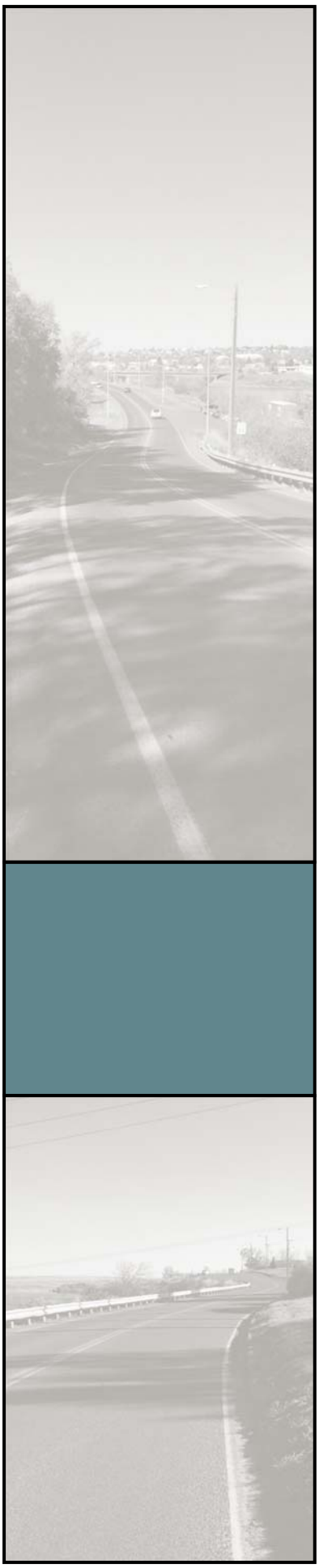


RIVERDRIVE
CORRIDOR STUDY

# Appendix 5

## *Improvement Options Technical Memorandum*

# IMPROVEMENT OPTIONS

*Technical Memorandum*

**July 08, 2016**

*Prepared for:*
Montana Department of Transportation

MONTANA MDT DEPARTMENT OF TRANSPORTATION

RPA
*Prepared by:*
Robert Peccia & Associates

# TABLE OF CONTENTS



## LIST OF FIGURES



## LIST OF TABLES



## APPENDIX

# Improvement Options

## 1.0. INTRODUCTION

The purpose of this memorandum is to identify and evaluate options for improving the study corridor. The study corridor consists of River Drive North between 15th Street North and 38th Street North. The potential improvement options were identified to address previously defined issues or areas of concern and are intended to satisfy the corridor needs and objectives. Improvement options contained in this memorandum reflect input from stakeholders and the public, as well as an evaluation of the existing and projected conditions of the study corridor. Three steps were applied to develop improvement options:

1. Identify roadway issues and areas of concern based on field review, engineering analysis of as-built drawings, crash data analysis, consultation with resource agencies, and information provided by the public.
2. Identify overall corridor needs and objectives.
3. Analyze the information gathered to develop a range of improvement options to address the roadway issues and areas of concern, as well as to satisfy corridor needs and objectives.

Implementation of improvement options ultimately depends on the availability of funding, personnel resources, right-of-way needs, and other project delivery elements. Recommended timeframes for implementation are defined as follows:

- Short-term timeframe: Implementation is recommended within a 0- to 5-year period.
- Mid-term timeframe: Implementation is recommended within a 5- to 10-year period.
- Long-term timeframe: Implementation is recommended within a 10- to 20-year period.

Planning level cost estimates are listed in 2016 dollars for each improvement option. The planning level costs were developed in accordance with procedures outlined in the MDT *Road Design Manual*[1]. The costs include estimates for right-of-way, utilities, preliminary engineering, construction engineering, construction, and indirect costs (IDC). In addition, an inflationary factor of three percent per year was applied to the planning level costs to account for estimated year of expenditure. Cost ranges are provided in some cases, indicating unknown factors at the particular planning level stage. **Appendix A** contains planning level cost estimate worksheets for each option.

The following sections discuss improvement options considered, recommendations for improvements, associated planning level cost estimates, potential implementation timeframes, limitations, constraints, and potential impacts to resources

[1] *MDT Road Design Manual*, Chapter 7 – Construction Cost Estimates, December 2004

# 2.0. RECOMMENDED IMPROVEMENT OPTIONS

This section contains an evaluation of potential improvement options intended to address previously defined issues and areas of concern. Improvement options were identified for individual spot locations as well as corridor-wide. There may be opportunity to develop spot improvements individually or as part of larger corridor-wide recommendations.

For each potential improvement option, an evaluation was made to determine if the improvements would address the needs and objectives of the corridor. The previously identified needs and objectives are as follows:

**Need 1 – Improve the safety of the corridor.**

- Reduce the frequency and severity of crashes.
- Improve roadway elements to meet current design criteria to address identified safety concerns.
- Reduce vehicle conflicts.

**Need 2 – Accommodate existing and future demands.**

- Reduce corridor congestion.
- Improve operations to achieve LOS standards.
- Accommodate large vehicles and freight movements.
- Accommodate non-motorized use.

**Need 3 – Minimize adverse impacts to the environmental characteristics of the study area.**

- Minimize adverse impacts to the Missouri River and surrounding wetlands.
- Avoid or minimize adverse impacts to historic, cultural, archaeological, and recreational resources.
- Preserve the scenic character of the corridor.

**Other Considerations**

- Local and regional planning efforts
- Funding availability
- Construction feasibility and physical constraints
- Impacts to existing residents and businesses in the area

Not all of the improvement options under consideration were carried forward as recommendations. Rather, this memo identifies the range of improvements currently being contemplated. **Section 2.2** discusses those options considered but not advanced as formal recommendations. A summary of recommended improvements are included in **Section 3** of this report.

## 2.1. INDIVIDUAL IMPROVEMENT OPTIONS

This section contains individual improvement options intended to address identified areas of concern for specific locations. These individual improvement options can either be developed as stand-alone improvements, or, in some cases, combined together as larger improvements. There may be cost savings and efficiencies by including packaging improvement options together. **Section 2.3** provides options for packaging improvement options together.

## 1. 15th Street North Intersection

The signalized intersection of River Drive North and 15th Street North currently operates at a Level of Service (LOS) of D, C and C during the AM, noon, and PM peak hours, respectively. The intersection is projected to operate at a LOS of E, C, and E during the respective peak hours. There were 41 crashes reported at the intersection during the five year analysis period.

The width of the north leg of the intersection is constrained by the existing 15th Street North bridge. The north leg is configured with four lanes, a shared through/right and shared through/left for the southbound direction and two northbound travel lanes. The east leg is also constrained due to the location of the bridge end and existing development on the southeast corner.

Due to existing lane configurations, the signal is currently operated using split phasing for the northbound and southbound directions (i.e. southbound and northbound movements receive green time separately from each other). Split phased signal timing is typically less efficient than standard signal timing. The signal timing was recently reviewed and a minor revised signal timing design is expected to be implemented in late-2016. The revised signal timing will include minor changes to clearance intervals and pedestrian crossing times. The revised timing does not include changes to signal phasing.

Full reconstruction of the intersection to address long-term operational issues would be difficult and needs further evaluation due to existing constraints. **Section 2.2** discusses full intersection reconstruction in more detail. As an interim improvement option, extending the westbound right-turn lane would help improve intersection operations. The existing turn lane is approximately 425 feet in length. During the PM peak hour, right-turning vehicles often queue beyond the length of the lane, causing blockage of the other westbound lanes. Extending the westbound right-turn lane to accommodate vehicle queues would allow more turning vehicles to exit the traffic stream and would improve intersection operations.

**Limitations/Constraints:**

- Steep side slope to the north.
- River's Edge Trail to the north.

**Potential Impacts to Resources:**

- None identified.

**Estimated Cost:**

- $180,000

**Implementation Timeframe:**

- Mid-term

## 2. 19th Street North Intersection

The intersection of River Drive North and 19th Street North is a three-legged intersection with stop control along 19th Street North. To the north, there is a shared use path spur of the River's Edge Rail that terminates at 19th Street North. There are currently no crossing treatments at this location. The intersection should be evaluated to determine if additional crossing treatment(s) should be provided to improve safety and connectivity for non-motorized users of the River's Edge Trail. Potential crossing treatments include, but are not limited to, advance signing and rectangular rapid flashing beacons. A grade separated crossing at this location would likely be difficult and costly as a stand-

alone project. Evaluation of a grade separated crossing should occur in conjunction with project development of a larger roadway reconstruction project.

**Limitations/Constraints:**

- Physical constraints due to topography.
- Lack of non-motorized connections south of 19th Street North.

**Potential Impacts to Resources:**

- None identified.

**Estimated Cost:**

- $2,000 (advance signing)
- $40,000 (rectangular rapid flashing beacons)

**Implementation Timeframe:**

- Short-term

### 3. Big Stack Mobile Home Court Approach

The Big Stack Mobile Home Court is located on the south side of River Drive North just east of the Caboose Trailhead. The development is accessed by a single approach off River Drive North near the top of the hill. The access has limited sight lines due to steep slopes and vegetation west of the approach. There were 19 reported crashes at this intersection during the five year analysis period.

Reconstruction of the intersection and of River Drive North to the west could improve alignment and increase sight distances and would likely help improve safety at the intersection. The geometrics of the approach and of River Drive North are constrained by steep hillsides on both the north and south sides of the roadway. It is likely that a retaining wall would be needed between River Drive North and the Big Stack Mobile Home Court to allow for improved sight distances.

If the intersection geometrics and sight distances cannot be improved at the current location due to existing constraints, it may be desirable to relocate the access to the west and create a new connection to 19th Street North. Relocating the access would require additional right-of-way or an easement.

**Limitations/Constraints:**

- Steep hillsides to the north and south of River Drive North.
- New approach would require additional right-of-way or an easement.

**Potential Impacts to Resources:**

- Environmental justice considerations.

**Estimated Cost:**

- $900,000 (existing location)
- $500,000 (new connection to 19th Street North)

**Implementation Timeframe:**

- Mid-term

### 4. Business District Parking and Access

A variety of businesses are located on the south side of River Drive North west of 25th Street North. There are currently no defined access points for the businesses located on the south side of River Drive North west of 25th Street North. Existing right-of-way for River Drive North generally extends close to the building fronts which provides little room for ingress/egress. Vehicles also commonly park at the building fronts and within the roadway right-of-way. There are no parking leases in place between land owners and MDT which would allow parking within the right-of-way. An evaluation of parking provisions should occur during project development.

The current roadway right-of-way in front of the buildings is held in easement by the City of Great Falls. Should development/redevelopment of the business district occur in the future, the businesses may be required to bring parking and landscaping into compliance with current standards. Absent of redevelopment of the businesses, reconstruction of the roadway would provide for better defined access, parking, and circulation. Reconstruction of the roadway to include one travel lane in each direction, center left-turn lane, bike lanes, and sidewalk on the south side of River Drive North could likely fit within existing constraints. There is likely not enough room between the existing businesses and the constraints of the cliffs to include on-street parking on both sides of the roadway. Additionally, on-street parking is not desirable due to safety and operational concerns. An evaluation of parking provisions should occur during project development.

**Limitations/Constraints:**

- Steep side slopes to the north.
- Buildings closely front the roadway right-of-way.

**Potential Impacts to Resources:**

- The businesses are likely properties of historic-age.
- A public water supply well and a domestic well are located on the south side of the roadway.

**Estimated Cost:**

- $1,500,000

**Implementation Timeframe:**

- Mid-term

### 5. 25th Street North Intersection

The intersection of 25th Street North and River Drive North is a three legged intersection with stop-control along 25th Street North. Right-turn slip lanes with yield control are included along the south and west approaches. The intersection currently operates at a LOS of D, C, and F during the AM, noon, and PM peak hours, respectively. Projected conditions result in a LOS of F during all peak hours. Eleven crashes were reported at the intersection during the five year analysis period.

Additional traffic control is necessary to improve operations and safety and to reduce vehicle delay. An intersection signal warrant analysis was completed by MDT on January 13, 2015. The results of the analysis showed that a higher form of traffic control is needed to accommodate northbound left-turning vehicles. The analysis ultimately recommended that the intersection be evaluated for a long-term solution as part of the entire River Drive North corridor. A traffic signal and single lane roundabout are potential options for improving the intersection. These configurations are discussed and compared in this section. Detailed traffic operational data for the configurations are contained in **Appendix B**.

### *Concept A – Traffic Signal Configuration*

Concept A includes construction of a traffic signal at the intersection. Under this configuration, the west leg includes dedicated through and right-turn lanes, the east leg includes dedicated through and left-turn lanes, and the south leg includes dedicated left-turn and right-turn lanes. The traffic signal would require reconstruction along all approach legs to provide for adequate turn-bay length and to flatten approach grades to meet existing standards. **Table 2.1** shows the operational analysis for this configuration under existing and projected conditions while **Figure 2.1** shows the conceptual layout.

The intersection is shown to operate at a LOS C or better for all approach legs during the peak hours under existing and projected conditions. Peak hour delay would be greatly reduced for vehicles along 25th Street North. Installation of a traffic signal would result in some induced delay for the through movements along River Drive North, however.

**Table 2.1: Traffic Signal Concept – Operational Analysis**

| Location | AM | | Noon | | PM | |
|---|---|---|---|---|---|---|
| | Delay (s) | LOS | Delay (s) | LOS | Delay (s) | LOS |
| **EXISTING CONDITIONS (2015)** | | | | | | |
| **Intersection Average** | **9.0** | **A** | **8.9** | **A** | **12.8** | **B** |
| *Eastbound* | *7.7* | *A* | *7.2* | *A* | *8.5* | *A* |
| *Westbound* | *9.7* | *A* | *10.2* | *B* | *17.3* | *B* |
| *Northbound* | *14.7* | *B* | *14.4* | *B* | *14.3* | *B* |
| **PROJECTED CONDITIONS (2035)** | | | | | | |
| **Intersection Average** | **12.2** | **B** | **12.2** | **B** | **20.6** | **C** |
| *Eastbound* | *11.6* | *B* | *11.9* | *B* | *13.0* | *B* |
| *Westbound* | *12.6* | *B* | *11.8* | *B* | *29.8* | *C* |
| *Northbound* | *14.4* | *B* | *14.6* | *B* | *16.9* | *B* |


**Figure 2.1: Traffic Signal Concept at 25th Street Intersection**

**Limitations/Constraints:**

- Accesses along 25th Street North.
- Scenic turnout north of the intersection.

