Appendix B:
Traffic & Operational Analysis

Front & Main Conversion Study

Methods and Assumptions Memorandum

Prepared for: City of Missoula Redevelopment Agency

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Table of Contents

1. Introduction and Project Description

Project Background and Understanding

The City of Missoula Redevelopment Agency (MRA) desires to complete a feasibility analysis to compare the existing one-way traffic couplet of Main and Front Streets in downtown Missoula with alternatives for two-way operations. The analysis will include the impact of operational changes to the commercial businesses, residential use, motorized and non-motorized traffic flows, safety, parking, public transit, and air quality.

Goals of Study

The project team has determined the following goals for this specific study:

- Analyze existing conditions within the study area
- Forecast future conditions
- Develop 4 to 6 potential alternatives
- Analyze most supported alternative using Synchro

Project Location

Figure 1 illustrates the general project location.

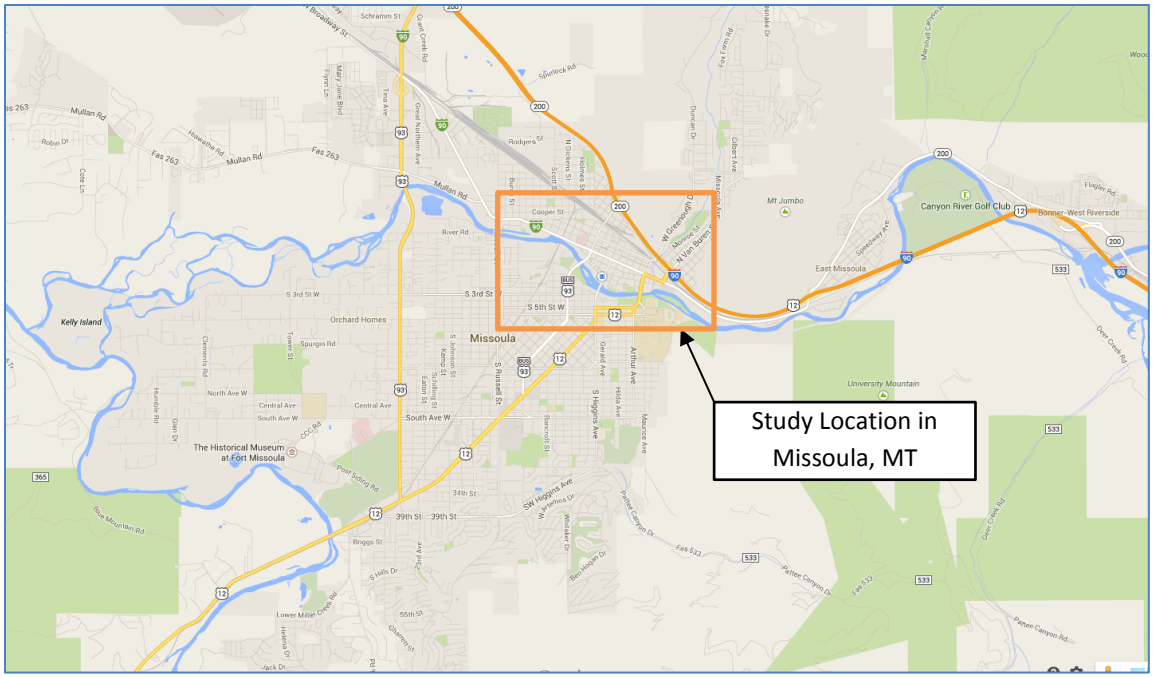

Figure 1 Front & Main Vicinity Map

Stakeholders

The Stakeholders are comprised of representatives from the following parties:

- City of Missoula Redevelopment Agency (MRA)
- Montana Department of Transportation (MDT)
- Project Advisory Committee (PAC)

2. Study Area

The study area includes the commercial areas and residential neighborhoods on Front Street and Main Street between Orange Street and Madison Street, to include the intersections of both Orange and Madison streets.

