# Corridor Alignment and Geometric Alternatives Analysis

Mississippi Drive Corridor
**Phase 1 Environmental Assessment & Preliminary Design**

**City of Muscatine**
Muscatine, Iowa

February 2012

Stanley Consultants INC.
A Stanley Group Company
Engineering, Environmental and Construction Services - Worldwide

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# Section 1

# Introduction

## Project History

Formerly called Front Street, the bulk of the project corridor is now called Mississippi Drive, although as shown below, this study corridor includes segments from several different streets. For the purposes of this report, the project corridor will be referred to as the Mississippi Drive Corridor. The Mississippi Drive Corridor is part of two state routes, US-61 (Business Loop) and IA 92 and is designated as a primary arterial route through downtown Muscatine. It connects to several regional transportation corridors, including Hwy 38 heading north towards I-80, US-61 heading south to Burlington and east to the Quad Cities, and IA 92 which connects to the Norbert F. Becky Bridge, the only Mississippi River crossing in Muscatine, within 20 miles of the City.

A number of events have occurred over the past 30 years which have contributed to the need for an evaluation of the corridor for proposed improvements. Among them are the following:

- From 1984 to the present, a number of improvements totaling over $20 million have been implemented along the riverfront to create park and recreation facilities between the Mississippi Drive Corridor and the Mississippi River, enhancing and preserving the corridor.
- In 1985, the US-61 bypass route was completed, making Mississippi Drive part of the local business loop through Muscatine. As a result, the character and volume of traffic using the corridor has changed somewhat, from a through route for most of the traffic through the area to a destination route for residents and business traffic in the City.
- In 2007, a corridor study was completed evaluating conceptual improvements for pedestrian and vehicular traffic, reduction of flood impacts, and enhancements to the visual image along Mississippi Drive. This study was used as a starting point for the Environmental Assessment currently underway.

Recommendations from the 2007 study included the need for further study along the corridor as well as funding for implementation of the proposed improvements. To that end, a grant was received to conduct preliminary engineering studies and complete an environmental assessment along the Mississippi Drive Corridor in order to receive clearance from the Federal Highway Administration (FHWA) to apply for Federal funding for final design and construction activities.

## Project Purpose and Need

The project purpose and need statement details four areas of need to be addressed, as follows:

- *Enhanced access for vehicles traveling through the downtown.* Traffic on the Mississippi Drive corridor has been on the decline since 1998 according to Iowa DOT average traffic counts. The major factor in this decline was the opening of the US-61 bypass which eliminated the need for regional traffic to travel through the central business district of Muscatine. The width of the corridor, which is mostly four lanes wide (approximately 40-64 feet), creates excess capacity for the existing traffic volume, a tendency for traffic to exceed the speed limit and a challenge for pedestrians crossing the roadway safely.
- *Safe access for pedestrians along and crossing Mississippi Drive.* Pedestrian safety is a frequent issue of concern among the public and stakeholders in Muscatine. The concern is due to the wide roadway that must be crossed which can be challenging for the elderly and persons with young children, the lack of pedestrian refuges and protected crosswalks, as well as the lack of convenient access for bicyclists reaching the recreational trail along the river from downtown.
- *Reducing instances of closure due to flooding.* The Mississippi Drive corridor runs parallel to the Mississippi River with less than 300-feet between them. Frequent flooding between Mulberry Avenue and Iowa Avenue causes Mississippi Drive to be closed, requiring detouring of traffic onto local streets in the downtown area.
- *Fostering economic development.* The City of Muscatine Comprehensive Plan lists economic development and downtown revitalization under the goals and objectives. One of the key elements includes revitalizing the riverfront area and downtown business district. The proposed improvements fit the intent in the comprehensive plan to improve community cohesion in the downtown area for all community uses.

# Section 2

# Existing Project Corridor

## Existing Project Corridor

The Mississippi Drive Corridor consists of approximately 1.6 miles of roadway along Business US-61/IA 92 through downtown Muscatine, Iowa. The project starts on Grandview Avenue at Main Street, continuing north becoming Green Street, turning east on Hershey Avenue, turning northeast on Mississippi Drive, turning northwest on Mulberry Avenue, and turning northeast on 2nd Street, ending at the Norbert F. Becky Bridge. Refer to Figure 2-1 for the Project Location Map.

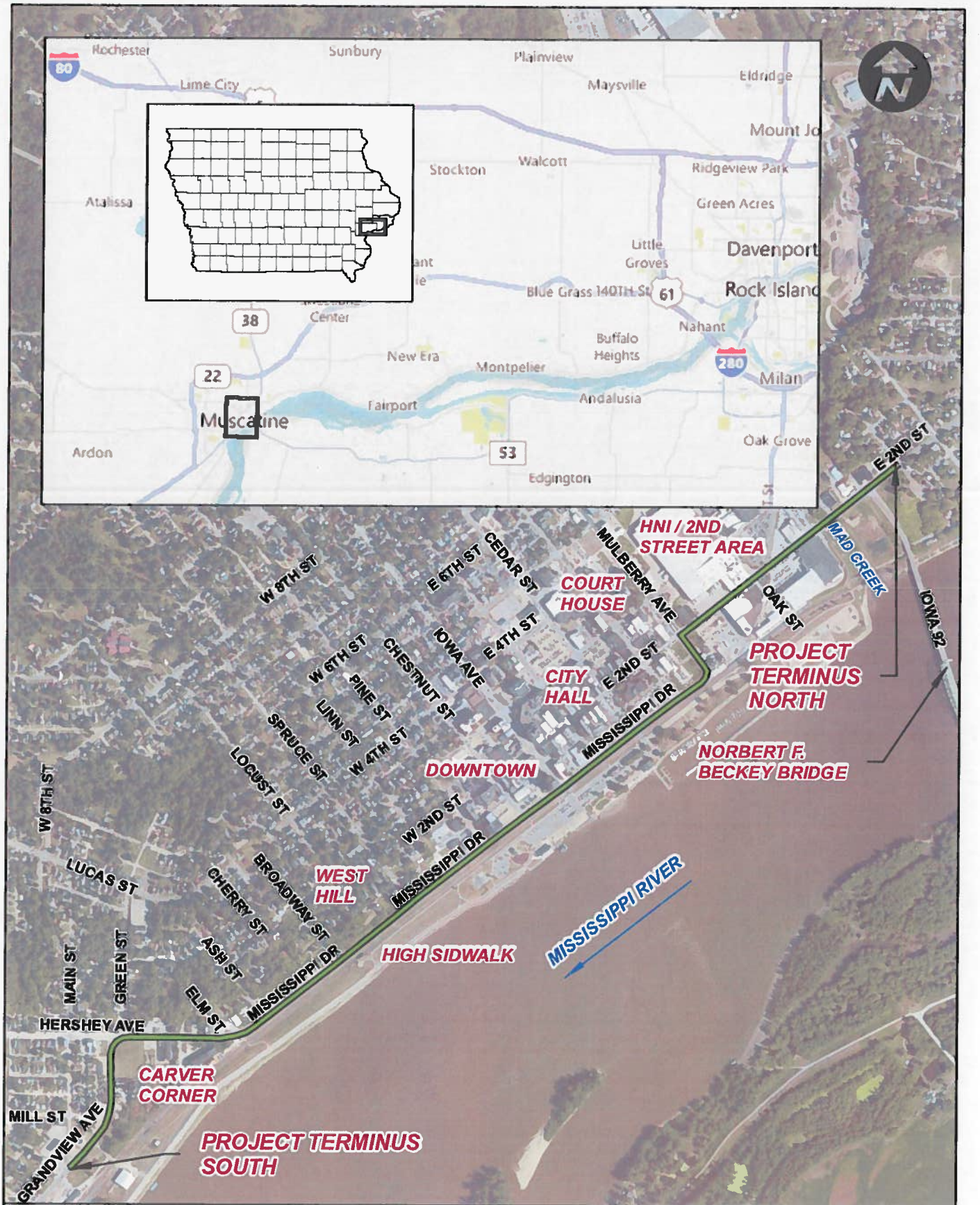
Mississippi Drive is classified as an arterial and a truck route with truck access along the entire length of the corridor. The posted speed limit along the corridor varies between 25 mph and 35 mph. Improvement objectives are to make the corridor more pedestrian friendly by possibly narrowing the number of lanes and connecting the riverfront to the downtown. The project is following the National Environmental Policy Act (NEPA) process for environmental assessment.

