineering, September 2009.
3. Traffic Capacity Analysis for roundabout intersections (VISSIM Simulation Software) - HDR Engineering, October 2009.

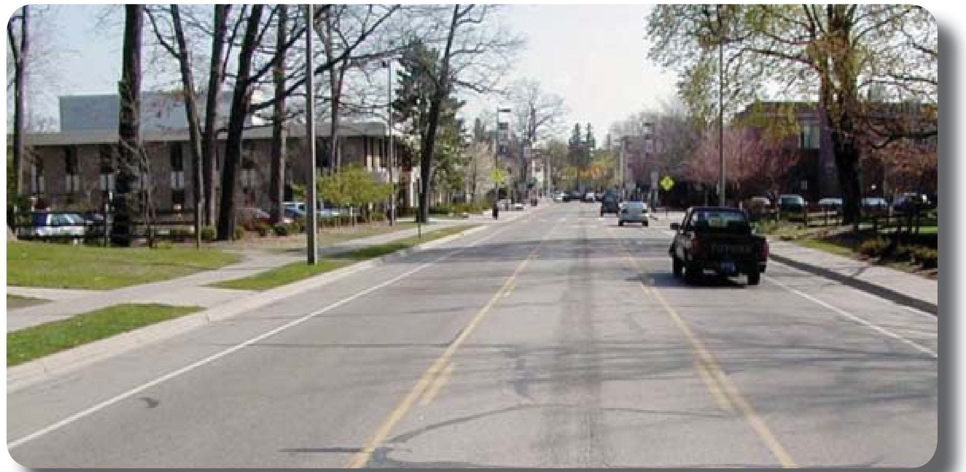
CHAPTER 5: CONCEPT DEVELOPMENT

COMPLETE STREETS CONSIDERATIONS

Improvements along the selected corridors will also consider Complete Streets philosophy in accommodating all roadway users. This concept stresses the provision of safe access for motorists, pedestrians, bicyclists and transit users. Besides safety, other improvements to the visual and physical environment of the roadway can provide additional health and economic benefits to users.

Dedicated Bicycle Lane with On-Street Parking

The needs of motorists, pedestrians, bicyclists and transit users may sometimes conflict, so the benefit to each user needs to be weighed within the context and constraints of each corridor. For safe and efficient travel, motorists desire minimal travel delays, minimal visual and physical conflicts or distractions and consistency in design. If walking is to be encouraged, pedestrians need more than a simple sidewalk and safe crossings to feel secure and comfortable. Protection from climate, buffering from motorists, an aesthetically pleasing environment, and access for the disabled are some of the issues to be considered. Bicyclists want a connected network of facilities that are safe and direct, they want to avoid stoppages, and they need their visibility to other roadway users improved. Transit users are defined not only by the riders, but also the drivers. Transit operators need space to operate, minimal delays to keep on schedule, and minimal conflicts with other roadway users or facilities. Riders desire accessible, comfortable and secure waiting areas placed along a well-connected network. Several concept design elements were considered for this study, in order to incorporate the Complete Streets philosophy.



Three-lane Cross Section with Dedicated Bicycle Lanes

STREET DESIGN

Long, straight, wide streets often create barriers for pedestrians and transit users and encourage higher vehicular speeds, which has an impact on the safety of all roadway users. Narrower streets encourage slower speeds and provide shorter crossing distances for pedestrians. Traffic calming strategies, such as mid-block curb bulbouts (with on-street parking), center medians, reduced turning radii, benefit the pedestrian and can be weighed with the needs and safety of bicyclists, and operability of transit vehicles. For bus transit, the use of bulbouts and turnouts need to be evaluated for effectiveness. Where it is not acceptable to stop a bus in traffic and a bus turnout is justified, a far-side or midblock stop is generally preferred. Stops located on the far side of a traffic signal are preferred so a bus does not get delayed waiting to re-enter traffic. Bulbouts allow more room for riders waiting to access transit, and can reduce delay to motorists waiting behind the transit vehicle by allowing for faster loading and unloading of passengers, and allow buses to reenter the flow of traffic more quickly.

Pedestrian Crossing with Raised Median for Two-Stage Gap Acceptance

INTERSECTION DESIGN

Crossing features such as medians, bulbouts, right-turn channelization, pavement markings, distinct pavement types and pedestrian and bicycle signalization help to regulate different travel modes as well as increase visibility. Medians and bulbouts shorten crossing distances and provide pedestrians with additional landing areas while crossing and more space along roadway edges. Median noses that extend beyond marked crosswalks at intersections help to control the speed of left turning vehicles. Vehicle channelization is another method that allows for shorter crossing distances, as well as making pedestrians more visible and turning movements safer for all users. Distinct paving types and pavement markings increase awareness from other motorists that the crossing space is dedicated to pedestrians or bicyclists. It can also reflect character of a neighborhood or region. Roundabouts allow vehicles and bicyclists to continue moving through the intersection, at reduced speeds, while providing shorter crossing distances for pedestrians. Roundabout splitter islands provide refuge to pedestrians and allow them to cross one direction of traffic flow at a time. Further, the horizontal deflection of vehicles entering a roundabout slows them to low speeds which allows them to easily yield to pedestrians crossing or waiting to cross. Finally, roundabouts provide opportunities for more visual interest and identifying neighborhood character. At signalized intersections, it is desirable to mark pedestrian crosswalks and use countdown pedestrian signal heads on all approaches.

SIDEWALKS

Sidewalks are often seen as optional or omitted due to current land use needs. Orientation and alignment are important considerations so that the walk provides an access between destinations. Pedestrians, and in some cases bicyclists, are more exposed to the environment as the users of sidewalks. This makes them more aware of the effects of sidewalk design elements such as location, width, utility interferences, shading, plantings, and the presence of amenities. A narrow sidewalk abutting the curb not only gets diminished by sharing space with utility poles, but makes the user feel less secure because there is no buffer from traffic. Conversely, a planting strip with room for trees provides buffering and shade, but require more right-of-way and may interfere with utilities. Pedestrian comfort is increased if they are buffered from passing vehicles. Some of the elements that serve as buffers include planting strips and landscaping, bicycle lanes, and on-street parking. Walking can be encouraged if the perceived distance can be minimized. Some ways to shorten a perceived distance is to create direct connections between land uses, provide mid-block crossings, and offer amenities along the way, such as benches, landscaping, defined paving, shelters and other resting area type design features. These amenities are also important design elements for transit stops. Rest areas' functions can be shared between users. Water coolers could be provided along a sidewalk that serves as a multi-use trail or shared use path. Bike racks at key points provide full service for the bicyclists, especially appropriate along commercial corridors within the streetscape, at destinations along a sidewalk, or at major transit stops.

Pedestrian Crossing with Raised Median for Two-Stage Gap Acceptance

LIGHTING

Lighting is a key element affecting roadway users' perception and safety. Motorists need better sight distances for safety, so higher levels of lighting provide better visibility. From a pedestrian level, the vehicular lighting level may not serve as well to provide the security that lower height lighting could achieve. Pedestrian scale lighting is spaced closer together and adds a higher lighting level for the user. The use of distinct poles provides an opportunity to identify a neighborhood or district. Other locations where pedestrian scaled lighting area is important are transit stops, intersections, and all marked midblock crosswalks.

Shared Lane with Sharrow

SUSTAINABLE DESIGN OPPORTUNITIES

Some of the strategies advocated by the Complete Streets philosophy, such as separation of walks and adding planting strips also provide the opportunity for additional sustainable design functions. A planting strip can also be utilized as a rain garden since it is adjacent to the curb. Runoff can be directed into these areas to be filtrated before being released which results in improved water quality and reduced velocities. Trees planted in this strip provide shade for pedestrians, bicyclists and parked cars, which results in reducing the heat island effect. Sidewalks can be constructed of porous pavements, which also reduce runoff and helps with groundwater recharge.

SHARROWS

Sharrows are shared lane pavement markings. This relatively new Complete Streets measure is a low-cost bicycle improvement used in lanes that are too narrow to be shared by bicycles and motor vehicles and when the roadway is too narrow to stripe an exclusive bicycle lane. They alert motorists to expect bicyclists, encourage safe passing, and provide lateral positioning guidance for bicyclists. Sharrows may be implemented on roadways with on-street parking.

Example Signage for Shared Lane

Sharrows have been implemented in other communities around the country and in Iowa, although still technically considered experimental according to the *Manual on Uniform Traffic Control Devices* (MUTCD). According to a draft version of the new MUTCD, some benefits to sharrow pavement markings are:

- Assist bicyclists with lateral positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist's impacting the open door of a parked vehicle,
- Assist bicyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side by side within the same traffic lane,
- Alert road users of the lateral location bicyclists are likely to occupy within the traveled way,
- Encourage safe passing of bicyclists by motorists, and
- Reduce the incidence of wrong-way bicycling.

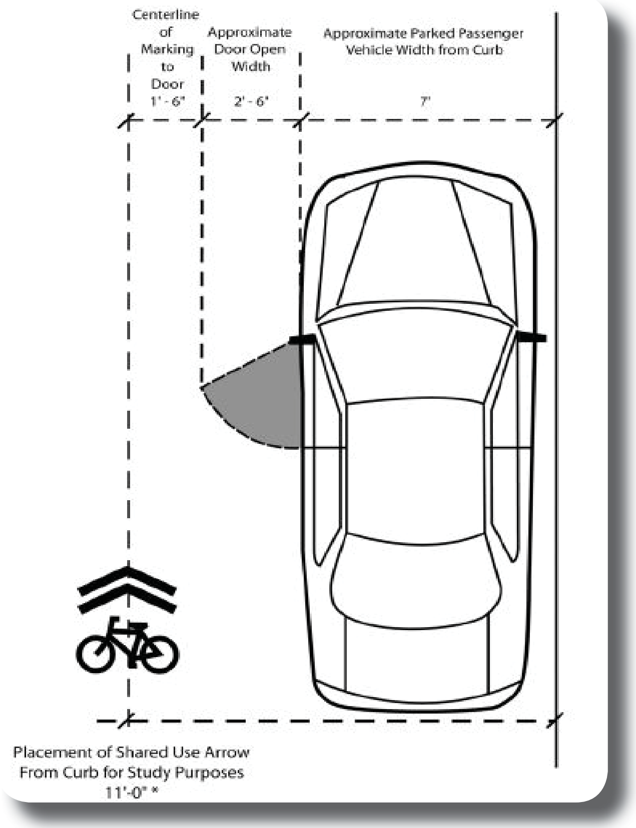
There are limits to the use of sharrows:

- They should not be on roads where the speed limits above 35 MPH.
- They should not be on shoulders or in bike lanes

Shared Lane with On-Street Parking

The draft MUTCD suggests the placement of sharrows after intersections and not more than every 250 feet thereafter. In areas without on-street parking, the spacing interval between sharrows may be greater.

With on-street parking, the recommended distance from curb to center of marking is 11 feet. However, larger vehicles including many trucks and SUVs are wider, have longer doors, and not all vehicles will park right up against the curb. For these reasons and to give bicyclists a more comfortable clearance from opening vehicle doors, it is recommended to place the center of sharrow markings 13 feet from the curb face when used with on-street parking. In areas without on-street parking, the draft MUTCD recommends the centers of sharrows be placed a minimum of four feet from the curb face.



MUTCD Guidance for Sharrow Placement

COMPLETE STREETS PEDESTRIAN ACCOMMODATIONS

Several locations along the study corridors were identified where enhanced pedestrian accommodations should be considered. Six pedestrian accommodation enhancements have been identified for potential implementation at these locations.

PAVEMENT MARKINGS AND HIGH VISIBILITY SIGNAGE

At a minimum, high visibility pavement markings in a ladder pattern as shown in the photo below should be used on all study area intersection approaches, roadways with higher volumes and major side streets. The two transverse line crosswalk can be used for minor streets and driveways.

In addition to pavement markings, high visibility LED signage can be utilized to identify pedestrian crossing areas. It should be noted that the high visibility signage could be used with any of the pedestrian accommodation options.

High Visibility Signage

RAISED MEDIANS

Raised medians provide a pedestrian refuge area as shown in the photograph to the right. Providing raised medians between opposing vehicular traffic flows allows pedestrians to cross each traffic stream independently, ultimately improving pedestrian safety. Isolated raised medians also provide a visual queue for drivers to be aware of potential pedestrian activity. The medians can be constructed entirely of concrete or they can include vegetation or landscaping behind the curb. It is recommended that during design of a raised median for enhanced pedestrian accommodations special consideration is given to proposing vegetation or landscaping that will not impair the visibility of a pedestrian. The benefit of angling the median refuge cut for pedestrians (as shown in the photo to the right) is that it forces them to face towards traffic when crossing the street from either direction.

Pedestrian Crossing with Raised Median for Two-Stage Gap Acceptance

COLORED CONCRETE CROSSWALKS

Colored Concrete Crosswalk

Another crosswalk enhancement is utilizing colored concrete to mark the crosswalk as shown in the photograph below. Colored concrete provides a visual cue to motorists to be aware of potential pedestrian activity. When used consistently throughout a community at either high pedestrian traffic areas or at areas with pedestrian safety concerns, they are quite effective in providing added emphasis on pedestrian safety. If colored pavers are desired for crosswalks, care must be taken to ensure that the crosswalk surfaces are flat and even; uneven surfaces are very challenging to use for those with visual or physical disabilities.

RAISED PEDESTRIAN CROSSWALK

A third option for enhanced pedestrian accommodations is a raised pedestrian crosswalk as shown in the photograph to the right. Raised pedestrian crosswalks can be used as traffic calming devices causing drivers to reduce their speeds to cross the crosswalk. Designs of the raised pedestrian crosswalks vary from a gradual rise to a noticeable grade difference depending on the proposed location of the crosswalk. Depending on the design of the raised pedestrian crosswalk, traffic capacity will not be negatively impacted by the installation of a raised crosswalk.

Raised Crosswalk

INTERNALLY ILLUMINATED LED CROSSINGS WITH PHOTOELECTRIC BOLLARDS

Internally illuminated LED crossings with photoelectric bollards are another option to enhance pedestrian accommodations. The photo below shows an activated internally illuminated crossing. The in-roadway lights are directly in the driver's line of sight and are only illuminated when activated so the drivers know when pedestrians are present. Guidance for the installation of in-roadway lights is provided in Chapter 4 of the *Manual of Uniform Traffic Control Devices*.

There are multiple options for activating the lights. One option, photoelectric bollards (shown below), detect pedestrians when the pedestrians pass through the bollards so no action is necessary by the pedestrian to illuminate the crosswalk lights. Other options include pedestrian push-button as described in the next section.

Internally Illuminated Crosswalk

Photoelectric Bollards

RECTANGULAR RAPID FLASHING BEACONS

An option for a flashing beacon is the LED Rectangular Rapid Flashing amber Beacons (RRFB). These devices are solar-powered, radio controlled, pedestrian activated and mounted under pedestrian crosswalk warning signs. Experimentation with these signs in the City of St. Petersburg, Florida at numerous midblock crossing locations on four-lane roadways determined their benefit with regard to motorist yielding to pedestrians. The results have been impressive, with motorists yielding to crossing pedestrians over 82 percent of the time at locations with the RRFB, compared to an average of only 11 percent with side mounted round flashing beacons. With the success of the implementation in St. Petersburg and other locations around the country, the RRFB has earned interim approval from FHWA for inclusion in the MUTCD.

Installed on roadside poles, the RRFB remains dark until a pedestrian activates the system by pressing a push-button. Once the system is activated, rapidly flashing amber beacon lights provide a bright warning to motorists. The system also provides an additional flashing amber light indicating to the pedestrian that the beacon lights are flashing.

Crosswalk with Rectangular Rapid Flashing Beacons

Rectangular Rapid Flashing Beacon

The following locations have been identified as potential locations for enhanced pedestrian accommodations. It should be noted that raised medians are the preferred mid-block pedestrian crossing improvement since medians provide improved crossing capacity with two-stage gap acceptance. Although, some locations conflict with streets and driveways necessitating the need for prohibiting certain left-turn movements. These locations should be evaluated to determine the appropriate enhancement to be utilized. The evaluation may determine that a mid-block location identified below does not need enhanced pedestrian accommodations and/or it may identify an alternative location.

ASBURY ROAD

- The addition of a mid-block pedestrian crossing between St. John Drive and Bonson Road

  This location was chosen to connect the residential development north and south of Asbury Road. The proposed location is mid-way between NW Arterial and JFK Road. Additionally, pedestrians destined to points south can use St. John Drive to Hillcrest Road, travel east two blocks to Key Way Drive and reach Pennsylvania Avenue.

- Asbury Road/JFK Road
- Asbury Road/Carter Road
- The addition of a mid-block pedestrian crossing between Gilby Road and Mullen Road
  - This location was chosen to connect the residential development south of Asbury Road to Emmaus Bible College and Emmaus baseball field located east of the college.
- Asbury Road/Relocated Clarke Drive
  - Note: Clarke Drive has been identified as an alternative downtown bicycle route by Tri-State Trail Vision
- Asbury Road/St. Ambrose Street

PENNSYLVANIA AVENUE

- Pennsylvania Avenue/Hempstead High School Bus Exit
- Pennsylvania Avenue/Hempstead High School Entrance
- Pennsylvania Avenue/JFK Road
- The addition of a raised median pedestrian crossing at Pennsylvania Avenue/Marmora Avenue
  - This location was chosen to connect the residential development south of Pennsylvania Avenue to Flora Park. It is recommended the crossing be constructed to prohibit the left-turn movement to/from Marmora Avenue. Additionally, the eastbound left-turn movement into the drive east of Marmora Avenue should be prohibited with the installation of a raised median.

- Existing Irving Elementary School signalized pedestrian crossing

UNIVERSITY AVENUE OVERLAP SECTION

- Pennsylvania Avenue/University Avenue Roundabout
- Asbury Road/University Avenue Roundabout
- Loras Boulevard/University Avenue Roundabout

UNIVERSITY AVENUE

- University Avenue/Delhi Street
  - Note: Delhi Street has been identified as an alternative downtown bicycle route by Tri-State Trail Vision

- University Avenue/Grandview Avenue
  - It is recommended that the pedestrian treatments applied to this intersection be consistent with the pedestrian treatments selected at Loras Avenue/Grandview Avenue given the short intersection spacing and potential for linked movements between the intersections

.

- University Avenue/Booth Street location of trail vision alternate bike route to downtown
  - Note: Booth Street has been identified as an alternative downtown bicycle route by Tri-State Trail Vision

LORAS BOULEVARD

- Loras Boulevard/Grandview Avenue
- Loras Boulevard/Adair Street
  - Note: Adair Street has been identified as an alternative downtown bicycle route by Tri-State Trail Vision

- Loras Boulevard/Alta Vista Street
  - Note: Alta Vista Street has been identified as an alternative downtown bicycle route by Tri-State Trail Vision

- The addition of a mid-block pedestrian crossing between Walnut Street and Prairie Street
  - This location was chosen to connect the residential development south of Loras Boulevard to Loras College. Consideration should be given to the installation of a raised median pedestrian crossing near Prairie Street constructed such that the left-turn movement to/from Prairie Street is prohibited.

ASBURY ROAD WEST OF NORTHWEST ARTERIAL

- Asbury Road/Seippel Road
- Asbury Road Springreen Drive
- Asbury Road/Heacock Road
- Existing signalized pedestrian crossing east of Heacock Road
- Asbury Road/Radford Road

RECOMMENDED CONCEPT

Based on the input provided by the Dubuque City Council an overall 2031 design concept was developed for each of the four study corridors. The goals of the concept were to provide operational and safety improvements and enhance pedestrian and bicycle accommodations while minimizing right of way acquisitions. Due to the minimal right of way available in the University Avenue overlap area and the traffic operational issues, major right of way impacts were considered. Selected right of way impacts were also considered at spot locations for localized improvements. Additionally, Complete Streets design elements were considered and bicycle accommodations were incorporated into the concept for each corridor. This concept sought to maintain an adequate level of operating efficiency with the following improvements:

- Asbury Road: 3-lane cross section from NW Arterial to University Avenue
- Pennsylvania Avenue: 5-lane cross section from NW Arterial to Hempstead High School
- Pennsylvania Avenue: 3-lane cross section east of Hempstead High School to University Avenue
- University Avenue Overlap Section: 5-lane cross section from Pennsylvania Avenue to Loras Boulevard
- Asbury Road west of Northwest Arterial: 3-lane cross section

The recommended concepts are shown in ***Figures 5-8*** through ***5-23***. Additionally, the recommended geometrics including proposed storage bay lengths are shown in ***Figures 4-3*** and ***4-4***. The recommended storage bay lengths were verified through the simulation analysis described in Chapter 4. An overview of the preferred concept improvements are shown in ***Figure 5-1***.