**Potential Impacts to Resources:**

- The Veteran's Memorial [4(f) property] is located on the southeast quadrant.

**Estimated Cost:**

- $2,600,000

### *Concept B – Single Lane Roundabout Configuration*

Configuration B includes construction of a single lane roundabout at the intersection. A right-turn bypass lane is included along the west approach leg to increase capacity and improve operations. The roundabout configuration requires reconstruction of the intersection and approaches in order to provide deflection and to flatten approach grades to meet existing standards. Installation of a roundabout would decrease conflict points and would likely improve safety at the intersection.

**Table 2.2** shows the operational analysis for this configuration under existing and projected conditions while **Figure 2.2** shows the conceptual layout. The intersection is shown to operate at a

LOS of C or better during the peak hours under existing and projected conditions. Delay along 25th Street North would be greatly reduced under this option. The westbound approach leg, however, is projected to approach capacity thresholds by the year 2035 due to high amounts of conflicting northbound left-turns.

**Table 2.2: Roundabout Concept - Operational Analysis**

| Location | AM | | | Noon | | | PM | | |
|---|---|---|---|---|---|---|---|---|---|
| | Delay (s) | v/c | LOS | Delay (s) | v/c | LOS | Delay (s) | v/c | LOS |
| **EXISTING CONDITIONS (2015)** | | | | | | | | | |
| **Intersection Average** | **7.5** | **0.49** | **A** | **6.4** | **0.37** | **A** | **9.8** | **0.68** | **A** |
| *Eastbound* | *7.4* | *0.49* | *A* | *6.1* | *0.37* | *A* | *7.3* | *0.49* | *A* |
| *Westbound* | *7.8* | *0.43* | *A* | *6.9* | *0.36* | *A* | *13.0* | *0.68* | *B* |
| *Northbound* | *7.0* | *0.19* | *A* | *6.3* | *0.18* | *A* | *7.0* | *0.20* | *A* |
| **PROJECTED CONDITIONS (2035)** | | | | | | | | | |
| **Intersection Average** | **9.3** | **0.61** | **A** | **8.3** | **0.51** | **A** | **16.9** | **0.89** | **C** |
| *Eastbound* | *9.1* | *0.61* | *A* | *7.8* | *0.51* | *A* | *9.6* | *0.63* | *A* |
| *Westbound* | *9.8* | *0.53* | *A* | *9.1* | *0.50* | *A* | *26.5* | *0.89* | *D* |
| *Northbound* | *8.7* | *0.26* | *A* | *8.2* | *0.28* | *A* | *9.1* | *0.29* | *A* |


**Figure 2.2: Roundabout Concept at 25th Street Intersection**

**Limitations/Constraints:**

- Long-term capacity constraints along the westbound approach leg during PM peak hour.
- Greater construction impacts than traffic signal configuration.
- Accesses along 25th Street North.
- Scenic turnout north of the intersection.

**Potential Impacts to Resources:**

- The Veteran's Memorial [4(f) property] is located on the southeast quadrant.

**Estimated Cost:**

- $4,000,000

### *Concept Comparison*

Two conceptual configurations (in addition to the existing configuration) were evaluated for the intersection of River Drive North and 25th Street North. **Table 2.3** shows the intersection operational analysis during the peak hours for each concept. The appropriate traffic control for this location should be evaluated further during the project development process. Changes made to this intersection should also be made in coordination with any corridor improvement options described in Option 8.

**Table 2.3: Intersection Operational Comparison**

| Configuration | Existing Conditions (2015) | | | | | | Projected Conditions (2035) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AM | | Noon | | PM | | AM | | Noon | | PM | |
| **Existing Configuration** | 31.4 | D | 23.5 | C | 92.7 | F | 73.8 | F | 65.9 | F | 517.9 | F |
| **Traffic Signal** | 9.0 | A | 8.9 | A | 12.8 | B | 12.2 | B | 12.2 | B | 20.6 | C |
| **Roundabout** | 7.5 | A | 6.4 | A | 9.8 | A | 9.3 | A | 8.3 | A | 16.9 | C |

**Limitations/Constraints:**

- Steep slope to the north.
- Steep roadway grade to the west.
- Approaches to the south along 25th Street North.
- Scenic turnout north of the intersection.

**Potential Impacts to Resources:**

- The Veteran's Memorial [4(f) property] is located on the southeast quadrant.

**Estimated Cost:**

- $2,600,000 (traffic signal)
- $4,000,000 (roundabout)

**Implementation Timeframe:**

- Mid-term

## 6. Eagle Falls Golf Club Access

Currently the Eagle Falls Golf Club is accessed by a single approach off 25th Street North just south of River Drive North. This approach is also used to access the Veteran's Memorial, Centene Stadium, and Pasta Montana's production facility. During special events, such as baseball games at

Centene Stadium, the existing approach experiences heavy use and results in vehicle queuing at the intersection with 25th Street North.

A secondary approach to River Drive North near the Eagle Falls Golf Club would improve access to the Eagle Falls Golf Club, Veteran's Memorial, and Centene Stadium and for emergency response vehicles. The approach may also help to reduce congestion at the existing approach along 25th Street North and at the intersection of River Drive North and 25th Street North. It is desirable that a higher form of traffic control be provided at the intersection of River Drive North and 25th Street North prior to development of a secondary approach.

**Limitations/Constraints:**

- Would create additional conflict points at the new access along River Drive North.
- A higher form of traffic control should be provided at the intersection of River Drive North and 25th Street North.

**Potential Impacts to Resources:**

- The Eagle Falls Golf Club [4(f) property] is located on the south side of River Drive North.

**Estimated Cost:**

- $60,000 (without westbound left-turn lane)
- $320,000 (with westbound left-turn lane)

**Implementation Timeframe:**

- Mid-term

### 7. Railroad Crossing Review

There is an at-grade railroad crossing of River Drive North between Giant Springs Road and 18th Avenue North. Traffic control at the crossing currently consists of a post mounted flashing light signal with a crossbuck sign. The railway has seen an increase in traffic recently due to increased development to the north. There were four reported crashes near the railroad crossing during the five year analysis period. An evaluation of the current crossing should be conducted through a diagnostics review. The review would evaluate the crossing and determine if the existing treatment is appropriate or if modifications are necessary.

**Limitations/Constraints:**

- Crossing is located in close proximity to the intersections with Giant Springs Road and 18th Avenue North.
- A spur to the River's Edge Trail is located to the north.

**Potential Impacts to Resources:**

- The Eagle Falls Golf Club [4(f) property] is located to the southwest.
- The Great Northern Railway is a known historic property.

**Estimated Cost:**

- $30,000

**Implementation Timeframe:**

- Short-term

## 8. River Drive North Reconstruction

The River Drive North corridor currently consists of two travel lanes, one in each direction, and has areas with narrow shoulders. The corridor serves as a key route, supporting both local access and regional travel demand. The north side of the roadway is generally constrained by the Missouri River and River's Edge Trail. The south side of the roadway has areas with commercial, light industrial, resident, and recreational developments.

The existing road facility is inadequate to accommodate existing and projected demands. Existing traffic volumes range from a low of approximately 11,000 vehicles per day (vpd) east of Giant Springs Road, to a high of 14,500 vpd west of 25th Street North. Volumes are projected to increase by approximately 1.5 percent per year over the next 20 years.

Reconstruction of the roadway is needed to address operational issues, improve safety, and to accommodate existing and future demands. An evaluation was made of multiple roadway typical sections given existing and projected demands, safety, and project development constraints. The typical sections were developed based on existing standards and include accommodations for non-motorized users. The corridor was broken into two segments – 15th Street North to 25th Street North and 25th Street North to 38th Street North. These segments represent logical breaks for project development and are discussed in more detail in this section.

### *Segment 1 – 15th Street North to 25th Street North*

This segment of River Drive North consists of multiple access points, businesses and a residential development on the south side of the roadway, and the River's Edge Trail on the north side. The existing traffic volume on this segment is 14,500 vpd with a projected 2035 volume of approximately 20,000 vpd. This area is constrained by terrain to the north and by the businesses to the south. Currently, parking occurs within the River Drive North right-of-way in undesignated areas. There are no parking leases in place between land owners and MDT which would allow parking within the right-of-way. An evaluation of parking provisions should occur during project development.

Reconstruction of this segment is envisioned to consist of one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations. Reconstruction would serve to improve safety and operations by removing turning vehicles from the traffic stream, improving roadway geometrics, and accommodating non-motorized users. The opportunity to expand the roadway is limited by terrain constraints west of 25th Street North. Near the business district, steep slopes exist to the north; near the Big Stack Mobile Home Court, steep slopes exist on both sides of the roadway. This option does not include full reconstruction of the intersection with 15th Street North. The intersection is constrained by the bridge to the north and by development to the south.

**Limitations/Constraints:**

- Physical constraints due to topography.
- River's Edge Trail to the north.

**Potential Impacts to Resources:**

- Environmental justice considerations.
- The businesses west of 25th Street North are likely properties of historic-age.
- A public water supply well and a domestic well are located on the south side of the roadway west of 25th Street North.

**Estimated Cost:**

- $6,000,000 to $8,000,000

### *Segment 2 – 25th Street North to 38th Street North*

This segment of River Drive North consists of limited access points, higher speeds, and lower traffic volumes than Segment 1. Existing traffic volumes range from 12,600 vpd west of Giant Springs Road to 10,800 vpd to the east. These volumes are projected to increase to 17,000 vpd and 15,000 vpd by the year 2035, respectively.

As with Segment 1, reconstruction is envisioned to consist of one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations. Reconstruction would serve to improve safety and operations by removing turning vehicles from the traffic stream, improving roadway geometrics, and accommodating non-motorized users. Unlike Segment 1, however, there are likely fewer locations where a center left-turn lane is needed due to less access points and approaches.

Between 25th Street North and Giant Springs Road the corridor is generally constrained by recreational property (Veteran's Memorial and Eagle Falls Golf Club) to the south. East of 25th Street North the roadway is constrained to the north by steep terrain. In addition, there are two scenic turnouts on the north side near the Eagle Falls Golf Club parking lot. A railroad crossing is located between the Giant Springs Road and 18th Avenue North intersections.

**Limitations/Constraints:**

- Physical constraints due to topography.
- Scenic turnouts on the north side.

**Potential Impacts to Resources:**

- The Veteran's Memorial and Eagle Falls Golf Club [4(f) properties] are located on the south side of River Drive North.
- The Great Northern Railway is a known historic property.
- Black Eagle Falls Historical Marker located at the scenic turnout.

**Estimated Cost:**

- $8,500,000 to $11,400,000

### *River Drive North Reconstruction Summary*

Full reconstruction of the corridor is needed to address identified needs. After review and analysis of multiple concepts (see **Section 2.2** for additional alternatives considered but not advanced), it was decided that a roadway consisting of one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations would best address the identified needs and fit within existing constraints. The corridor was broken into two segments at logical project development termini points.

With the development of any reconstruction of the corridor, consideration should be made to include non-motorized accommodations as identified in the *Great Falls Area Long Range Transportation Plan (LRTP) – 2014*. The *LRTP* recommended that an assessment of the viability of on-street bike lanes along River Drive North be made if the roadway is reconstructed. In addition, the *LRTP* recommended that a shared-use path be constructed to provide a connection to the River's Edge Trail at the intersection of 15th Street North and River Drive North.

**Limitations/Constraints:**

- Physical constraints due to topography.
- River's Edge Trail to the north.
- Business access and parking.
- Scenic turnouts on the north side.

**Potential Impacts to Resources:**

- Environmental justice considerations.
- The businesses west of 25th Street North are likely properties of historic-age.
- A public water supply well and a domestic well are located on the south side of the roadway west of 25th Street North.
- The Veteran's Memorial and Eagle Falls Golf Club (4(f) properties) are located on the south side of River Drive North east of 25th Street North.
- The Great Northern Railway is a known historic property.
- Black Eagle Falls Historical Marker located at the scenic turnout.

**Estimated Cost:**

- $6,000,000 to $8,000,000 (Segment 1)
- $8,500,000 to $11,400,000 (Segment 2)

**Implementation Timeframe:**

- Mid to Long-term

## 2.2. Options Considered but not Advanced

A number of additional improvement options were considered for the corridor but ultimately are not considered formal recommendations emerging from this corridor planning study. This section provides a description of the other improvement options considered, including the rationale for not furthering them as a recommendation from this study.

### 15th Street North Intersection Reconstruction

Operations at the intersection of River Drive North and 15th Street North are projected to deteriorate in the future. Reconstruction of the intersection to include additional lanes and improved geometrics are needed as a long-term solution to improve operations. The constraints of the existing bridge to the north and development to the southeast make expanding the intersection difficult, however. It is likely that a widened, or new, bridge structure would be needed to accommodate an expanded intersection in order to increase capacity and improve operations. Further evaluation of the structure and existing constraints is needed to determine the feasibility of intersection reconstruction. This option was not included with full roadway reconstruction due to the existing constraints.

### Scenic Turnouts Reconfiguration

There are currently three scenic turnouts along River Drive North. One is located on the north side of the intersection of River Drive North and 25th Street North, while the other two are located in succession near the Eagle Falls Golf Club parking lot. The turnouts currently do not have defined ingress/egress points or parking areas. The *MDT Road Design Manual*[2] provides guidance for

[2] *MDT Road Design Manual*, Chapter 18 – Special Design Elements, Figure 18.4D – Typical Historical Marker Turnout (2-Lane Highway), December 2004

design of historical marker turnouts on a two lane highway. The guidance does not give specific recommendations for access control or ingress/egress treatments at scenic turnouts, however.