The corridor length can be divided into four areas that depict unique character and hence affect the potential design alternatives as follows:

1. HNI / East 2nd Street (Mulberry Street to the Northern Termini)
2. Downtown (Pine Street to Mulberry Avenue)
3. High Sidewalk (Mississippi Drive between Ash Street and Spruce Street)
4. Carver Corner (Southern Termini to Elm Street)

These corridor areas were detailed and evaluated in the 2007 corridor study mentioned in Section 1. The evaluation process and resulting recommendations in the following sections also take the unique characteristics in each of the above referenced areas into account.

The project corridor, along with the 11 cross streets, were observed and surveyed to document their major characteristics, for use in later analysis and evaluation of the corridor. Tables 2-1 and 2-2 summarize the intersection and roadway characteristics along the Mississippi Drive Corridor.

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**Project Location Map**
**Figure 2-1**

**Table 2-1 Roadway Details**

| | Roadway | Jurisdiction | Roadway Classification | Speed Limit | Number of Lanes | On-Street Parking (Type) | Access to/from River Front |
|---|---|---|---|---|---|---|---|
| 1 | Mississippi Drive | Iowa DOT | Arterial | 25 -35 | 4 | Yes (between Sycamore St and Linn St) | No |
| 2 | Beckey Bridge | Iowa DOT | Arterial | 30 | 2 | No | No |
| 3 | Oak Street | City | Collector | 25 | 2 | Yes (parallel) | No |
| 4 | Mulberry Avenue | Iowa DOT | Collector | 25 | 2 | Yes (parallel) | No |
| 5 | Walnut Street | City | Collector | 25 | 2 | Yes (parallel) | No |
| 6 | Cedar Street | Iowa DOT | Collector | 25 | 2 | Yes (parallel) | Yes |
| 7 | Sycamore Street | City | Collector | 25 | 2 | Yes (parallel) | No |
| 8 | Iowa Avenue | City | Collector | 25 | 2 | Yes (parallel & angled) | Yes |
| 9 | Chestnut Street | City | Collector | 25 | 2 | Yes (parallel) | No |
| 10 | Pine Street | City | Collector | 25 | 2 | Yes (parallel) | No |
| 11 | Hershey Avenue | County | Arterial | 25 | 2 | Yes (parallel) | No |
| 12 | Mill Street | City | Collector | 25 | 2 | Yes (parallel) | No |

Source: Stanley Consultants, Inc.

**Table 2-2 Intersection Details**

| | Intersection | Jurisdiction | Signalized (Yes/No) | Pedestrian Signals (Yes/No) | On-Street Parking | Bus Stop |
|---|---|---|---|---|---|---|
| 1 | Mississippi Drive / Becky Bridge | Iowa DOT | Yes | No | - | - |
| 2 | Mississippi Drive / Oak Street | Iowa DOT | Yes | No | SB | - |
| 3 | Mississippi Drive / Mulberry Avenue | Iowa DOT | Yes | Yes | NB | - |
| 4 | Mississippi Drive / Walnut Street | Iowa DOT | No | No | NB/SB | - |
| 5 | Mississippi Drive / Cedar Street | Iowa DOT | Yes | Yes | NB/SB | - |
| 6 | Mississippi Drive / Sycamore Street | Iowa DOT | No | No | SB | - |
| 7 | Mississippi Drive / Iowa Avenue | Iowa DOT | Yes | Yes | NB/SB | - |
| 8 | Mississippi Drive / Chestnut Street | Iowa DOT | No | No | NB/SB | - |
| 9 | Mississippi Drive / Pine Street | Iowa DOT | No | No | NB/SB | - |
| 10 | Mississippi Drive / Hershey Avenue | Iowa DOT | Yes | No | EB/WB | - |
| 11 | Mississippi Drive / Mill Street | Iowa DOT | No | No | EB/WB | - |

Source: Stanley Consultants, Inc.

# Section 3

# Proposed Improvements

The proposed project will generally include improvements to the mainline roadway, pavement rehabilitation, intersection improvements to tie into existing side streets and upgrade intersection control, pedestrian facility improvements, drainage and utility improvements, flood protection measures, access management implementation, and corridor enhancements. Specific alternatives and options will be discussed in later report sections.

The improvements will fall within the existing road Right-of-Way (ROW) in all areas except Carver Corner. There are several improvement options being considered at Carver Corner, which will be detailed below.

In developing alternative alignments, the Iowa Department of Transportation (IaDOT) design standards were followed for major design elements for the roadway. Features that are common with all build alternatives and options are summarized in Tables 3-1 and 3-2.

**Table 3-1 Cross Section Design Criteria**

| Design Element | | Acceptable Values | Preferred Values |
|---|---|---|---|
| | | SUDAS Function Class | SUDAS Functional Class |
| | | Arterial | Arterial |
| Full Depth Paved Width (ft) | Outside Lane | 11 | 12 |
| | Inside Lane (s) | 11 | 12 |
| Auxiliary-Lane Width (ft) | | 11 | 12 |
| Mainline Cross-Slope (%) | | 1.5% minimum | 2% not to exceed 3% |
| Foreslope (see Roadway Typical Cross Sections) | Adjacent to Roadway | -- | -- |
| | Beyond Ditch Depth and Clearzone | 4:1 | 6:1 |
| | Beyond 12' Behind Curb | -- | -- |
| North Median Width (ft) | | 15 | 16 |
| Backslope (For cut areas greater than 25 feet, contact the Soils Design Section for assistance with backslope benches.) | | 3:1 | 4:1 |
| Vertical Clearance (ft) (Above Lanes & Shoulders) (See Section 1C-2) | Over Primary Road | 16 | 16 |
| | Over Non-Primary | 14 | 15 |
| | Over Railroad | 23.3 | 23.3 |
| | Sign Truss | 17 | 17.5 |
| Level of Service | | C | -- |

Source: Iowa DOT Design Criteria

**Table 3-2 Corridor Design Criteria**

| Design Element | | Acceptable Design Criteria Based Upon Design Speed (require approval according to Section 1C-8) Design Speed, mph (cannot be less than speed limit) | | | | Preferred Design Criteria Based Upon Design Speed Design Speed, mph (Preferred design speed is 5 mph over posted speed limit and a minimum 70 mph for Interstates) | | | |
|---|---|---|---|---|---|---|---|---|---|
| Speed | | 25 | 30 | 35 | 40 | 25 | 30 | 35 | 40 |
| Stopping sight Distance (ft) (see Section 6D-1) | | 155 | 200 | 250 | 305 | 155 | 200 | 250 | 305 |
| Minimum horizontal curve radius (ft) | $e_{max}$ = 4% | 154 | 250 | 370 | 533 | 154 | 250 | 370 | 533 |
| | $e_{max}$ = 6% | -- | -- | -- | -- | -- | -- | -- | -- |
| | $e_{max}$ = 8% | -- | -- | -- | -- | | | | |
| Minimum horizontal curve length (including spirals) (ft) | | 375 | 450 | 525 | 600 | 375 | 450 | 525 | 600 |
| Minimum vertical curve length (ft) | | 75 | 90 | 105 | 120 | 75 | 90 | 105 | 120 |
| Minimum rate of vertical curvature (K) | Crest | 12 | 19 | 29 | 44 | 19 | 31 | 48 | 70 |
| | Sag | 26 | 37 | 49 | 64 | 26 | 37 | 49 | 64 |
| Minimum gradient (5) | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Maximum gradient (%) on other roadways | | 9 | 9 | 8 | 6 | 5 | 5 | 5 | 5 |
| Curb type | | 6" Standard | | | | 6" Standard | | | |

Source: Iowa DOT Design Criteria

# Section 4

# Development of Alternatives

After review of available data, survey of the existing corridor, observations in the field, capacity and safety studies, public comments, and discussions with City staff, the project team developed several design alternatives and options for the proposed Mississippi Drive Corridor.