FIGURE 5-1. PREFERRED CONCEPT OVERVIEW

ASBURY ROAD

Asbury Road serves primarily residential property with some commercial development including Emmaus Bible College. The current cross section of Asbury Road varies between a two-lane undivided and three-lane (one lane in each direction and a center two-way left-turn lane) cross section. Some on-street parking exists along the corridor, primarily near University Avenue.

The primary recommended cross sections for Asbury Road are shown in *Figures 5-2A*, *5-2B* and *5-2C*. Elements of the typical cross section do vary at some locations. The recommended cross sections for the entire length of the corridor are shown in *Figures 5-8* through *5-12*. Dedicated bicycle lanes are proposed for the entire length of the corridor except at three locations:

- Approximately 250 feet east and west of the JFK Road intersection (both directions)
- Between realigned Hillcrest Road and realigned Clarke Drive (eastbound direction only)
- Between Green Street and University Avenue (both directions)

Shared lanes with sharrows (described in the Complete Streets Considerations section of this chapter) are proposed at these three locations. All existing parking west of Green Street along Asbury Road would need to be removed to accommodate the bicycle lanes or shared lanes and the center two-way left-turn lane where it does not exist today. On-street parking east of Green Street would remain. All businesses and residences were reviewed to determine if off-street or side street parking was available in locations where on-street parking removal is being proposed. It was determined that all properties have access to off-street or side street parking in locations where on-street parking removal is being proposed.

Figure 5-2A. Asbury Road Proposed Cross Section

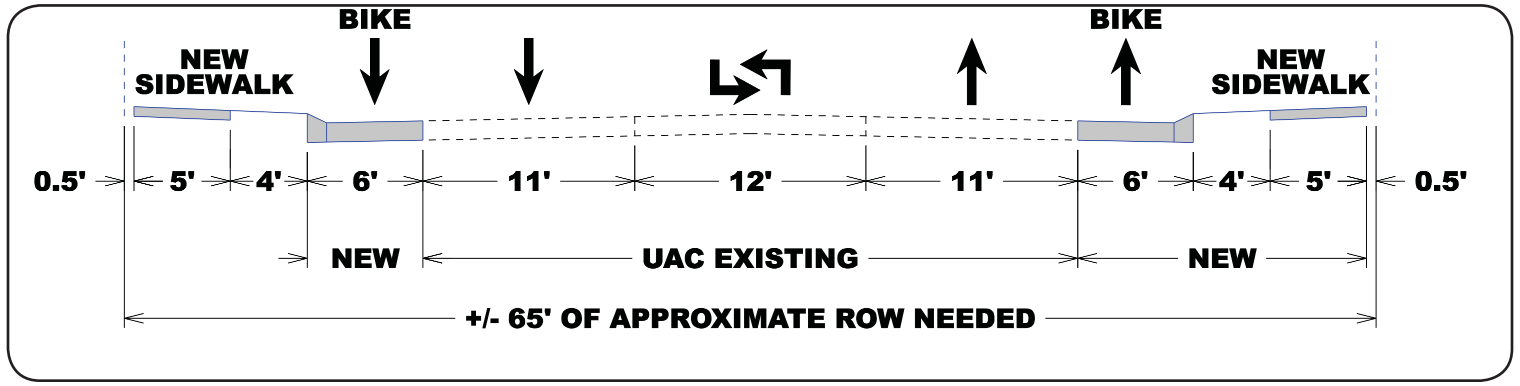


Figure 5-2B. Asbury Road Proposed Cross Section from Hillcrest Road to Clarke Drive

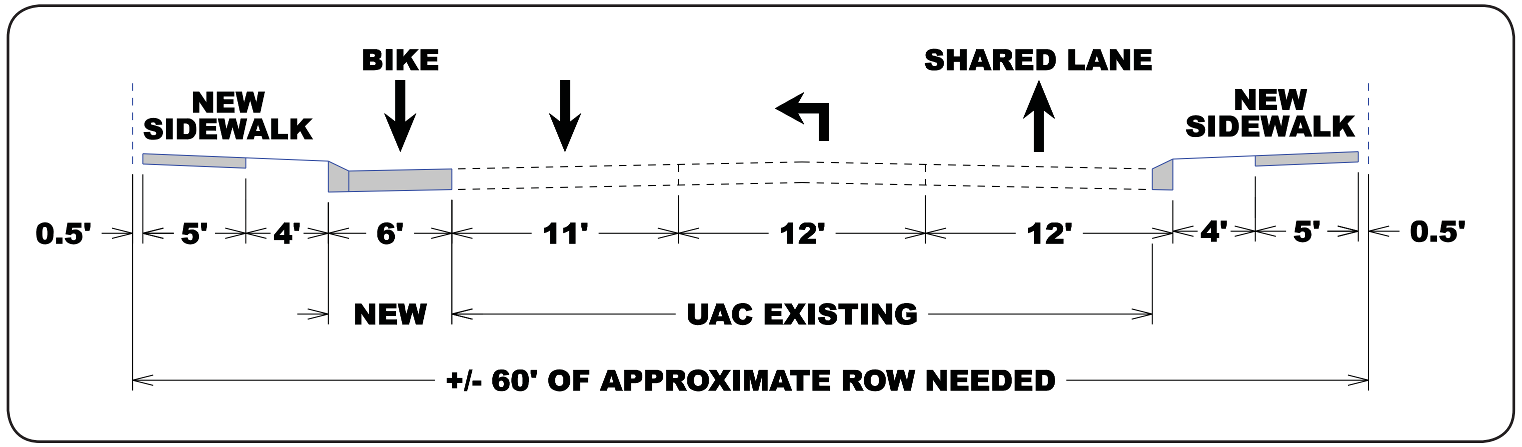
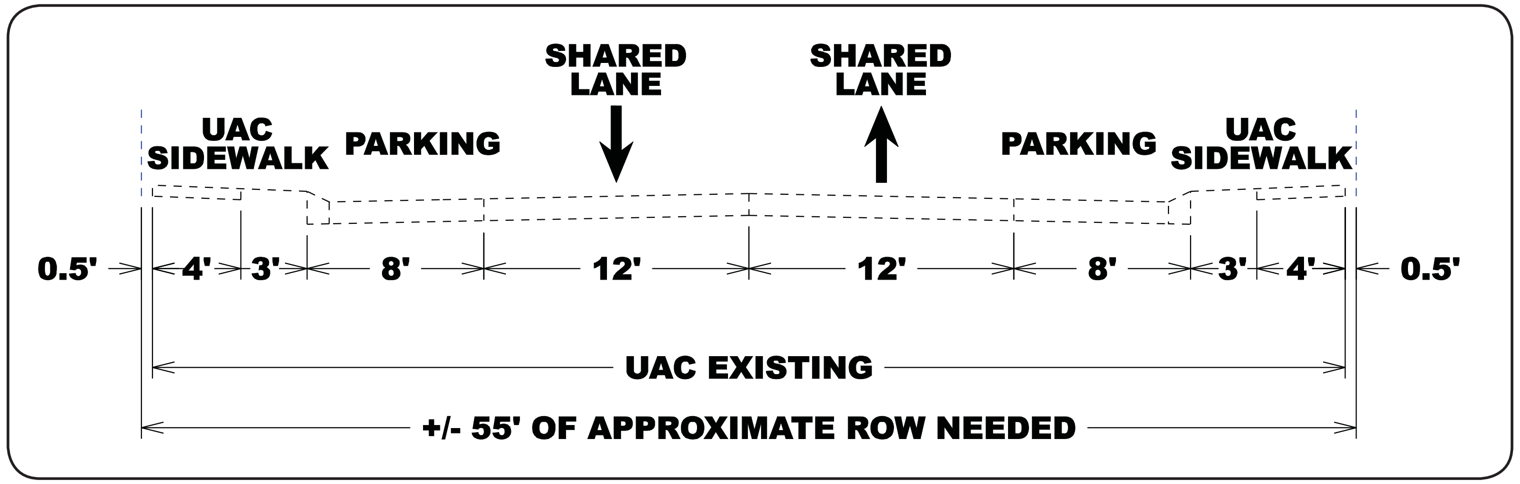


Figure 5-2C. Asbury Road Proposed Cross Section from Green Street to University Avenue



For cost estimation purposes it was assumed that pavement would be removed and reconstructed from the curb to the point where the bicycle lanes would begin in areas of pavement widening unless otherwise noted. The remaining pavement would be milled and the corridor would be overlaid with asphalt providing a template correction to reset the crownline.

The proposed typical section for Asbury Road includes widening the existing roadway pavement and installing 5-foot sidewalks on each side setback 4 feet from the back of curb. Pavement widening was assumed to occur on both sides. During the preliminary design phase, consideration should be given to holding the existing curb line and widening only to one side if existing features warrant. Specifically, it might be preferable to hold the south curb line of Asbury Road from about 1,000 feet west of JFK Road to JFK Road to minimize reconstruction of multiple curb returns. This would result in the need to acquire right of way on the north side.

There are two options for bicycle accommodations in the vicinity of the JFK Road intersection. The dedicated bicycle lanes could extend through the intersection; however this would require an additional 8 feet of right of way for approximately 200 feet east and west of JFK Road. This would impact parking stalls for the business in the southwest corner of the intersection. The right of way needs could be reduced if the sidewalk setback between the sidewalk and curb was eliminated. The second option for accommodating bicycles through the JFK Road intersection would be to end the dedicated bicycle lanes approximately 200 feet from JFK Road and provide sharrows in the through lane through the intersection. The latter option was selected and is shown in ***Figure 5-9***.

The proposed Asbury Road concept would impact the parking lot of the business property located in the southeast quadrant of Asbury Road/Carter Road. Consideration should be given to closing the two business driveways onto Asbury Road between Carter Road and Avalon Road. Parking for this business is located west of the business and driveways exist on the east side of the business. Additionally, on-street parking is available on Avalon Road as shown in ***Figure 5-10***.

The recommended Asbury Road concept shown in ***Figures 5-8*** through ***5-12*** would result in 7 full property acquisitions.

Hillcrest Road, Clarke Drive/Wilbricht Lane Realignment

Another recommended improvement to Asbury Road is the realignment of:

- Hillcrest Road
- Clarke Drive
- Wilbricht Lane

Hillcrest Road and Clarke Drive serve as collector roads. A linked movement exists between the two roadways. Vehicles were observed to turn right from Hillcrest Road and Clarke Drive onto Asbury Road and immediately turn left onto Clarke Drive and Hillcrest Road, respectively. Hillcrest Road and Clarke Drive are less than 200 feet apart. The proposed realignment of these two collectors would result in an approximately 600-foot spacing, creating room for left-turn storage lanes as shown in ***Figure 5-11***.

Hillcrest Road would intersect Asbury Road creating a four-legged two-way stop controlled intersection with an existing driveway north of Asbury Road. Left-turn lanes would be provided along Asbury Road. Clarke Drive and Wilbricht Lane would be realigned to create a four-legged signalized intersection. Left-turn lanes would be provided on all four intersection approaches. The proposed realignment of Hillcrest Road, Clarke Drive and Wilbricht Lane would result in 4 full property acquisitions. These acquisitions are included in the total Asbury Road acquisitions noted previously.

St. Ambrose Street Realignment, Asbury Road Curve Modification

In addition to the realignment of Hillcrest Road, Clarke Drive and Wilbricht Lane, the realignment of St. Ambrose Street at Asbury Road is recommended. The St. Ambrose Street intersection is signalized today and currently serves residential property and St. Anthony's Church and School. St. Ambrose Street intersects Asbury Road at approximately 50 degrees on a sharp curve. It is recommended that St. Ambrose Street be realigned to intersect Asbury Road at 90-degree angle. Additionally, it is recommended that Asbury Road be reconstructed through this area to improve the geometry of the roadway. The current design speed for the curve is 20 mph. It is recommended that Asbury Road be redesigned with a 510-foot radius curve to accommodate a 35 mph design speed. Both of these modifications would improve driver expectancy and ultimately safety at the intersection. Modifying the Asbury Road curve at this location may improve safety for cyclists since motorists have the potential to drift into the dedicated bicycle lane in this area without the recommended improvement.

The improved intersection of St. Ambrose Street with Asbury Road would reduce the intersection spacing of Poplar Street to approximately 80 feet. Given this undesirable intersection spacing and the other access options for the two homes that front Poplar Street, it is recommended that Poplar Street be closed from Asbury Road and a cul-de-sac be constructed at the north end of Poplar Street. The recommended geometric improvements are shown in ***Figure 5-12***.

In addition to geometric improvements in this area, this location has been identified as a location where enhanced pedestrian accommodations should be considered as noted in the Complete Streets Pedestrian Accommodations section of this chapter. Options to consider include high visibility pavement markings, colored concrete or a median island on the east approach. The recommended realignment of St. Ambrose Street and curve modification on Asbury Road would result in 3 full property acquisitions. These acquisitions are included in the total Asbury Road acquisitions noted previously.

PENNSYLVANIA AVENUE

Pennsylvania Avenue serves primarily residential development with some commercial development and a recreational area, Flora Park. Additionally, two schools are located on Pennsylvania Avenue including Hempstead High School and Irving Elementary School. High pedestrian activity occurs near the schools and Flora Park. These locations were identified as locations where enhanced pedestrian accommodations should be considered as noted in the Complete Streets Pedestrian Accommodations section of this chapter.

Prior to this study the cross section of Pennsylvania Avenue in the vicinity of Hempstead High School consisted of a four-lane undivided facility. In 2007, a pedestrian fatality occurred in this area. As a result, the cross section of Pennsylvania Avenue was converted into a three-lane cross section with one through lane in each direction and a center two-way left-turn lane. Pennsylvania Avenue elsewhere in the study area varies between a two-lane undivided and three-lane cross section. On-street parking exists at some locations along the south side of the corridor.

The primary recommended cross sections for Pennsylvania Avenue are shown in *Figures 5-3A* and *5-3B*. Elements of the typical cross section do vary at some locations. The recommended cross sections for the entire length of the corridor are shown in *Figures 5-13* through *5-16*. Dedicated bicycle lanes are proposed for the entire length of the corridor except at two locations:

- Between Northwest Arterial and just west of Vizaleea Drive
- Near the University Avenue roundabout

Shared lanes with sharrows (described in the Complete Streets Considerations section of this chapter) are proposed at these locations. All existing parking along Pennsylvania Avenue would need to be removed to accommodate the bicycle lanes or shared lanes and the center two-way left-turn lane where it doesn't exist today. All businesses and residences were reviewed to determine if off-street or side street parking was available in locations where on-street parking removal is being proposed. It was determined that all properties have access to off-street or side street parking in locations where on-street parking removal is being proposed.

Figure 5-3A. Pennsylvania Avenue Proposed Cross Section East of Hempstead High School

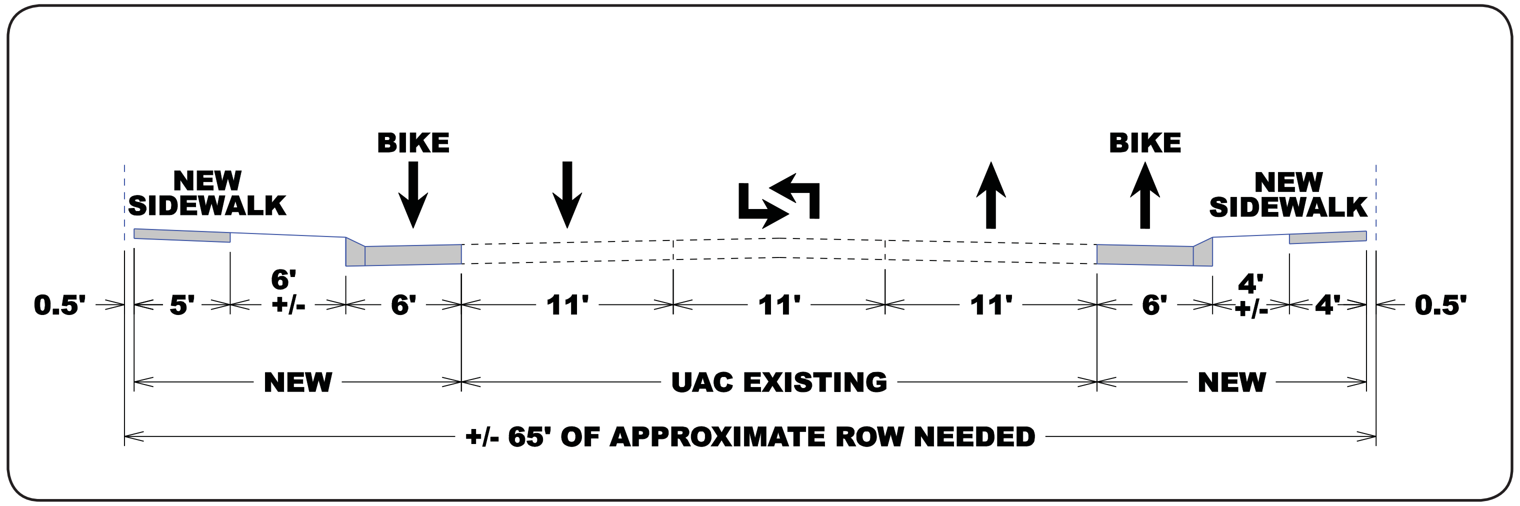
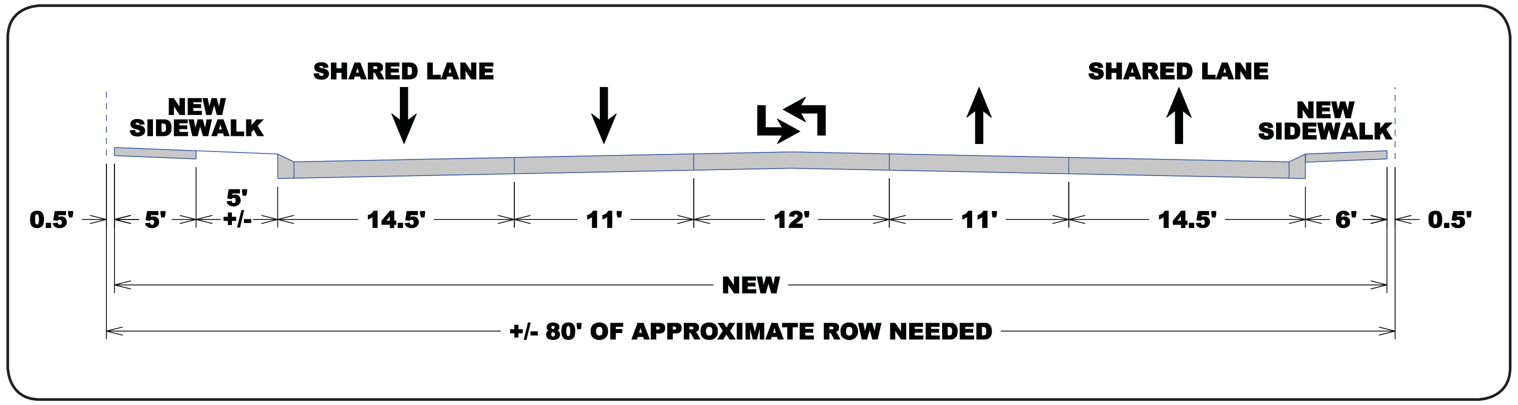


Figure 5-3B. Pennsylvania Avenue Proposed Cross Section from NW Arterial to Hempstead High School



Partial right of way impacts would occur on the south side of Pennsylvania west of Hempstead High School to convert the corridor to a five-lane cross section. Construction of a five-lane cross section would improve the existing bottleneck that occurs in this area as documented in the existing conditions analysis (Chapter 3). No sidewalk setback between the sidewalk and curb are proposed in this area to minimize right of way impacts. Further east of this location, a retaining wall is proposed south of the Hempstead High School baseball field due to grade differences.

The sidewalk along the corridor varies from having a sidewalk setback to being directly behind the curb depending on the available right of way. Near the JFK Road intersection the sidewalks are proposed to be directly behind the curb. Additional proposed modifications to the JFK Road intersection include dedicated right-turn lanes on the northbound, southbound, and eastbound intersection approaches.

Near Van Buren a point of inflection without a curve exists on Pennsylvania Avenue. It is recommended that this lane shift is lengthened utilizing a 20:1 taper rate to meet criteria. The recommended geometric improvements are shown in *Figure 5-15*.

