



Appendix A – Data Collection and Existing Conditions Technical Memo



Memo

Date: Friday, February 05, 2016

Project: Fairview Ave. and Main St. Local Streets Improvement Plan

To: Brooke Green, ACHD Project Manager
Project Team

From: Cameron Waite

Subject: Data Collection and Existing Conditions Technical Memo

Introduction

The Ada County Highway District (ACHD) is developing a Local Streets Improvement Plan for the Fairview Ave. and Main St. one-way couplet from Whitewater Park Blvd. to 16th St. The purpose of this plan is to recommend the feasibility of a lane reconfiguration for both Fairview Ave. and Main St. and to identify cross sections for new local streets within the plan area. This memo summarizes the data collection efforts, information gathered, and existing conditions analysis and results.

Data Collection

Data Requested From Project Team Members

ACHD provided the following data:

- Current average daily traffic (ADT) for the Fairview Ave., Main St., 16th St., 23rd St., 27th St., 28th St., 29th St., and Whitewater Park Blvd.
- Current AM and PM peak hour volumes for the Fairview Ave. and Main St. signalized intersections
- Available pedestrian counts
- Existing storm drain facilities and outfalls within the plan area
- VISSIM software base model for use in the existing and forecast analyses
- Existing signal timings
- Existing right-of-way information
- Existing travel time runs on Front St. and Main St.

The City of Boise provided the following data:

- Committed and planned infrastructure improvements in the plan area, including private development
- Current and planned land use and zoning

Valley Regional Transit (VRT) provided the following data:

- Confirmation of existing bus routes and headways in the study area
- Estimate of bus routes and headways for forecast analyses



The Community Planning Association of Southwest Idaho (COMPASS), the regional metropolitan planning organization (MPO), provided the following data:

- 2015 and 2040 PM peak and daily regional travel demand model runs for the study area

The Idaho Transportation Department (ITD) Office of Highway Safety provided the following data:

- 2010-2014 crash data for the Fairview Ave. and Main St. streets and intersections in the study area

Data Collected by HDR

- Document Review
 - *30th Street Area Master Plan*
 - *Blueprint Boise; Boise's Comprehensive Plan*
 - *Urban Renewal Plan: 30th Street Area Urban Renewal Project*
- Research driveway density effect on traffic flow and safety and determine threshold values for analysis
- Existing physical conditions, including:
 - Lane configurations and widths
 - Speed limits
 - Functional classification, including Transportation-Land Use Integration Plan (TLIP) designations
 - Bus stops
 - Curb-to-curb width (measured to the face of curb)
 - Sidewalk locations and widths
 - Driveway density/spacing
 - Existing intersection configurations and control (stop control, signal control)
 - Travel times during the a.m. and p.m. peak hours along Fairview Ave. and Main St.

Summary of Document Review

The following documents were reviewed to determine how they interact with the transportation components of the Fairview Ave. and Main St. Local Streets Improvement Plan.

30th Street Area Master Plan

- The Fairview Ave. and Main St. couplet should be redesigned to reduce the number of travel lanes in each direction from four to three and allow bicycle and parking lanes, street trees, and street furnishing to be added.
- The 30th St. Extension (Whitewater Park Blvd.) is designed to accommodate transit in accordance with the VRT State Street Transit and Traffic Operational Plan (TTOP), Valleyconnect, VRT's regional mobility plan, Transit Regional Operations and Capital Improvement Plan, and Transit Development Plan.
- ACHD determined acquiring more right-of-way was not feasible and improvements should be provided within existing right-of-way.