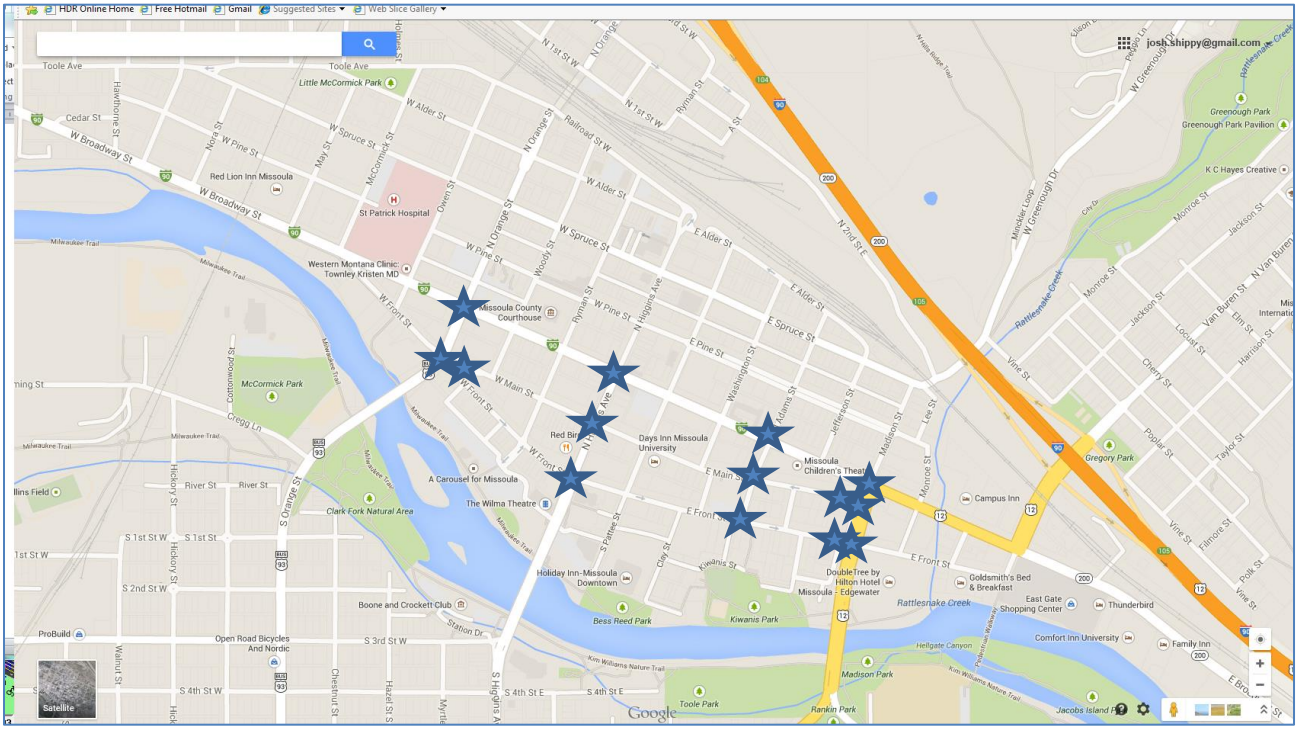

Figure 2 Project Study Area Map

Study Intersections:

1) Orange St & Broadway St
2) Orange St & Front St
3) Main St & Front St (Future)
4) Broadway St & Higgins Ave
5) Main St & Higgins Ave
6) Front St & Higgins Ave
7) Broadway St & Adams St
8) Main St & Adams St
9) Front St & Adams St
10) Broadway St & Madison St/US 12
11) Main St & Madison St/US 12
12) Main St & Madison St
13) Front St & Madison St/US 12
14) Front St & Madison St

3. Analysis Years/Periods

Existing Conditions – Existing conditions will be conducted for year 2014 volume conditions. For existing condition, the following scenarios and time periods will be evaluated:

- Existing one-way condition (Year 2014) - AM and PM Peak Hour
- Existing one-way condition (Year 2014) - Noon and Weekend (non-event/non-football) Peak Hour

Based upon community input, the following scenarios will be evaluated even though it wasn't in the original scope. We agree that these are reasonable scenarios to evaluate.