Near Marmora Avenue a curve exists that does not meet criteria. It is recommended that the Pennsylvania Avenue alignment be shifted north and the curve be redesigned with a 350-foot radius to accommodate a 30 mph design speed. Shifting Pennsylvania Avenue to the north would not impact parking to the business in the southwest corner of the intersection. The recommended geometric improvements are shown in *Figure 5-16*.

For cost estimation purposes, it was assumed that full reconstruction would be necessary on Pennsylvania Avenue due to potential elevation differences for implementation of the proposed five-lane section from Hempstead High School to NW Arterial. Elsewhere, it was assumed that pavement would be removed and reconstructed from the curb to the point where the bicycle lanes would begin unless otherwise noted. The remaining pavement would be milled and the corridor would be overlaid with asphalt providing a template correction to reset the crownline depending on construction date given the good existing pavement condition of Pennsylvania Avenue.

The recommended Pennsylvania Avenue concept shown in *Figures 5-13* through *5-16* would not result in any full property acquisitions.

UNIVERSITY AVENUE OVERLAP SECTION

Each of the study corridors meet at the University Avenue Overlap section. Pennsylvania Avenue and Asbury Road begin at University Avenue and extend west. Loras Boulevard begins at University Avenue and extends east to downtown Dubuque. Given each of these corridors share this section of roadway, the University Avenue Overlap section is heavily used and is a major bottleneck today and will be in the future without major improvements.

The University Avenue Overlap section currently serves primarily commercial development with some residential properties located west of Asbury Road. The University of Dubuque is located in the southeast corner of the intersection of University Avenue with Loras Boulevard.

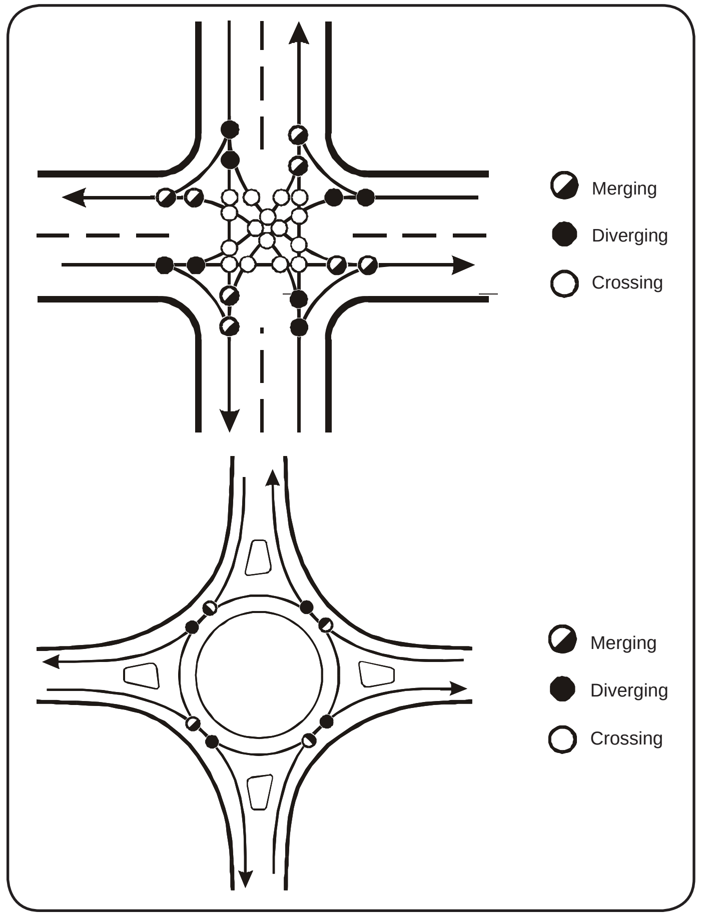
Two concepts were initially considered for the University Avenue Overlap section including a series of signalized intersections and roundabouts. Since the City of Dubuque does not currently have any roundabouts special consideration was given to the benefits and disadvantages of roundabouts. The following section provides background information on modern roundabouts compared to signalized intersections.

Roundabouts versus Signalized Intersections

A modern roundabout is a roadway junction where vehicles circulate counterclockwise around a center island. There are several benefits to the installation of a roundabout compared to a signalized intersection including:

- Safety
- Sustainability
- Reduction in off-peak delay
- Long-term maintenance cost savings

A typical four-legged intersection has 32 conflict points whereas a modern single-lane roundabout has only 8 conflict points. In addition to fewer potential crash locations, circulating traffic in a roundabout operate at slower speeds than vehicles passing through a signalized intersection. The slower speeds and directional circulation offer safety benefits including less severe crashes. Right-angle crashes are eliminated and the typical roundabout crashes that occur are sideswipes which result in fewer fatalities and injury crashes than other crash types. Additionally, the slower speeds and single direction circulation make it easier for younger and elderly drivers to enter the traffic stream and appropriately judge adequate gaps in the circulating traffic. Although the number of conflict points increases from a single-lane to a multi-lane roundabout, the relative number of conflict points remains substantially lower compared to a signalized intersection.



Single-approach Intersection and Roundabout Conflict Points

Not only are roundabouts safer for drivers, but roundabouts offer safety benefits for pedestrian and bicycle traffic. Roundabouts are designed to have splitter islands dividing vehicles entering and exiting the roundabout at each approach. The divider islands offer pedestrians a refuge when crossing the street allowing pedestrians to cross each direction of traffic independently. Cyclists can either dismount and cross as pedestrians or they can enter the roundabout as non-motorized vehicles. The slow circulating speeds of roundabouts are more cyclist friendly than signalized intersections.

One of the benefits of roundabouts is sustainability. Since roundabouts allow continuous vehicular flow, vehicle emissions are lower for roundabouts compared to signalized intersections. Additionally, as noted previously, roundabouts are typically safer for all modes of traffic including pedestrian and bicycle traffic as well as vehicular traffic.

Roundabouts are yield controlled which results in minimal vehicular delay during uncongested time periods. Initial costs for the installation of roundabouts are typically higher than signalized intersections due to the need for additional right of way, but roundabouts offer improved long-term maintenance costs compared to signalized intersections and typically cost less over time.

A few disadvantages of roundabouts include:

- Heavy vehicles may need to utilize both lanes of traffic when traversing multilane roundabouts
- Emergency vehicles are required to reduce their speed when passing through roundabouts regardless of time of day ; however, the slowing required to negotiate a roundabout typically represents a negligible impact on total emergency vehicle travel time (and it's noted that emergency vehicles typically have to slow on approaches with red signal indications before proceeding through the intersection).
- Vehicles are continuously flowing through roundabouts prohibiting the opportunity to stop vehicular traffic for pedestrians unlike signalized intersections; however, vehicles are moving slow enough that yielding for pedestrians crossing or waiting to cross becomes very easy.

Modern roundabouts that are designed properly with sufficient horizontal deflection and have adequate pavement markings offer several advantages over signalized intersections given the vehicular volumes can be adequately served by a roundabout and the roundabout is geometricly feasible. The traffic operations of a roundabout need to be analyzed with future traffic projections to ensure a roundabout is the best solution. Additionally, other considerations may prohibit the installation of a roundabout including approach grades, right of way constraints or at a location within a network of signalized intersections.

Signalized Intersections Concept

The signalized intersection concept for the University Avenue Overlap section would consist of three signals located at the intersections of University Avenue with:

- Pennsylvania Avenue
- Asbury Road
- Loras Boulevard

University Avenue from Pennsylvania Avenue to Loras Boulevard would consist of a five-lane section including two through lanes and a left-turn lane. Additional improvements would include:

- An additional left-turn lane on Asbury Road (southbound)
- A westbound right-turn lane at the intersection with Asbury Road
- Realignment of Loras Boulevard and McCormick Street to create a four-legged intersection
- An exclusive northbound left-turn lane on McCormick Street

Based on a preliminary review of the parcel data provided by the City in GIS, an estimated 11 properties would need to be acquired with the signalized intersections concept. Additionally, the existing pedestrian signal located west of Loras Boulevard would be removed. This location has been identified as a location where enhanced pedestrian accommodations should be considered as noted in the Complete Streets Pedestrian Accommodations section of this chapter. Operational analysis was utilized as a screening tool and it was determined that the signalized intersections concept would operate comparably with the roundabouts concept. The signalized intersections concept for the University Avenue Overlap section is shown in the appendix. Complete Streets amenities were not incorporated into the preliminary intersections concept.

PREFERRED CONCEPT – ROUNDABOUTS

The roundabouts concept was selected as the preferred concept for several reasons including:

- Improved safety compared to the signalized intersections concept
- Consistent with Dubuque's sustainability goals
- Compatibility with Complete Streets design elements, specifically bicycle accommodations
- Long-term maintenance cost savings

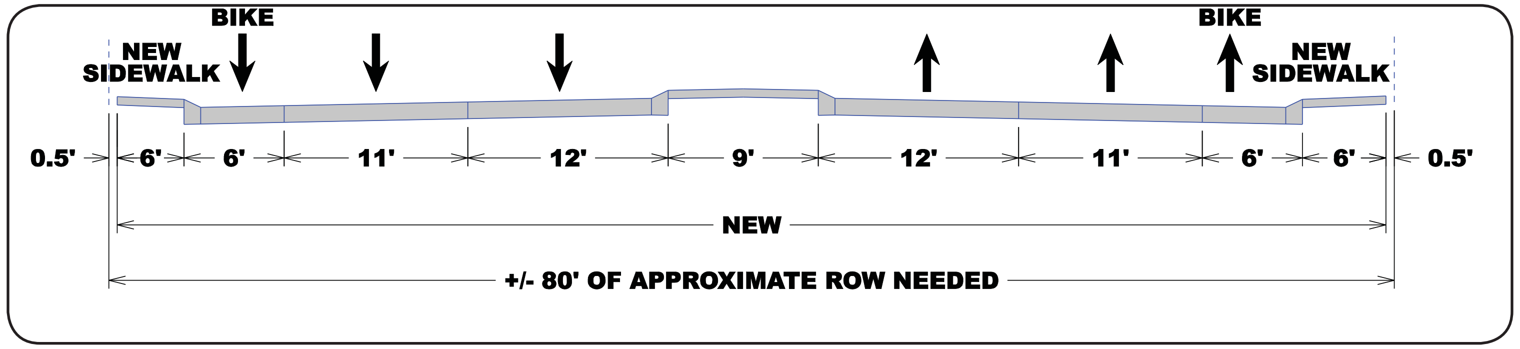
The roundabouts concept for the University Avenue Overlap section would consist of three 150-foot inscribed diameter roundabouts located at the intersections of University Avenue with:

- Pennsylvania Avenue
- Asbury Road
- Loras Boulevard

The roundabouts were designed for 15 to 25 miles per hour circulating speed and 15 miles per hour approach speed.

University Avenue from Pennsylvania Avenue to Loras Boulevard would consist of a four-lane divided section with two through lanes and a center raised median. This cross section would result in right-in/right-out access for streets and driveways on University Avenue within this section. Additionally, dedicated bicycle lanes would be included along this corridor outside of the roundabouts. Cyclists would be treated as a vehicle within the roundabouts given the low circulating speeds. The recommended cross section is shown in *FIGURE 5-4*. Only one additional improvement would be necessary with the roundabouts concept: an additional approach lane on Asbury Road (southbound).

FIGURE 5-4. UNIVERSITY AVENUE OVERLAP SECTION PROPOSED CROSS SECTION



Based on a preliminary review of the parcel data provided by the City in GIS, an estimated 15 properties would need to be acquired with the roundabouts concept. Additionally, the existing pedestrian signal located west of Loras Boulevard would be removed. Pedestrians would be accommodated at the Loras Boulevard roundabout. This location has been identified as a location where enhanced pedestrian accommodations should be considered as noted in the Complete Streets Pedestrian Accommodations section of this chapter. Consideration should be given to closing the driveway north of Loras Boulevard near the proposed roundabout to improve safety.

Enhanced pedestrian accommodations are also recommended at the Pennsylvania Avenue roundabout given the intersection is frequently utilized by students of Irving Elementary School. A school crossing guard at this location is recommended to ensure the elementary-age children can safely cross the roadway. Information on how to safely cross a roundabout should be provided to parents and students of the school during orientation and properly crossing the roundabout should be a part of the safe walk to school prior to school commencing in the fall. Detailed simulation operational analysis was conducted for the roundabouts concept. Details of the analysis are discussed in Chapter 4.

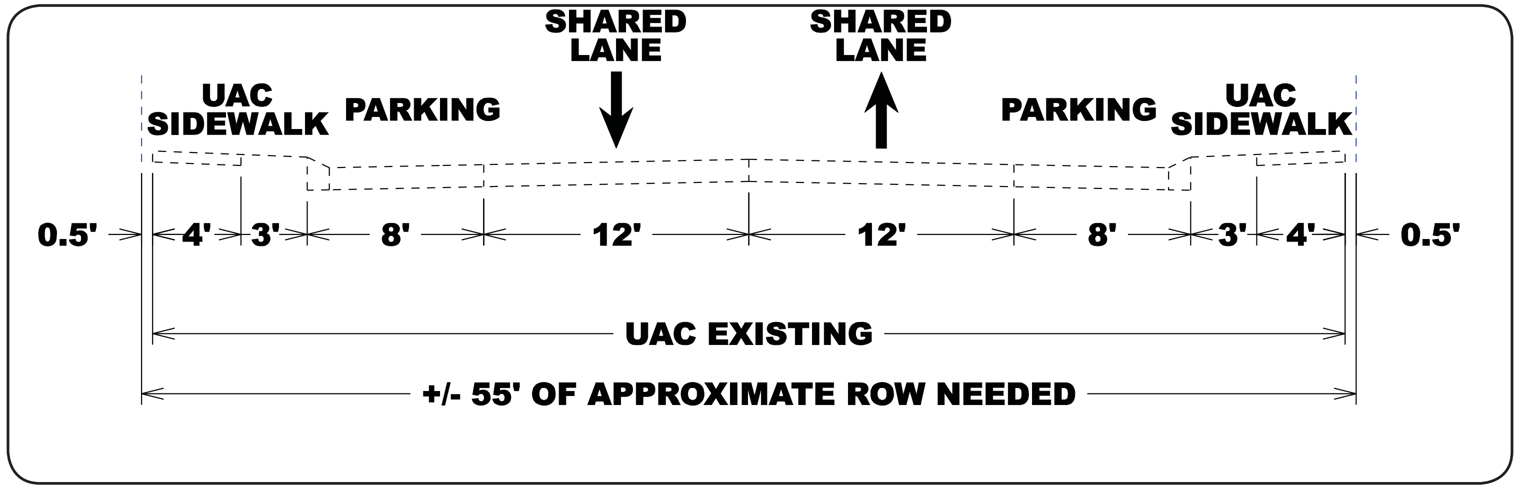
It should be noted that supplemental lighting should be installed at the proposed roundabouts. Cameras can also be installed if desired. The recommended University Avenue Overlap section concept is shown in *FIGURE 5-17.*

UNIVERSITY AVENUE EAST OF LORAS BOULEVARD

University Avenue east of Loras Boulevard serves primarily residential property with some commercial development including the University of Dubuque and a recreational area, Henderson Memorial Park. University Avenue east of Loras Boulevard and west of Hill Street consists of a two-lane undivided cross section with on-street parking.

The primary recommended cross section for University Avenue east of Loras Boulevard and west of Booth Street is shown in *Figure 5-5*. The on-street parking component of the typical cross section varies. The recommended cross sections for the entire length of the corridor are shown in *Figures 5-18* and *5-19*. Shared lanes with sharrows (described in the Complete Streets Considerations section of this chapter) are proposed west of Booth Street. Based on input from Tri-State Trail Vision Booth Street was identified as a potential future bicycle route to downtown given the grades that exist along University Avenue east of Booth Street. No modifications or recommendations east of Booth Street are being proposed.

Figure 5-5. University Avenue Proposed Cross Section east of Loras Boulevard



All existing on-street parking would remain except near the Grandview Avenue intersection. It is recommended that on-street parking be removed within 200 feet of the intersection, left-turn lanes be added on all four intersection approaches and the intersection be signalized in the future. All businesses and residences were reviewed to determine if off-street or side street parking was available where on-street parking removal is being proposed. It was determined that all properties have access to off-street or side street parking in locations where on-street parking removal is being proposed.

The recommended University Avenue concept east of Loras Boulevard shown in *Figures 5-18* and *5-19* would require 1 property acquisition.

Delhi Street Realignment

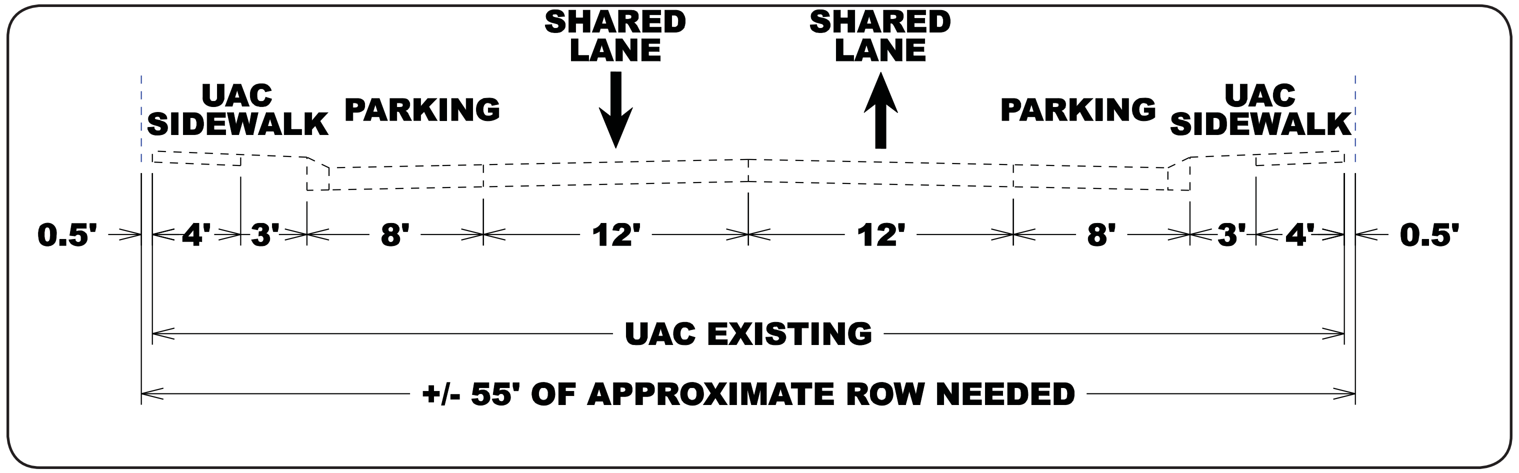
In addition to signalizing the intersection Grandview Avenue with University Avenue, the realignment of Delhi Street at University Avenue is recommended. The existing intersection of Delhi Street with University Avenue meets at a skew causing eastbound University Avenue through vehicles to veer to the left to stay on University Avenue. It is recommended that Delhi Street be realigned to intersect University Avenue at 90-degree angle to improve driver expectancy and safety. Based on a preliminary review of contours near the study intersection it was determined that the proposed improvement would result in a 7 to 9 percent grade on Delhi Street. While this grade is not ideal, it is preferred to the skewed intersection that exists today. The recommended realignment of Delhi Street would result in 1 full property acquisition. This acquisition is the only acquisition on the University Avenue corridor east of Loras Boulevard .

LORAS BOULEVARD

Loras Boulevard serves primarily residential property including multi-family units with some commercial development including Loras College and a recreational area, Henderson Memorial Park. High pedestrian activity occurs near Loras College. This location was identified as a location where enhanced pedestrian accommodations should be considered as noted in the Complete Streets Pedestrian Accommodations section of this chapter. The current cross section of Loras Boulevard varies between a two-lane undivided and three-lane (one lane in each direction and a center two-way left-turn lane) cross section. On-street parking exists at several locations along the corridor.

The primary recommended cross section for Loras Boulevard west of Alta Vista Street is shown in *Figure 5-6*. The on-street parking component of the typical cross section varies. The recommended cross sections for the entire length of the corridor are shown in *Figures 5-18* and *5-19*. Shared lanes with sharrows (described in the Complete Streets Considerations section of this chapter) are proposed west of Alta Vista Street. Based on input from Tri-State Trail Vision Alta Vista Street was identified as a potential future bicycle route to downtown given the steep grades that exist along Loras Boulevard east of Alta Vista Street. No modifications or recommendations east of Alta Vista Street are being proposed.