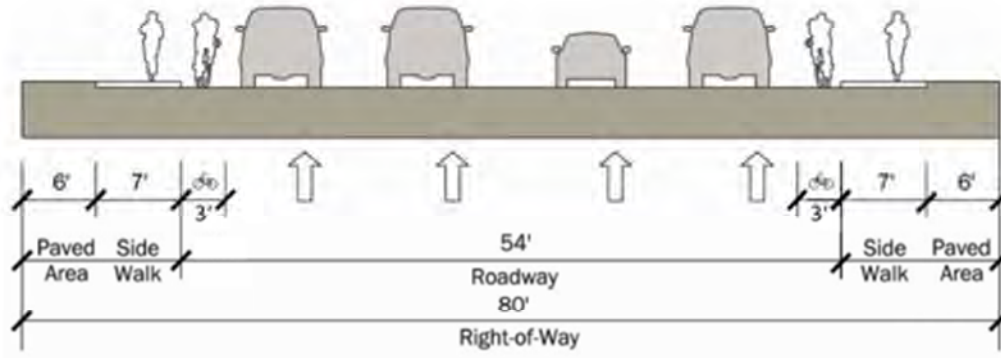
- Preferred street section for Fairview Ave. & Main St. (**See Figures 1 and 2**)
 - Two 11' wide travel lanes and 1-11.5' wide transit lane
 - 8.5' wide parking lanes, including gutter width
 - One 5.5' wide bicycle lane
 - 6.5' wide planter strips with 9' wide sidewalk on either side of roadway

Blueprint Boise; Boise's Comprehensive Plan

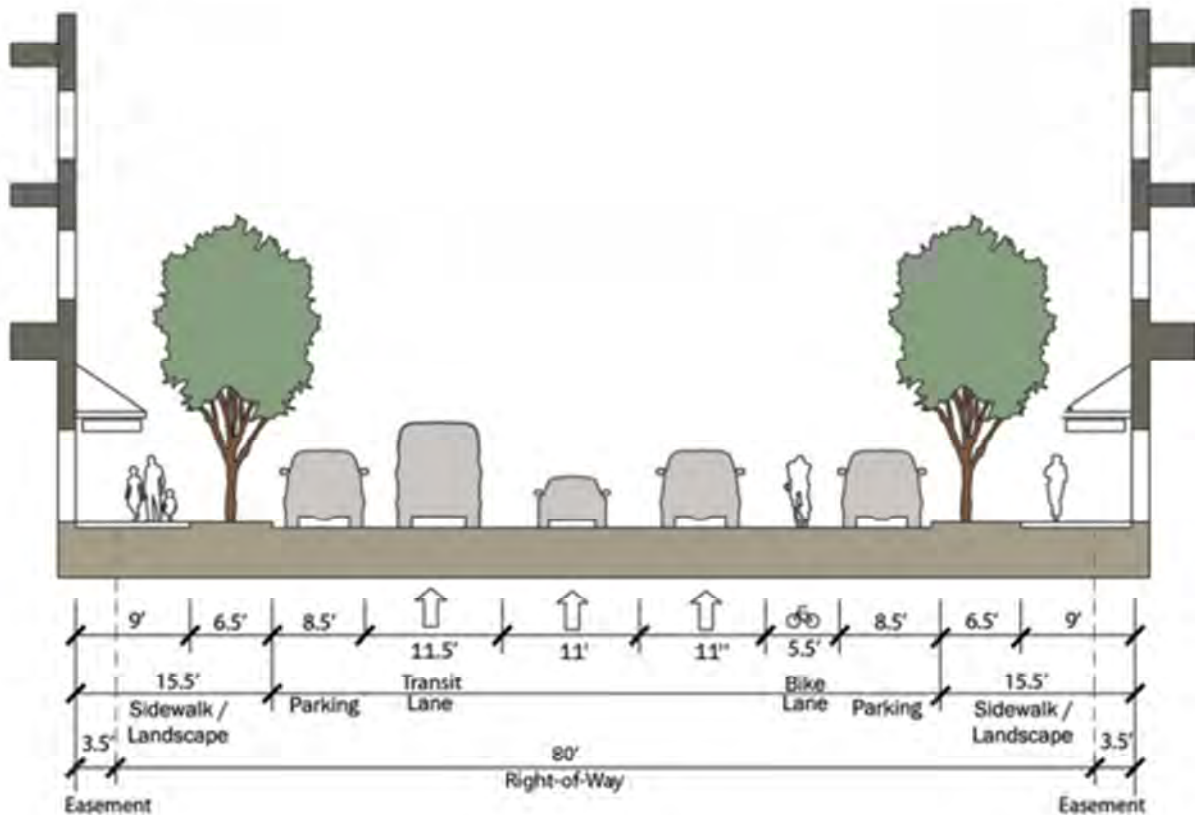
- Goals
 - Goal DT-CCN 2: Create in-town residential neighborhoods and increase the amount and range of housing choices available in Downtown and adjacent neighborhoods.
 - Goal DT-CCN 3: Encourage redevelopment of surface parking lots and other underutilized properties.
 - Goal DT-PKG 1: Implement a Downtown-wide parking system that coordinates all on and off-street parking resources.
 - Goal DT-C 1: Develop a robust, multimodal transportation system in Downtown, with an emphasis on transit, bicycle, and pedestrian circulation and safety.
 - Goal DT-C 2: Continue to develop a framework of streets, paths and open spaces that builds upon existing networks and strengthen connections to the Boise River and Downtown subdistricts.
 - Goal DT-PSF 1: Maximize the use of existing infrastructure Downtown and make improvements as needed as development intensifies.
 - Goal DT-NC 1: Use Downtown development as a model for sustainable land use, development, and construction practices.
 - Goal DT-NC 2: Create a safe, clean, and enjoyable environment for businesses residents, and visitors in Downtown.
 - Goal DT-NC 4: Set a high standard for the quality of urban design, building design, and construction in Downtown, especially in the central business district (CBD).
 - Goal DT-CEA 2: Retain and expand K-12 educational facilities, higher education, and a variety of learning opportunities in Downtown.
 - Goal DT-CEA 3: Recognize and protect the historic resources in Downtown.
 - Goal DT-ED 3: Find an appropriate balance between the demands for economic prosperity, historic preservation, and quality design in reviewing development applications.
- The Fairview Ave. and Main St. Local Streets Improvement Plan study area is included in the Downtown Planning Area.
- Current Land Use Map
 - Mixed use throughout the study area with a Community Activity Center near the Main St./Whitewater Park Blvd. intersection
- Existing Greenbelt pathway on the east side of the Boise River under the Fairview Ave. and Main St. Bridges
- New Greenbelt pathway being constructed on the west side of the Boise River under the Fairview Ave. and Main St. Bridges.