A stand-alone recommendation for the scenic turnouts was not included at this time. Rather, evaluation of the turnouts should be conducted during development of other improvement options forwarded from this study. The scenic turnout located at the intersection with 25th Street North should be evaluated during project development for Option 6. It is likely that if this intersection were to be reconstructed, the scenic turnout would need to be removed/reconstructed. The two scenic turnouts near the Eagle Falls Golf Club should be evaluated in coordination with reconstruction of River Drive North (Option 9).

### Giant Springs Road Intersection

The intersection of River Drive North and Giant Springs Road is located near the railroad crossing on the east end of the study corridor. The intersection has three approach legs with stop control along Giant Springs Road. An eastbound left-turn lane is provided along River Drive North. The intersection is located on a horizontal curve and the north approach has a steep negative grade.

The intersection was reconstructed in 2001. Concern was expressed difficulty to see the Giant Springs approach leg when approaching from the west due to the steep grade. There were seven reported crashes at this intersection during the five year analysis period, two of which involved left-turning vehicles. It is unlikely that stand-alone improvements to this intersection would make sense from a cost-benefit standpoint. Rather, evaluation of the intersection should be included with full corridor reconstruction as discussed in Option 9.

### River Drive North Reconstruction Alternatives

The River Drive North corridor suffers from operational and safety concerns. Reconstruction is needed to accommodate existing and future demands and to improve safety and operations. A diverse array of full reconstruction improvement options for the corridor was initially evaluated. These included two-, three-, four- and five-lane road facilities. After review and analysis of the initial concepts, it was determined that a typical section consisting of one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations would best address the identified needs while limiting impacts and fitting within existing constraints.

Future projected traffic volumes for the segment between 15th Street North and 25th Street North suggest that additional travel lanes may be desirable to accommodate projected demands. After a thorough evaluation of a typical section with additional travel lanes, however, it was determined that the larger roadway section would result in additional impacts and may require total acquisition of several businesses and residential units. As such, it was decided that Option 9 adequately accommodated identified corridor needs while limiting impacts to businesses, residents, and resources.

## 2.3. Combined Options

Several individual improvement options discussed previously could be incorporated into full roadway reconstruction. Combining improvement options may help reduce project development time and may result in cost savings. The following discusses the improvement options which may be combined for the two identified roadway segments.

### Segment 1 – 15th Street North to 25th Street North

Reconstruction of Segment 1 could combine the following individual improvement options:

- Option 1: Extended westbound right-turn lane at the intersection with 15th Street North.
- Option 2: At-grade non-motorized crossing enhancements at the intersection with 19th Street North.
- Option 3: Realignment of the approach for the Big Stack Mobile Home Court.
- Option 4: Consideration for parking and access for the business district west of 25th Street North.
- Option 5: Improved traffic control at the intersection with 25th Street North.
- Option 8: Corridor reconstruction to include one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations.

**Estimated Cost:**

- $9,400,000 to $14,500,000

**Implementation Timeframe:**

- Mid to Long-term

### Segment 2 – 25th Street North to 38th Street North

Reconstruction of Segment 1 could combine the following individual improvement options:

- Option 6: New approach to Eagle Falls Golf Club
- Option 8: Corridor reconstruction to include one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations.

**Estimated Cost:**

- $8,600,000 to $11,800,000

**Implementation Timeframe:**

- Mid to Long-term

## 3.0. SUMMARY

This memorandum identifies improvement options for the River Drive North corridor between 15th Street North and 38th Street North. The improvement options were based on the evaluation of several factors, including but not limited to field review, engineering analysis of as-built drawings, crash data analysis, consultation with resource agencies, and information provided by the public.

The improvement options identified for advancement are intended to offer a range of potential mitigation strategies for corridor issues and areas of concern. Small scale improvement options were identified as low-cost options for addressing identified areas of concern. Larger, more complex reconstruction improvements are also envisioned. Note that the potential may exist to combine improvement options during project development for ease of implementation and other efficiencies.

Tabular summaries of the improvement options, both advanced and not advanced, are included in **Table 3.1**. Those improvement options recommended for advancement are shown graphically in **Figure 3.1**.

## Table 3.1: Improvement Options

| | Improvement Option | Description | Implementation Timeframe | Cost Estimate |
|---|---|---|---|---|
| **SPOT IMPROVEMENT OPTIONS** | | | | |
| **1.** | 15th Street North Intersection | Extend the westbound right-turn lane to accommodate vehicle queues. | Mid-term | $180,000 |
| **2.** | 19th Street North Intersection | Evaluate and install enhanced non-motorized crossing treatment(s) | Short-term | $2,000 (advance signing)<br>$40,000 (rectangular rapid flashing beacons) |
| **3.** | Big Stack Mobile Home Court Approach | Reconstruct or relocate the existing approach to River Drive North. | Mid-term | $900,000 (existing location)<br>$500,000 (new connection to 19th Street North) |
| **4.** | Business District Access | Reconstruct roadway to provide for a center left-turn lane, bike lanes, and sidewalk on the south side. | Mid-term | $1,500,000 |
| **5.** | 25th Street North Intersection | Install additional traffic control such as a traffic signal or roundabout in coordination with corridor improvement options. | Mid-term | $2,600,000 (Signal)<br>$4,000,000 (Roundabout) |
| **6.** | Eagle Falls Golf Club Access | Construct a new access along River Drive North near Eagle Falls Golf Club. | Mid-term | $60,000 (without westbound left-turn lane)<br>$320,000 (with westbound left-turn lane) |
| **7.** | Railroad Crossing Review | Perform a diagnostics review of the railroad crossing. | Short-term | $30,000 |
| **8.** | River Drive North Reconstruction | Reconstruct to include one travel lane in each direction, center left-turn lane (where appropriate), and non-motorized accommodations. | Mid- to Long-term | $6,000,000 to $8,000,000 (Segment 1)<br>$8,500,000 to $11,400,000 (Segment 2) |
| **COMBINED OPTIONS** | | | | |
| **1.** | Segment 1 – 15TH Street North to 25th Street North | Include recommendations from options 1, 2, 3, 4, 5, and 8. | Mid- to Long-term | $9,400,000 to $14,500,000 |
| **2.** | Segment 2 – 25th Street North to 38th Street North | Include recommendations from options 6 and 8. | Mid- to Long-term | $8,600,000 to $11,800,000 |

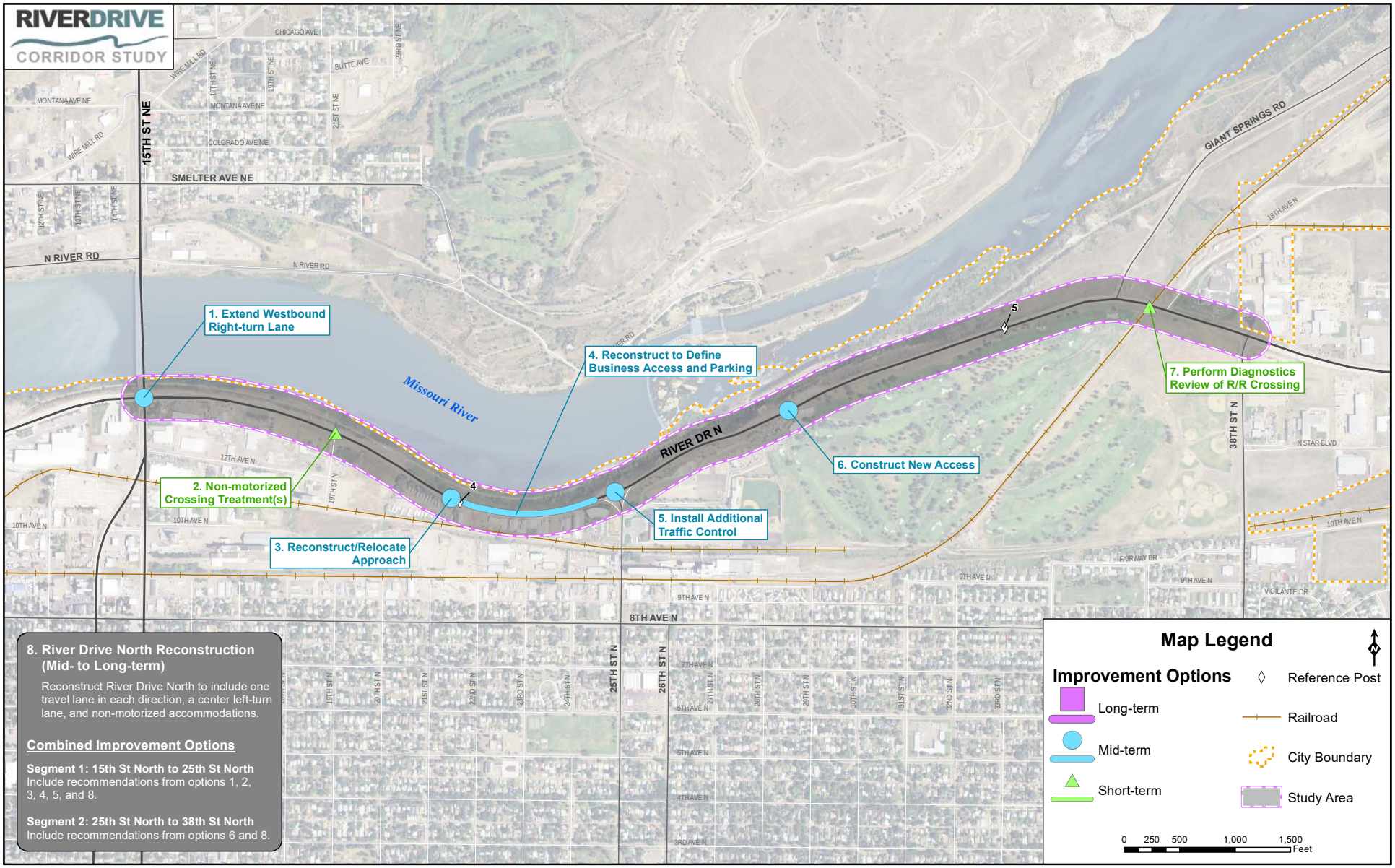
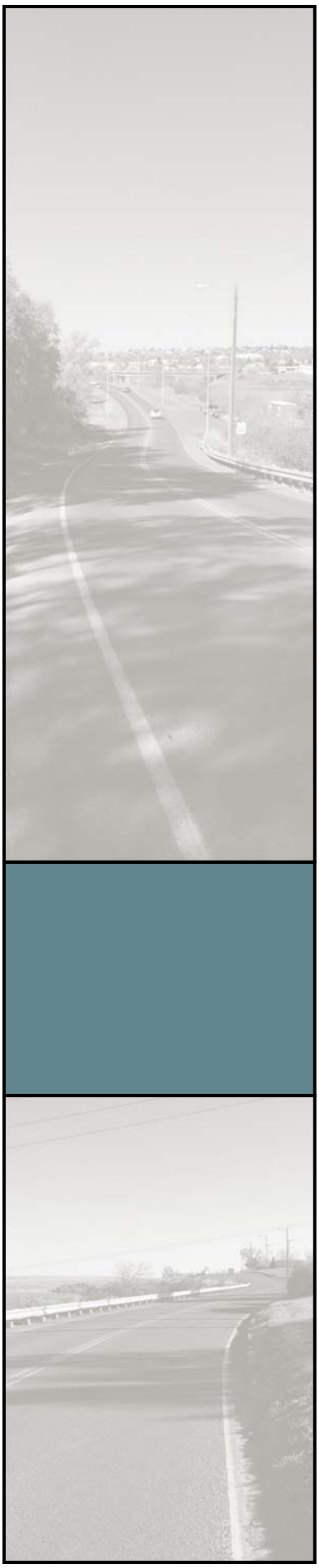



**Figure 3.1: Recommended Improvement Options**



RIVERDRIVE
CORRIDOR STUDY

# Appendix A

## *Planning Level Cost Estimates*

Planning level cost estimates are listed in 2016 dollars for each improvement option. The planning level costs include estimates for right-of-way, preliminary engineering, construction engineering, construction, and indirect costs (IDC). In addition, an inflationary factor of 3 percent per year was applied to the planning level costs to account for estimated year of expenditure. Construction cost estimates were based on unit quantity estimates and price information determined from the MDT Preliminary Estimating Tool (PET) and MDT Road Design Cost Estimate Spreadsheet (Jan 2016). Cost ranges are provided in some cases, indicating unknown factors at the particular planning level stage.