Figure 5-6. Loras Boulevard Proposed Cross Section



All existing on-street parking would remain except near the Grandview Avenue intersection. It is recommended that on-street parking be removed within 200 feet of the intersection and left-turn lanes be added on the northbound, southbound and eastbound intersection approaches. All businesses and residences were reviewed to determine if off-street or side street parking was available where on-street parking removal is being proposed. It was determined that all properties have access to off-street or side street parking in locations where on-street parking removal is being proposed.

The proposed Loras Boulevard concept shown in *Figures 5-18* and *5-19* would not require any property acquisitions.

ASBURY ROAD WEST OF NORTHWEST ARTERIAL

Asbury Road west of Northwest Arterial is the primary east-west roadway through the City of Asbury. Residential and commercial development extends to approximately Briarwood Drive. West of Briarwood Drive agricultural land lines Asbury Road with occasional residential development that may have originally been farmsteads. Lower density residential development and a golf course exist within one half mile of Lore Mound Road. Asbury Road is a two-lane undivided roadway within the study area. Limited on-street parking exists east of Hales Mill Road.

Based on available GIS data, there is approximately 66 feet of right of way along the Asbury Road corridor. The primary recommended cross sections for Asbury Road west of Northwest Arterial are shown in *Figure 5-7*. The recommended cross sections for the entire length of the corridor are shown in *Figures 5-20* through *5-23*.

Figure 5-7A. Asbury Road West of Northwest Arterial Proposed Cross Section between Seippel Road and Hales Mill Road

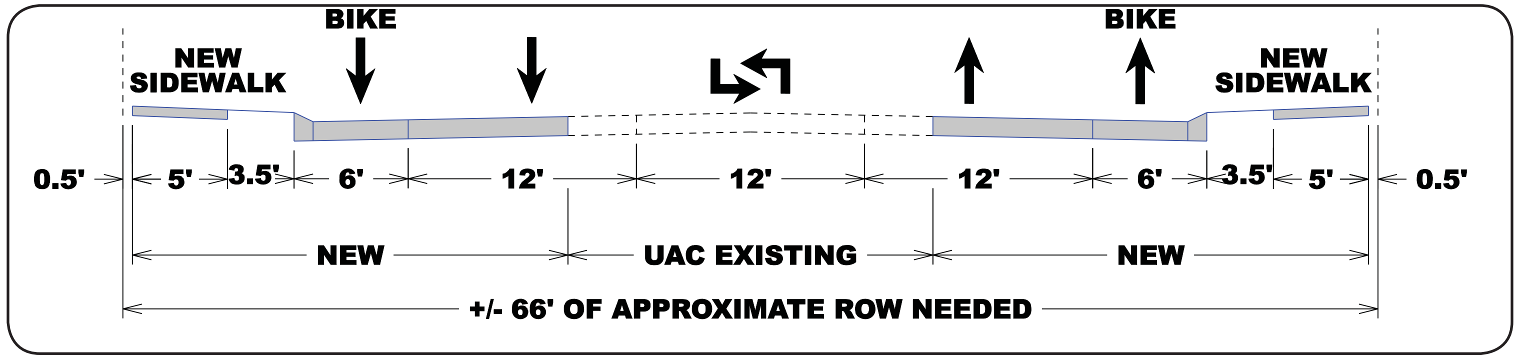
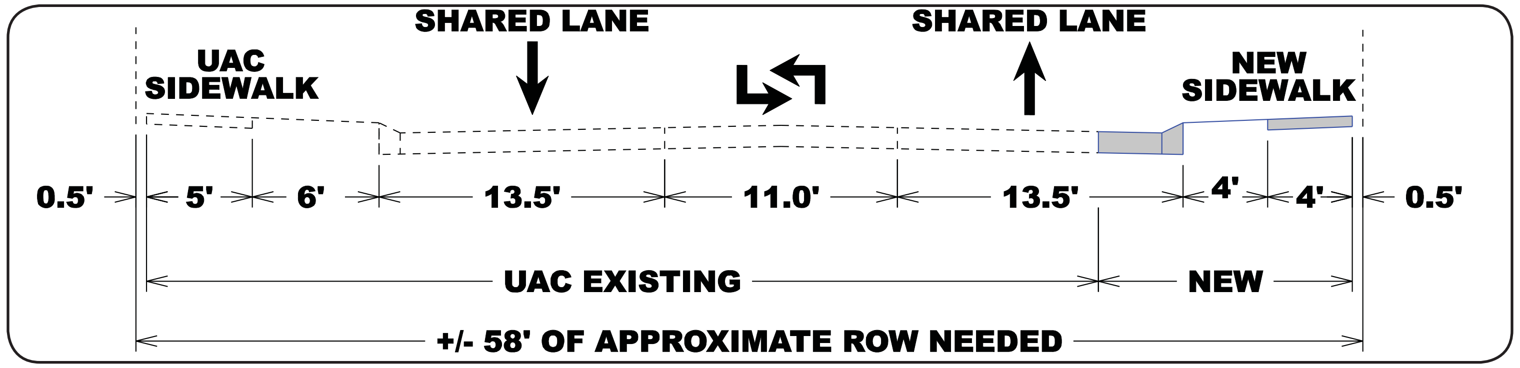


Figure 5-7B. Asbury Road west of Northwest Arterial Proposed Cross Section East of Hales Mill Road



Complete Streets elements including bicycle accommodations were incorporated into the recommended cross sections for Asbury Road. Between Seippel Road and Hales Mill Road dedicated bicycle lanes are recommended. Additionally, it is recommended that two curves within this section of Asbury Road be reconstructed to remove superelevation. Removing superelevation is preferable since the section would be transitioned from a rural section with shoulders to an urban section with curb and gutter. Eliminating superelevation would improve bicycle accommodations along the corridor as well.

West of Seippel Road the proposed three-lane section with dedicated bicycle lanes could be continued depending on future development along this section of the corridor. It is recommended that right of way be reserved along the corridor to construct a three-lane section with dedicated bike lanes and sidewalks. Given the existing rural nature of Asbury Road west of Seippel Road, the roadway shoulders could be paved or a 10-foot shared use path could be constructed west of Seippel Road to accommodate bicyclists until development occurs along the corridor. Designating Asbury Road west of Seippel Road as a shared use facility with sharrows is not recommended given the rural design and higher speeds along this segment of the corridor.

It is recommended that access consolidation and internal circulation roads are incorporated into any future development proposed along Asbury Road in conformance with the *Iowa Statewide Urban Design and Specifications (SUDAS) Manual*. It is recommended that a minimum of 660-foot spacing be used between access points west of Briarwood Drive. Since it is recommended that an access control policy be adopted, it is recommended that improvements to Asbury Road west of Seippel Road be constructed as needed based on development and future traffic needs. Consideration should be given to realigning Hales Mill Road with Radford Road when new development occurs north of Asbury Road in this area.

A three-lane cross section (two through lanes with a center two-way left-turn lane) with sharrows (described in the Complete Streets Considerations section of this chapter) is proposed east of Hales Mill Road. Dedicated bicycle lanes currently exist on Radford Road; however they do not connect to other bicycling facilities. Additionally, providing continuous sidewalks along Asbury Road east of Hales Mill Road is recommended with the three-lane cross section and sharrows. Some sidewalk exists along this segment of Asbury Road, but continuous sidewalks are not provided. Based on discussions with City of Asbury staff, sidewalks will be installed in these locations by fall 2010. The recommended Asbury Road concept west of Northwest Arterial shown in ***Figures 5-20*** through ***5-23*** would not require any full property acquisitions.

COST OF IMPROVEMENTS

The opinions of probable construction cost were prepared based on the determination of selected quantities for the developed design concept for each corridor. Quantities for the proposed roadway improvements were measured directly for pavement removal, new pavement, hot mix asphalt (HMA) overlay, sidewalk, retaining walls, traffic and pedestrian signals, mid-block pedestrian crossings and bicycle lane pavement markings and signage. Additionally, right of way costs were quantified based on partial and full acquisitions. Costs for other items not specifically quantified, such as traffic control, storm sewer, lighting and signing, were estimated based on a review of recent similar construction and accounted for by applying a suitable multiplier to items that were quantified.

Cost summaries for the roadway improvements for Pennsylvania Avenue, University Avenue (including the proposed roundabouts along the overlap section), Loras Boulevard and Asbury Road are shown in ***Table 5-1***.

In addition to the items that were quantified, consideration was given to the cost of enhancing crosswalks utilizing internally illuminated LEDs or speed tables. A vendor for the enhancement was contacted and it was found that based on a 40-foot segment of roadway internally illuminating the crosswalk (1 approach/leg) would cost $14,000 installed. Options that could be included with the illuminated crosswalk and estimated costs include:

- Battery backup ($1,800)
- LED enhanced signs ($900 - $1,300 each)
- Solar power ($4,000 - $5,000)
- Push button activation ($800 - $2,100)
- Photoelectric Bollards ($6,000)
- Pedestrian footpad activation ($5,200)
- Beacons ($200 - $500 each)
- On-site technical support during construction (1 week: $3,600)

The cost of speed tables range from $4,000 to $10,000 each depending on the construction of the table. The range of options for the installation of a speed table includes placing asphalt on the existing roadway to using concrete, colored concrete or pavers.

In addition to the order of magnitude cost of improvements shown in ***Table 5-1***, each project was evaluated based on traffic operations, safety, complete streets accommodations and priority.

TABLE 5-1. IMPROVEMENT PRIORITY SUMMARY INCLUDING APPROXIMATE ORDER OF MAGNITUDE COSTS

	Priority	Traffic Operations	Safety	Complete Streets		2009 Approximate Order of Magnitude Cost[1]
				Bicycle Accommodations	Pedestrian Accommodations	
Asbury Road						
Three-Lane Pavement Markings	○	◒	○	◒	●	$160,000
JFK Road Intersection Turn Lanes	●	◒	◒	●	●	$12,000
Hillcrest Road / Clarke Drive / Wilbricht Lane Realignment	◒	○	○	◒	○	$1,540,000
St. Ambrose Street Realignment	◒	◒	◒	◒	○	$1,050,000
Bicycle Lanes - NW Arterial to East of Mathew John Drive	●	●	●	○	○	$240,000
Bicycle Lanes - East of Mathew John Drive to JFK Road	●	●	●	○	○	$1,070,000
Bicycle Lanes - JFK Road to Carter Road	●	●	●	○	○	$1,170,000
Bicycle Lanes - Carter Road to Hillcrest Road	●	●	●	○	○	$1,140,000
Bicycle Lanes - Wilbricht Lane to St. Ambrose Street	●	●	●	○	○	$460,000
Pennsylvania Avenue						
Three-Lane Pavement Markings	○	◒	○	◒	●	$130,000
JFK Road Intersection Turn Lanes	●	◒	○	●	●	$640,000
NW Arterial to Vizaleea Drive Reconstruction	●	○	○	◒	○	$2,720,000
Bicycle Lanes - Vizaleea Drive to JFK Road	●	●	●	○	○	$600,000
Bicycle Lanes - JFK Road to Van Buren Avenue	●	●	●	○	○	$390,000
Van Buren Intersection Reconstruction	●	●	◒	○	○	$450,000
Bicycle Lanes - Van Buren Avenue to Wisconsin Avenue	●	●	●	○	○	$1,250,000
Marmora Avenue Intersection Reconstruction	●	●	◒	○	○	$250,000
Bicycle Lanes - Marmora Avenue to University Avenue	●	●	●	○	○	$450,000

TABLE 5-1. IMPROVEMENT PRIORITY SUMMARY INCLUDING APPROXIMATE ORDER OF MAGNITUDE COSTS (CONTINUED)

	Priority	Traffic Operations	Safety	Complete Streets		2009 Approximate Order of Magnitude Cost[1]
				Bicycle Accommodations	Pedestrian Accommodations	
University Avenue						
Sharrows - Loras Avenue to Booth Street	○	●	●	◒	●	$32,000
Overlap Section Reconstruction - Roundabouts	○	○	○	○	○	$5,410,000
Grandview Avenue Intersection Improvements	●	○	◒	●	●	$190,000
Delhi Street Realignment	◒	◒	◒	●	●	$510,000
Loras Boulevard						
Sharrows - University Avenue to Alta Vista Street	○	●	●	◒	●	$74,000
Grandview Avenue Intersection Improvements	◒	◒	○	●	●	$190,000
Asbury Road west of Northwest Arterial						
Radford Road Right-Turn Lane	◒	◒	◒	●	●	$300,000
NW Arterial to Resurrection Cemetery	○	◒	◒	○	○	$11,000
Radford Road to Resurrection Cemetery	○	◒	◒	○	○	$10,000
Reconstruction of Curve West of Hales Mill Road	●	◒	●	○	○	$1,250,000
Antler Ridge to Curve Reconstruction	●	◒	○	○	○	$1,100,000
Asbury City Limits to Antler Ridge	●	◒	○	○	○	$1,090,000
City of Dubuque	●	◒	○	○	○	$1,970,000
West of Seippel Road	●	◒	○	○	○	$200,000

[1] Utility relocations and aesthetic treatments not included

Symbol Key:

○ Immediate or High Priority/Short-Term; Significant Traffic Operations Improvements; Significant Safety Improvements; Dedicated Bike Lanes; Enhanced Pedestrian Accommodatio

◒ Moderate Priority; Traffic Operations Improvements; Safety Improvements; Shared Bike Lanes

● Low Priority/Long-Term; No Traffic Operations Improvements; No Safety Improvements; No Bicycle Accommodations Improvements; No Pedestrian Accommodation Improvement

PROJECT SEQUENCING

Each of the recommended improvements associated with the Phase 2 corridor concepts were reviewed to establish a recommended implementation plan. Factors including safety, cost, operational benefit, and perceived public priority were considered in the development of the project implementation plan. Additionally, consideration was given to completing continuous sections of the proposed bicycle accommodations. If the bicycle accommodation improvements are not implemented along an entire corridor, it is recommended that the construction projects be divided at logical terminating points such as a location where the cross section changes including where the bicycle accommodations change from dedicated lanes to sharrows. A summary of the evaluation criteria utilized to establish project sequencing is shown in ***Table 5-1***.

EAST-WEST CORRIDOR RECOMMENDATIONS EAST OF NORTHWEST ARTERIAL

Immediate Recommendations

During this project it was found that some potentially impacted properties were planning improvements, were undeveloped or were available for purchase. It is recommended that every effort be made to coordinate with the owners and/or acquire these properties to reserve the right of way for the proposed improvements even though immediate construction may not be occurring at these locations in the near term. Three locations in particular were identified including:

- Hillcrest Family Services located south of Hillcrest Road is proposing to construct a new chapel in the northwest corner of the existing Wilbricht Lane/Asbury Road intersection.
- Potential improvements to the undeveloped parcel in the northeast corner of the Asbury Road/University Avenue intersection are being planned including an ice cream store with additional tenants.
- A residence is available for purchase near the proposed Delhi Street realignment with University Avenue.

In addition to reserving right of way for future improvements it is recommended that parking be removed where proposed on Asbury Road and Pennsylvania Avenue and the pavement markings be modified to provide a two-way left-turn lane where it doesn't exist today. This recommendation is consistent with long-term plans for 3-laning the corridors and would improve safety as well as add capacity along the corridors. It is recommended that sharrows be applied along Asbury Road and Pennsylvania Avenue until dedicated bicycle lanes can be constructed given the corridors are designated as walk/bike/hike routes in the Tri-State Area: Integrated Walking, Bicycling, Hiking Network Plan – Final Copy. According to Tri-State Trail Vision Asbury Road is one of the highest priority corridors and the addition of sharrows along the corridor would provide warning for drivers that cyclists may be in the roadway. The installation of supplemental bicycle route designation signage is also recommended.

In addition to adding sharrows on Asbury Road and Pennsylvania Avenue, it is recommended that sharrows be added to University Avenue, east of Loras Boulevard to Booth Street, and Loras Boulevard, west of Alta Vista Street, in the near term. These two corridors are also designated as walk/bike/hike routes in the Tri-State Area: Integrated Walking, Bicycling, Hiking Network Plan – Final Copy and identified as high priority corridors by Tri-State Trail Vision. The addition of sharrows to these corridors would improve safety for cyclists.

Highest Priority Improvement

As noted previously, all of the study corridors overlap along a section of University Avenue. This area has been identified as an existing and future bottleneck of the east-west corridor network as shown in the simulation analysis. For these reasons, improving the University Avenue Overlap section was identified as the highest priority project. It is recommended that all three proposed roundabouts be constructed concurrently. Additionally, a major public education plan will need to be executed given that the proposed roundabouts will be the first to be constructed in Dubuque.

Moderate Priority Improvements

The following improvements were identified as moderate priority improvements which will improve safety and have operational benefits.

- Left-turn lane additions on northbound, southbound and eastbound approaches at Grandview Avenue (Loras Boulevard)
- Hillcrest Road, Clarke Drive and Wilbricht Lane realignment (Asbury Road)
- St. Ambrose Street Realignment, Asbury Road curve modification
- Delhi Street realignment (University Avenue)

Low Priority Improvements

- Dedicated bicycle lanes on Asbury Road
- Signalization and left-turn lane additions on at Grandview Avenue (University Avenue)
- Right-turn lane additions or extension at JFK Road (Pennsylvania Avenue)
- Dedicated bicycle lanes on Pennsylvania Avenue
- Five-lane cross section from Hempstead High School west to NW Arterial (Pennsylvania Avenue)

ASBURY ROAD RECOMMENDATIONS WEST OF NORTHWEST ARTERIAL

Recommended improvements along Asbury Road west of the Northwest Arterial were reviewed to determine a recommended implementation plan. The proposed improvements to Asbury Road could be implemented in 3 phases. The recommended sequencing is discussed below.

Immediate Recommendations

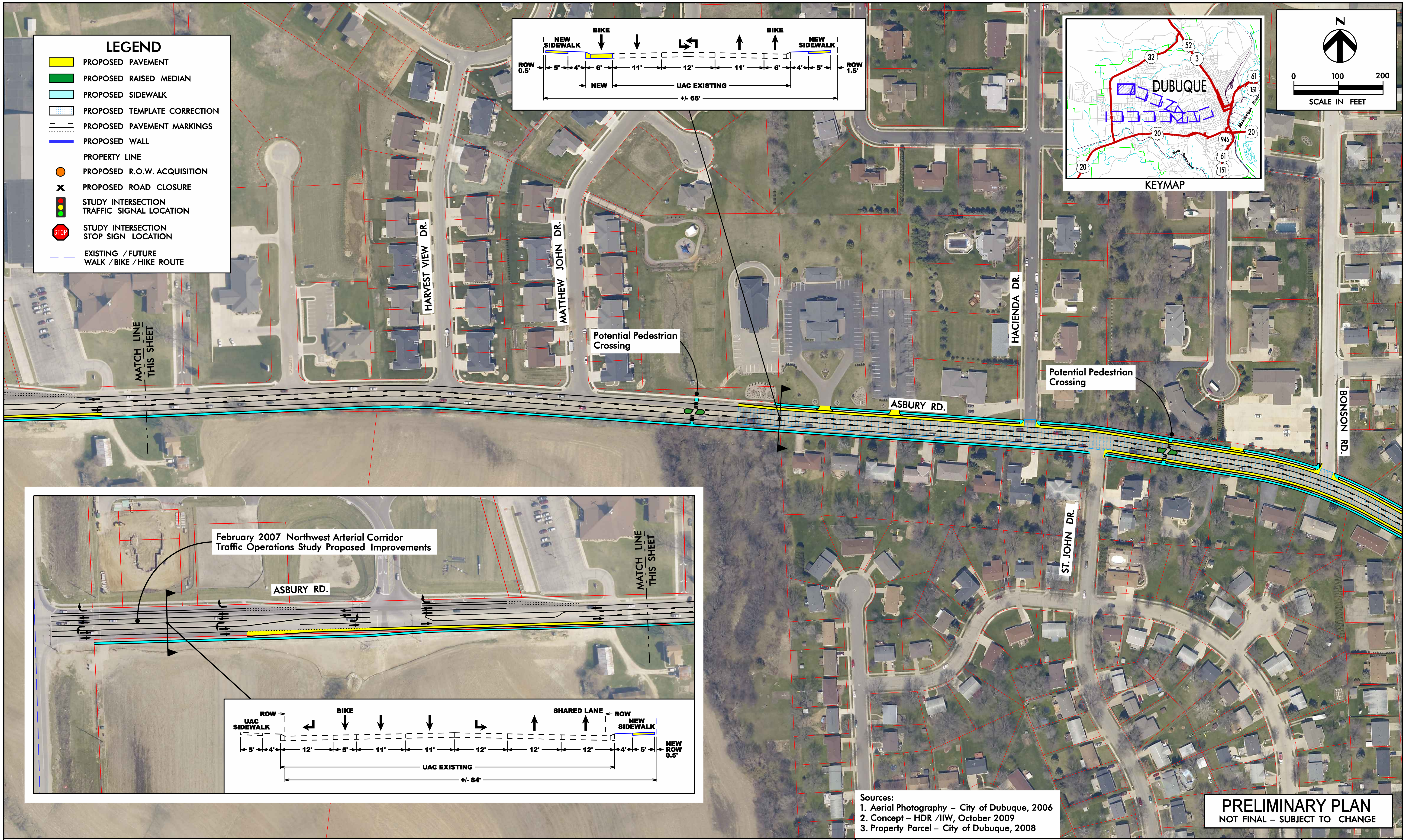
The highest priority for the Asbury Road corridor west of Northwest Arterial is to adopt an access control policy based on recommendations presented earlier in this chapter and reserve proposed corridor right of way needs west of Seippel Road. In addition, it is recommended that pavement markings be modified to provide a two-way left-turn lane and shared lanes east of Radford Road. Sidewalks should be completed along this segment of Asbury Road as well.