Two base mainline roadway improvement alternatives were considered along the route, utilizing a three and five lane section as described below. A No-Build alternative was also considered, as required by the National Environmental Policy Act (NEPA). The proposed improvements generally followed the existing roadway alignment, except in the Carver Corner area, where several intersection options were considered, as described in Option 1 below. Additionally, several options were considered in the bluff area to address unique roadway width constraints created by the bluff on the City side and several man-made constraints on the river side, as described in Option 2 below. Following is a brief description of each of the alternatives. These alternatives are also shown graphically in Appendix A.

## Mainline Roadway Improvement Alternatives

### No-Build Alternative

Currently the Mississippi Drive corridor consists of several different cross sections, which are summarized as follows:

- Grandview Avenue (from Main Street to Mill Street) – two lanes in each direction.
- Green Street/Hershey Avenue/Mississippi Drive (from Mill Street to Linn Street) – one lane in each direction with center two-way left turn lane.
- Mississippi Drive (from Linn Street to Walnut Street) – four lane boulevard with channelized left turn lanes at side street intersections.

- Mississippi Drive/Mulberry Avenue (From Walnut Street to 2nd Street) - one lane in each direction with center two-way left turn lane.
- 2nd Street (From Mulberry Avenue to Norbert F. Becky bridge) – two lanes in each direction.

The existing route is over capacity for current and projected traffic and is deteriorating in several locations. The existing driveway access along the route is not managed appropriately. Also the no-build alternative does not address flooding issues, a key component in the purpose and need for the project.

**Alternative 1 – Three Lane Roadway**

The Alternative 1 alignment follows the existing alignment along the entire route, except the Carver Corner area (Refer to Option 1 below). The cross section includes one driving lane in each direction with a variety of left turn variations throughout the corridor, as follows:

- Two-Way Left Turn Lane (16-feet wide) – between Main Street and Hershey Avenue, between Walnut Street and the Norbert F. Becky Bridge.
- Mountable Center Median (16-feet wide) – between Green Street and Linn Street.
- Channelized Left-Turn Lanes with Non-Mountable Median Islands (16-feet wide) – between Linn Street and Walnut Street.

Right turn lanes were also added at the Iowa Avenue and Cedar Street intersections in the downtown area, to allow right turn queues to get out of the through traffic stream when trains are present in the crossing.

**Alternative 2 – Five Lane Roadway**

The Alternative 2 alignment would be the same as Alternative 1, except in the downtown area between Linn Street and Walnut Street. That part of the corridor would be a four lane boulevard, including two through driving lanes in each direction with a curbed median. Left turns in the four lane boulevard section would be accommodated with channelized left turn lanes similar to Alternative 1. Right turn lanes at Iowa Avenue and Cedar Street would not be necessary with Alternative 2 since there are two through driving lanes in both directions.

**Variations Considered and Dismissed**

Several variations of the above two alternatives were considered and dismissed from further consideration. Following is a brief discussion of each.

An option that included on street parking along the downtown portion of the corridor was considered. However, during discussion with the City it was noted that there is sufficient, even excess existing parking along the river front. There were also other priorities that were considered more important, such as providing sufficient space for pedestrians and storm water management facilities, and limiting the crossing distance for pedestrians at intersections. Therefore, on street parking was dismissed from further consideration along the corridor.

An option was also considered to provide a recreational path on the river side of the corridor between the road and the railroad right-of-way. However, the City staff and members of the public were very resistant to the idea of a recreational path at this location. The reasons given were limited available space and the fact that this path would be redundant to the existing recreational facilities along the riverfront. So, this option was dismissed from further consideration as well.

In addition to the recreational path discussed above, on street bicycle lanes were also considered to accommodate bicycle traffic. However, again due to the lack of space, as well as insufficient connectivity with other facilities, and a desire by the City to encourage other routes for bicyclists, striped bicycle lanes were eliminated from further consideration. An accommodation for bicyclists is provided, though, by use of 12-foot wide outside driving lanes and 2-foot gutter pan, which provides space for bicyclists to share the roadway with motorized vehicles.

## Roadway Geometric Options

### Option 1 – Carver Corner Intersection Geometry

The Carver Corner intersection currently operates as a signalized crossing intersection. The east-west roadway is Hershey Avenue and the north-south roadway is Green Street. The two approaches for Green Street are offset by approximately 50-feet at the intersection creating an intersection with deficiencies in both geometry and safety. To address these deficiencies, several alternative intersection options were evaluated. These options are briefly described as follows:

- Option 1A – Four Leg Roundabout – The four approaches are realigned to form the four approaches to the roundabout. The center of the intersection will be located south and east of the existing intersection.
- Option 1B – Three Leg Roundabout – The east and west Hershey Avenue approaches and the south Green Street approach form the three legs of the roundabout, whose center is located south of the existing intersection. The north leg of Green Street is realigned to intersect Hershey Avenue east of the roundabout. The north Green Street approach would have turning movements limited to westbound rights from Hershey Avenue and southbound rights from Green Street.
- Option 1C – Sweeping Curve Roadway – The four approaches are realigned. A smooth sweeping curve from the south Green Street approach to east Hershey Avenue approach eliminating turns between these approaches. The west Hershey Avenue approach will tee into the sweeping curve. The north Green Street approach will tee into the west Hershey Avenue approach west of the new sweeping curve. Intersection control on the sweeping curve could be either traffic signal or modern roundabout.
- Option 1D – Realigned Crossing Intersection – The south Green Street approach will be realigned to line up with the north approach to create a traditional four leg crossing intersection.

- Option 1E – Realigned Crossing Intersection, Avoiding 4(f) Impacts - Similar to Option 1D except realignment starts north of the TeStrake property, thus avoiding potential 4(f) impacts.

Refer to Appendix A to see graphical representations for the above options.

**Option 2 – Bluff Area Geometry**

Due to the limited corridor width in the bluff area, between Broadway Street and Linn Street, mainline roadway improvement alternatives were considered. Following is a brief description of the options that were evaluated:

- Option 2A – Two Lane with mountable median and walkway on bluff side
- Option 2B – Two Lane with mountable median, no walkway on bluff side
- Option 2C – Two Lane with narrow/no median and walkway on bluff side

Refer to Figure 4-1 depicting the three cross section variations for Option 2.