## 1. 15TH STREET NORTH INTERSECTION — $ 180,000 TOT

| | |
|---|---|
| LENGTH (FT) | 400 |
| WIDTH (FT) | 12 |
| SURFACING (IN) | 5 |
| BASE (IN) | 18 |

| TYPE | | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | | CUYD | $ 4.35 | 1086.35 | $ 4,726 |
| CRUSHED AGGREGATE COURSE | | CUYD | $ 21.69 | 288.89 | $ 6,266 |
| COVER - TYPE 1 | | SQYD | $ 0.54 | 400.00 | $ 216 |
| PLANT MIX BIT SURF GR S-3/4 IN | | TON | $ 30.74 | 107.08 | $ 3,292 |
| ASPHALT CEMENT PG 64-28 | | TON | $ 685.62 | 5.78 | $ 3,963 |
| EMULS ASPHALT CRS-2P | | TON | $ 613.48 | 0.80 | $ 491 |
| SIGNS - URBAN | | MI | $ 52,000.00 | 0.08 | $ 3,939 |
| STRIPING & PAVEMENT MARKINGS - URBAN | | MI | $ 20,000.00 | 0.08 | $ 1,515 |
| DRAINAGE PIPE - URBAN | | MI | $ 240,000.00 | 0.08 | $ 18,182 |
| LIGHTS - URBAN | | MI | $ 175,000.00 | 0.08 | $ 13,258 |
| GUARDRAIL-STEEL | | LNFT | $ 16.04 | 400.00 | $ 6,416 |
| TRAFFIC CONTROL | | | | 5% | $ 3,113 |
| ESTIMATED RIGHT-OF-WAY | | ACRE | $ - | 0.00 | $ - |
| | *Subtotal 1* | | | | *$ 65,376* |
| MISCELLANEOUS ITEMS [1] | | | | 15% | $ 9,806 |
| MOBILIZATION | | | | 10% | $ 6,538 |
| | *Subtotal 2* | | | | *$ 81,720* |
| CONTINGENCIES | | | | 20% | $ 16,344 |
| | *Subtotal 3* | | | | *$ 98,064* |
| MID-TERM INFLATION | | % PER YEAR | 3% | 10 | $ 33,726 |
| | *Subtotal 4* | | | | *$ 131,790* |
| CONSTRUCTION ENGINEERING (CE) | | | | 10% | $ 13,179 |
| PRELIMINARY ENGINEERING (PE) | | | | 10% | $ 13,179 |
| | *Subtotal 5* | | | | *$ 158,148* |
| INDIRECT COSTS (IDC) | | | | 10.91% | $ 17,254 |
| | **TOTAL** | | | | **$ 175,402** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

## 2. 19TH STREET NORTH INTERSECTION

### ADVANCE SIGNING — $ 2,000 TOT

| TYPE | | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|---|
| SIGNS-ALUM SHEET INCR IV | | SQFT | $ 22.88 | 18.00 | $ 412 |
| POLES-TREATED WOOD 4 IN | | LNFT | $ 11.12 | 28.00 | $ 311 |
| | *Subtotal 1* | | | | *$ 723* |
| CONTINGENCIES | | | | 20% | $ 145 |
| | *Subtotal 2* | | | | *$ 868* |
| SHORT-TERM INFLATION | | % PER YEAR | 3% | 5 | $ 138 |
| | *Subtotal 3* | | | | *$ 1,006* |
| | **TOTAL** | | | | **$ 1,144** |

### RECTANGULAR RAPPID FLASHING BEACON — $ 40,000 TOT

| TYPE | | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|---|
| RECTANGULAR RAPID FLASING BEACON | | EACH | $ 10,000.00 | 2.00 | $ 20,000 |
| | *Subtotal 1* | | | | *$ 20,000* |
| CONTINGENCIES | | | | 30% | $ 6,000 |
| | *Subtotal 2* | | | | *$ 26,000* |
| SHORT-TERM INFLATION | | % PER YEAR | 3% | 5 | $ 4,141 |
| | *Subtotal 3* | | | | *$ 30,141* |
| | **TOTAL** | | | | **$ 34,282** |

## 3. BIG STACK MOBILE HOME COURT APPROACH

### REALIGNMENT — $ 900,000 TOT

| | |
|---|---|
| LENGTH (FT) | 400 |

AVERAGE HEIGHT (FT) 12

| TYPE | | UNITS | | UNIT PRICE | QUANTITY | | COST |
|---|---|---|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | | CUYD | $ | 4.35 | 2133.33 | $ | 9,280 |
| RETAINING WALL | | SQYD | $ | 491.75 | 533.33 | $ | 262,267 |
| DRAINAGE PIPE - URBAN | | MI | $ | 240,000.00 | 0.08 | $ | 18,182 |
| TRAFFIC CONTROL | | | | | 5% | $ | 14,486 |
| ESTIMATED RIGHT-OF-WAY | | ACRE | $ | - | 0.00 | $ | - |
| | *Subtotal 1* | | | | | *$* | *304,215* |
| MISCELLANEOUS ITEMS [1] | | | | | 15% | $ | 45,632 |
| MOBILIZATION | | | | | 10% | $ | 30,421 |
| | *Subtotal 2* | | | | | *$* | *380,269* |
| CONTINGENCIES | | | | | 20% | $ | 76,054 |
| | *Subtotal 3* | | | | | *$* | *456,322* |
| MID-TERM INFLATION | | % PER YEAR | | 3% | 10 | $ | 156,937 |
| | *Subtotal 4* | | | | | *$* | *613,259* |
| CONSTRUCTION ENGINEERING (CE) | | | | | 10% | $ | 61,326 |
| PRELIMINARY ENGINEERING (PE) | | | | | 10% | $ | 61,326 |
| | *Subtotal 5* | | | | | *$* | *735,911* |
| INDIRECT COSTS (IDC) | | | | | 10.91% | $ | 80,288 |
| | **TOTAL** | | | | | **$** | **816,199** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

**NEW CONNECTION TO 19TH STREET NORTH** **$ 500,000 TOT**

LENGTH (FT) 750
WIDTH (FT) 24
SURFACING (IN) 4
BASE (IN) 18

| TYPE | | UNITS | | UNIT PRICE | QUANTITY | | COST |
|---|---|---|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | | CUYD | $ | 4.35 | 2501.31 | $ | 10,881 |
| CRUSHED AGGREGATE COURSE | | CUYD | $ | 21.69 | 1041.67 | $ | 22,594 |
| COVER - TYPE 1 | | SQYD | $ | 0.54 | 1750.00 | $ | 945 |
| PLANT MIX BIT SURF GR S-3/4 IN | | TON | $ | 30.74 | 374.79 | $ | 11,521 |
| ASPHALT CEMENT PG 64-28 | | TON | $ | 685.62 | 20.24 | $ | 13,877 |
| EMULS ASPHALT CRS-2P | | TON | $ | 613.48 | 3.20 | $ | 1,963 |
| STRIPING & PAVEMENT MARKINGS - URBAN | | MI | $ | 20,000.00 | 0.14 | $ | 2,841 |
| DRAINAGE PIPE - URBAN | | MI | $ | 240,000.00 | 0.14 | $ | 34,091 |
| CURB AND GUTTER-CONC | | LNFT | $ | 18.15 | 1500.00 | $ | 27,225 |
| TRAFFIC CONTROL | | | | | 5% | $ | 6,297 |
| ESTIMATED RIGHT-OF-WAY | | ACRE | $ | 50,000.00 | 0.79 | $ | 39,256 |
| | *Subtotal 1* | | | | | *$* | *171,491* |
| MISCELLANEOUS ITEMS [1] | | | | | 15% | $ | 25,724 |
| MOBILIZATION | | | | | 10% | $ | 17,149 |
| | *Subtotal 2* | | | | | *$* | *214,363* |
| CONTINGENCIES | | | | | 30% | $ | 64,309 |
| | *Subtotal 3* | | | | | *$* | *278,672* |
| MID-TERM INFLATION | | % PER YEAR | | 3% | 10 | $ | 95,840 |
| | *Subtotal 4* | | | | | *$* | *374,512* |
| CONSTRUCTION ENGINEERING (CE) | | | | | 10% | $ | 37,451 |
| PRELIMINARY ENGINEERING (PE) | | | | | 10% | $ | 37,451 |
| | *Subtotal 5* | | | | | *$* | *449,414* |
| INDIRECT COSTS (IDC) | | | | | 10.91% | $ | 49,031 |
| | **TOTAL** | | | | | **$** | **498,446** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

**4. BUSINESS DISTRICT ACCESS** **$ 1,500,000 TOT**

LENGTH (FT) 1320
WIDTH (FT) [2] 52
SURFACING (IN) 5
BASE (IN) 18

| TYPE | UNITS | | UNIT PRICE | QUANTITY | | COST |
|---|---|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ | 4.35 | 7895.32 | $ | 34,345 |
| CRUSHED AGGREGATE COURSE | CUYD | $ | 21.69 | 4326.67 | $ | 93,845 |
| COVER - TYPE 1 | SQYD | $ | 0.54 | 8067.00 | $ | 4,356 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ | 30.74 | 2159.51 | $ | 66,383 |
| ASPHALT CEMENT PG 64-28 | TON | $ | 685.62 | 116.61 | $ | 79,950 |
| EMULS ASPHALT CRS-2P | TON | $ | 613.48 | 14.40 | $ | 8,834 |
| SIGNS - URBAN | MI | $ | 52,000.00 | 0.25 | $ | 13,000 |
| STRIPING & PAVEMENT MARKINGS - URBAN | MI | $ | 20,000.00 | 0.25 | $ | 5,000 |
| DRAINAGE PIPE - URBAN | MI | $ | 240,000.00 | 0.25 | $ | 60,000 |
| LIGHTS - URBAN | MI | $ | 175,000.00 | 0.25 | $ | 43,750 |
| SIDEWALK-CONCRETE 4" | SQYD | $ | 57.78 | 733.33 | $ | 42,372 |
| CURB AND GUTTER-CONC | LNFT | $ | 18.15 | 2640.00 | $ | 47,916 |
| GUARDRAIL-STEEL | LNFT | $ | 16.04 | 1320.00 | $ | 21,173 |
| TRAFFIC CONTROL | | | | 5% | $ | 26,046 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ESTIMATED RIGHT-OF-WAY | | ACRE | $ | - | 0.00 | $ | - |
| | *Subtotal 1* | | | | | *$* | *546,971* |
| MISCELLANEOUS ITEMS [1] | | | | | 15% | $ | 82,046 |
| MOBILIZATION | | | | | 10% | $ | 54,697 |
| | *Subtotal 2* | | | | | *$* | *683,714* |
| CONTINGENCIES | | | | | 20% | $ | 136,743 |
| | *Subtotal 3* | | | | | *$* | *820,456* |
| MID-TERM INFLATION | | % PER YEAR | | 3% | 10 | $ | 282,168 |
| | *Subtotal 4* | | | | | *$* | *1,102,625* |
| CONSTRUCTION ENGINEERING (CE) | | | | | 10% | $ | 110,262 |
| PRELIMINARY ENGINEERING (PE) | | | | | 10% | $ | 110,262 |
| | *Subtotal 5* | | | | | *$* | *1,323,150* |
| INDIRECT COSTS (IDC) | | | | | 10.91% | $ | 144,356 |
| | **TOTAL** | | | | | **$** | **1,467,505** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

[2] Width includes bike lanes, two 12' driving lanes, and center left-turn lane.

## 5. 25TH STREET NORTH INTERSECTION

**TRAFFIC SIGNAL** **$ 2,600,000 TOT**

| | |
|---|---|
| LENGTH (FT) | 1320 |
| WIDTH (FT) | 44 |
| SURFACING (IN) | 5 |
| BASE (IN) | 18 |

| TYPE | UNITS | | UNIT PRICE | QUANTITY | | COST |
|---|---|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ | 4.35 | 2992.48 | $ | 13,017 |
| CRUSHED AGGREGATE COURSE | CUYD | $ | 21.69 | 3300.00 | $ | 71,577 |
| COVER - TYPE 1 | SQYD | $ | 0.54 | 6014.00 | $ | 3,248 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ | 30.74 | 1609.82 | $ | 49,486 |
| ASPHALT CEMENT PG 64-28 | TON | $ | 685.62 | 86.93 | $ | 59,601 |
| EMULS ASPHALT CRS-2P | TON | $ | 613.48 | 10.80 | $ | 6,626 |
| COLD MILLING | SQYD | $ | 1.42 | 1993.33 | $ | 2,831 |
| SIGNS - URBAN | MI | $ | 52,000.00 | 0.25 | $ | 13,000 |
| STRIPING & PAVEMENT MARKINGS - URBAN | MI | $ | 20,000.00 | 0.25 | $ | 5,000 |
| DRAINAGE PIPE - URBAN [2] | MI | $ | 500,000.00 | 0.25 | $ | 125,000 |
| LIGHTS - URBAN | MI | $ | 175,000.00 | 0.25 | $ | 43,750 |
| GUARDRAIL-STEEL | LNFT | $ | 16.04 | 1320.00 | $ | 21,173 |
| SIGNALS | EACH | $ | 500,000.00 | 1.00 | $ | 500,000 |
| TRAFFIC CONTROL | | | | 5% | $ | 45,715 |
| ESTIMATED RIGHT-OF-WAY | ACRE | $ | - | 0.00 | $ | - |
| *Subtotal 1* | | | | | *$* | *960,023* |
| MISCELLANEOUS ITEMS [1] | | | | 15% | $ | 144,003 |
| MOBILIZATION | | | | 10% | $ | 96,002 |
| *Subtotal 2* | | | | | *$* | *1,200,029* |
| CONTINGENCIES | | | | 20% | $ | 240,006 |
| *Subtotal 3* | | | | | *$* | *1,440,034* |
| MID-TERM INFLATION | % PER YEAR | | 3% | 10 | $ | 495,251 |
| *Subtotal 4* | | | | | *$* | *1,935,286* |
| CONSTRUCTION ENGINEERING (CE) | | | | 10% | $ | 193,529 |
| PRELIMINARY ENGINEERING (PE) | | | | 10% | $ | 193,529 |
| *Subtotal 5* | | | | | *$* | *2,322,343* |
| INDIRECT COSTS (IDC) | | | | 10.91% | $ | 253,368 |
| **TOTAL** | | | | | **$** | **2,575,711** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

[2] Drainage costs were increased due to MS4 requirements and anticipated drainage concerns and constraints.