Short-Term Improvements

- Signalize (when traffic volumes warrant the installation of a signal) the intersection of Asbury Road/Radford Road
- Add eastbound right-turn lane at Asbury Road/Radford Road

Long-Term Improvements

- Construct a three-lane urban section with dedicated bicycle lanes between Seippel Road and Hales Mill Road
- Construct the proposed cross section west of Seippel Road as needed based on development and future traffic need



Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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RECOMMENDED CONCEPT – ASBURY ROAD

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
5 – 8

Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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RECOMMENDED CONCEPT – ASBURY ROAD

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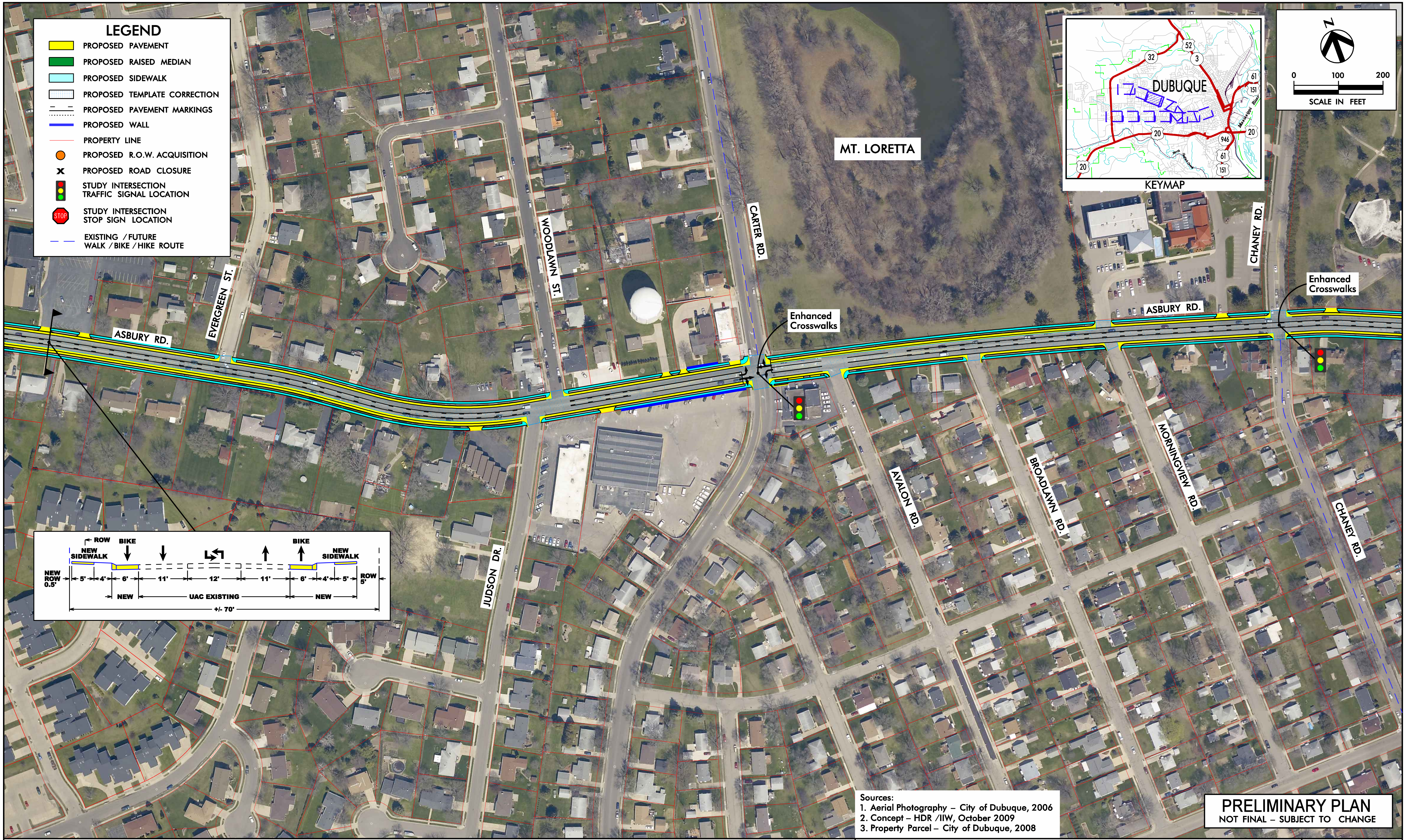
Figure
5 – 9



Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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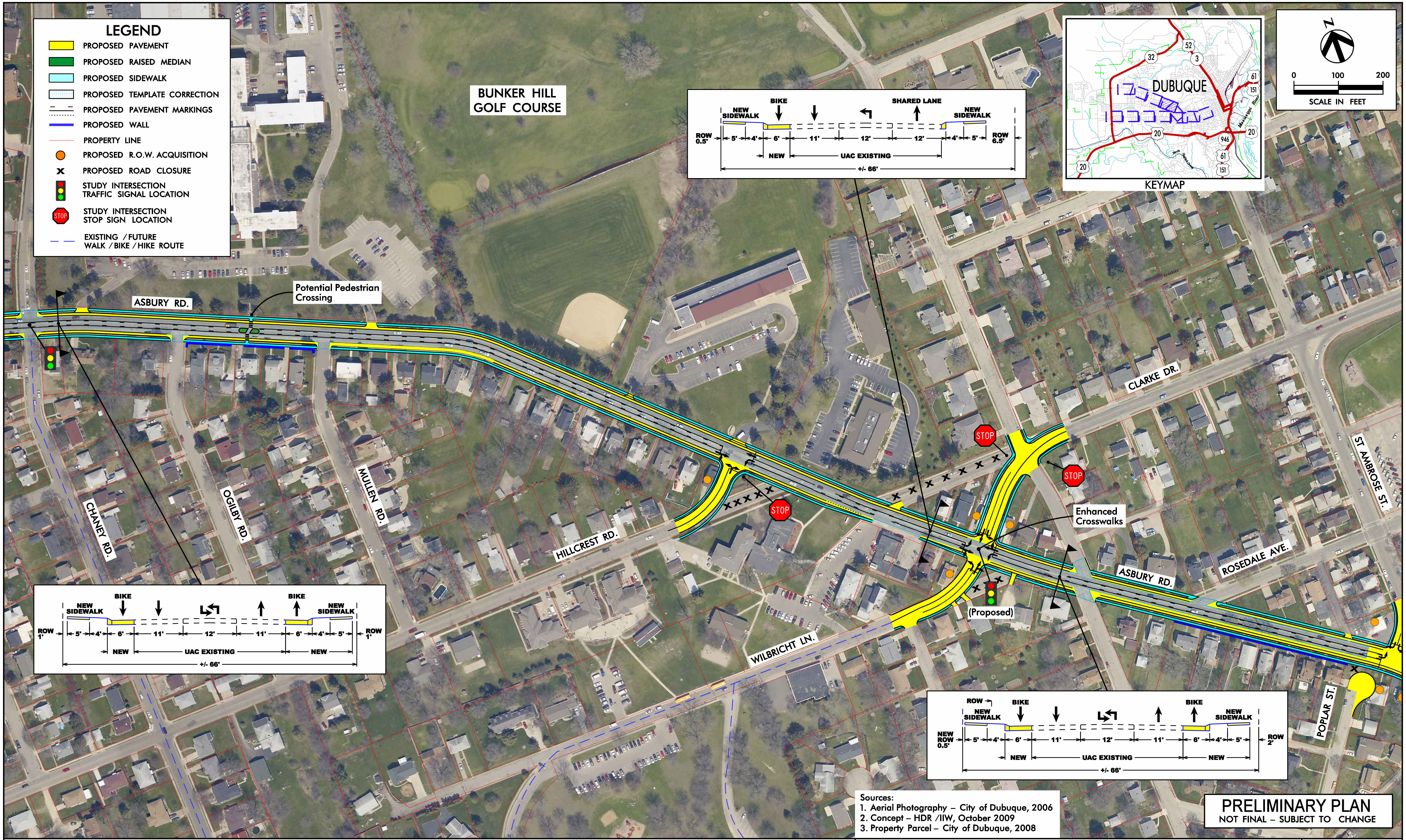
RECOMMENDED CONCEPT – ASBURY ROAD

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
5 – 10



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RECOMMENDED CONCEPT – ASBURY ROAD

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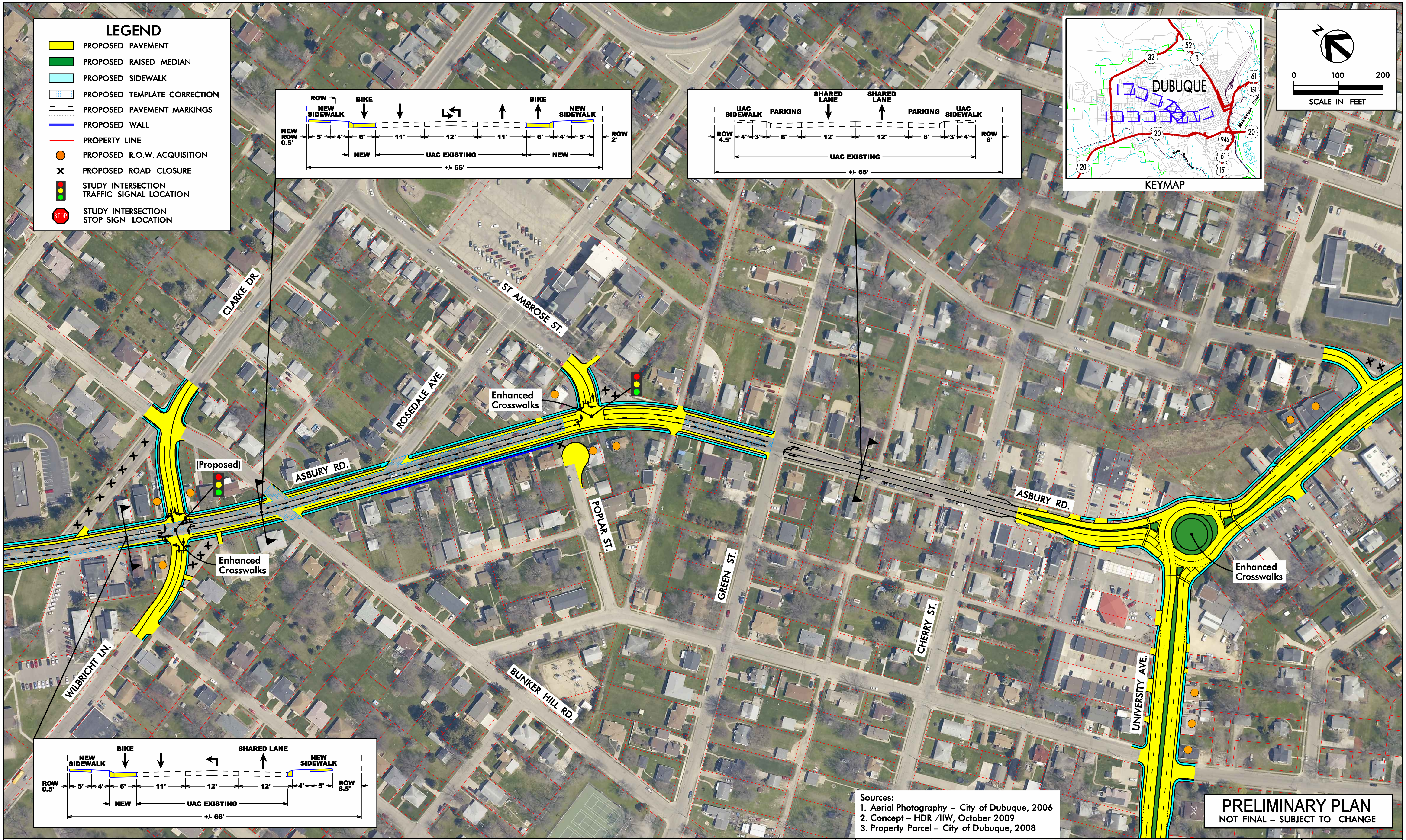
Date
September 2010

Figure
5 – 11



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2. Concept – HDR /IIW, October 2009
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RECOMMENDED CONCEPT – ASBURY ROAD

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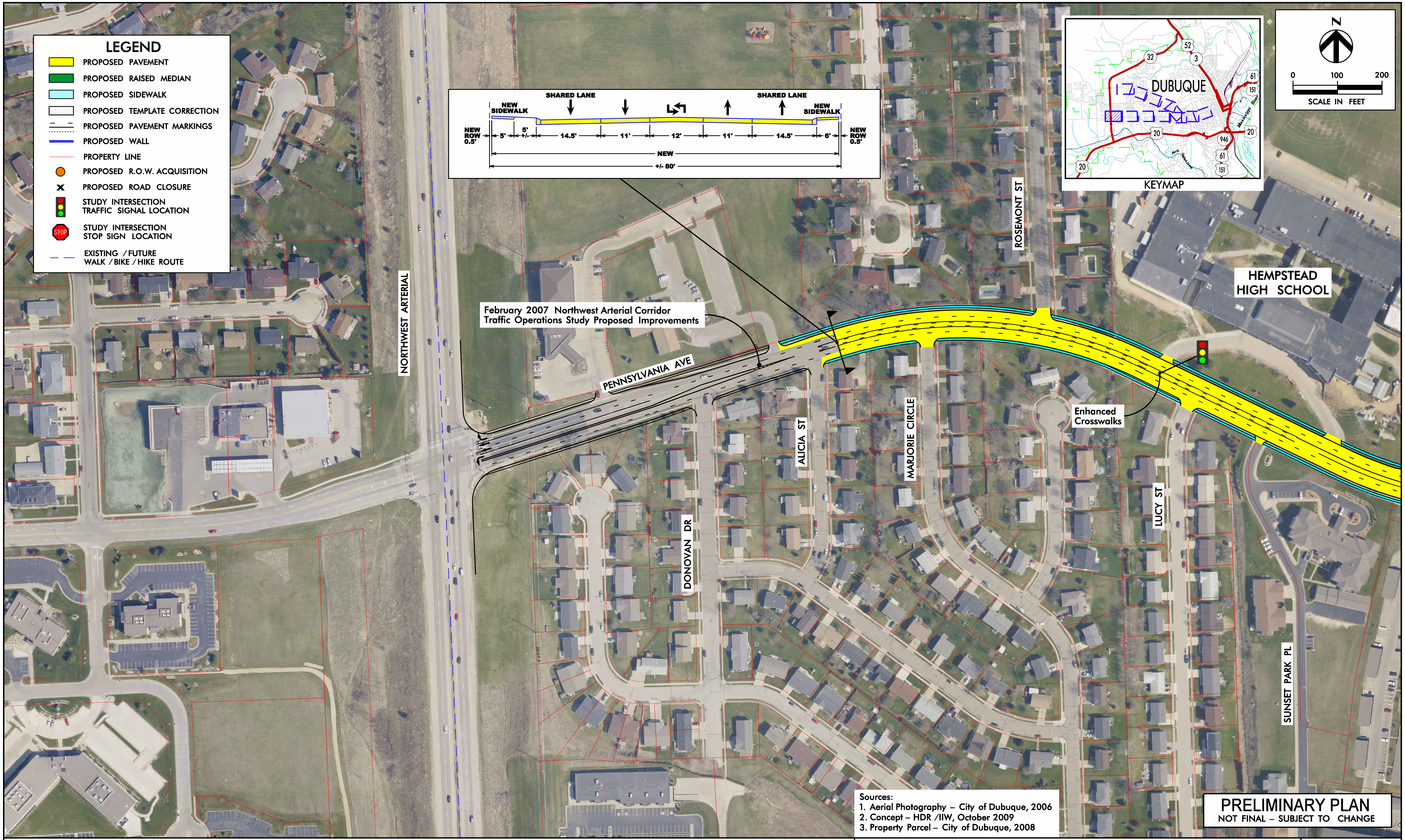
Figure
5 – 12



Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
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RECOMMENDED CONCEPT – PENNSYLVANIA AVENUE

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
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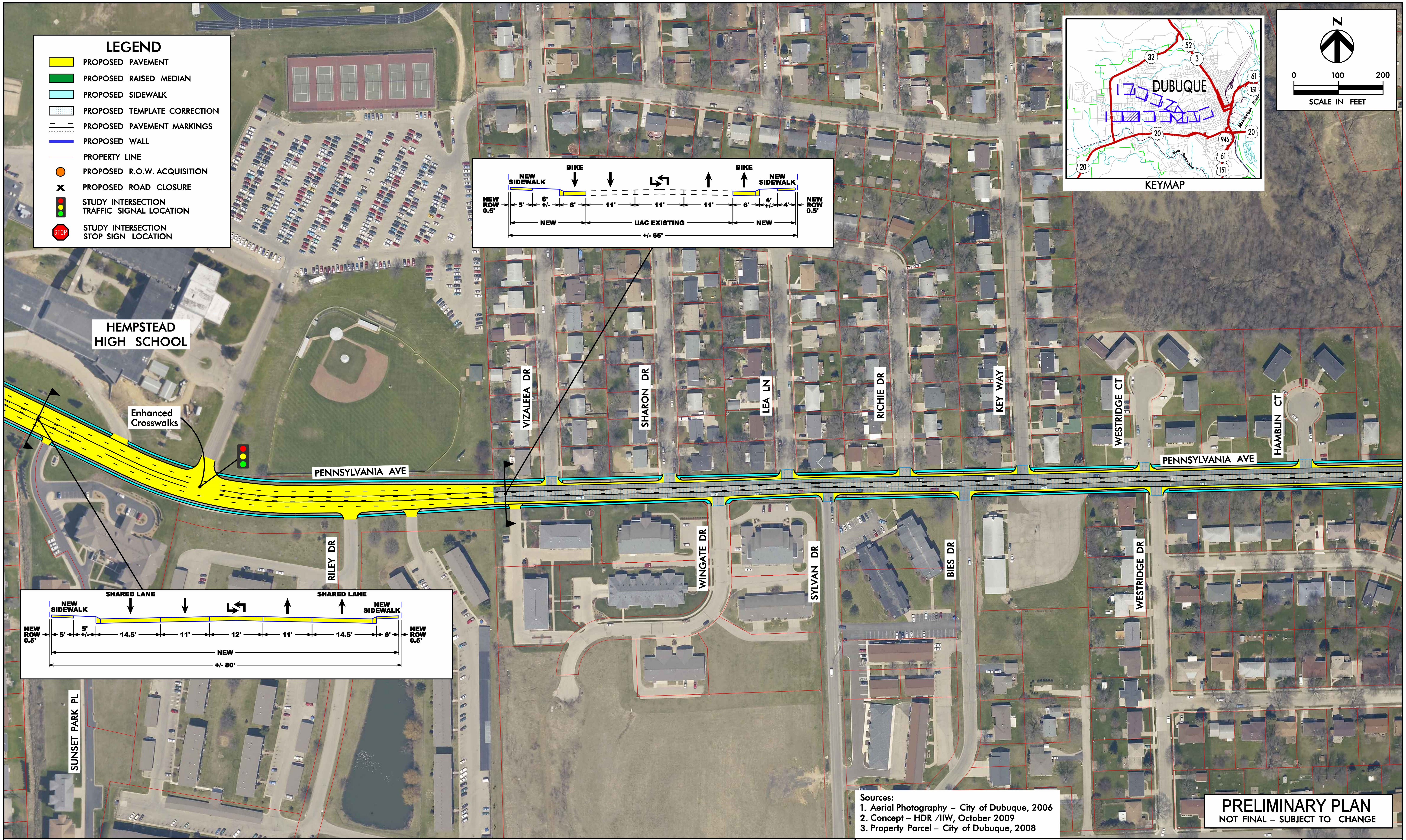
Figure
5 – 13