- Existing with two-way condition (Year 2014) - AM and PM Peak Hour
- Existing with two-way condition (Year 2014) - Noon and Weekend (non-event/non-football) Peak Hour

Design Year Conditions – Design year analysis will be conducted for year 2040 peak hour conditions. The projected traffic volumes from the MPO Travel Demand Model will be utilized to determine year 2040 volumes. For the design year conditions, the following scenarios and time periods will be evaluated:

- Design Year one-way condition (Year 2040) – AM and PM Peak Hour
- Design Year two-way condition (Year 2040) - AM and PM Peak Hour
- Design Year two-way condition (Year 2040) - Noon and Weekend (non-event/non-football) Peak Hour

4. Travel Demand Forecast

Travel demand modeling services using the TransCAD models for the study will be performed by the Missoula Metropolitan Planning Organization (MPO) with input from HDR traffic modeling staff. The model run results will be used primarily for comparing the air quality differences between the existing one-way couplet and two-way couplet conditions.

The following model runs will be conducted:

- Existing condition
- Year 2040 existing one-way condition
- Year 2040 two-way condition

5. Traffic Operations Analysis

The Highway Capacity Manual (HCM) (Transportation Research Board, 2010) will be used a primary reference for traffic the operational analysis for intersections. Synchro 8.0 and its HCM compatible outputs will be used for intersection analysis. SimTraffic as part of Synchro Studio 8 (Trafficware) will

be used for visualizations. The following Synchro parameters were developed using data from the Synchro models received from MDT in July of 2013.

Operational Analysis Assumptions

a. Level of Service (Based on Peak Hour Conditions)
   - The minimum allowable LOS is 'C' or better for urban principal and urban minor arterials and LOS 'D' or better for collectors based on values identified in the MDT Road Design Manual (MDT November 2007).

b. Parameters
   - Peak Hour Factor (PHF). Existing year analyses will use PHF as input in the provided Synchro file. Design year (2040) condition analysis will use PHF of 0.95.
   - Saturation Flow Rate. The use of 1600 vehicles per hour per lane (vphpl), for arterial intersections will be used.
   - Heavy Vehicle Percentage. Field heavy vehicle (truck and bus) traffic counts will be used to calculate Heavy Vehicle Percentage. For the locations where Heavy Vehicle Percentages are not available, a default value of 5% will be used. Future Year analysis will assume the same values as used in Existing Year.
   - Lane Utilization Factors (Heaviest Lane Volume Parameter in HCS Street Module). Default Synchro values will be used for lane utilization.
   - Traffic Signal Controllers. Operational analysis will allow for actuated and coordinated controllers.
   - Left-Turn Phasing. Protected, Permitted/Protected or Split phasing will be allowed at intersections.
   - Phase Change Interval. Existing signal timing will be used for phase change intervals of phases that exist at intersections that gave no geometric change from existing conditions.

c. Additional assumptions for Synchro
   - Lane Width=12 feet
   - Grade=0
   - Type of Area= CBD
   - Link Speed= Posted Speed limit
   - Storage Length= As of aerial photos/CAD drawings
   - Signal Phasing and Coordination: The Synchro models will use current fixed time AM and PM phasing and coordination used for the existing condition. These signal plans will be optimized and coordinated for the future year models.
   - Detector Settings: default detector layouts by Synchro
   - Balance traffic volume between intersections using bi-proportional OD Matrix balancing technique.

6. Safety Issues/Bike/Pedestrian

Crash data will be reviewed for the study area for years 2010 through 2014. A visual assessment of the current physical conditions for non-motorized traffic will be completed. It will include reviewing the sidewalks, crosswalks, and bicycle and transit amenities. The following information will be provided as a result of this analysis:

- Potential non-motorized conflict areas as well as areas of opportunity will be identified.

7. Operational Measures of Effectiveness

The following Measures of Effectiveness (MOEs) are proposed to quantify the traffic operational impact for the signalized and unsignalized intersections:

- Intersection and Individual Lane Group Average Delay and LOS
- 95th Percentile Queue Length for Individual Lane Groups
- Volume/Capacity Ratio
- Delay and LOS

8. Deviations /Justifications

No deviations from standards are currently known. If it is determined during the study that deviations are required, the methods and assumptions document will be amended prior to processing.

9. Conclusion

All sections contained in this document will guide traffic data collection, traffic assessment and verification of engineering & operational feasibility for this study. If it is determined during the study that deviations are required to any sections included in this document, the document will be amended prior to processing.