**ROUNDABOUT** **$ 4,000,000 TOT**

| | |
|---|---|
| LENGTH (FT) | 1320 |
| WIDTH (FT) | 44 |
| SURFACING (IN) | 5 |
| BASE (IN) | 18 |

| TYPE | UNITS | | UNIT PRICE | QUANTITY | | COST |
|---|---|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ | 4.35 | 2992.48 | $ | 13,017 |
| CRUSHED AGGREGATE COURSE | CUYD | $ | 21.69 | 3300.00 | $ | 71,577 |
| COVER - TYPE 1 | SQYD | $ | 0.54 | 6014.00 | $ | 3,248 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ | 30.74 | 1609.82 | $ | 49,486 |
| ASPHALT CEMENT PG 64-28 | TON | $ | 685.62 | 86.93 | $ | 59,601 |
| EMULS ASPHALT CRS-2P | TON | $ | 613.48 | 10.80 | $ | 6,626 |
| COLD MILLING | SQYD | $ | 1.42 | 1993.33 | $ | 2,831 |
| SIGNS - URBAN | MI | $ | 52,000.00 | 0.25 | $ | 13,000 |
| STRIPING & PAVEMENT MARKINGS - URBAN | MI | $ | 20,000.00 | 0.25 | $ | 5,000 |
| DRAINAGE PIPE - URBAN [2] | MI | $ | 500,000.00 | 0.25 | $ | 125,000 |
| LIGHTS - URBAN | MI | $ | 175,000.00 | 0.25 | $ | 43,750 |

| | | | | | | |
|---|---|---|---|---|---|---|
| GUARDRAIL-STEEL | | LNFT | $ 16.04 | 1320.00 | $ | 21,173 |
| CONCRETE ROUNDABOUT - ONE LANE | | EACH | $ 1,000,000.00 | 1.00 | $ | 1,000,000 |
| TRAFFIC CONTROL | | | | 5% | $ | 70,715 |
| ESTIMATED RIGHT-OF-WAY | | ACRE | $ - | 0.00 | $ | - |
| | *Subtotal 1* | | | | *$* | *1,485,023* |
| MISCELLANEOUS ITEMS [1] | | | | 15% | $ | 222,753 |
| MOBILIZATION | | | | 10% | $ | 148,502 |
| | *Subtotal 2* | | | | *$* | *1,856,279* |
| CONTINGENCIES | | | | 20% | $ | 371,256 |
| | *Subtotal 3* | | | | *$* | *2,227,534* |
| MID-TERM INFLATION | | % PER YEAR | 3% | 10 | $ | 766,086 |
| | *Subtotal 4* | | | | *$* | *2,993,620* |
| CONSTRUCTION ENGINEERING (CE) | | | | 10% | $ | 299,362 |
| PRELIMINARY ENGINEERING (PE) | | | | 10% | $ | 299,362 |
| | *Subtotal 5* | | | | *$* | *3,592,344* |
| INDIRECT COSTS (IDC) | | | | 10.91% | $ | 391,925 |
| | **TOTAL** | | | | **$** | **3,984,269** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

[2] Drainage costs were increased due to MS4 requirements and anticipated drainage concerns and constraints.

## 6. EAGLE FALLS GOLF CLUB APPROACH

### WITHOUT LEFT-TURN LANE — $ 60,000 TOT

| | |
|---|---|
| LENGTH (FT) | 150 |
| WIDTH (FT) | 24 |
| SURFACING (IN) | 4 |
| BASE (IN) | 18 |

| TYPE | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ 4.35 | 500.26 | $ 2,176 |
| CRUSHED AGGREGATE COURSE | CUYD | $ 21.69 | 208.33 | $ 4,519 |
| COVER - TYPE 1 | SQYD | $ 0.54 | 350.00 | $ 189 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ 30.74 | 74.96 | $ 2,304 |
| ASPHALT CEMENT PG 64-28 | TON | $ 685.62 | 4.05 | $ 2,777 |
| EMULS ASPHALT CRS-2P | TON | $ 613.48 | 0.70 | $ 429 |
| SIGNS - URBAN | MI | $ 52,000.00 | 0.03 | $ 1,477 |
| STRIPING & PAVEMENT MARKINGS - URBAN | MI | $ 20,000.00 | 0.03 | $ 568 |
| DRAINAGE PIPE - URBAN | MI | $ 240,000.00 | 0.03 | $ 6,818 |
| TRAFFIC CONTROL | | | 5% | $ 1,063 |
| ESTIMATED RIGHT-OF-WAY | ACRE | $ - | 0.00 | $ - |
| *Subtotal 1* | | | | *$ 22,321* |
| MISCELLANEOUS ITEMS [1] | | | 15% | $ 3,348 |
| MOBILIZATION | | | 10% | $ 2,232 |
| *Subtotal 2* | | | | *$ 27,901* |
| CONTINGENCIES | | | 20% | $ 5,580 |
| *Subtotal 3* | | | | *$ 33,481* |
| MID-TERM INFLATION | % PER YEAR | 3% | 10 | $ 11,515 |
| *Subtotal 4* | | | | *$ 44,996* |
| CONSTRUCTION ENGINEERING (CE) | | | 10% | $ 4,500 |
| PRELIMINARY ENGINEERING (PE) | | | 10% | $ 4,500 |
| *Subtotal 5* | | | | *$ 53,995* |
| INDIRECT COSTS (IDC) | | | 10.91% | $ 5,891 |
| **TOTAL** | | | | **$ 59,886** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

### WITH LEFT-TURN LANE — $ 320,000 TOT

| | |
|---|---|
| LENGTH (FT) | 1000 |
| WIDTH (FT) | 12 |
| SURFACING (IN) | 5 |
| BASE (IN) | 18 |

| TYPE | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ 4.35 | 2715.87 | $ 11,814 |
| CRUSHED AGGREGATE COURSE | CUYD | $ 21.69 | 722.22 | $ 15,665 |
| COVER - TYPE 1 | SQYD | $ 0.54 | 1000.00 | $ 540 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ 30.74 | 267.71 | $ 8,229 |
| ASPHALT CEMENT PG 64-28 | TON | $ 685.62 | 14.46 | $ 9,914 |
| EMULS ASPHALT CRS-2P | TON | $ 613.48 | 1.80 | $ 1,104 |
| SIGNS - URBAN | MI | $ 52,000.00 | 0.19 | $ 9,848 |
| STRIPING & PAVEMENT MARKINGS - URBAN | MI | $ 20,000.00 | 0.19 | $ 3,788 |
| DRAINAGE PIPE - URBAN | MI | $ 240,000.00 | 0.19 | $ 45,455 |
| TRAFFIC CONTROL | | | 5% | $ 5,318 |
| ESTIMATED RIGHT-OF-WAY | ACRE | $ - | 0.00 | $ - |
| *Subtotal 1* | | | | *$ 111,676* |
| MISCELLANEOUS ITEMS [1] | | | 20% | $ 22,335 |
| MOBILIZATION | | | 10% | $ 11,168 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | *Subtotal 2* | | | | $ | *145,178* |
| CONTINGENCIES | | | | 20% | $ | 29,036 |
| | *Subtotal 3* | | | | $ | *174,214* |
| MID-TERM INFLATION | | % PER YEAR | 3% | 10 | $ | 59,915 |
| | *Subtotal 4* | | | | $ | *234,129* |
| CONSTRUCTION ENGINEERING (CE) | | | | 10% | $ | 23,413 |
| PRELIMINARY ENGINEERING (PE) | | | | 10% | $ | 23,413 |
| | *Subtotal 5* | | | | $ | *280,955* |
| INDIRECT COSTS (IDC) | | | | 10.91% | $ | 30,652 |
| | **TOTAL** | | | | **$** | **311,607** |

(1) Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

## 7. RAILROAD CROSSING REVIEW — $ 30,000 TOT

| | | | | | | |
|---|---|---|---|---|---|---|
| | *Subtotal 1* | | | | $ | 25,000 |
| SHORT-TERM INFLATION | | % PER YEAR | 3% | 5 | $ | 3,982 |
| | **Total** | | | | **$** | **28,982** |

## 8. RIVER DRIVE NORTH RECONSTRUCTION

### SEGMENT 1 - 15TH STREET NORTH TO 25TH STREET NORTH — $6,000,000 to $8,000,000 TOT

| | | |
|---|---|---|
| LENGTH (FT) | 4500 | |
| WIDTH (FT) (2) | 52 | (TBC to TBC) |
| SURFACING (IN) | 5 | |
| BASE (IN) | 18 | |

| TYPE | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ 4.35 | 24999.19 | $ 108,746 |
| CRUSHED AGGREGATE COURSE | CUYD | $ 21.69 | 13250.00 | $ 287,393 |
| COVER - TYPE 1 | SQYD | $ 0.54 | 24500.00 | $ 13,230 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ 30.74 | 6558.85 | $ 201,619 |
| ASPHALT CEMENT PG 64-28 | TON | $ 685.62 | 354.18 | $ 242,833 |
| EMULS ASPHALT CRS-2P | TON | $ 613.48 | 43.80 | $ 26,870 |
| SIGNS - URBAN | MI | $ 52,000.00 | 0.85 | $ 44,318 |
| STRIPING & PAVEMENT MARKINGS - URBAN | MI | $ 20,000.00 | 0.85 | $ 17,045 |
| DRAINAGE PIPE - URBAN | MI | $ 240,000.00 | 0.85 | $ 204,545 |
| LIGHTS - URBAN | MI | $ 175,000.00 | 0.85 | $ 149,148 |
| SIDEWALK-CONCRETE 4" | SQYD | $ 57.78 | 2500.00 | $ 144,450 |
| CURB AND GUTTER-CONC | LNFT | $ 18.15 | 9000.00 | $ 163,350 |
| GUARDRAIL-STEEL | LNFT | $ 16.04 | 3000.00 | $ 48,120 |
| RETAINING WALL | SQYD | $ 491.75 | 838.00 | $ 412,087 |
| TRAFFIC CONTROL | | | 5% | $ 103,188 |
| ESTIMATED RIGHT-OF-WAY | ACRE | $ 50,000.00 | 0.98 | $ 49,000 |
| *Subtotal 1* | | | | *$ 2,215,942* |
| MISCELLANEOUS ITEMS (1) | | | 15% | $ 332,391 |
| MOBILIZATION | | | 10% | $ 221,594 |
| *Subtotal 2* | | | | *$ 2,769,928* |
| CONTINGENCIES | | | 20% | $ 553,986 |
| *Subtotal 3* | | | | *$ 3,323,914* |

| | | | MID-TERM | LONG-TERM |
|---|---|---|---|---|
| INFLATION | % PER YEAR | 3% | $ 1,143,148 | $ 2,679,444 |
| *Subtotal 4* | | | *$ 4,467,062* | *$ 6,003,358* |
| CONSTRUCTION ENGINEERING (CE) | | 10% | $ 446,706 | $ 600,336 |
| PRELIMINARY ENGINEERING (PE) | | 10% | $ 446,706 | $ 600,336 |
| *Subtotal 5* | | | *$ 5,360,474* | *$ 7,204,029* |
| INDIRECT COSTS (IDC) | | 10.91% | $ 584,828 | $ 785,960 |
| **TOTAL** | | | **$ 5,945,302** | **$ 7,989,989** |

(1) Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

(2) Width includes 6' bike lanes on north and south side, two 12' driving lanes, and 16' TWLTL.

### SEGMENT 2 - 25TH STREET NORTH TO 38TH STREET NORTH — $8,500,000 to 11,400,000 TOT

| | | |
|---|---|---|
| LENGTH (FT) | 6000 | |
| WIDTH (FT) | 52 | (TBC to TBC) |
| SURFACING (IN) | 5 | |
| BASE (IN) | 18 | |

| TYPE | UNITS | UNIT PRICE | QUANTITY | COST |
|---|---|---|---|---|
| EXCAVATION-UNCLASSIFIED | CUYD | $ 4.35 | 33332.25 | $ 144,995 |
| CRUSHED AGGREGATE COURSE | CUYD | $ 21.69 | 17666.67 | $ 383,190 |
| COVER - TYPE 1 | SQYD | $ 0.54 | 32667.00 | $ 17,640 |
| PLANT MIX BIT SURF GR S-3/4 IN | TON | $ 30.74 | 8745.14 | $ 268,826 |
| ASPHALT CEMENT PG 64-28 | TON | $ 685.62 | 472.24 | $ 323,777 |
| EMULS ASPHALT CRS-2P | TON | $ 613.48 | 58.40 | $ 35,827 |
| SIGNS - URBAN | MI | $ 52,000.00 | 1.14 | $ 59,091 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STRIPING & PAVEMENT MARKINGS - URBAN | | MI | $ | 20,000.00 | 1.14 | $ | 22,727 |
| DRAINAGE PIPE - URBAN | | MI | $ | 240,000.00 | 1.14 | $ | 272,727 |
| LIGHTS - URBAN | | MI | $ | 175,000.00 | 1.14 | $ | 198,864 |
| SIDEWALK-CONCRETE 4" | | SQYD | $ | 57.78 | 3333.33 | $ | 192,600 |
| CURB AND GUTTER-CONC | | LNFT | $ | 18.15 | 12000.00 | $ | 217,800 |
| GUARDRAIL-STEEL | | LNFT | $ | 16.04 | 4500.00 | $ | 72,180 |
| RETAINING WALL | | SQYD | $ | 491.75 | 1485.00 | $ | 730,249 |
| TRAFFIC CONTROL | | | | | 5% | $ | 147,025 |
| ESTIMATED RIGHT-OF-WAY | | ACRE | $ | 50,000.00 | 1.39 | $ | 69,500 |
| | *Subtotal 1* | | | | | *$* | *3,157,018* |
| MISCELLANEOUS ITEMS [1] | | | | | 15% | $ | 473,553 |
| MOBILIZATION | | | | | 10% | $ | 315,702 |
| | *Subtotal 2* | | | | | *$* | *3,946,273* |
| CONTINGENCIES | | | | | 20% | $ | 789,255 |
| | *Subtotal 3* | | | | | *$* | *4,735,527* |

| | | | | MID-TERM | | LONG-TERM |
|---|---|---|---|---|---|---|
| INFLATION | | % PER YEAR | 3% | $ 1,628,625 | $ | 3,817,362 |
| | *Subtotal 4* | | | *$ 6,364,152* | *$* | *8,552,889* |
| CONSTRUCTION ENGINEERING (CE) | | | 10% | $ 636,415 | $ | 855,289 |
| PRELIMINARY ENGINEERING (PE) | | | 10% | $ 636,415 | $ | 855,289 |
| | *Subtotal 5* | | | *$ 7,636,983* | *$* | *10,263,466* |
| INDIRECT COSTS (IDC) | | | 10.91% | $ 833,195 | $ | 1,119,744 |
| | **TOTAL** | | | **$ 8,470,178** | **$** | **11,383,211** |

[1] Miscellaneous items include unknown factors such as excavation, embankment, topsoil, utilities, slope treatments, ditch or channel excavation, temporary striping, erosion control, and public relations.