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3. Property Parcel – City of Dubuque, 2008

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RECOMMENDED CONCEPT – PENNSYLVANIA AVENUE

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Date
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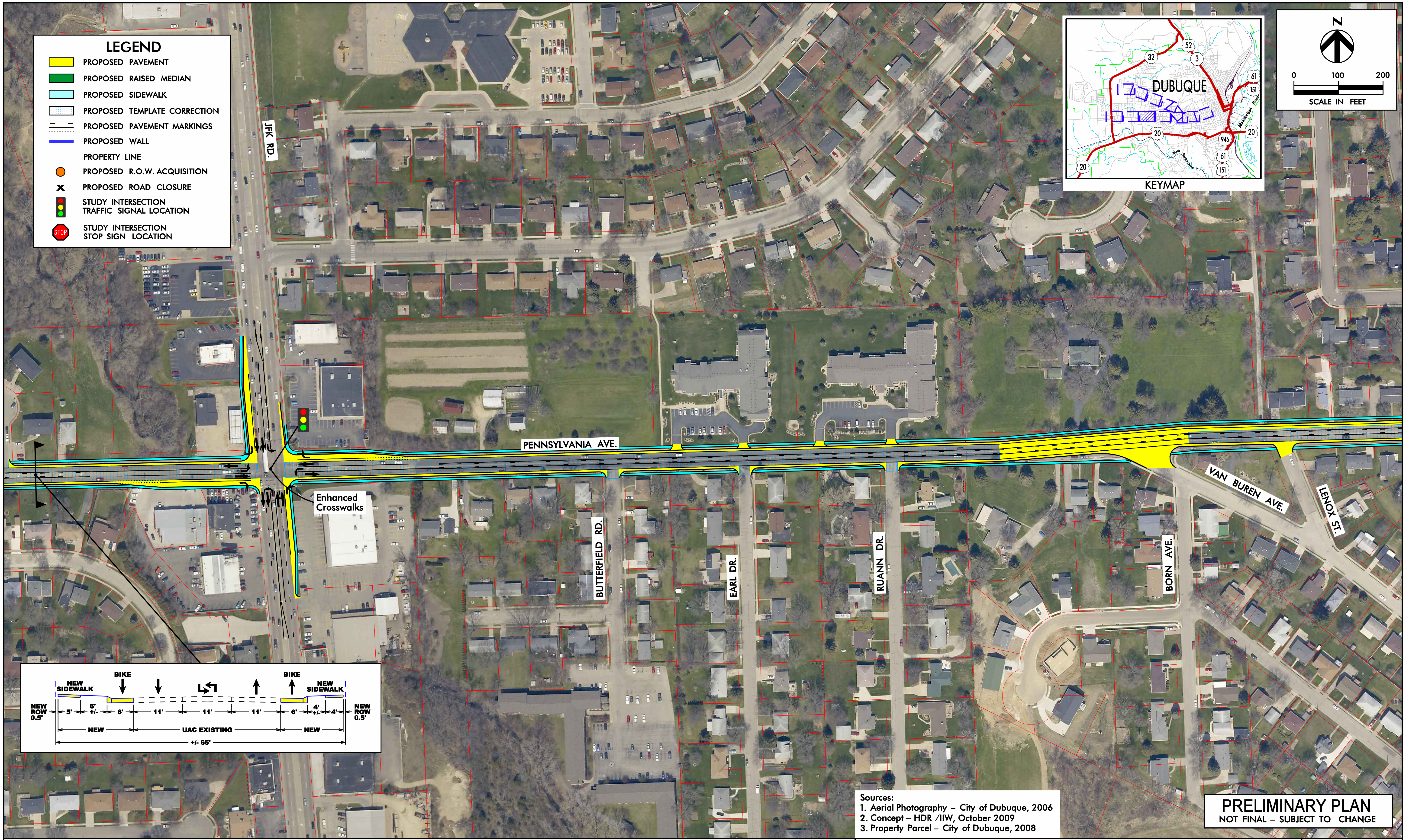
Figure
5 – 14



Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
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Figure
5 – 15

Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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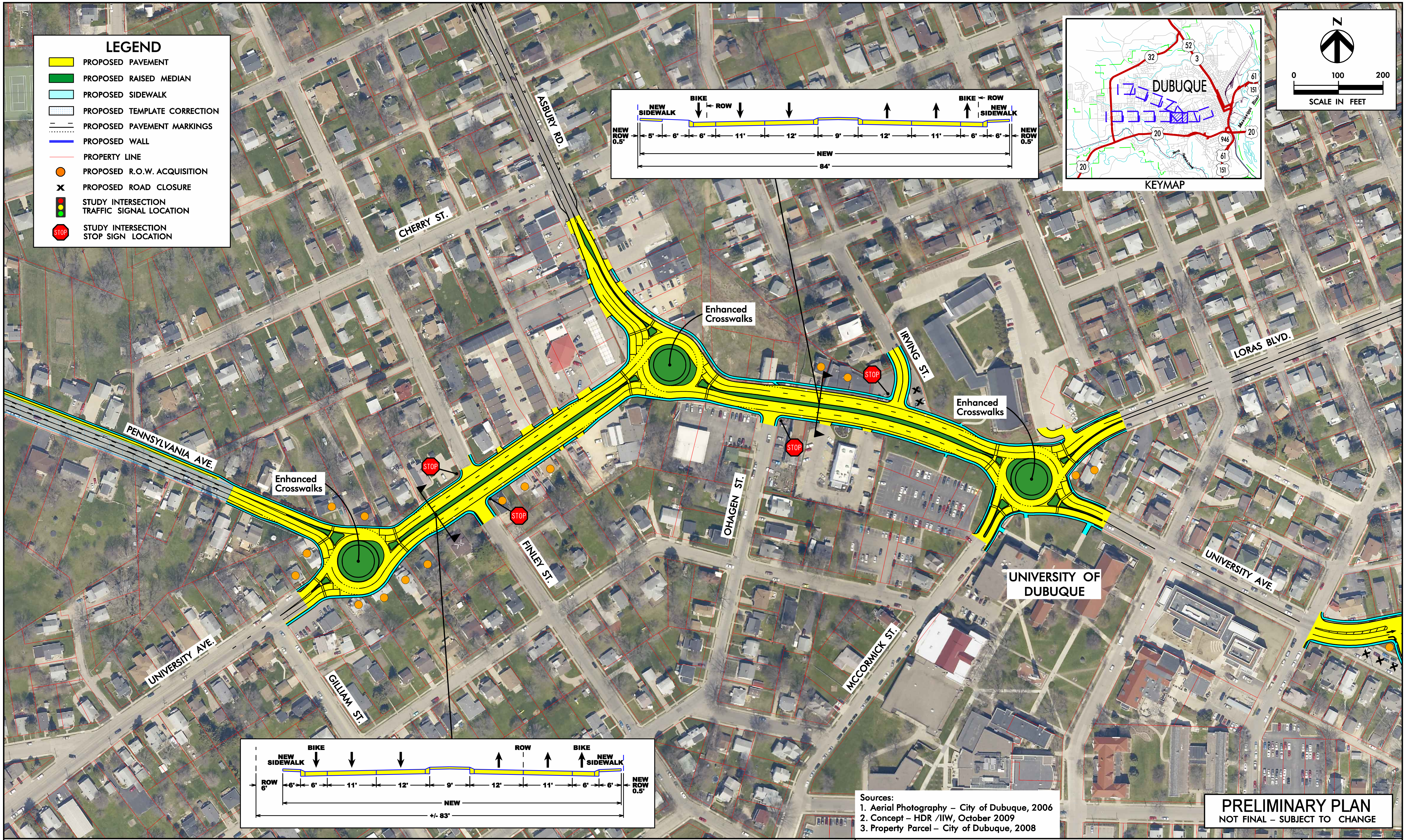
RECOMMENDED CONCEPT – PENNSYLVANIA AVENUE

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
5 – 16



Sources:
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RECOMMENDED CONCEPT – UNIVERSITY AVENUE OVERLAP SECTION

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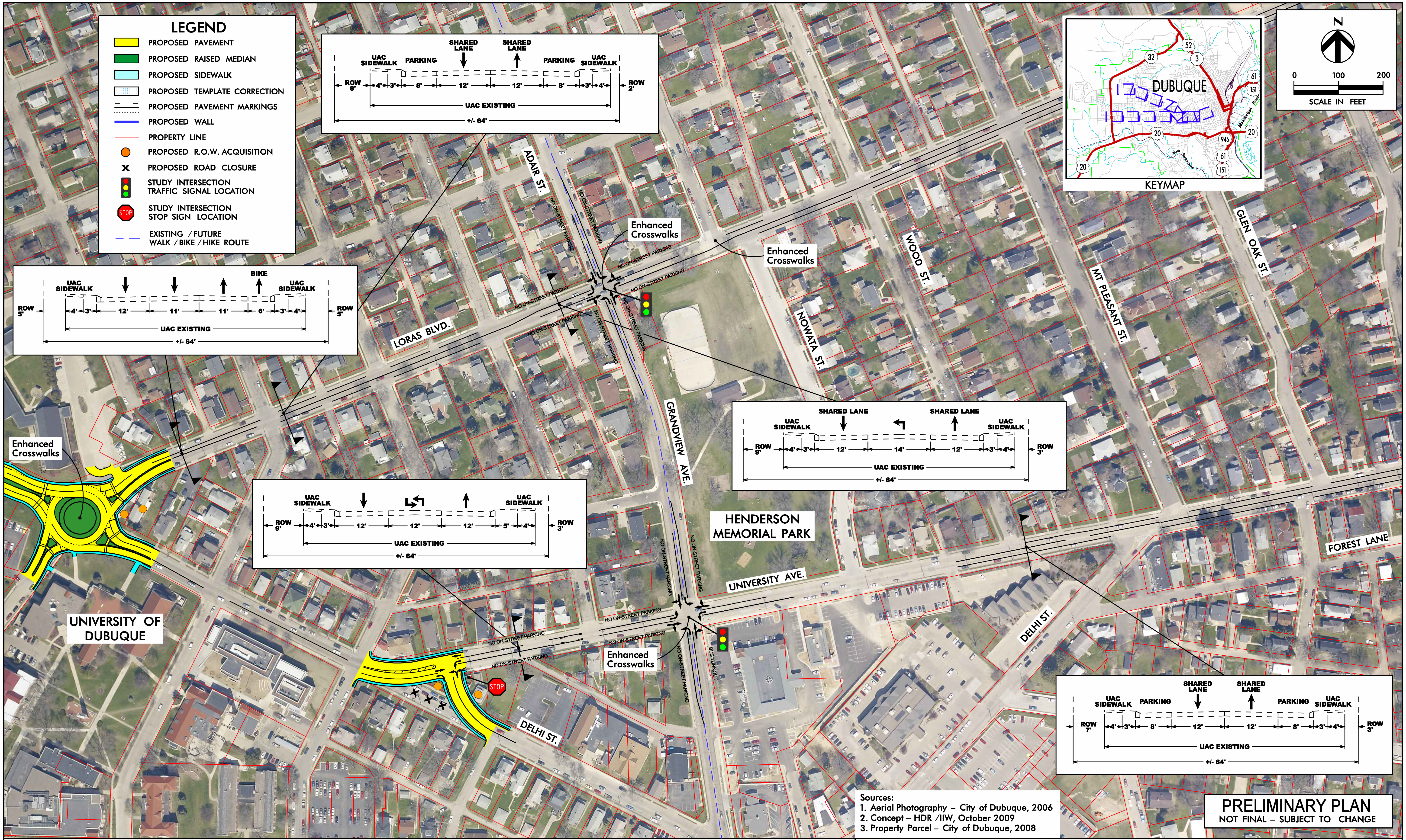
Figure
5 – 17



Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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RECOMMENDED CONCEPT – UNIVERSITY AVENUE AND LORAS BOULEVARD

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Date
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Figure
5 – 18

Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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RECOMMENDED CONCEPT – UNIVERSITY AVENUE AND LORAS BOULEVARD

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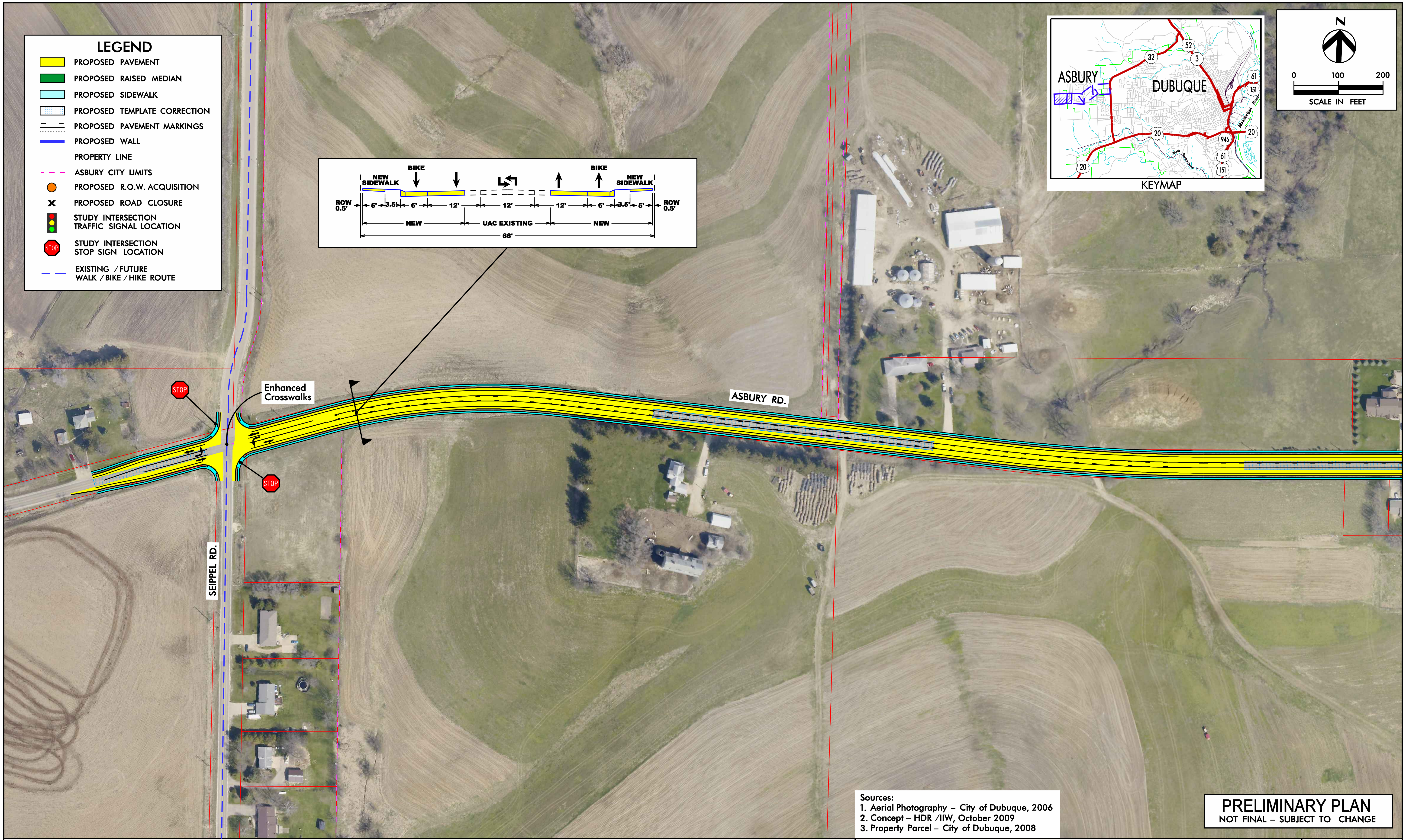
Figure
5 – 19



Sources:
1. Aerial Photography – City of Dubuque, 2006
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RECOMMENDED CONCEPT – ASBURY ROAD WEST OF NW ARTERIAL

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
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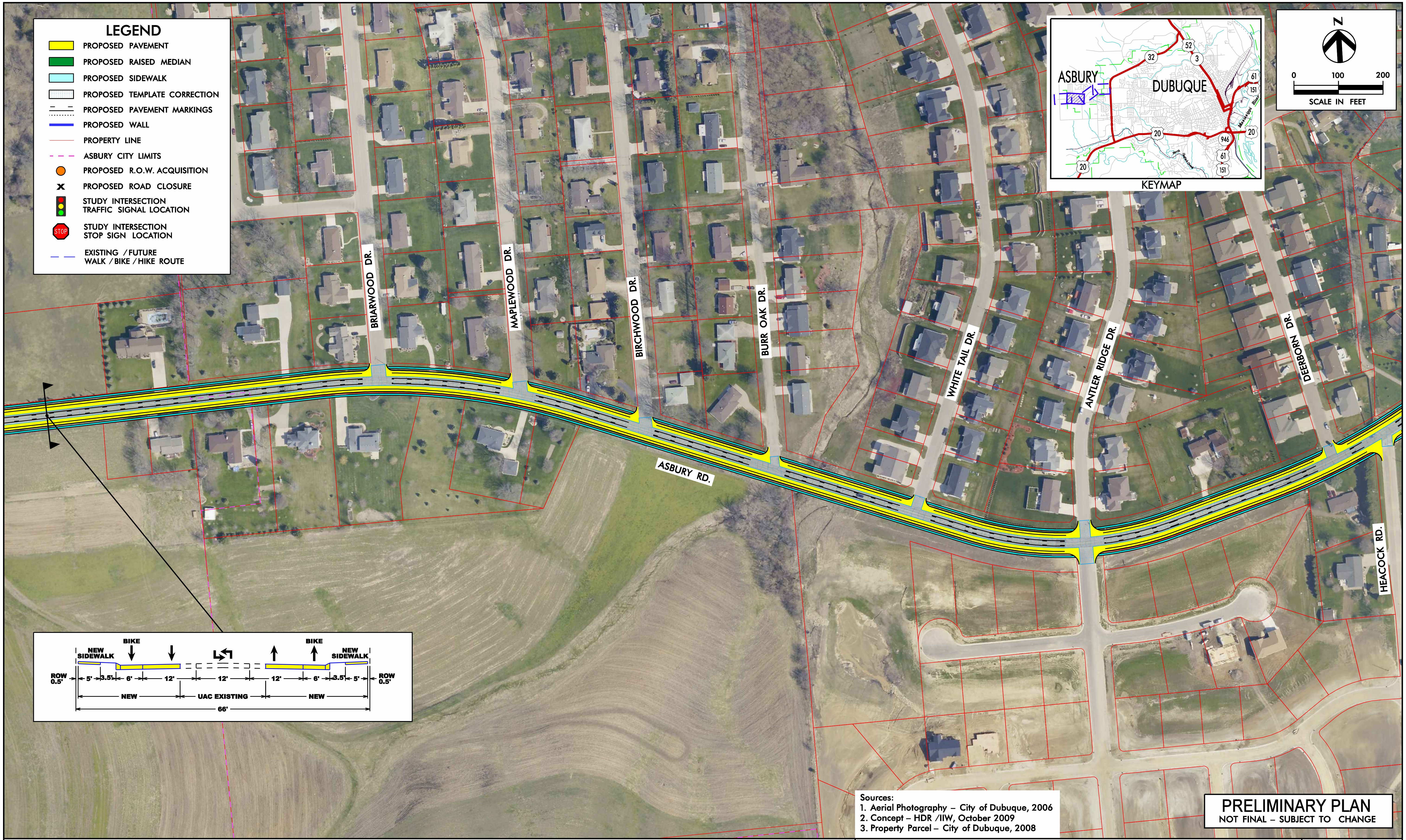
Figure
5 – 20