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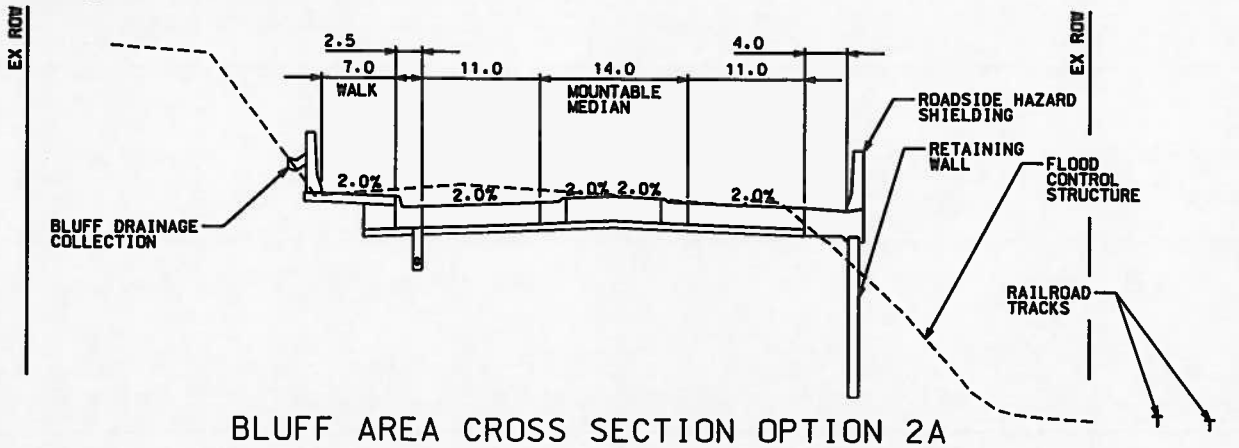
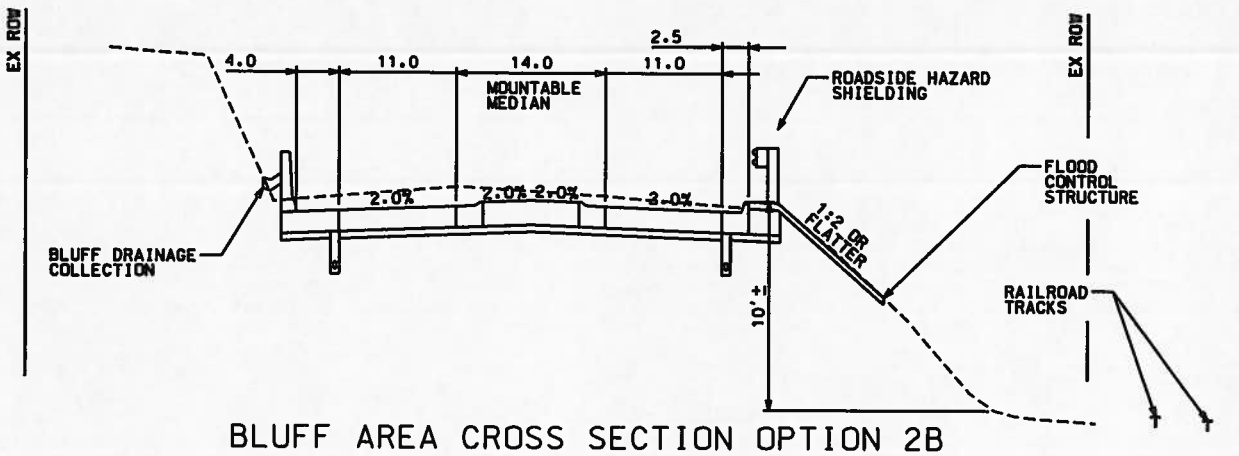
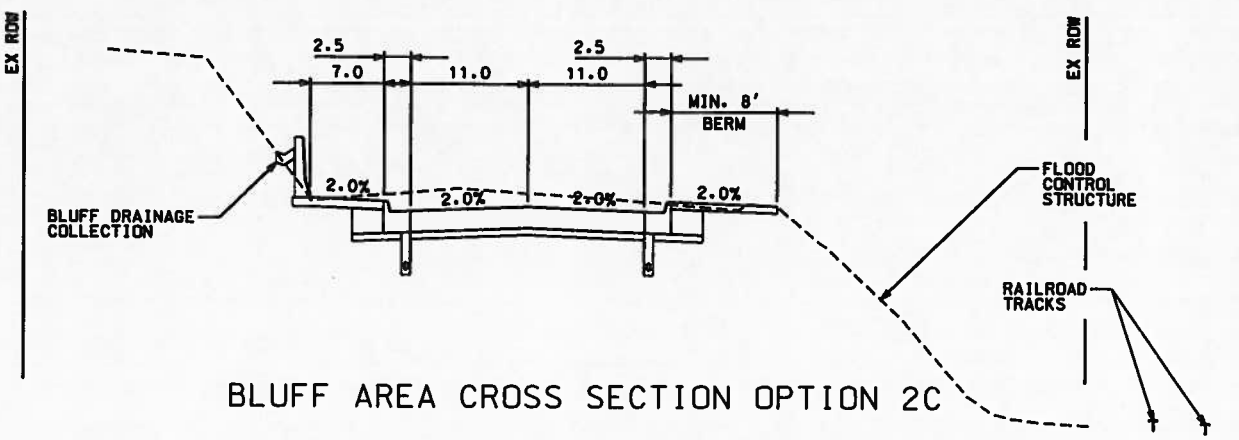



BLUFF AREA CROSS SECTION OPTION 2A




BLUFF AREA CROSS SECTION OPTION 2B




BLUFF AREA CROSS SECTION OPTION 2C

# BLUFF AREA GEOMETRIC OPTIONS
# FIGURE 4-1

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# Section 5

# Screening and Evaluation of Alternatives

In order to evaluate the alignment alternatives and the various roadway options, a screening process was completed. Tables 5-3, 5-4, and 5-5 present the advantages and disadvantages of each alternative and option noted in Section 4.

The various alternatives and options were presented to the City Staff, project team, and other stakeholders and consideration of the advantages and disadvantages of each were considered. A summary of the evaluation process and the reasons for recommending certain alternatives/options over others is discussed below.

## Roadway Alignment Alternatives

Two roadway alignment improvement alternatives, along with a No-Build alternative, were considered for the Mississippi Drive Corridor project as follows:

- No-Build Alternative
- Alternative 1 – Three Lane Roadway
- Alternative 2 – Five Lane Roadway

The No-Build Alternative is evaluated in Table 5-3. Under this alternative, traffic will continue to use the existing 3 to 5 lane roadway through downtown. Due to safety concerns, flooding concerns, and the desire to create gateway features entering the downtown and riverfront areas, the No-Build Alternative is not recommended.

Alternative 1, called the Three Lane Roadway in Table 5-3, includes one driving lane in each direction along with accommodation for left and right turns throughout the corridor.

Alternative 2, called the Five Lane Roadway in Table 5-3, is the same as Alternative 1, except between Linn Street and Walnut Street, where it widens out to two driving lanes in each direction.

The evaluation process began with traffic analysis for the existing condition as well as the two build alternatives for the corridor. As noted in Section 1, the US-61 bypass was completed in the 1980s, which changed the character of the traffic using the Mississippi Drive corridor. The result has been relatively negligible traffic volume growth over the past 20 years. This trend is expected to continue into the future as well. Capacity calculation for the intersections throughout the corridor revealed that the current 3 to 5 lane corridor is over capacity for the traffic currently using it. Furthermore, with negligible traffic growth projections into the future, the current roadway system will continue to operate with excess capacity. The recommendation then, from a traffic capacity standpoint, was to narrow the roadway to three lanes, thus providing appropriate capacity for projected traffic.

A summary of the capacity analyses for the corridor under existing conditions and for projected 2040 traffic volumes are shown in Tables 5-1 and 5-2. The tables detail capacity analysis for the signalized intersections along the corridor, and thus provide a good summary of operations for the Mississippi Drive Corridor. Typically in urban areas, an intersection Level of Service of C or higher is considered acceptable (refer to Table 3-1 showing target level of service). For the Mississippi Drive Corridor, all signalized intersections currently operate at Level of Service B or better, and will continue to do so under 2040 projected traffic volumes, either under the 5 lane or 3 lane configurations. When comparing 3 lane and 5 lane configurations, the fact that the Level of Service does not change, is an indication that the 5 lanes are unnecessary for the corridor.