[2] Width includes 6' bike lanes on north and south side, two 12' driving lanes, and 16' TWLTL.

**COMBINED OPTIONS**

**SEGMENT 1 - 15TH STREET NORTH TO 25TH STREET NORTH** — **$9,400,000 to $14,500,000** — **TOT**

| | | | SOURCE | COST (LOW) | COST (HIGH) |
|---|---|---|---|---|---|
| OPTION 1 | | | None [1] | $ - | $ - |
| OPTION 2 | | | Subtotal 2 | $ 26,000 | $ 26,000 |
| OPTION 3 | | | Subtotal 3 | $ 456,322 | $ 456,322 |
| OPTION 4 | | | None [1] | $ - | $ - |
| OPTION 5 | | | Subtotal 3 | $ 1,440,034 | $ 2,227,534 |
| OPTION 8 | | | Subtotal 3 | $ 3,323,914 | $ 3,323,914 |
| | *Subtotal1* | | | $ 5,246,270 | $ 6,033,770 |
| INFLATION | | % PER YEAR | 3% | $ 1,804,278 | $ 4,863,890 |
| | *Subtotal 2* | | | *$ 7,050,549* | *$ 10,897,660* |
| CONSTRUCTION ENGINEERING (CE) | | | 10% | $ 705,055 | $ 1,089,766 |
| PRELIMINARY ENGINEERING (PE) | | | 10% | $ 705,055 | $ 1,089,766 |
| | *Subtotal 3* | | | *$ 8,460,658* | *$ 13,077,193* |
| INDIRECT COSTS (IDC) | | | 10.91% | $ 923,058 | $ 1,426,722 |
| | **TOTAL** | | | **$ 9,383,716** | **$ 14,503,914** |

[1] Cost would be included with roadway reconstruction (Option 9).

**SEGMENT 2 - 25TH STREET NORTH TO 28TH STREET NORTH** — **$8,600,000 to $11,800,000** — **TOT**

| | | | SOURCE | COST (LOW) | COST (HIGH) |
|---|---|---|---|---|---|
| OPTION 7 | | | Subtotal 3 [1] | $ 33,481 | $ 174,214 |
| OPTION 8 | | | Subtotal 3 | $ 4,735,527 | $ 4,735,527 |
| | *Subtotal1* | | | $ 4,769,008 | $ 4,909,741 |
| INFLATION | | % PER YEAR | 3% | $ 1,640,140 | $ 3,957,797 |
| | *Subtotal 2* | | | *$ 6,409,148* | *$ 8,867,538* |
| CONSTRUCTION ENGINEERING (CE) | | | 10% | $ 640,915 | $ 886,754 |
| PRELIMINARY ENGINEERING (PE) | | | 10% | $ 640,915 | $ 886,754 |
| | *Subtotal 3* | | | *$ 7,690,978* | *$ 10,641,046* |
| INDIRECT COSTS (IDC) | | | 10.91% | $ 839,086 | $ 1,160,938 |
| | **TOTAL** | | | **$ 8,530,064** | **$ 11,801,984** |

[1] Cost for improvement option with left-turn lane was included as a conservative estimate.

RIVERDRIVE
CORRIDOR STUDY

# Appendix B

## *25th Street North Intersection Operational Analysis*

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.7 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Vol, veh/h | 477 | 254 | 26 | 364 | 84 | 35 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | 250 | 150 | - | 0 | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 84 | 84 | 84 | 84 | 84 | 84 |
| Heavy Vehicles, % | 7 | 7 | 7 | 7 | 7 | 7 |
| Mvmt Flow | 568 | 302 | 31 | 433 | 100 | 42 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 568 | 0 | 1063 | 568 |
| Stage 1 | - | - | - | - | 568 | - |
| Stage 2 | - | - | - | - | 495 | - |
| Critical Hdwy | - | - | 4.17 | - | 6.47 | 6.27 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.47 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.47 | - |
| Follow-up Hdwy | - | - | 2.263 | - | 3.563 | 3.363 |
| Pot Cap-1 Maneuver | - | - | 980 | - | 242 | 513 |
| Stage 1 | - | - | - | - | 557 | - |
| Stage 2 | - | - | - | - | 602 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 980 | - | 234 | 513 |
| Mov Cap-2 Maneuver | - | - | - | - | 234 | - |
| Stage 1 | - | - | - | - | 557 | - |
| Stage 2 | - | - | - | - | 583 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.6 | 25.9 |
| HCM LOS | | | D |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 234 | 513 | - | - | 980 | - |
| HCM Lane V/C Ratio | 0.427 | 0.081 | - | - | 0.032 | - |
| HCM Control Delay (s) | 31.4 | 12.6 | - | - | 8.8 | - |
| HCM Lane LOS | D | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 2 | 0.3 | - | - | 0.1 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.9 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Vol, veh/h | 395 | 197 | 45 | 315 | 99 | 39 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | 250 | 150 | - | 0 | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 8 | 8 | 8 | 8 | 8 | 8 |
| Mvmt Flow | 429 | 214 | 49 | 342 | 108 | 42 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 429 | 0 | 869 | 429 |
| Stage 1 | - | - | - | - | 429 | - |
| Stage 2 | - | - | - | - | 440 | - |
| Critical Hdwy | - | - | 4.18 | - | 6.48 | 6.28 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.48 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.48 | - |
| Follow-up Hdwy | - | - | 2.272 | - | 3.572 | 3.372 |
| Pot Cap-1 Maneuver | - | - | 1099 | - | 315 | 613 |
| Stage 1 | - | - | - | - | 644 | - |
| Stage 2 | - | - | - | - | 637 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 1099 | - | 301 | 613 |
| Mov Cap-2 Maneuver | - | - | - | - | 301 | - |
| Stage 1 | - | - | - | - | 644 | - |
| Stage 2 | - | - | - | - | 609 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 1.1 | 20.1 |
| HCM LOS | | | C |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 301 | 613 | - | - | 1099 | - |
| HCM Lane V/C Ratio | 0.358 | 0.069 | - | - | 0.045 | - |
| HCM Control Delay (s) | 23.5 | 11.3 | - | - | 8.4 | - |
| HCM Lane LOS | C | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 1.6 | 0.2 | - | - | 0.1 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 6.5 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Vol, veh/h | 494 | 256 | 54 | 622 | 100 | 28 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | 250 | 150 | - | 0 | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 87 | 87 | 87 | 87 | 87 | 87 |
| Heavy Vehicles, % | 5 | 5 | 5 | 5 | 5 | 5 |
| Mvmt Flow | 568 | 294 | 62 | 715 | 115 | 32 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 568 | 0 | 1407 | 568 |
| Stage 1 | - | - | - | - | 568 | - |
| Stage 2 | - | - | - | - | 839 | - |
| Critical Hdwy | - | - | 4.15 | - | 6.45 | 6.25 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.45 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.45 | - |
| Follow-up Hdwy | - | - | 2.245 | - | 3.545 | 3.345 |
| Pot Cap-1 Maneuver | - | - | 989 | - | 151 | 517 |
| Stage 1 | - | - | - | - | 561 | - |
| Stage 2 | - | - | - | - | 419 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 989 | - | 142 | 517 |
| Mov Cap-2 Maneuver | - | - | - | - | 142 | - |
| Stage 1 | - | - | - | - | 561 | - |
| Stage 2 | - | - | - | - | 393 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.7 | 75.1 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 142 | 517 | - | - | 989 | - |
| HCM Lane V/C Ratio | 0.809 | 0.062 | - | - | 0.063 | - |
| HCM Control Delay (s) | 92.7 | 12.4 | - | - | 8.9 | - |
| HCM Lane LOS | F | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 5.1 | 0.2 | - | - | 0.2 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 5.6 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Vol, veh/h | 477 | 254 | 26 | 364 | 84 | 35 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | 250 | 150 | - | 0 | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 7 | 7 | 7 | 7 | 7 | 7 |
| Mvmt Flow | 700 | 373 | 38 | 534 | 123 | 51 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 700 | 0 | 1310 | 700 |
| Stage 1 | - | - | - | - | 700 | - |
| Stage 2 | - | - | - | - | 610 | - |
| Critical Hdwy | - | - | 4.17 | - | 6.47 | 6.27 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.47 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.47 | - |
| Follow-up Hdwy | - | - | 2.263 | - | 3.563 | 3.363 |
| Pot Cap-1 Maneuver | - | - | 874 | - | 171 | 431 |
| Stage 1 | - | - | - | - | 483 | - |
| Stage 2 | - | - | - | - | 533 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 874 | - | 164 | 431 |
| Mov Cap-2 Maneuver | - | - | - | - | 164 | - |
| Stage 1 | - | - | - | - | 483 | - |
| Stage 2 | - | - | - | - | 510 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.6 | 56.4 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 164 | 431 | - | - | 874 | - |
| HCM Lane V/C Ratio | 0.752 | 0.119 | - | - | 0.044 | - |
| HCM Control Delay (s) | 73.8 | 14.5 | - | - | 9.3 | - |
| HCM Lane LOS | F | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 4.7 | 0.4 | - | - | 0.1 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 6.8 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Vol, veh/h | 395 | 197 | 45 | 315 | 99 | 39 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | 250 | 150 | - | 0 | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 8 | 8 | 8 | 8 | 8 | 8 |
| Mvmt Flow | 580 | 289 | 66 | 462 | 145 | 57 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 580 | 0 | 1174 | 580 |
| Stage 1 | - | - | - | - | 580 | - |
| Stage 2 | - | - | - | - | 594 | - |
| Critical Hdwy | - | - | 4.18 | - | 6.48 | 6.28 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.48 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.48 | - |
| Follow-up Hdwy | - | - | 2.272 | - | 3.572 | 3.372 |
| Pot Cap-1 Maneuver | - | - | 965 | - | 206 | 503 |
| Stage 1 | - | - | - | - | 548 | - |
| Stage 2 | - | - | - | - | 540 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 965 | - | 192 | 503 |
| Mov Cap-2 Maneuver | - | - | - | - | 192 | - |
| Stage 1 | - | - | - | - | 548 | - |
| Stage 2 | - | - | - | - | 503 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 1.1 | 51 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 192 | 503 | - | - | 965 | - |
| HCM Lane V/C Ratio | 0.757 | 0.114 | - | - | 0.068 | - |
| HCM Control Delay (s) | 65.9 | 13.1 | - | - | 9 | - |
| HCM Lane LOS | F | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 5 | 0.4 | - | - | 0.2 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 33.9 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Vol, veh/h | 494 | 256 | 54 | 622 | 100 | 28 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | Yield |
| Storage Length | - | 250 | 150 | - | 0 | 250 |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 0 | - | - | 0 | 0 | - |
| Peak Hour Factor | 92 | 92 | 92 | 92 | 92 | 92 |
| Heavy Vehicles, % | 5 | 5 | 5 | 5 | 5 | 5 |
| Mvmt Flow | 725 | 376 | 79 | 913 | 147 | 41 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 725 | 0 | 1796 | 725 |
| Stage 1 | - | - | - | - | 725 | - |
| Stage 2 | - | - | - | - | 1071 | - |
| Critical Hdwy | - | - | 4.15 | - | 6.45 | 6.25 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.45 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.45 | - |
| Follow-up Hdwy | - | - | 2.245 | - | 3.545 | 3.345 |
| Pot Cap-1 Maneuver | - | - | 864 | - | ~ 87 | 420 |
| Stage 1 | - | - | - | - | 474 | - |
| Stage 2 | - | - | - | - | 325 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 864 | - | ~ 79 | 420 |
| Mov Cap-2 Maneuver | - | - | - | - | ~ 79 | - |
| Stage 1 | - | - | - | - | 474 | - |
| Stage 2 | - | - | - | - | 295 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.8 | $ 407.8 |
| HCM LOS | | | F |

| Minor Lane/Major Mvmt | NBLn1 | NBLn2 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|---|
| Capacity (veh/h) | 79 | 420 | - | - | 864 | - |
| HCM Lane V/C Ratio | 1.857 | 0.098 | - | - | 0.092 | - |
| HCM Control Delay (s) | $ 517.9 | 14.5 | - | - | 9.6 | - |
| HCM Lane LOS | F | B | - | - | A | - |
| HCM 95th %tile Q(veh) | 12.8 | 0.3 | - | - | 0.3 | - |