LEGEND

🟨	PROPOSED PAVEMENT
🟩	PROPOSED RAISED MEDIAN
▭	PROPOSED SIDEWALK
▭	PROPOSED TEMPLATE CORRECTION
— —	PROPOSED PAVEMENT MARKINGS
—	PROPOSED WALL
—	PROPERTY LINE
- - -	ASBURY CITY LIMITS
●	PROPOSED R.O.W. ACQUISITION
×	PROPOSED ROAD CLOSURE
🚦	STUDY INTERSECTION TRAFFIC SIGNAL LOCATION
STOP	STUDY INTERSECTION STOP SIGN LOCATION
— —	EXISTING / FUTURE WALK / BIKE / HIKE ROUTE

Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR / IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

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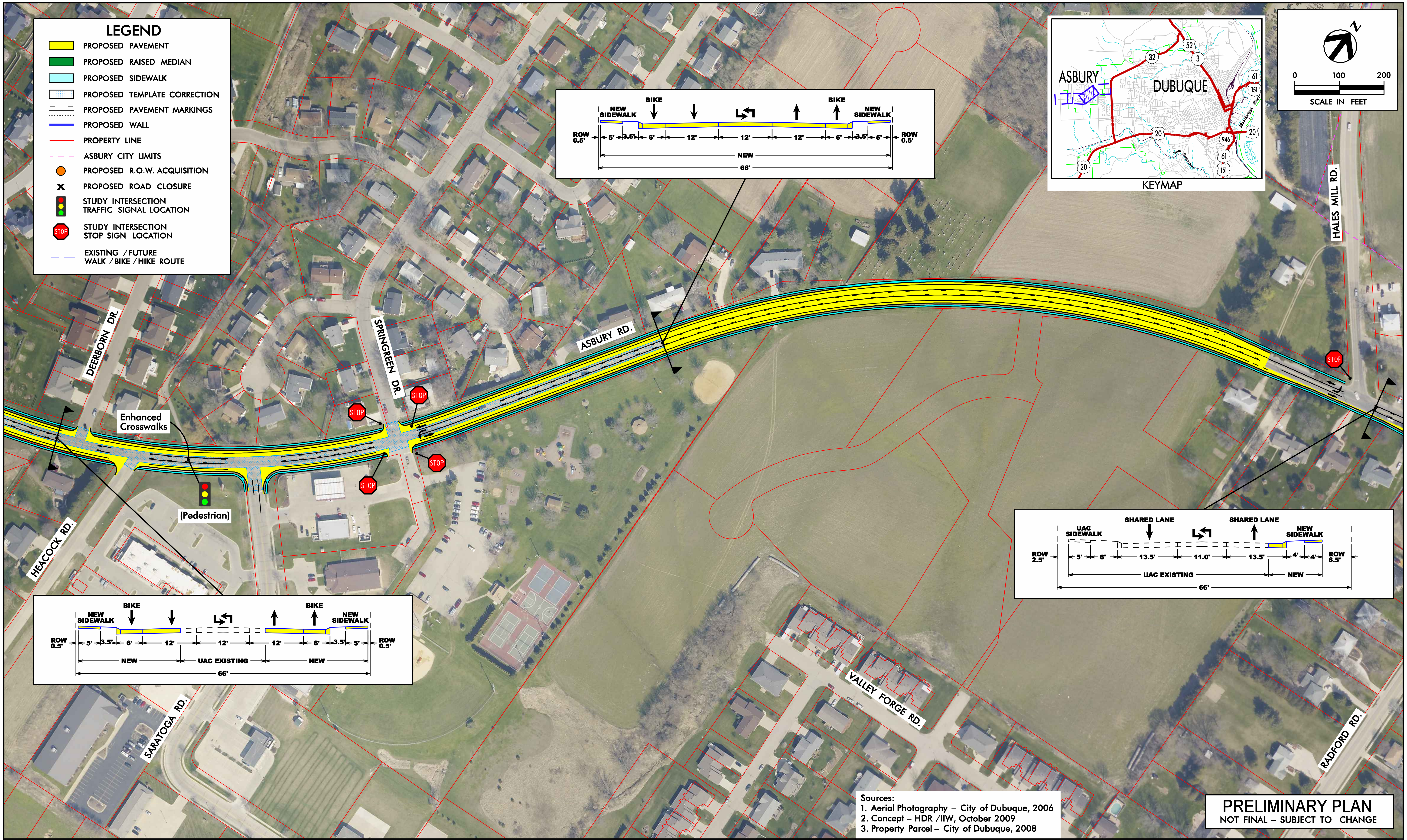
RECOMMENDED CONCEPT – ASBURY ROAD WEST OF NW ARTERIAL

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
5 – 21



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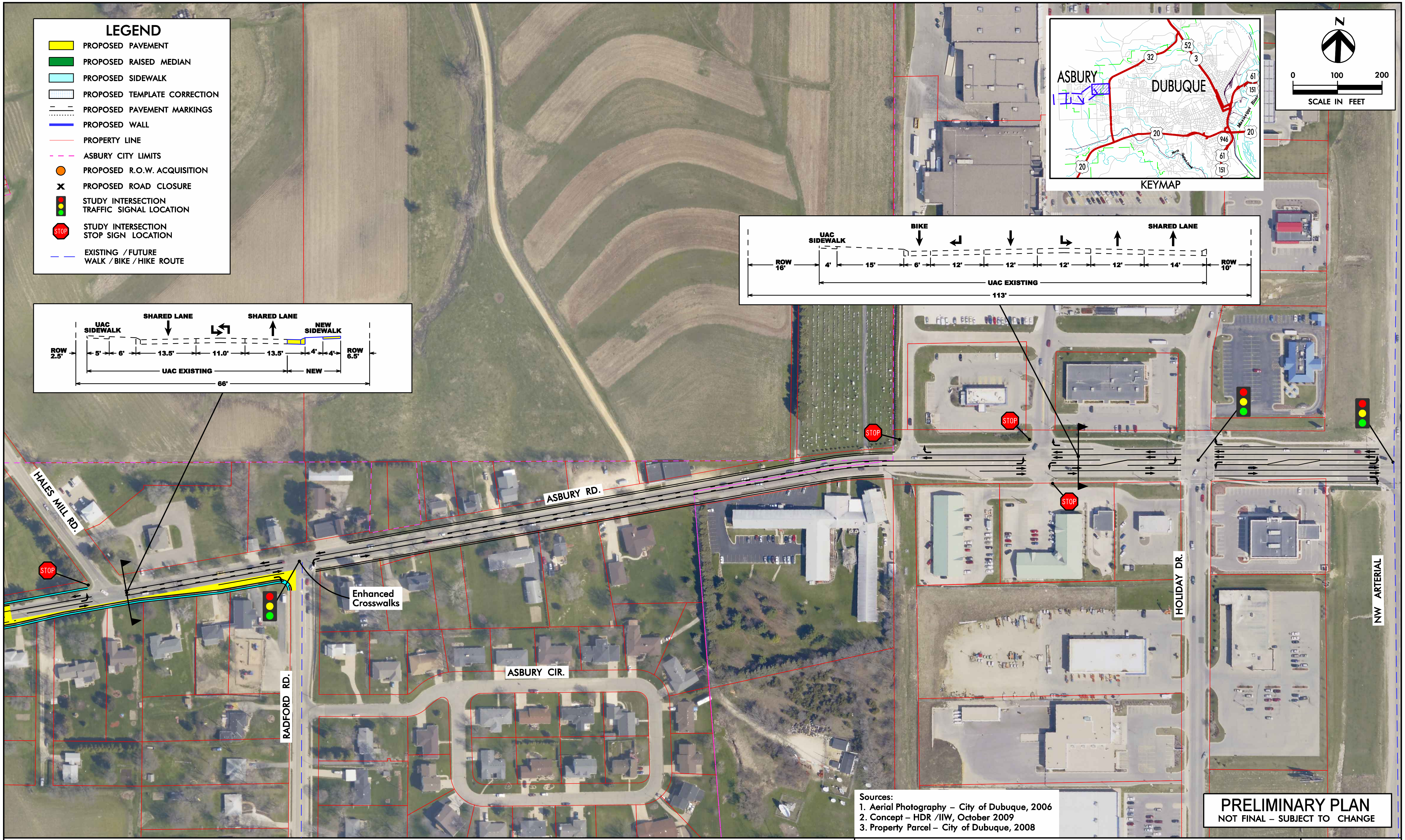
RECOMMENDED CONCEPT – ASBURY ROAD WEST OF NW ARTERIAL

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
5 – 22



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RECOMMENDED CONCEPT – ASBURY ROAD WEST OF NW ARTERIAL

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
5 – 23

CHAPTER 6: PUBLIC INVOLVEMENT

An important part of the study was to gather input from the public. The consultant updated the Dubuque City Council throughout the study with three work sessions. Two public meetings were held in the City of Dubuque and one public meeting was held in the City of Asbury. In addition to public meetings, two days of individual stakeholder meetings were conducted in Dubuque. Not only was information gathered from the public, but the study progress and findings were presented at these meetings. The following sections summarize these public involvement meetings.

DUBUQUE CITY COUNCIL WORK SESSION NOVEMBER 2008

The first Dubuque City Council work session was held on Monday, November 3, 2008. At this meeting, a review of the study process and schedule was presented. The corridor screening process (Chapter 2) was also discussed at the work session, including a review of the operations, public acceptance and estimated costs for each of the future corridor screening alternatives (Scenarios 1 through 18). The corridor screening process showed that providing adequate capacity to the future east-west roadway system would be challenging due to latent demand on the transportation network that would utilize the improved corridors. It was determined that regardless of roadway improvements, future capacity needs would not be met.

In this work session, Phase 2 corridors were identified as Asbury Road, Loras Boulevard, University Avenue and Pennsylvania Avenue. The City Council directed that future improvements may include localized right of way acquisition, but in general recommended improvements should not extend beyond available right of way. The University Avenue Overlap section (University Avenue from Pennsylvania Avenue to Loras Boulevard) was noted as a location where major right of way impacts could be considered. Additionally, the City Council requested Complete Streets accommodations be incorporated into the recommended improvements, specifically bicycle accommodations.

PUBLIC INFORMATION MEETING NOVEMBER 2008

A public information meeting was held on Wednesday, November 19, 2008. The meeting consisted of an open house format with four exhibits displaying project information including:

- Study Process Flow Chart
- Aerial based figure of the Phase 2 corridors with traffic control
- Existing (2005) Volume to Capacity Ratios for Study and High Capacity Corridors
- Future (2031) Volume to Capacity Ratios for Study and High Capacity Corridors

Additionally, a PowerPoint presentation was prepared to provide project information including City Council direction and corridor improvements being considered.

The purpose of the meeting was to present the study process and Phase 2 corridors as well as to gather feedback from the attendees. Comment forms were available to be filled out at the meeting or mailed in after the meeting. Five comment forms were returned. The meeting was attended by 14 citizens.

Several attendees expressed concern regarding bicycle lanes. In their opinions Asbury Road is a critical corridor for commuting cyclists. Based on the comments that were heard regarding bicycle lanes it was felt that separate bike/hike trails were preferred over bicycle lanes incorporated into the street (although, after the conference call on December 22, 2008 with the Tri-State Trails Vision group it was decided that given the City Council direction to minimize right of way impacts, a bicycle lane adjacent to the roadway would be more feasible).

Other comments that were gathered at the meeting included the recommendation to consider roundabouts within the University Avenue Overlap section. A summary of all the comments gathered at the meeting is provided in the appendix.

DUBUQUE CITY COUNCIL WORK SESSION JULY 2009

The Dubuque City Council work session on Monday, July 20, 2009 included a presentation of the additional corridor screening alternatives (Scenarios 19-22), Travel Demand Management (TDM) strategies, typical roadway cross sections that incorporated bicycle accommodations and a summary of potential Complete Streets elements that could be incorporated into the proposed corridor improvements. Preliminary Phase 2 corridor concepts were also discussed with the City Council including the use of sharrows.

AGENCY COORDINATION AND STAKEHOLDER MEETINGS SEPTEMBER 2009

Agency coordination and individual stakeholder meetings were held on Wednesday, September 16 and Thursday, September 17, 2009. A summary of the preliminary concepts was presented including:

- Incorporating dedicated bicycle lanes or sharrows on all of the Phase 2 corridors
- Hillcrest Road, Clarke Drive and Wilbricht Lane realignment (Asbury Road)
- Delhi Road realignment (University Avenue)
- Five-lane cross section from Hempstead High School west to NW Arterial (Pennsylvania Avenue)
- Right-turn lane additions at JFK Road (Pennsylvania Avenue)
- Left-turn lane additions at Grandview Avenue (Loras Boulevard)
- Signalization and left-turn lane additions at Grandview Avenue (University Avenue)
- Two concepts for University Avenue Overlap section
    - Signals at: Pennsylvania Avenue, Asbury Road, Loras Boulevard
    - Roundabouts at: Pennsylvania Avenue, Asbury Road, Loras Boulevard

The goal of the meetings was to gather input on the preliminary concepts, determine a preferred concept within the University Avenue Overlap section, identify improvement priorities as well as to identify any areas along that study corridors that had not been addressed with the preliminary concepts. Most of the stakeholders preferred the roundabout concept for the University Avenue Overlap section. Two priorities were identified including improving the University Avenue Overlap section and improving skewed intersections. Most stakeholders approved of incorporating Complete Streets accommodations. A summary of each individual meeting is provided in the appendix.

DUBUQUE CITY COUNCIL WORK SESSION NOVEMBER 2009

The purpose of the Dubuque City Council work session held on Tuesday, November 17, 2009 was to present the study findings and recommendations. The study process and previous input, including a summary of the previous City Council workshops, the stakeholder meetings and the Long Range Planning Advisory Commission presentation was discussed. The process for identifying the recommended concept was presented noting that several factors were taken into consideration when developing the recommended concept including:

- Safety
- Traffic Operations
- Complete Streets
- Property Impacts
- Sustainability
- Technical Staff Input
- Stakeholder Input

Both the University Avenue Overlap section roundabouts and signalized intersections concepts were presented to the City Council with comparisons of property acquisitions, construction and right of way costs, traffic operations, safety and Complete Streets.

The City Council endorsed the full plan including the recommended roundabouts for the University Avenue Overlap section.

PUBLIC INFORMATION MEETINGS NOVEMBER 2009

Public information meetings were held on Monday, November 16 and Wednesday, November 18, 2009. The meetings consisted of an open house format with five exhibits displaying project information including:

- The Study Process Flow Chart
- An aerial based figure summarizing the proposed improvements along the study corridors
- A Complete Streets board with photos
- Roundabout displays identifying benefits and proper navigation

Additionally, seven aerial based scrolls were displayed showing the recommended concept along each of the study corridors and a simulation animation was shown for the proposed roundabouts.

The purpose of the meetings was to present the study findings and recommendations as well as to gather feedback from the attendees. Comment forms were available to be filled out at the meeting or mailed in after the meeting. Twenty-seven comment forms were returned. Eleven people signed-in at the Monday meeting and 74 citizens signed-in at the Wednesday meeting.

Comments were generally positive including support for the roundabouts on University Avenue. Many expressed support for the bicycle accommodations including acquiring right of way to provide dedicated bicycle lanes on Asbury Road and University Avenue where shared lanes are proposed and Delhi Street west of Grandview Avenue outside of the study area. Impacted property owners were concerned with schedule, property values and other details specific to their property. A summary of all the comments gathered at the meetings is provided in the appendix.

CHAPTER 7: FINDINGS AND RECOMMENDATIONS

The corridors that were studied in detail in this study include Asbury Road, Loras Boulevard, University Avenue and Pennsylvania Avenue. The City Council directed that future improvements may include localized right of way acquisition, but in general recommended improvements should not extend beyond available right of way. The University Avenue Overlap section (University Avenue from Pennsylvania Avenue to Loras Boulevard) was noted as a location where major right of way impacts could be considered. Additionally, the City Council requested Complete Streets accommodations were incorporated into the recommended improvements, specifically bicycle accommodations.

A recommended concept was identified for the Phase 2 east-west corridors as discussed in detail in Chapter 5. This concept includes a series of pedestrian and bicycle accommodations, converting three intersections along University Avenue to roundabouts, and a series of roadway realignments, turn lane additions and cross section modifications.

EAST-WEST CORRIDOR RECOMMENDED CONCEPT EAST OF NORTHWEST ARTERIAL

IMMEDIATE RECOMMENDATIONS

- Reserve right-of-way for proposed improvements, specifically:
  - The northwest corner of the existing Wilbricht Lane/Asbury Road
  - The northeast corner of Asbury Road/University Avenue
  - The intersection of Delhi Street/University Avenue
- Remove parking along Asbury Road and convert to a three-lane cross section
- Remove parking along Pennsylvania Avenue and convert to a three-lane cross section
- Add sharrows along Asbury Road
- Add sharrows along Pennsylvania Avenue
- Add sharrows along University Avenue east of Loras Boulevard and west of Booth Street
- Add sharrows along Loras Boulevard to Alta Vista Street

HIGH PRIORITY IMPROVEMENT

- Convert the University Avenue Overlap section to three proposed roundabouts

MODERATE PRIORITY IMPROVEMENTS

- Add left-turn lanes at Grandview Avenue/Loras Boulevard northbound, southbound and eastbound intersection approaches
- Realign Hillcrest Road, Clarke Drive and Wilbricht Lane with Asbury Road
- Realign St. Ambrose Street with Asbury Road including Asbury Road curve modification
- Realign Delhi Street with University Avenue

LOW PRIORITY IMPROVEMENTS

- Dedicated bicycle lanes on Asbury Road
- Signalize and add left-turn lanes at Grandview Avenue/University Avenue
- Add right-turn lanes at JFK Road/Pennsylvania Avenue northbound, southbound and eastbound intersection approaches and extend westbound right-turn lane
- Dedicated bicycle lanes on Pennsylvania Avenue east of Hempstead High School
- Modify cross section along Pennsylvania Avenue to 5 lanes from Hempstead High School west to NW Arterial

INCORPORATING TRAVEL DEMAND MANAGEMENT

Given the City Council direction for no major roadway capacity improvements, alternative plans for mitigating congestion on east-west corridors should be considered, including Travel Demand Management (TDM) strategies. A public/private partnership such as a Transportation Management Association (TMA) can establish incentive-based policies, programs and services to address local transportation problems.

ADDITIONAL CONSIDERATIONS

Two intersections outside of the study area were identified as intersections that should be studied in the future to identify improvement alternatives:

- Grandview Avenue/Delhi Street/Grace Street 5-leg intersection
- University Avenue/Hill Street/W 9th Street/W 8th Street

Additionally, Tri-State Trail Vision has requested that consideration be given to acquire right of way along University Avenue and Delhi Street from Loras Boulevard to the Grandview Avenue/Grace Street 5-leg intersection for bicycle and pedestrian accommodations. It was noted that there were safety concerns for bicyclists and pedestrians along this route.

ASBURY ROAD WEST OF NORTHWEST ARTERIAL RECOMMENDED CONCEPT

IMMEDIATE RECOMMENDATIONS

- Adopt an access control policy
- Reserve right-of-way for future improvements
- Remove parking and convert to a three-lane cross section east of Radford Road
- Add sharrows east of Radford Road
- Complete sidewalks along east of Hales Mill Road

SHORT-TERM IMPROVEMENTS

- Signalize (when traffic volumes warrant the installation of a signal) the intersection of Asbury Road/Radford Road
- Add eastbound right-turn lane at Asbury Road/Radford Road

LONG-TERM IMPROVEMENTS

- Construct a three-lane urban section with dedicated bicycle lanes between Seippel Road and Hales Mill Road
- Construct the proposed cross section west of Seippel Road as needed based on development and future traffic need

ADDITIONAL CONSIDERATIONS

Consideration should be given to realigning Hales Mill Road with Radford Road when new development occurs north of Asbury Road in this area.