## Table 5-1 Capacity Analysis Summary (2011 Traffic Volumes)

**Capacity Analysis Summary - 2011 Traffic Volumes, Five Lane Configuration**

| Intersection | Eastbound | | | | | | | | Westbound | | | | | | | | Northbound | | | | | | | | Southbound | | | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | | |
| | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM |
| Mississippi Dr at Becky Bridge | - | - | 6.5 | 4.6 | - | - | *6.5* | *4.6* | 8.2 | 5.8 | 11 | 4.1 | - | - | *11* | *4.5* | 41 | 25 | - | - | - | - | *41* | *25* | - | - | - | - | - | - | - | - | 17.5 | 6.0 |
| | - | - | A | A | - | - | *A* | *A* | A | A | B | A | - | - | *B* | *A* | D | C | - | - | - | - | *D* | *C* | - | - | - | - | - | - | - | - | B | A |
| Mississippi Dr at Oak St | 1.9 | 2.7 | 1.8 | 3.5 | - | - | *1.8* | *3.5* | 2 | - | 3 | 4.7 | - | - | *3* | *4.7* | - | - | 37 | 24 | - | - | *37* | *24* | - | - | 30 | 31 | - | - | *30* | *31* | 4.2 | 5.9 |
| | A | A | A | A | - | - | *A* | *A* | A | - | A | A | - | - | *A* | *A* | - | - | D | C | - | - | *D* | *C* | - | - | C | C | - | - | *C* | *C* | A | A |
| Mississippi Dr at Mulberry Ave | - | - | - | - | - | - | - | - | 17 | 17 | 12 | 11 | - | - | *14* | *14* | - | - | 18 | 15 | 3.4 | 2.2 | *6.2* | *3.9* | 43 | 12 | 9 | 7.4 | - | - | *22* | *10* | 13.5 | 8.6 |
| | - | - | - | - | - | - | - | - | B | B | B | B | - | - | *B* | *B* | - | - | B | B | A | A | *A* | *A* | D | B | A | A | - | - | *C* | *A* | B | A |
| Mississippi Dr at Cedar St | 1 | 3.6 | 1.7 | 4.9 | - | - | *1.6* | *4.7* | 1.3 | 1.7 | 2.3 | 3.4 | - | - | *2.2* | *3.3* | 1 | 28 | 1.7 | 17 | - | - | *1.6* | *18* | - | - | 26 | 29 | - | - | *26* | *29* | 5.1 | 8.6 |
| | A | A | A | A | - | - | *A* | *A* | A | A | A | A | - | - | *A* | *A* | A | C | A | B | - | - | *A* | *B* | - | - | C | C | - | - | *C* | *C* | A | A |
| Mississippi Dr at Iowa Ave | 2.7 | 2.9 | 5.4 | 4.9 | - | - | *5.2* | *4.7* | 2.4 | 1.7 | 4.5 | 4.1 | - | - | *4.2* | *4* | - | 35 | 36 | 35 | 23 | 17 | *29* | *30* | 37 | 37 | 28 | 18 | - | - | *29* | *25* | 7.7 | 7.6 |
| | A | A | A | A | - | - | *A* | *A* | A | A | A | A | - | - | *A* | *A* | - | C | D | C | C | B | *C* | *C* | D | D | C | B | - | - | *C* | *C* | A | A |
| Hershey Ave at Green St | - | - | 17 | 26 | - | 16 | *17* | *25* | 5.3 | 5.8 | 3.1 | 2.8 | - | - | *5* | *5.2* | - | - | 29 | 25 | 0.3 | 0.4 | *1* | *0.9* | - | - | 27 | 23 | - | - | *27* | *23* | 5.7 | 4.9 |
| | - | - | B | C | - | B | *B* | *C* | A | A | A | A | - | - | *A* | *A* | - | - | C | C | A | A | *A* | *A* | - | - | C | C | - | - | *C* | *C* | A | A |

**Capacity Analysis Summary - 2011 Traffic Volumes, Three Lane Configuration**

| Intersection | Eastbound | | | | | | | | Westbound | | | | | | | | Northbound | | | | | | | | Southbound | | | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | | |
| | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM |
| Mississippi Dr at Becky Bridge | - | - | 7 | 3.4 | - | - | *7* | *3.4* | 8.2 | 5.2 | 11 | 3.7 | - | - | *11* | *4.1* | 41 | 28 | - | - | - | - | *41* | *28* | - | - | - | - | - | - | - | - | 17.6 | 5.4 |
| | - | - | A | A | - | - | *A* | *A* | A | A | B | A | - | - | *B* | *A* | D | C | - | - | - | - | *D* | *C* | - | - | - | - | - | - | - | - | B | A |
| Mississippi Dr at Oak St | 1.9 | 2.2 | 1.8 | 2.8 | - | - | *1.8* | *2.8* | 2 | - | 3 | 4.3 | - | - | *3* | *4.3* | - | - | 37 | 37 | - | - | *37* | *37* | - | - | 30 | 35 | - | - | *30* | *35* | 4.1 | 5.8 |
| | A | A | A | A | - | - | *A* | *A* | A | - | A | A | - | - | *A* | *A* | - | - | D | D | - | - | *D* | *D* | - | - | C | D | - | - | *C* | *D* | A | A |
| Mississippi Dr at Mulberry Ave | - | - | - | - | - | - | - | - | 17 | 21 | 12 | 15 | - | - | *14* | *18* | - | - | 17 | 17 | 2.9 | 2.6 | *5.6* | *4.4* | 43 | 11 | 9 | 7.1 | - | - | *22* | *9.7* | 13.4 | 10 |
| | - | - | - | - | - | - | - | - | B | C | B | B | - | - | *B* | *B* | - | - | B | B | A | A | *A* | *A* | D | B | A | A | - | - | *C* | *A* | B | A |
| Mississippi Dr at Cedar St | 1 | 2.6 | 2.3 | 5.1 | 0.2 | 3 | *2* | *4.8* | 1.3 | 1.6 | 3.3 | 3.5 | - | - | *3.1* | *3.4* | 36 | 31 | 22 | 18 | - | - | *25* | *19* | - | - | 26 | 36 | - | - | *26* | *36* | 5.7 | 9.7 |
| | A | A | A | A | A | A | *A* | *A* | A | A | A | A | - | - | *A* | *A* | D | C | C | B | - | - | *C* | *B* | - | - | C | D | - | - | *C* | *D* | A | A |
| Mississippi Dr at Iowa Ave | 2.7 | 2.5 | 6.5 | 5.1 | 2.8 | 4 | *6* | *4.9* | 2.4 | 2.3 | 5.1 | 5.6 | - | - | *4.7* | *5.5* | - | 41 | 35 | 40 | 23 | 19 | *29* | *35* | 37 | 43 | 28 | 21 | - | - | *29* | *29* | 8.3 | 8.8 |
| | A | A | A | A | A | A | *A* | *A* | A | A | A | A | - | - | *A* | *A* | - | D | C | D | C | B | *C* | *C* | D | D | C | C | - | - | *C* | *C* | A | A |
| Hershey Ave at Green St | - | - | 17 | 18 | - | 12 | *17* | *17* | 5.1 | 5.6 | 3.2 | 2.8 | - | - | *4.8* | *5* | - | - | 29 | 29 | 0.3 | 0.4 | *1* | *0.9* | - | - | 27 | 26 | - | - | *27* | *26* | 5.6 | 4.5 |
| | - | - | B | B | - | B | *B* | *B* | A | A | A | A | - | - | *A* | *A* | - | - | C | C | A | A | *A* | *A* | - | - | C | C | - | - | *C* | *C* | A | A |