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 477 | 254 | 26 | 364 | 84 | 35 |
| Number | 4 | 14 | 3 | 8 | 5 | 12 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln | 1776 | 1776 | 1776 | 1776 | 1776 | 1776 |
| Adj Flow Rate, veh/h | 568 | 302 | 31 | 433 | 100 | 42 |
| Adj No. of Lanes | 1 | 1 | 1 | 1 | 1 | 1 |
| Peak Hour Factor | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 |
| Percent Heavy Veh, % | 7 | 7 | 7 | 7 | 7 | 7 |
| Cap, veh/h | 919 | 1249 | 300 | 919 | 524 | 468 |
| Arrive On Green | 0.52 | 0.52 | 0.52 | 0.52 | 0.31 | 0.31 |
| Sat Flow, veh/h | 1776 | 1509 | 604 | 1776 | 1691 | 1509 |
| Grp Volume(v), veh/h | 568 | 302 | 31 | 433 | 100 | 42 |
| Grp Sat Flow(s),veh/h/ln | 1776 | 1509 | 604 | 1776 | 1691 | 1509 |
| Q Serve(g_s), s | 13.2 | 2.5 | 2.2 | 9.0 | 2.5 | 1.1 |
| Cycle Q Clear(g_c), s | 13.2 | 2.5 | 15.4 | 9.0 | 2.5 | 1.1 |
| Prop In Lane | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 919 | 1249 | 300 | 919 | 524 | 468 |
| V/C Ratio(X) | 0.62 | 0.24 | 0.10 | 0.47 | 0.19 | 0.09 |
| Avail Cap(c_a), veh/h | 919 | 1249 | 300 | 919 | 583 | 521 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 9.9 | 1.1 | 15.4 | 8.9 | 14.7 | 14.2 |
| Incr Delay (d2), s/veh | 1.3 | 0.1 | 0.1 | 0.4 | 0.2 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 6.6 | 1.0 | 0.4 | 4.4 | 1.2 | 0.5 |
| LnGrp Delay(d),s/veh | 11.2 | 1.2 | 15.5 | 9.3 | 14.8 | 14.3 |
| LnGrp LOS | B | A | B | A | B | B |
| Approach Vol, veh/h | 870 | | | 464 | 142 | |
| Approach Delay, s/veh | 7.7 | | | 9.7 | 14.7 | |
| Approach LOS | A | | | A | B | |

| Timer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Assigned Phs | | 2 | | 4 | | | | 8 |
| Phs Duration (G+Y+Rc), s | | 23.0 | | 35.0 | | | | 35.0 |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | | | 5.0 |
| Max Green Setting (Gmax), s | | 20.0 | | 30.0 | | | | 30.0 |
| Max Q Clear Time (g_c+I1), s | | 4.5 | | 15.2 | | | | 17.4 |
| Green Ext Time (p_c), s | | 0.3 | | 6.7 | | | | 6.1 |

| Intersection Summary | |
|---|---|
| HCM 2010 Ctrl Delay | 9.0 |
| HCM 2010 LOS | A |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 395 | 197 | 45 | 315 | 99 | 39 |
| Number | 4 | 14 | 3 | 8 | 5 | 12 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln | 1759 | 1759 | 1759 | 1759 | 1759 | 1759 |
| Adj Flow Rate, veh/h | 429 | 214 | 49 | 342 | 108 | 0 |
| Adj No. of Lanes | 1 | 1 | 1 | 1 | 1 | 1 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 8 | 8 | 8 | 8 | 8 | 8 |
| Cap, veh/h | 880 | 1246 | 371 | 880 | 558 | 498 |
| Arrive On Green | 0.50 | 0.50 | 0.50 | 0.50 | 0.33 | 0.00 |
| Sat Flow, veh/h | 1759 | 1495 | 740 | 1759 | 1675 | 1495 |
| Grp Volume(v), veh/h | 429 | 214 | 49 | 342 | 108 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1759 | 1495 | 740 | 1759 | 1675 | 1495 |
| Q Serve(g_s), s | 9.7 | 1.7 | 2.8 | 7.2 | 2.8 | 0.0 |
| Cycle Q Clear(g_c), s | 9.7 | 1.7 | 12.5 | 7.2 | 2.8 | 0.0 |
| Prop In Lane | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 880 | 1246 | 371 | 880 | 558 | 498 |
| V/C Ratio(X) | 0.49 | 0.17 | 0.13 | 0.39 | 0.19 | 0.00 |
| Avail Cap(c_a), veh/h | 880 | 1246 | 371 | 880 | 558 | 498 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 9.9 | 1.0 | 14.0 | 9.3 | 14.3 | 0.0 |
| Incr Delay (d2), s/veh | 0.4 | 0.1 | 0.2 | 0.3 | 0.2 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 4.8 | 2.0 | 0.6 | 3.5 | 1.3 | 0.0 |
| LnGrp Delay(d),s/veh | 10.3 | 1.0 | 14.2 | 9.6 | 14.4 | 0.0 |
| LnGrp LOS | B | A | B | A | B | |
| Approach Vol, veh/h | 643 | | | 391 | 108 | |
| Approach Delay, s/veh | 7.2 | | | 10.2 | 14.4 | |
| Approach LOS | A | | | B | B | |

| Timer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Assigned Phs | | 2 | | 4 | | | | 8 |
| Phs Duration (G+Y+Rc), s | | 25.0 | | 35.0 | | | | 35.0 |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | | | 5.0 |
| Max Green Setting (Gmax), s | | 20.0 | | 30.0 | | | | 30.0 |
| Max Q Clear Time (g_c+I1), s | | 4.8 | | 11.7 | | | | 14.5 |
| Green Ext Time (p_c), s | | 0.2 | | 5.5 | | | | 5.1 |

| Intersection Summary | |
|---|---|
| HCM 2010 Ctrl Delay | 8.9 |
| HCM 2010 LOS | A |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 494 | 256 | 54 | 622 | 100 | 28 |
| Number | 4 | 14 | 3 | 8 | 5 | 12 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 |
| Adj Flow Rate, veh/h | 568 | 294 | 62 | 715 | 115 | 32 |
| Adj No. of Lanes | 1 | 1 | 1 | 1 | 1 | 1 |
| Peak Hour Factor | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 |
| Cap, veh/h | 905 | 1282 | 288 | 905 | 574 | 513 |
| Arrive On Green | 0.50 | 0.50 | 0.50 | 0.50 | 0.33 | 0.33 |
| Sat Flow, veh/h | 1810 | 1538 | 621 | 1810 | 1723 | 1538 |
| Grp Volume(v), veh/h | 568 | 294 | 62 | 715 | 115 | 32 |
| Grp Sat Flow(s),veh/h/ln | 1810 | 1538 | 621 | 1810 | 1723 | 1538 |
| Q Serve(g_s), s | 13.7 | 2.4 | 4.9 | 19.6 | 2.9 | 0.8 |
| Cycle Q Clear(g_c), s | 13.7 | 2.4 | 18.6 | 19.6 | 2.9 | 0.8 |
| Prop In Lane | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 905 | 1282 | 288 | 905 | 574 | 513 |
| V/C Ratio(X) | 0.63 | 0.23 | 0.22 | 0.79 | 0.20 | 0.06 |
| Avail Cap(c_a), veh/h | 905 | 1282 | 288 | 905 | 574 | 513 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 10.9 | 1.0 | 17.7 | 12.4 | 14.3 | 13.6 |
| Incr Delay (d2), s/veh | 1.4 | 0.1 | 0.4 | 4.8 | 0.2 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 7.1 | 3.0 | 0.9 | 10.7 | 1.4 | 0.4 |
| LnGrp Delay(d),s/veh | 12.3 | 1.1 | 18.1 | 17.2 | 14.5 | 13.7 |
| LnGrp LOS | B | A | B | B | B | B |
| Approach Vol, veh/h | 862 | | | 777 | 147 | |
| Approach Delay, s/veh | 8.5 | | | 17.3 | 14.3 | |
| Approach LOS | A | | | B | B | |

| Timer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Assigned Phs | | 2 | | 4 | | | | 8 |
| Phs Duration (G+Y+Rc), s | | 25.0 | | 35.0 | | | | 35.0 |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | | | 5.0 |
| Max Green Setting (Gmax), s | | 20.0 | | 30.0 | | | | 30.0 |
| Max Q Clear Time (g_c+I1), s | | 4.9 | | 15.7 | | | | 21.6 |
| Green Ext Time (p_c), s | | 0.3 | | 8.3 | | | | 5.6 |

| Intersection Summary | |
|---|---|
| HCM 2010 Ctrl Delay | 12.8 |
| HCM 2010 LOS | B |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 477 | 254 | 26 | 364 | 84 | 35 |
| Number | 4 | 14 | 3 | 8 | 5 | 12 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln | 1776 | 1776 | 1776 | 1776 | 1776 | 1776 |
| Adj Flow Rate, veh/h | 700 | 373 | 38 | 534 | 123 | 51 |
| Adj No. of Lanes | 1 | 1 | 1 | 1 | 1 | 1 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 7 | 7 | 7 | 7 | 7 | 7 |
| Cap, veh/h | 888 | 1258 | 207 | 888 | 564 | 503 |
| Arrive On Green | 0.50 | 0.50 | 0.50 | 0.50 | 0.33 | 0.33 |
| Sat Flow, veh/h | 1776 | 1509 | 499 | 1776 | 1691 | 1509 |
| Grp Volume(v), veh/h | 700 | 373 | 38 | 534 | 123 | 51 |
| Grp Sat Flow(s),veh/h/ln | 1776 | 1509 | 499 | 1776 | 1691 | 1509 |
| Q Serve(g_s), s | 19.5 | 3.3 | 4.1 | 12.9 | 3.1 | 1.4 |
| Cycle Q Clear(g_c), s | 19.5 | 3.3 | 23.6 | 12.9 | 3.1 | 1.4 |
| Prop In Lane | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 888 | 1258 | 207 | 888 | 564 | 503 |
| V/C Ratio(X) | 0.79 | 0.30 | 0.18 | 0.60 | 0.22 | 0.10 |
| Avail Cap(c_a), veh/h | 888 | 1258 | 207 | 888 | 564 | 503 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 12.4 | 1.1 | 22.1 | 10.7 | 14.4 | 13.8 |
| Incr Delay (d2), s/veh | 4.8 | 0.1 | 0.4 | 1.1 | 0.2 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 10.5 | 4.1 | 0.6 | 6.5 | 1.5 | 0.6 |
| LnGrp Delay(d),s/veh | 17.2 | 1.2 | 22.5 | 11.9 | 14.6 | 13.9 |
| LnGrp LOS | B | A | C | B | B | B |
| Approach Vol, veh/h | 1073 | | | 572 | 174 | |
| Approach Delay, s/veh | 11.6 | | | 12.6 | 14.4 | |
| Approach LOS | B | | | B | B | |

| Timer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Assigned Phs | | 2 | | 4 | | | | 8 |
| Phs Duration (G+Y+Rc), s | | 25.0 | | 35.0 | | | | 35.0 |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | | | 5.0 |
| Max Green Setting (Gmax), s | | 20.0 | | 30.0 | | | | 30.0 |
| Max Q Clear Time (g_c+I1), s | | 5.1 | | 21.5 | | | | 25.6 |
| Green Ext Time (p_c), s | | 0.4 | | 5.6 | | | | 3.3 |

| Intersection Summary | |
|---|---|
| HCM 2010 Ctrl Delay | 12.2 |
| HCM 2010 LOS | B |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 395 | 197 | 45 | 315 | 99 | 39 |
| Number | 4 | 14 | 3 | 8 | 5 | 12 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln | 1759 | 1759 | 1759 | 1759 | 1759 | 1759 |
| Adj Flow Rate, veh/h | 580 | 289 | 66 | 462 | 145 | 57 |
| Adj No. of Lanes | 1 | 1 | 1 | 1 | 1 | 1 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 8 | 8 | 8 | 8 | 8 | 8 |
| Cap, veh/h | 880 | 748 | 272 | 880 | 558 | 498 |
| Arrive On Green | 0.50 | 0.50 | 0.50 | 0.50 | 0.33 | 0.33 |
| Sat Flow, veh/h | 1759 | 1495 | 599 | 1759 | 1675 | 1495 |
| Grp Volume(v), veh/h | 580 | 289 | 66 | 462 | 145 | 57 |
| Grp Sat Flow(s),veh/h/ln | 1759 | 1495 | 599 | 1759 | 1675 | 1495 |
| Q Serve(g_s), s | 14.8 | 7.2 | 5.5 | 10.7 | 3.8 | 1.6 |
| Cycle Q Clear(g_c), s | 14.8 | 7.2 | 20.3 | 10.7 | 3.8 | 1.6 |
| Prop In Lane | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 880 | 748 | 272 | 880 | 558 | 498 |
| V/C Ratio(X) | 0.66 | 0.39 | 0.24 | 0.53 | 0.26 | 0.11 |
| Avail Cap(c_a), veh/h | 880 | 748 | 272 | 880 | 558 | 498 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 11.2 | 9.3 | 18.8 | 10.2 | 14.6 | 13.9 |
| Incr Delay (d2), s/veh | 1.8 | 0.3 | 0.5 | 0.6 | 0.2 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 7.5 | 3.0 | 1.0 | 5.3 | 1.8 | 0.7 |
| LnGrp Delay(d),s/veh | 13.0 | 9.6 | 19.2 | 10.7 | 14.8 | 14.0 |
| LnGrp LOS | B | A | B | B | B | B |
| Approach Vol, veh/h | 869 | | | 528 | 202 | |
| Approach Delay, s/veh | 11.9 | | | 11.8 | 14.6 | |
| Approach LOS | B | | | B | B | |

| Timer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Assigned Phs | | 2 | | 4 | | | | 8 |
| Phs Duration (G+Y+Rc), s | | 25.0 | | 35.0 | | | | 35.0 |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | | | 5.0 |
| Max Green Setting (Gmax), s | | 20.0 | | 30.0 | | | | 30.0 |
| Max Q Clear Time (g_c+I1), s | | 5.8 | | 16.8 | | | | 22.3 |
| Green Ext Time (p_c), s | | 0.5 | | 6.7 | | | | 4.6 |