APPENDIX

Items included on the CD Appendix

- Dubuque City Council Work Session Presentation: Monday, November 3, 2008
- Dubuque Public Meeting Summary: Wednesday, November 19, 2008
- ECIA Model Review and Screening Analysis Memorandum dated April 14, 2009
- 2031 No-Build and Build Volume Development Memorandum dated May 6, 2009
- Dubuque City Council Work Session Presentation: Monday, July 20, 2009
- Dubuque Stakeholder Coordination Meetings Summary: Wednesday, September 16 and Thursday, September 17, 2009
- Asbury and Dubuque Public Meetings Summary: Monday, November 16 and Wednesday, November 18, 2009
- Dubuque City Council Work Session Presentation: Tuesday, November 17, 2009
- Analysis summaries for traffic analysis conducted
- Simulation animation of proposed roundabouts along University Avenue

TABLE A-1. ASBURY ROAD APPROXIMATE ORDER OF MAGNITUDE COST OF IMPROVEMENTS

Item	Unit	Unit Price	Asbury Rd. Add 3-Lane Pavement Markings		Asbury Rd. JFK Rd. Intersection Turn Lanes		Asbury Rd. Hillcrest Rd. / Clarke Dr. / Wilbricht Ln. Realignment		Asbury Rd. St. Ambrose St. Realignment		Asbury Rd. Bike Lanes - NW Arterial to East of Matthew John Dr.		Asbury Rd. Bike Lanes - East of Matthew John Dr. to JFK Rd.		Asbury Rd. Bike Lanes - JFK Rd. to Carter Rd.		Asbury Rd. Bike Lanes - Carter Rd. to Hillcrest Rd.		Asbury Rd. Bike Lanes - Wilbricht Ln. to St. Ambrose St.	
			Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Road Construction																				
Pavement Removal	SY	$15	---	---	---	---	4,171	$62,565	2,239	$33,585	800	$12,000	2,476	$37,140	2,878	$43,170	2,217	$33,255	617	$9,255
PCC Pavement/Drives	SY	$50	---	---	---	---	4,368	$218,400	2,666	$133,300	576	$28,800	3,888	$194,400	4,382	$219,100	3,997	$199,850	1,748	$87,400
HMA Overlay (1)	TON	$70	---	---	---	---	263	$18,410	84	$5,880	---	---	1,157	$80,990	923	$64,610	1,158	$81,060	321	$22,470
Sidewalk	SY	$25	---	---	---	---	1,198	$29,950	587	$14,675	1,428	$35,700	2,734	$68,350	2,631	$65,775	2,896	$72,400	888	$22,200
Retaining Walls	SF	$50	---	---	---	---	---	---	---	---	---	---	---	---	1,139	$56,950	1,068	$53,400	2,015	$100,750
Other Items (2)	% of paving cost		---	---	---	---	150%	$327,600	150%	$199,950	150%	$43,200	150%	$291,600	150%	$328,650	150%	$299,775	150%	$131,100
		Subtotal		**$0**		**$0**		**$660,000**		**$390,000**		**$120,000**		**$670,000**		**$780,000**		**$740,000**		**$370,000**
Signals	EACH	$150,000	---	---	---	---	1	$150,000	1	$150,000	---	---	1	$150,000	1	$150,000	1	$150,000	---	---
Pedestrian Signal	EACH	$75,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Mid-Block Pedestrian Crossing	EACH	$30,000	---	---	---	---	---	---	---	---	1	$30,000	1	$30,000	---	---	1	$30,000	---	---
3-Lane with Sharrow Pavement Markings	Per Mile	$50,000	2.6	$130,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Bike Lane Pavement Markings/Signs	Per Mile	$45,000	---	---	---	---	0.28	$12,600	0.12	$5,400	0.51	$22,950	0.57	$25,650	0.48	$21,600	0.52	$23,400	0.16	$7,200
Spot Intersection Pavement Markings	EACH	$10,000	---	---	1	$10,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Contingencies			20%	$26,000	20%	$2,000	20%	$164,520	20%	$109,083	20%	$34,590	20%	$175,130	20%	$190,320	20%	$188,680	20%	$75,440
Road Construction and Contingencies Total				**$160,000**		**$12,000**		**$990,000**		**$650,000**		**$210,000**		**$1,050,000**		**$1,140,000**		**$1,130,000**		**$450,000**
ROW Cost																				
Residential Partial		$3.00	---	---	---	---	---	---	1,130	$3,390	10,522	$31,566	---	---	1,900	$5,700	42	$126	2,602	$7,806
Commercial Partial	SF	$8.50	---	---	---	---	---	---	---	---	---	---	2,514	$21,369	2,299	$19,542	1,243	$10,566	---	---
Full Impacts (3)	Each	Varies	---	---	---	---	4	$553,200	3	$398,550	---	---	---	---	---	---	---	---	---	---
		ROW Total		**$0**		**$0**		**$553,200**		**$401,940**		**$31,566**		**$21,369**		**$25,242**		**$10,692**		**$7,806**
Construction and ROW Costs per Segment Total				**$160,000**		**$12,000**		**$1,540,000**		**$1,050,000**		**$240,000**		**$1,070,000**		**$1,170,000**		**$1,140,000**		**$460,000**

Note: Utility relocations and aesthetic treatments are not included with this cost estimate

(1) *For template correction*

(2) *Items not quantified*

(3) *1.5 X Assessor property values, Approximates Relocation Costs*

TABLE A-2. PENNSYLVANIA AVENUE APPROXIMATE ORDER OF MAGNITUDE COST OF IMPROVEMENTS

			Pennsylvania Ave. Add 3-Lane Pavement Markings		Pennsylvania Ave. JFK Rd. Intersection Turn Lanes		Pennsylvania Ave. NW Arterial to Vizaleea Dr. Reconstruction		Pennsylvania Ave. Bike Lanes - Vizaleea Dr. to JFK Rd.		Pennsylvania Ave. Bike Lanes - JFK Rd. to Van Buren Ave.		Pennsylvania Ave. Van Buren Ave Intersection Reconstruction		Pennsylvania Ave. Bike Lanes - Van Buren Ave to Wisconsin Ave		Pennsylvania Ave. Marmora Ave Intersection Reconstruction		Pennsylvania Ave. Bike Lanes - Mamora Ave to University Ave	
Item	Unit	Unit Price	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Road Construction																				
Pavement Removal	SY	$15	---	---	1,059	$15,885	11,567	$173,505	1,690	$25,350	932	$13,980	2,241	$33,615	2,990	$44,850	1,341	$20,115	780	$11,700
PCC Pavement/Drives	SY	$50	---	---	2,191	$109,550	14,801	$740,050	2,724	$136,200	1,752	$87,600	2,600	$130,000	4,307	$215,350	1,438	$71,900	1,334	$66,700
HMA Overlay (1)	TON	$70	---	---	253	$17,710	---	---	899	$62,930	559	$39,130	---	---	914	$63,980	---	---	533	$37,310
Sidewalk	SY	$25	---	---	1,017	$25,425	2,290	$57,250	2,027	$50,675	1,404	$35,100	424	$10,600	2,369	$59,225	275	$6,875	687	$17,175
Retaining Walls	SF	$50	---	---	---	---	---	---	---	---	---	---	---	---	5,970	298,500	---	---	---	---
Other Items (2)	% of paving cost		---	---	150%	$164,325	120%	$888,060	150%	$204,300	150%	$131,400	150%	$195,000	150%	$323,025	150%	$107,850	150%	$100,050
		Subtotal		**$0**		**$330,000**		**$1,860,000**		**$480,000**		**$310,000**		**$370,000**		**$1,000,000**		**$210,000**		**$230,000**
Signals	EACH	$150,000	---	---	1	$150,000	2	$300,000	---	---	---	---	---	---	---	---	---	---	---	---
Pedestrian Signal	EACH	$75,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	75,000
Mid-Block Pedestrian Crossing	EACH	$30,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	$30,000
3-Lane with Sharrow Pavement Markings	Per Mile	$50,000	2.1	$105,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Bike Lane Pavement Markings/Signs	Per Mile	$45,000	---	---	0.24	$10,800	0.41	$18,450	0.39	$17,550	0.25	$11,250	0.08	$3,600	0.44	$19,800	0.05	$2,250	0.23	$10,350
Contingencies	% of roadway costs		20%	$21,000	20%	$98,160	20%	$435,690	20%	$99,510	20%	$64,250	20%	$74,720	20%	$203,960	20%	$42,450	20%	$69,070
Road Construction and Contingencies Total				**$126,000**		**$590,000**		**$2,610,000**		**$600,000**		**$390,000**		**$450,000**		**$1,220,000**		**$250,000**		**$410,000**
ROW Cost																				
Residential Partial	SF	$3.00	---	---	---	---	7,577	$22,731	---	---	---	---	---	---	---	---	---	---	---	---
Commercial Partial	SF	$8.50	---	---	6,450	$54,825	---	---	---	---	---	---	---	---	---	---	312	2,652	---	---
City of Dbq-Flora Park	SF	$5.00	---	---	---	---	---	---	---	---	---	---	---	---	5,752	28,760	---	---	7960	39,800
Dbq Comm. Schools	SF	$5.00	---	---	---	---	17,222	86,110	---	---	---	---	---	---	---	---	---	---	---	---
Full Impacts (3)	Each	Varies	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		ROW Total		**$0**		**$54,825**		**$108,841**		**$0**		**$0**		**$0**		**$28,760**		**$2,652**		**$39,800**
Construction and ROW Costs per Segment Total				**$130,000**		**$640,000**		**$2,720,000**		**$600,000**		**$390,000**		**$450,000**		**$1,250,000**		**$250,000**		**$450,000**

Note: Utility relocations and aesthetic treatments are not included with this cost estimate

(1) *For template correction*

(2) *Items not quantified*

(3) *1.5 X Assessor property values, Approximates Relocation Costs*

Table A-3. University Avenue Approximate Order of Magnitude Cost of Improvements

Item	Unit	Unit Price	University Ave. Sharrows - Loras Ave to Booth St.		University Ave. Overlap Section Reconstruction		University Ave. Grandview Ave Intersection Improvements		University Ave. Delhi St. Realignment	
			Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Road Construction										
Pavement Removal	SY	$15	---	---	15,723	$235,845	---	---	2,069	$31,035
PCC Pavement/Drives	SY	$50	---	---	18,710	$935,500	---	---	1,957	$97,850
HMA Overlay (1)	TON	$70	---	---	---	---	---	---	---	---
Sidewalk	SY	$25	---	---	3,495	$87,375	---	---	460	$11,500
Retaining Walls	SF	$50	---	---	---	---	---	---	---	---
Other Items (2)	% of paving cost		---	---	120%	$1,122,600	---	---	150%	$146,775
		Subtotal		**$0**		**$2,380,000**		**$0**		**$290,000**
Signals	EACH	$150,000	---	---	---	---	1	$150,000	---	---
Pedestrian Signal	EACH	$75,000	---	---	---	---	---	---	---	---
Mid-Block Pedestrian Crossing	EACH	$30,000	---	---	---	---	---	---	---	---
Bike Lane Pavement Markings/Signs	Per Mile	$45,000	0.6	$27,000	0.4	$18,000	---	---	---	---
Spot Intersection Pavement Markings	EACH	$10,000	---	---	---	---	1	$10,000	---	---
Contingencies			20%	$5,400	20%	$479,600	20%	$32,000	20%	$58,000
Road Construction and Contingencies Total				**$32,000**		**$2,880,000**		**$190,000**		**$350,000**
ROW Cost										
Residential Partial	SF	$3.00	---	---	3,985	$11,955	---	---	---	---
Commercial Partial	SF	$8.50	---	---	37,441	$318,249	---	---	---	---
Full Impacts (3)	Each	Varies	---	---	15	2,198,325	---	---	2	$160,800
		ROW Total		**$0**		**$2,528,529**		**$0**		**$160,800**
Construction and ROW Costs per Segment Total				**$32,000**		**$5,410,000**		**$190,000**		**$510,000**

Note: Utility relocations and aesthetic treatments are not included with this cost estimate

(1) *For template correction*

(2) *Items not quantified*

(3) *1.5 X Assessor property values, Approximates Relocation Costs*

TABLE A-4. LORAS BOULEVARD APPROXIMATE ORDER OF MAGNITUDE COST OF IMPROVEMENTS

			Loras Ave. Sharrows - University Ave to Alta Vista St.		Loras Ave. Grandview Ave Intersection Improvements	
Item	Unit	Unit Price	Quantity	Item Cost	Quantity	Item Cost
Road Construction						
Pavement Removal	SY	$15	---	---	---	---
PCC Pavement/Drives	SY	$50	---	---	---	---
HMA Overlay (1)	TON	$70	---	---	---	---
Sidewalk	SY	$25	---	---	---	---
Retaining Walls	SF	$50	---	---	---	---
Other Items (2)	% of paving cost		---	---	---	---
		Subtotal		$0		$0
Signals	EACH	$150,000	---	---	1	$150,000
Pedestrian Signal	EACH	$75,000	---	---	---	---
Mid-Block Pedestrian Crossing	EACH	$30,000	1	$30,000	---	---
Bike Lane Pavement Markings/Signs	Per Mile	$45,000	0.7	$31,500	---	---
Spot Intersection Pavement Markings	EACH	$10,000	---	---	1	10,000
Contingencies			20%	$12,300	20%	$32,000
Road Construction and Contingencies Total				$74,000		$190,000
ROW Cost						
Residential Partial		$3.00	---	---	---	---
Commercial Partial	SF	$8.50	---	---	---	---
Full Impacts (3)	Each	Varies	---	---	---	---
		ROW Total		$0		$0
Construction and ROW Costs per Segment Total				$74,000		$190,000

Note: Utility relocations and aesthetic treatments are not included with this cost estimate

(1) *For template correction*

(2) *Items not quantified*

(3) *1.5 X Assessor property values, Approximates Relocation Costs*

Table A-5. Asbury Road West of Northwest Arterial Approximate Order of Magnitude Cost of Improvements

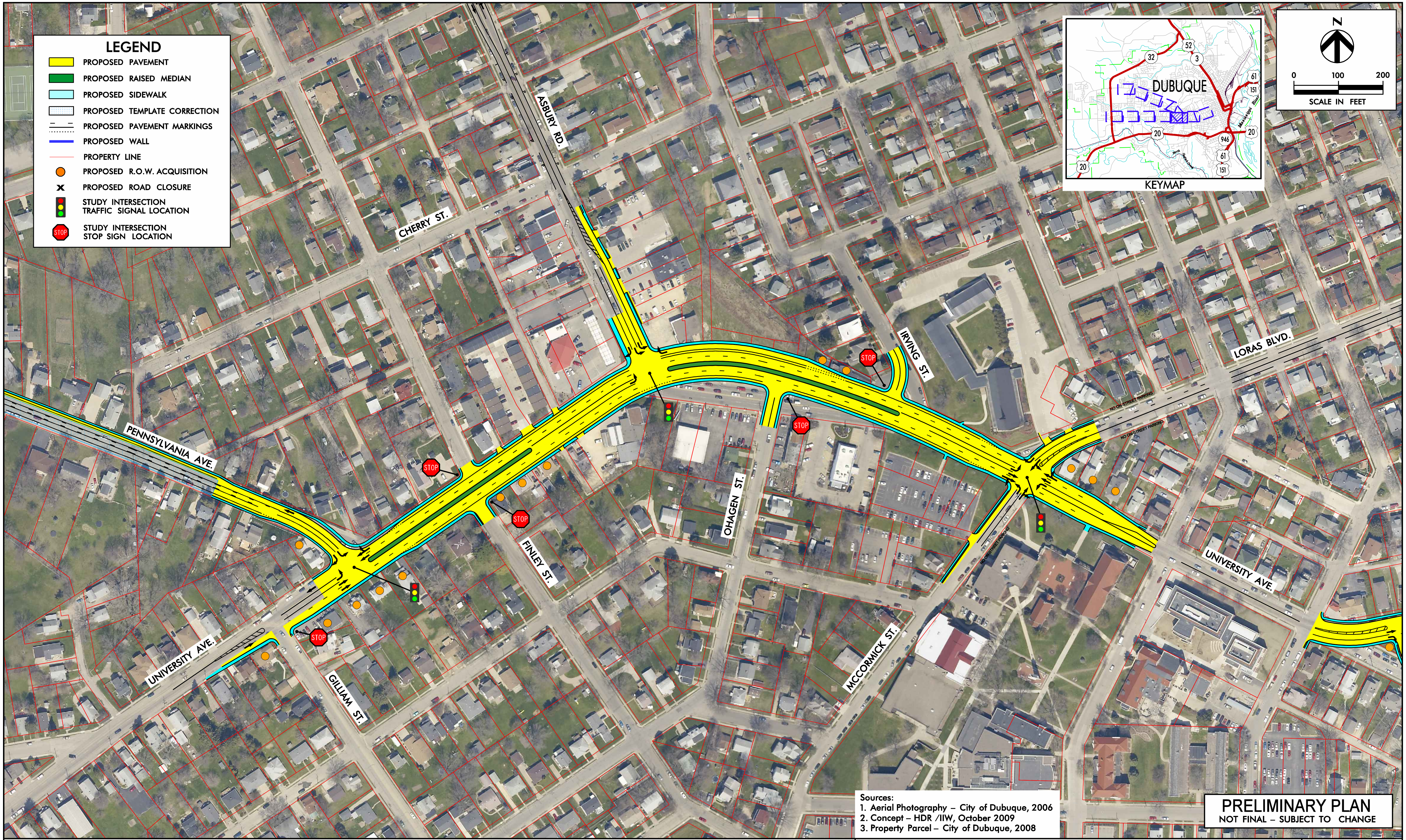
			Asbury Road West Radford Rd. Turn Lane		Asbury Road West NW Arterial to Resurrection Cemetery		Asbury Road West Radford Rd. to Resurrection Cemetery		Asbury Road West Reconstruction of Curve west of Hales Mill Rd		Asbury Road West Antler Ridge to Curve Reconstruction		Asbury Road West Asbury City Limits to Antler Ridge		Asbury Road West City of Dubuque		Asbury Road West West of Seippel Rd.	
Item	Unit	Unit Price	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost	Quantity	Item Cost
Road Construction																		
Pavement Removal	SY	$15	81	$1,215	---	---	---	---	3,402	$51,030	559	$8,385	406	$6,090	173	$2,595	163	$2,445
PCC Pavement/Drives	SY	$50	529	$26,450	---	---	---	---	7,518	$375,900	5,748	$287,400	6,086	$304,300	12,264	$613,200	1,071	$53,550
HMA Overlay (1)	TON	$70	---	---	---	---	---	---	---	---	565	$39,550	573	$40,110	257	$17,990	57	$3,990
Sidewalk	SY	$25	163	$4,075	---	---	---	---	1,475	$36,875	1,635	$40,875	1,718	$42,950	2,453	$61,325	304	$7,600
Retaining Walls	SF	$50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Other Items (2)	% of paving cost		150%	39,675	---	---	---	---	150%	$563,850	150%	$431,100	150%	$456,450	150%	$919,800	150%	$80,325
		Subtotal		$71,000		$0		$0		$1,030,000		$810,000		$850,000		$1,610,000		$150,000
Signals	EACH	$150,000	1	150,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pedestrian Signal	EACH	$75,000	---	---	---	---	---	---	---	---	1	75,000	---	---	---	---	---	---
Mid-Block Pedestrian Crossing	EACH	$30,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
3-Lane with Sharrow Pavement Markings	Per Mile	$50,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Bike Lane Pavement Markings/Signs	Per Mile	$45,000	0.13	$5,850	0.21	$9,450	0.19	$8,550	0.32	$14,400	0.37	$16,650	0.39	$17,550	0.52	$23,400	0.1	$4,500
Spot Intersection Pavement Markings	EACH	$10,000	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Contingencies			20%	$45,370	20%	$1,890	20%	$1,710	20%	$208,880	20%	$180,330	20%	$173,510	20%	$326,680	20%	$30,900
Road Construction and Contingencies Total				$272,000		$11,000		$10,000		$1,250,000		$1,080,000		$1,040,000		$1,960,000		$190,000
ROW Cost																		
Residential Partial		$3.00	708	$2,124	---	---	---	---	---	---	4,255	$12,765	15,107	$45,321	2,098	$6,294	2,300	$6,900
Commercial Partial	SF	$8.50	3,352	$28,492	---	---	---	---	---	---	929	$7,897	---	---	---	---	---	---
Full Impacts (3)	Each	Varies	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
		ROW Total		$30,616		$0		$0		$0		$20,662		$45,321		$6,294		$6,900
Construction and ROW Costs per Segment Total				$300,000		$11,000		$10,000		$1,250,000		$1,100,000		$1,090,000		$1,970,000		$200,000

Note: Utility relocations and aesthetic treatments are not included with this cost estimate

(1) *For template correction*

(2) *Items not quantified*

(3) *1.5 X Assessor property values, Approximates Relocation Costs*



Sources:
1. Aerial Photography – City of Dubuque, 2006
2. Concept – HDR /IIW, October 2009
3. Property Parcel – City of Dubuque, 2008

PRELIMINARY PLAN
NOT FINAL – SUBJECT TO CHANGE

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East Central Intergovernmental Association

SIGNALIZATION CONCEPT – UNIVERSITY AVENUE AND LORAS BOULEVARD

East – West Corridor Connectivity Study, Dubuque County, Iowa

Date
September 2010

Figure
Appendix