## Table 5-2 Capacity Analysis Summary (2040 Traffic Volumes)

**Capacity Analysis Summary - 2040 Traffic Volumes, Five Lane Configuration**

| Intersection | Eastbound | | | | | | | | Westbound | | | | | | | | Northbound | | | | | | | | Southbound | | | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | | |
| | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM |
| Mississippi Dr at Becky Bridge | - | - | 10 | 4.4 | - | - | *10* | *4.4* | 8.5 | 6.9 | 13 | 4.1 | - | - | *13* | *4.8* | 38 | 31 | - | - | - | - | *38* | *31* | - | - | - | - | - | - | - | - | 18.5 | 6.3 |
| | - | - | B | A | - | - | *B* | *A* | A | A | B | A | - | - | *B* | *A* | D | C | - | - | - | - | *D* | *C* | - | - | - | - | - | - | - | - | B | A |
| Mississippi Dr at Oak St | 2.6 | 2.4 | 2.3 | 3.3 | - | - | *2.4* | *3.3* | 2.6 | 4.2 | 3.7 | 5.1 | - | - | *3.6* | *5.1* | - | - | 26 | 27 | - | - | *26* | *27* | - | - | 27 | 37 | - | - | *27* | *37* | 5.1 | 6.9 |
| | A | A | A | A | - | - | *A* | *A* | A | A | A | A | - | - | *A* | *A* | - | - | C | C | - | - | *C* | *C* | - | - | C | D | - | - | *C* | *D* | A | A |
| Mississippi Dr at Mulberry Ave | - | - | - | - | - | - | - | - | 17 | 21 | 11 | 15 | - | - | *14* | *18* | - | - | 16 | 16 | 2.7 | 3.8 | *5.2* | *5.2* | 38 | 12 | 7.9 | 7.2 | - | - | *20* | *10* | 12.9 | 10.4 |
| | - | - | - | - | - | - | - | - | B | C | B | B | - | - | *B* | *B* | - | - | B | B | A | A | *A* | *A* | D | B | A | A | - | - | *C* | *A* | B | B |
| Mississippi Dr at Cedar St | 1.2 | 3.2 | 2.3 | 4.5 | - | - | *2.1* | *4.4* | 1.7 | 2.1 | 3.6 | 3.8 | - | - | *3.4* | *3.7* | 32 | 30 | 23 | 18 | - | - | *26* | *19* | - | - | 25 | 36 | - | - | *25* | *36* | 6.6 | 9.3 |
| | A | A | A | A | - | - | *A* | *A* | A | A | A | A | - | - | *A* | *A* | C | C | C | B | - | - | *C* | *B* | - | - | C | D | - | - | *C* | *D* | A | A |
| Mississippi Dr at Iowa Ave | 2.8 | 2.7 | 5.7 | 4.3 | - | - | *5.5* | *4.1* | 2.5 | 2.6 | 4.8 | 4.8 | - | - | *4.5* | *4.7* | 34 | 40 | 31 | 40 | 17 | 18 | *29* | *34* | 32 | 43 | 24 | 20 | - | - | *25* | *29* | 7.8 | 7.8 |
| | A | A | A | A | - | - | *A* | *A* | A | A | A | A | - | - | *A* | *A* | C | D | C | D | B | B | *C* | *C* | C | D | C | B | - | - | *C* | *C* | A | A |
| Hershey Ave at Green St | - | - | 19 | 18 | 12 | 10 | *19* | *17* | 9.7 | 5.9 | 3.7 | 2 | - | - | *8.7* | *5.2* | - | - | 26 | 30 | 0.3 | 0.5 | *1.7* | *1.6* | - | - | 23 | 28 | - | - | *23* | *28* | 8.0 | 5.1 |
| | - | - | B | B | B | A | *B* | *B* | A | A | A | A | - | - | *A* | *A* | - | - | C | C | A | A | *A* | *A* | - | - | C | C | - | - | *C* | *C* | A | A |

**Capacity Analysis Summary - 2040 Traffic Volumes, Three Lane Configuration**

| Intersection | Eastbound | | | | | | | | Westbound | | | | | | | | Northbound | | | | | | | | Southbound | | | | | | | | Overall | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | L | | T | | R | | *Approach* | | | |
| | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM | AM | PM | AM | PM | *AM* | *PM* | AM | PM |
| Mississippi Dr at Becky Bridge | - | - | 10 | 4.2 | - | - | *10* | *4.2* | 8.5 | 6.9 | 13 | 4.1 | - | - | *13* | *4.8* | 38 | 31 | - | - | - | - | *38* | *31* | - | - | - | - | - | - | - | - | 18.5 | 6.1 |
| | - | - | B | A | - | - | *B* | *A* | A | A | B | A | - | - | *B* | *A* | D | C | - | - | - | - | *D* | *C* | - | - | - | - | - | - | - | - | B | A |
| Mississippi Dr at Oak St | 2.6 | 2.4 | 2.3 | 3.4 | - | - | *2.4* | *3.4* | 2.6 | 4.2 | 3.7 | 5.1 | - | - | *3.6* | *5.1* | - | - | 26 | 27 | - | - | *26* | *27* | - | - | 27 | 37 | - | - | *27* | *37* | 5.1 | 6.9 |
| | A | A | A | A | - | - | *A* | *A* | A | A | A | A | - | - | *A* | *A* | - | - | C | C | - | - | *C* | *C* | - | - | C | D | - | - | *C* | *D* | A | A |
| Mississippi Dr at Mulberry Ave | - | - | - | - | - | - | - | - | 17 | 21 | 11 | 15 | - | - | *14* | *18* | - | - | 16 | 15 | 2.7 | 2.4 | *5.2* | *3.8* | 38 | 12 | 7.9 | 7.2 | - | - | *20* | *10* | 12.9 | 9.7 |
| | - | - | - | - | - | - | - | - | B | C | B | B | - | - | *B* | *B* | - | - | B | B | A | A | *A* | *A* | D | B | A | A | - | - | *C* | *A* | B | A |
| Mississippi Dr at Cedar St | 1.2 | 4.4 | 2.3 | 7.2 | - | 4 | *2.1* | *6.7* | 1.7 | 2.2 | 3.6 | 5 | - | - | *3.4* | *4.9* | 32 | 30 | 23 | 17 | - | - | *26* | *18* | - | - | 25 | 38 | - | - | *25* | *38* | 6.6 | 11.1 |
| | A | A | A | A | - | A | *A* | *A* | A | A | A | A | - | - | *A* | *A* | C | C | C | B | - | - | *C* | *B* | - | - | C | D | - | - | *C* | *D* | A | B |
| Mississippi Dr at Iowa Ave | 2.8 | 2.7 | 5.7 | 5.8 | - | 4 | *5.5* | *5.5* | 2.5 | 1.6 | 4.8 | 4.4 | - | - | *4.5* | *4.4* | 34 | 40 | 31 | 40 | 17 | 18 | *29* | *34* | 32 | 43 | 24 | 20 | - | - | *25* | *29* | 7.8 | 8.4 |
| | A | A | A | A | - | A | *A* | *A* | A | A | A | A | - | - | *A* | *A* | C | D | C | D | B | B | *C* | *C* | C | D | C | C | - | - | *C* | *C* | A | A |
| Hershey Ave at Green St | - | - | 19 | 18 | 12 | 10 | *19* | *17* | 9.7 | 5.1 | 3.7 | 2 | - | - | *8.7* | *4.5* | - | - | 26 | 30 | 0.3 | 0.5 | *1.7* | *1.6* | - | - | 23 | 28 | - | - | *23* | *28* | 8.0 | 4.8 |
| | - | - | B | B | B | A | *B* | *B* | A | A | A | A | - | - | *A* | *A* | - | - | C | C | A | A | *A* | *A* | - | - | C | C | - | - | *C* | *C* | A | A |

The three lane cross section in the downtown area provides other advantages as well. Eliminating two through lanes creates a narrower crossing at intersections for pedestrians, which enhances safety. In addition, the additional green space reduces the impervious area in the ROW, and provides additional space for enhancements to storm water management facilities, pedestrian facilities, and landscaping/streetscape features.

Under both build alternatives, access management criteria were applied to provide controlled loading and unloading zones and eliminate uncontrolled access areas along the Mississippi Drive corridor.

One advantage for the Five lane alternative is that two continuous driving lanes allow for easier passing of slower vehicles by faster moving vehicles. However, safety is negatively affected because traffic speeds tend to increase due to excess capacity through the downtown area.

As detailed herein, the overall advantages for the Three Lane Alternative outweighed those of the Five Lane Alternative; therefore the Five Lane Alternative was eliminated from further consideration.

**Roadway Design Criteria Matrix Evaluation**

As part of the evaluation process, a design criteria matrix was created comparing the No-Build and both Build Alternatives against various roadway design criteria. The criteria were developed to align with the project purpose and need criteria as well as general road design criteria. Following is a list of the criteria used in the matrix.

1. Improved Safety for Vehicles
2. Improved Safety for Pedestrians
3. Improved Safety for Bicycles
4. Reduced Flooding Potential
5. Provide Infrastructure for Future Development
6. Operations
7. Improve Aesthetics
8. Cost
9. Constructability
10. Improve Bicycle and Pedestrian Connection to the Riverfront
11. Create Gateway Opportunities

The first five criteria were considered primary to the project purpose and need. Criteria 6 - 9 were also considered primary but not part of the project purpose and need. Criteria 10 and 11 were considered secondary criteria.

The matrix was sent to various stakeholders and team members, who were asked to compare the No-Build Alternative, the Three Lane Alternative and the Five Lane Alternative for each of the

11 design criteria and rate them on a scale of 1 to 5, with 1 being the worst and 5 being the best. The results showed that in 10 of 11 categories the Three Lane Alternative ranked first of the three alternatives being considered. The only category that differed was cost, in which the No-Build Alternative ranked first.