| Intersection Summary | |
|---|---|
| HCM 2010 Ctrl Delay | 12.2 |
| HCM 2010 LOS | B |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Volume (veh/h) | 494 | 256 | 54 | 622 | 100 | 28 |
| Number | 4 | 14 | 3 | 8 | 5 | 12 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln | 1810 | 1810 | 1810 | 1810 | 1810 | 1810 |
| Adj Flow Rate, veh/h | 725 | 376 | 79 | 913 | 147 | 41 |
| Adj No. of Lanes | 1 | 1 | 1 | 1 | 1 | 1 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 5 | 5 | 5 | 5 | 5 | 5 |
| Cap, veh/h | 971 | 825 | 224 | 971 | 533 | 475 |
| Arrive On Green | 0.54 | 0.54 | 0.54 | 0.54 | 0.31 | 0.31 |
| Sat Flow, veh/h | 1810 | 1538 | 495 | 1810 | 1723 | 1538 |
| Grp Volume(v), veh/h | 725 | 376 | 79 | 913 | 147 | 41 |
| Grp Sat Flow(s),veh/h/ln | 1810 | 1538 | 495 | 1810 | 1723 | 1538 |
| Q Serve(g_s), s | 20.1 | 9.7 | 9.5 | 30.6 | 4.2 | 1.2 |
| Cycle Q Clear(g_c), s | 20.1 | 9.7 | 29.6 | 30.6 | 4.2 | 1.2 |
| Prop In Lane | | 1.00 | 1.00 | | 1.00 | 1.00 |
| Lane Grp Cap(c), veh/h | 971 | 825 | 224 | 971 | 533 | 475 |
| V/C Ratio(X) | 0.75 | 0.46 | 0.35 | 0.94 | 0.28 | 0.09 |
| Avail Cap(c_a), veh/h | 979 | 832 | 226 | 979 | 533 | 475 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | 11.6 | 9.2 | 23.0 | 14.0 | 16.9 | 15.9 |
| Incr Delay (d2), s/veh | 3.2 | 0.4 | 0.9 | 16.3 | 0.3 | 0.1 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 10.7 | 4.2 | 1.4 | 19.4 | 2.0 | 0.5 |
| LnGrp Delay(d),s/veh | 14.8 | 9.6 | 24.0 | 30.3 | 17.2 | 16.0 |
| LnGrp LOS | B | A | C | C | B | B |
| Approach Vol, veh/h | 1101 | | | 992 | 188 | |
| Approach Delay, s/veh | 13.0 | | | 29.8 | 16.9 | |
| Approach LOS | B | | | C | B | |

| Timer | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Assigned Phs | | 2 | | 4 | | | | 8 |
| Phs Duration (G+Y+Rc), s | | 25.0 | | 39.7 | | | | 39.7 |
| Change Period (Y+Rc), s | | 5.0 | | 5.0 | | | | 5.0 |
| Max Green Setting (Gmax), s | | 20.0 | | 35.0 | | | | 35.0 |
| Max Q Clear Time (g_c+I1), s | | 6.2 | | 22.1 | | | | 32.6 |
| Green Ext Time (p_c), s | | 0.4 | | 9.8 | | | | 2.2 |

| Intersection Summary | |
|---|---|
| HCM 2010 Ctrl Delay | 20.6 |
| HCM 2010 LOS | C |

# MOVEMENT SUMMARY

## Site: 25th St N & River Drive AM 2015 w RT Bypass

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: 25th St N | | | | | | | | | | | |
| 3 | L2 | 100 | 7.1 | 0.193 | 7.0 | LOS A | 0.6 | 15.7 | 0.49 | 0.49 | 31.4 |
| 18 | R2 | 42 | 11.5 | 0.193 | 7.0 | LOS A | 0.6 | 15.7 | 0.49 | 0.49 | 30.8 |
| Approach | | 142 | 8.4 | 0.193 | 7.0 | LOS A | 0.6 | 15.7 | 0.49 | 0.49 | 31.3 |
| East: River Drive | | | | | | | | | | | |
| 1 | L2 | 31 | 11.1 | 0.426 | 7.8 | LOS A | 1.8 | 48.9 | 0.27 | 0.15 | 32.2 |
| 6 | T1 | 434 | 8.1 | 0.426 | 7.8 | LOS A | 1.8 | 48.9 | 0.27 | 0.15 | 32.4 |
| Approach | | 465 | 8.3 | 0.426 | 7.8 | LOS A | 1.8 | 48.9 | 0.27 | 0.15 | 32.4 |
| West: River Drive | | | | | | | | | | | |
| 2 | T1 | 569 | 8.0 | 0.490 | 8.5 | LOS A | 2.4 | 64.6 | 0.16 | 0.06 | 32.3 |
| 12 | R2 | 303 | 3.0 | 0.249 | 5.2 | LOS A | 0.9 | 24.2 | 0.12 | 0.04 | 33.4 |
| Approach | | 871 | 6.3 | 0.490 | 7.4 | LOS A | 2.4 | 64.6 | 0.14 | 0.05 | 32.6 |
| All Vehicles | | 1478 | 7.1 | 0.490 | 7.5 | LOS A | 2.4 | 64.6 | 0.22 | 0.13 | 32.4 |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

## Site: 25th St N & River Drive Noon 2015 w RT Bypass

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: 25th St N | | | | | | | | | | | |
| 3 | L2 | 108 | 9.8 | 0.182 | 6.3 | LOS A | 0.6 | 15.0 | 0.43 | 0.38 | 31.7 |
| 18 | R2 | 42 | 9.0 | 0.182 | 6.3 | LOS A | 0.6 | 15.0 | 0.43 | 0.38 | 31.2 |
| Approach | | 150 | 9.6 | 0.182 | 6.3 | LOS A | 0.6 | 15.0 | 0.43 | 0.38 | 31.5 |
| East: River Drive | | | | | | | | | | | |
| 1 | L2 | 49 | 14.7 | 0.356 | 6.9 | LOS A | 1.4 | 37.7 | 0.26 | 0.15 | 32.4 |
| 6 | T1 | 342 | 5.7 | 0.356 | 6.9 | LOS A | 1.4 | 37.7 | 0.26 | 0.15 | 32.9 |
| Approach | | 391 | 6.8 | 0.356 | 6.9 | LOS A | 1.4 | 37.7 | 0.26 | 0.15 | 32.8 |
| West: River Drive | | | | | | | | | | | |
| 2 | T1 | 429 | 6.6 | 0.372 | 6.8 | LOS A | 1.6 | 41.1 | 0.18 | 0.08 | 33.1 |
| 12 | R2 | 214 | 6.2 | 0.185 | 4.7 | LOS A | 0.6 | 16.3 | 0.14 | 0.06 | 33.5 |
| Approach | | 643 | 6.5 | 0.372 | 6.1 | LOS A | 1.6 | 41.1 | 0.16 | 0.07 | 33.2 |
| All Vehicles | | 1185 | 7.0 | 0.372 | 6.4 | LOS A | 1.6 | 41.1 | 0.23 | 0.14 | 32.9 |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

## Site: 25th St N & River Drive PM 2015 W RT Bypass

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: 25th St N | | | | | | | | | | | |
| 3 | L2 | 115 | 7.8 | 0.198 | 7.0 | LOS A | 0.6 | 16.2 | 0.48 | 0.48 | 31.3 |
| 18 | R2 | 32 | 13.0 | 0.198 | 7.0 | LOS A | 0.6 | 16.2 | 0.48 | 0.48 | 30.7 |
| Approach | | 147 | 8.9 | 0.198 | 7.0 | LOS A | 0.6 | 16.2 | 0.48 | 0.48 | 31.1 |
| East: River Drive | | | | | | | | | | | |
| 1 | L2 | 62 | 5.6 | 0.680 | 13.0 | LOS B | 5.0 | 127.5 | 0.47 | 0.30 | 30.1 |
| 6 | T1 | 715 | 1.9 | 0.680 | 13.0 | LOS B | 5.0 | 127.5 | 0.47 | 0.30 | 30.3 |
| Approach | | 777 | 2.2 | 0.680 | 13.0 | LOS B | 5.0 | 127.5 | 0.47 | 0.30 | 30.3 |
| West: River Drive | | | | | | | | | | | |
| 2 | T1 | 568 | 4.5 | 0.486 | 8.4 | LOS A | 2.5 | 64.3 | 0.23 | 0.11 | 32.4 |
| 12 | R2 | 294 | 3.9 | 0.250 | 5.3 | LOS A | 0.9 | 24.0 | 0.17 | 0.08 | 33.3 |
| Approach | | 862 | 4.3 | 0.486 | 7.3 | LOS A | 2.5 | 64.3 | 0.21 | 0.10 | 32.7 |
| All Vehicles | | 1786 | 3.8 | 0.680 | 9.8 | LOS A | 5.0 | 127.5 | 0.35 | 0.22 | 31.5 |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

## Site: 25th St N & River Drive AM 2035 w RT bypass

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: 25th St N | | | | | | | | | | | |
| 3 | L2 | 123 | 7.1 | 0.264 | 8.7 | LOS A | 0.8 | 21.9 | 0.55 | 0.55 | 30.7 |
| 18 | R2 | 51 | 11.5 | 0.264 | 8.7 | LOS A | 0.8 | 21.9 | 0.55 | 0.55 | 30.1 |
| Approach | | 174 | 8.4 | 0.264 | 8.7 | LOS A | 0.8 | 21.9 | 0.55 | 0.55 | 30.5 |
| East: River Drive | | | | | | | | | | | |
| 1 | L2 | 38 | 11.1 | 0.532 | 9.8 | LOS A | 2.6 | 70.2 | 0.35 | 0.22 | 31.3 |
| 6 | T1 | 533 | 8.1 | 0.532 | 9.8 | LOS A | 2.6 | 70.2 | 0.35 | 0.22 | 31.6 |
| Approach | | 571 | 8.3 | 0.532 | 9.8 | LOS A | 2.6 | 70.2 | 0.35 | 0.22 | 31.6 |
| West: River Drive | | | | | | | | | | | |
| 2 | T1 | 699 | 8.0 | 0.607 | 10.9 | LOS B | 3.7 | 97.6 | 0.22 | 0.09 | 31.2 |
| 12 | R2 | 373 | 3.0 | 0.309 | 5.8 | LOS A | 1.3 | 32.2 | 0.14 | 0.05 | 33.0 |
| Approach | | 1072 | 6.3 | 0.607 | 9.1 | LOS A | 3.7 | 97.6 | 0.19 | 0.08 | 31.8 |
| All Vehicles | | 1816 | 7.1 | 0.607 | 9.3 | LOS A | 3.7 | 97.6 | 0.27 | 0.17 | 31.6 |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

## Site: 25th St N & River Drive Noon 2035 w RT bypass

Roundabout

| Movement Performance - Vehicles | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
| South: 25th St N | | | | | | | | | | | |
| 3 | L2 | 145 | 9.8 | 0.277 | 8.2 | LOS A | 0.9 | 23.7 | 0.51 | 0.51 | 30.8 |
| 18 | R2 | 57 | 9.0 | 0.277 | 8.2 | LOS A | 0.9 | 23.7 | 0.51 | 0.51 | 30.4 |
| Approach | | 201 | 9.6 | 0.277 | 8.2 | LOS A | 0.9 | 23.7 | 0.51 | 0.51 | 30.7 |
| East: River Drive | | | | | | | | | | | |
| 1 | L2 | 66 | 14.7 | 0.496 | 9.1 | LOS A | 2.3 | 61.8 | 0.36 | 0.25 | 31.4 |
| 6 | T1 | 461 | 5.7 | 0.496 | 9.1 | LOS A | 2.3 | 61.8 | 0.36 | 0.25 | 31.8 |
| Approach | | 527 | 6.8 | 0.496 | 9.1 | LOS A | 2.3 | 61.8 | 0.36 | 0.25 | 31.8 |
| West: River Drive | | | | | | | | | | | |
| 2 | T1 | 577 | 6.6 | 0.508 | 8.9 | LOS A | 2.6 | 67.8 | 0.25 | 0.13 | 32.1 |
| 12 | R2 | 288 | 6.2 | 0.252 | 5.5 | LOS A | 0.9 | 24.0 | 0.18 | 0.09 | 33.1 |
| Approach | | 865 | 6.5 | 0.508 | 7.8 | LOS A | 2.6 | 67.8 | 0.23 | 0.12 | 32.4 |
| All Vehicles | | 1593 | 7.0 | 0.508 | 8.3 | LOS A | 2.6 | 67.8 | 0.31 | 0.21 | 32.0 |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

# MOVEMENT SUMMARY

## Site: 25th St N & River Drive PM 2035 w RT bypass

Roundabout

**Movement Performance - Vehicles**

| Mov ID | OD Mov | Demand Flows Total veh/h | HV % | Deg. Satn v/c | Average Delay sec | Level of Service | 95% Back of Queue Vehicles veh | Distance ft | Prop. Queued | Effective Stop Rate per veh | Average Speed mph |
|---|---|---|---|---|---|---|---|---|---|---|---|
| South: 25th St N | | | | | | | | | | | |
| 3 | L2 | 147 | 7.8 | 0.285 | 9.1 | LOS A | 0.9 | 24.0 | 0.56 | 0.56 | 30.4 |
| 18 | R2 | 40 | 13.0 | 0.285 | 9.1 | LOS A | 0.9 | 24.0 | 0.56 | 0.56 | 29.8 |
| Approach | | 187 | 8.9 | 0.285 | 9.1 | LOS A | 0.9 | 24.0 | 0.56 | 0.56 | 30.3 |
| East: River Drive | | | | | | | | | | | |
| 1 | L2 | 78 | 5.6 | 0.889 | 26.5 | LOS D | 15.1 | 385.1 | 0.93 | 0.74 | 25.5 |
| 6 | T1 | 911 | 1.9 | 0.889 | 26.5 | LOS D | 15.1 | 385.1 | 0.93 | 0.74 | 25.7 |
| Approach | | 989 | 2.2 | 0.889 | 26.5 | LOS D | 15.1 | 385.1 | 0.93 | 0.74 | 25.6 |
| West: River Drive | | | | | | | | | | | |
| 2 | T1 | 724 | 4.5 | 0.627 | 11.4 | LOS B | 4.1 | 106.1 | 0.34 | 0.18 | 31.1 |
| 12 | R2 | 375 | 3.9 | 0.323 | 6.2 | LOS A | 1.3 | 33.8 | 0.21 | 0.11 | 32.8 |
| Approach | | 1099 | 4.3 | 0.627 | 9.6 | LOS A | 4.1 | 106.1 | 0.29 | 0.16 | 31.6 |
| All Vehicles | | 2275 | 3.8 | 0.889 | 16.9 | LOS C | 15.1 | 385.1 | 0.59 | 0.44 | 28.6 |

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.