**Table 5-3 Evaluation of Roadway Alignment Alternatives**

| Advantages | Disadvantages |
|---|---|
| **No-Build Alternative** | |
| • Lowest Cost<br>• No temporary disruption to local businesses | • Does not satisfy project purpose and need<br>• Wider crossing widths for pedestrians.<br>• Maintains existing character of the roadway.<br>• Does not address flooding concerns between Iowa Avenue and Mulberry Avenue.<br>• Does not address safety concerns at Carver Corner.<br>• Does not address the desire to create gateway features coming into downtown from the north and south. |
| **Alternative 1 – Three Lane Roadway** | |
| • Satisfies project purpose and need<br>• Lower cost than the five-lane option<br>• Provides the best opportunity for streetscape, landscape, and storm water management improvements.<br>• Lower impervious area.<br>• Provides appropriate traffic capacity based on the operational analysis for the corridor.<br>• Narrower crossing widths for pedestrians at intersections.<br>• A designated loading zone provides designated areas for trucks and improves overall road safety. | • Higher cost than the do nothing alternative.<br>• Limits passing opportunities for faster moving vehicles. |

| Alternative 2 – Five Lane Roadway | |
|---|---|
| • Higher capacity.<br>• Two driving lanes make it easier for faster moving vehicles to pass slower vehicles. | • Does not satisfy project purpose and need for decreased width for pedestrians, or for safety concerns due to higher speeds.<br>• Highest cost, when compared to either of the other two alternatives<br>• Limited potential for streetscape and storm water management improvements.<br>• Higher impervious area.<br>• Provides more traffic capacity than is necessary based on traffic analysis.<br>• Wider crossing widths for pedestrians<br>• Five lanes can't be accommodated on 2nd Street, in the bluff area, or in the Carver corner area due to site constraints such as buildings, utilities, and flood control structures. |

Source: Stanley Consultants, Inc.

## Carver Corner Intersection Geometric Options

### Introduction

Carver corner is located in the southwest corner of Muscatine on the main arterial access to the City. The current intersection at the corner of Hershey Avenue and Green Street is an offset signalized intersection which has inherent operational and safety issues, requiring the City to consider changes. In addition, the City of Muscatine wants to create an entry statement (or gateway effect) for traffic entering the downtown area from the south and west, most of which is funneled through this intersection. However, due to the unusual existing geometry and limitations presented by nearby buildings, an innovative solution is required.

The 2007 corridor study considered options at Carver Corner that included a recommendation for a modern roundabout at this intersection. The current study, building on the previous recommendations, considered five options with a mixture of modern roundabout and traffic signal control. Appendix A shows graphical representations for the intersection options presented below.

### Discussion

In Table 5-4, five intersection geometric options were evaluated. A variety of intersection control methods and orientations were considered in the Carver Corner area. Following is a summary of the evaluation process completed while considering these options.

The first intersection configuration considered, Option 1A, was a four-leg roundabout. This option addressed the offset between the north and south Green Street approaches as well as the safety and operational concerns that existed under the current intersection configuration. Capacity analysis showed that one lane approaches on all four legs could accommodate projected traffic volumes and design checks confirmed that the design vehicles could navigate the intersection without difficulty. The main disadvantage with Option 1A was the challenge presented by the steep approach slopes on the north leg of Green Street. Due to the

proximity of the existing building on the northwest corner of the intersection, raising the grade of the intersection to flatten the transition from the north would be difficult.

In order to address the concerns with grading on the north leg of Green Street, additional geometric configurations were considered. The second option, Option 1B, was a three-leg roundabout. The east and west legs of Hershey Avenue and the south leg of Green Street form the three legs of the intersection. The north leg of Green Street was realigned to intersect Hershey Avenue east of the roundabout, thus allowing a smoother transition from the steep slope to the north. Operationally, the roundabout functions well, accommodating the major traffic movements and necessary design vehicle turns. However, the tie in with the north leg of Green Street is very close to the roundabout, which is not an optimal condition. To address this issue, turning movements at the north Green Street approach would be limited to right-in and right-out turns. Since Green Street is a very low volume roadway (less than 10 vehicle turns in the peak hour) this option could work, however, there are better solutions which didn't limit vehicular movement so Option 1B was eliminated from further consideration.

In order to address the concerns with intersection spacing and proximity to buildings, a third option, Option 1C, was developed. Option 1C creates a sweeping curve between the south approach on Green Street and the east approach on Hershey Avenue. The west approach on Hershey Avenue then tees into the new roadway creating an intersection that is farther south and east from the existing configuration. The north leg of Green Street intersects Hershey Avenue west of the main intersection with sufficient spacing, allowing full movement capability for both intersections. One of the advantages for Option 1C is that the heaviest traffic movements through the intersection (previously westbound to southbound lefts and northbound to eastbound rights) are now through movements. Therefore traffic signal operations become simpler and more efficient. As an alternate, a three leg modern roundabout configuration also works well for Option 1C, as shown in the drawings in Appendix A. The main disadvantages with Option 1C include significant impacts to potential 4(f) resources and limited redevelopment potential for the remaining property once roadway improvements are completed. Whereas Options 1A and 1B leave one large developable property in the southeast quadrant of the intersection, Option 1C cuts that available property into several smaller pieces, leaving less desirable options for development.

A traditional crossing intersection configuration, Option 1D, was also considered in the study. Under this option, the south approach on Green Street was aligned with the north leg, making intersection operations simpler and traffic signal operation more efficient. The main advantage for this option is its similarity to the existing condition both in appearance and operation. Disadvantages include a significant impact to potential 4(f) resources, similar to Option 1C. Also, efficiency and safety concerns are not addressed, due to the fact that the major traffic movements still have to turn at the intersection.

A fifth intersection geometric option, Option 1E, was considered mainly to avoid impacts to potential 4(f) resources in the Carver Corner area. Option 1E is similar to Option 1D in that the south leg of Green Street is aligned with the north leg, creating a traditional signalized crossing intersection. The difference is that the south leg realignment begins north of the

TeStrake property, a 4(f) resource, and a tight S-curve is used to align the north and south legs of Green Street at Hershey Avenue. This tight S-curve configuration does not comply with sound road design principals which creates potential safety concerns, making this option less desirable. Due to this design deficiency, Option 1E was eliminated from further consideration.

**Roadway Design Criteria Matrix Evaluation**

As part of the evaluation process, a design criteria matrix was created comparing intersection options against various roadway design criteria. The criteria were developed to align with the project purpose and need criteria as well as general road design criteria. Following is a list of the criteria used in the matrix.

1. Improved Safety for Vehicles
2. Improved Safety for Pedestrians
3. Improved Safety for Bicycles
4. Reduced Flooding Potential
5. Provide Infrastructure for Future Development
6. Operations
7. Improve Aesthetics
8. Cost
9. Constructability
10. Improve Bicycle and Pedestrian Connection to the Riverfront
11. Create Gateway Opportunities

The first five criteria were considered primary to the project purpose and need. Criteria 6 - 9 were also considered primary but not part of the project purpose and need. Criteria 10 and 11 were considered secondary criteria.

The matrix was sent to various stakeholders and team members, who were asked to compare the five intersection options for each of the 11 design criteria and rate them on a scale of 1 to 5, with 1 being the worst and 5 being the best. The results showed that Option 1A ranked first overall in total points (167), followed closely by Options 1C (161) and 1D (159). Looking at the individual criteria, Option 1A scored highest in 6 of 11 categories, followed by Option 1D scoring highest in 3 of 11 categories. Interestingly, Option 1C, having the second highest total points did not score highest in any one category but was second in 7 of 11 categories.

**Recommendation for Carver Corner Area**

Based on the discussion above, Option 1B and 1E were eliminated from consideration, leaving Options 1A, 1C, and 1D for further evaluation.

Option 1A, the four leg roundabout was rated highly in the criteria matrix evaluation chiefly in the areas of safety, operations and aesthetics. However, the issue of constructability may not be able to be overcome, making this option less desirable.

Given that Option 1C, the sweeping curve, can also be constructed with a roundabout, most of the desirable traits from Option 1A could then be applied to Option 1C. The downside of this option is the major impact on the TeStrake property and the less desirable options for redevelopment of the property surrounding the intersection. However, from an engineering standpoint, Option 1C with a modern roundabout at the main intersection is the most desirable of the remaining options.

Option 1D, the conventional signalized intersection, is the option that is most similar to the existing condition and was favored by some of the local residents. It also preserves a larger portion of the available redevelopment property, which is an advantage over Option 1C. However, it has a similar impact on the TeStrake property as Option 1C, and does not address the operational deficiencies as well as the other options under consideration.

A definitive recommendation in the Carver Corner area is difficult to determine, given the differing decision criteria of engineering advantages, land development potential, and public opinion. A case could be made for Option 1C (with a traffic signal), Option 1C (with a roundabout), or Option 1D, all of which meet the project purpose and need and are viable engineering solutions. In light of this situation, it is prudent to carry all three remaining options into the next stage of the NEPA process for further evaluation of the competing priorities in the Carver Corner area. Further input is needed from the public, the City of Muscatine and the Iowa DOT before a final determination can be made at this location.

**Table 5-4 Evaluation of Carver Corner Intersection Geometric Options**

| Advantages | Disadvantages |
|---|---|
| **Option 1A – Four Leg Roundabout** | |
| • Provides opportunity for attractive entry/gateway feature at the south end of the corridor.<br>• Addresses safety and operational deficiencies.<br>• Provides opportunity for one large parcel for redevelopment.<br>• Satisfies project purpose and need.<br>• Provides separation from traffic lanes in the front yards of residents along Green Street. | • Difficult to accommodate the approach grades on the north leg of Green Street.<br>• Local drivers are unfamiliar with modern roundabout operation.<br>• Up-front construction cost is slightly higher than other improvement options.<br>• Section 4(f) impacts can't be avoided. |
| **Option 1B – Three Leg Roundabout** | |
| • Section 4(f) Statement impacts can be avoided at TeStrake property.<br>• Provides opportunity for attractive | • North leg of Green Street is offset, creating two closely spaced intersections.<br>• Vehicular turning movements to/from the |

| | |
|---|---|
| entry/gateway feature at the south end of the corridor<br>• Provides opportunity for one large parcel for redevelopment.<br>• Satisfies project purpose and need. | north leg of Green Street are restricted.<br>• Local drivers are unfamiliar with modern roundabout operation. |
| **Option 1C – Sweeping Curve Roadway (Signalized or Roundabout)** | |
| • Best facilitates the main traffic movements through the intersection.<br>• Provides opportunity for attractive entry/gateway feature at the south end of the corridor<br>• Simplifies traffic operations and provides better separation between intersections.<br>• Provides opportunity for several small redevelopment parcels.<br>• Satisfies project purpose and need. | • Significant impacts to Section 4(f) resources.<br>• The opportunity for one large parcel for redevelopment is eliminated. |
| **Option 1D – Conventional Intersection (Signalized)** | |
| • Similar to the existing condition, so operations will not change significantly.<br>• Provides opportunity for attractive entry/gateway feature at the south end of the corridor<br>• Several local residents favored this option because they were more familiar with it.<br>• Provides opportunity for one large parcel for redevelopment.<br>• Satisfies project purpose and need.<br>• Provides separation from traffic lanes in the front yards of residents along Green Street. | • South leg realignment causes significant impacts to Section 4(f) resources.<br>• Less safe than roundabout options.<br>• |
| **Option 1E – Conventional Intersection, No 4(f) Impacts at TeStrake Property (Signalized)** | |
| • Section 4(f) Statement impacts can be avoided at TeStrake property.<br>• Provides opportunity for one large parcel for redevelopment. | • Geometry on the south approach includes very tight S-curve close to the intersection.<br>• Does not satisfy project purpose and need for safety improvements.<br>• Less safe than roundabout options.<br>• |

Source: Stanley Consultants, Inc.

## Bluff Area Geometric Options

In table 5-5, three geometric options were evaluated in the bluff area along Mississippi Drive between Broadway Street and Linn Street. This area of the corridor is unique due to the narrow constructible space between the bluff, flood control structure, utility poles, and the railroad. Three potential cross sections were considered, as shown in Figure 4-1.

Option 2A has several advantages, in that it maintains the standard 40-foot roadway width consistent with the rest of the corridor, including two 12-foot driving lanes and a 16-foot mountable center median. Continuous pedestrian facilities are maintained on the bluff side as well. The main disadvantage with this option is the amount of space necessary, which creates the need to relocate several high voltage power poles and also requires the construction of a retaining wall on the river side of the roadway along with hazard shielding for up to 10-feet of vertical drop immediately adjacent to the driving lane. In addition to the expense of roadside hazard shielding, the view of the riverfront is impeded for motorists traveling along Mississippi Drive.

Option 2B maintains the standard 40-foot cross section as in Option 2A, but the walkway on the bluff side is eliminated. This change eliminates the need to relocate the line of power poles and construct a retaining wall, but does not eliminate the need to provide roadside hazard shielding on the river side of the roadway. The other main disadvantage for Option 2B is that the continuity of pedestrian access is not maintained throughout the corridor. As this is an element in the purpose and need statement, Option 2B does not satisfy the project purpose and need statement and is therefore eliminated from further consideration.

Option 2C provides a continuous pedestrian facility and one lane in each direction, but the center median is narrowed or eliminated in the bluff area. The main disadvantage for this condition is a decrease in safety, in that with no center median, opposing traffic lanes are closer causing and increased risk for head-on collisions. Also, available space for snow removal and disabled vehicles is diminished with the narrower cross section. The advantages include significant cost savings, since the power poles don't need to be relocated and the retaining wall is not necessary. Also, the increased separation of the 10-foot drop off from the driving lane eliminates the need for roadside hazard screening.

Due to the ease of construction, maintaining continuous pedestrian access, cost savings, and cleaner, more open views of the riverfront, Option 2C was the recommended option for the geometry in the bluff area.

**Table 5-5 Evaluation of Bluff Area Geometric Options**

| Advantages | Disadvantages |
|---|---|
| **Option 2A – Two Lane with mountable median and walkway on bluff side** | |
| • Maintains continuous pedestrian walkway throughout the corridor.<br>• Maintains continuity of three lane cross section throughout the corridor.<br>• Satisfies project purpose and need.<br>• Provides refuge for disabled vehicles.<br>• Provides more space for snow storage. | • Requires utility pole relocation<br>• Higher cost due to structural requirements and pole relocation on the river side.<br>• Requires retaining wall and roadside hazard shielding from steep slope on the river side. |
| **Option 2B – Two Lane with mountable median, no walkway on bluff side** | |
| • Utility poles do not require relocation<br>• Retaining wall is not required on the river side.<br>• Provides refuge for disabled vehicles.<br>• Provides more space for snow storage. | • No walkway in the bluff area; continuity of pedestrian access is not maintained, which does not satisfy the project purpose and need.<br>• Requires roadside hazard shielding from steep slope on the river side. |
| **Option 2C – Two Lane with narrow/no median and walkway on bluff side** | |
| • Utility poles do not require relocation<br>• Maintains continuous pedestrian walkway throughout the corridor.<br>• Satisfies project purpose and need. | • Potential for head-on collisions is higher with no median.<br>• Less space for disabled vehicles.<br>• Less space for snow storage. |

Source: Stanley Consultants, Inc.

Option 2 Note – A variation of Option 2A was briefly considered that moved the road cross section closer to the bluff. However, this requires a structural wall (sheet piling or similar) that increases the cost to an unacceptable level. Discussions with the City revealed that the bluff face could become unstable if disturbed, so any option that cuts into the cliff face should be avoided if possible. Therefore this option was not considered further.

## Summary of Evaluation Results

Based on the above screening and evaluation of alternatives and options, and after discussion with the City of Muscatine, the general recommendations for the Mississippi Drive corridor are summarized as follows:

- Alternative 1 – Three Lane Roadway.
- Option 1C (signalized), 1C (modern roundabout), 1D – Further evaluation is needed.
- Option 2C – Two Lane Roadway with narrow/no median and walkway on bluff side.

These alternatives and options will be presented in the Environmental Assessment and at the upcoming Public Hearing to receive further public comment.

# Appendix A

## Corridor Alignment Alternatives and Carver Corner Options