Figure 1. Existing and Preferred Street Sections for Fairview Ave.

Source: 30th Street Area Master Plan, 2012.



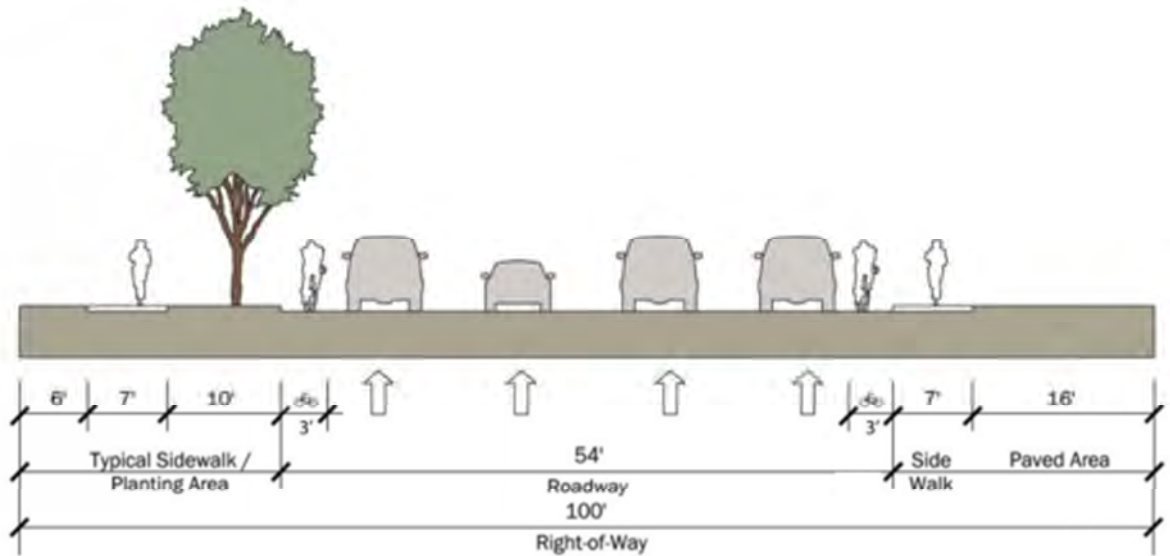
Existing Street Section



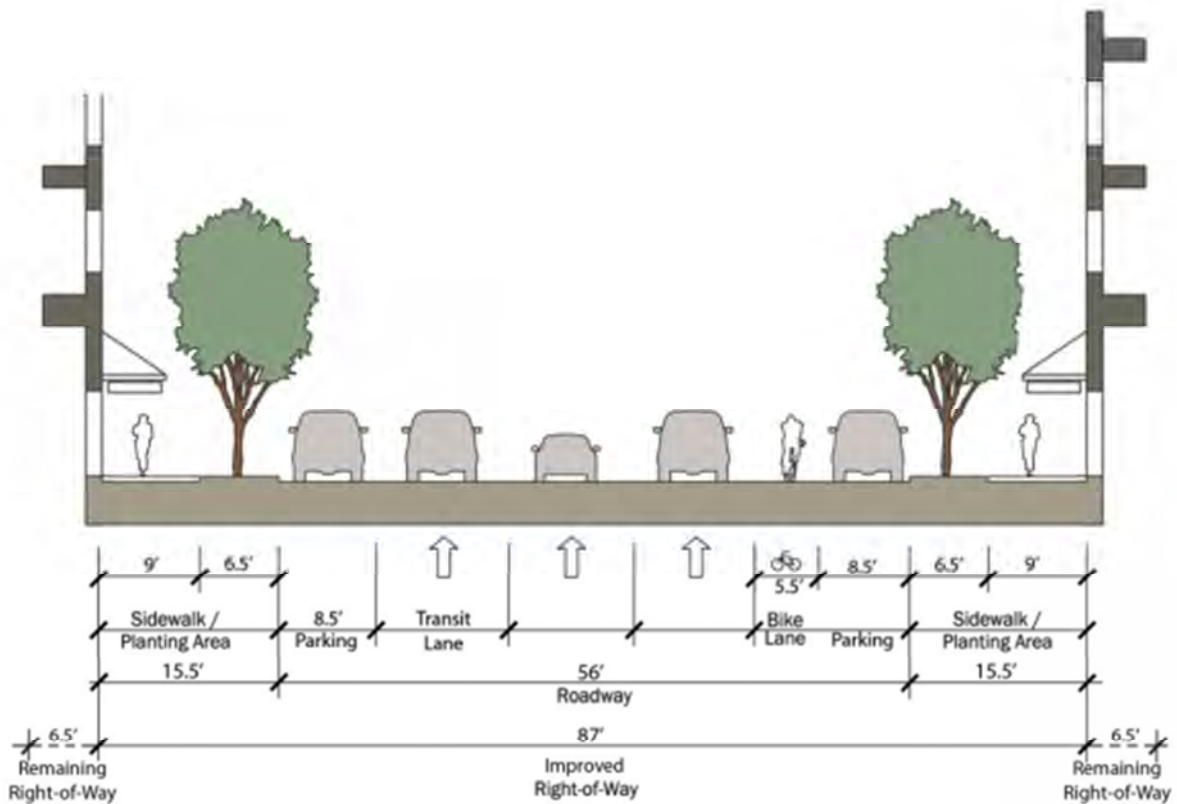
Preferred Street Section

Figure 2. Existing and Preferred Street Sections for Main St.

Source: 30th Street Area Master Plan, 2012



Existing Street Section



Preferred Street Section



- Current zoning for the area includes:
 - C-2D – Neighborhood Commercial along both Fairview Ave. and Main St. between the Boise River and 16th St.
 - C-3D – Service Commercial along the south side of Fairview Ave. between 27th St., and 16th St.

Urban Renewal Plan: 30th Street Area Urban Renewal Project

- The Main-Fairview Corridor includes the most visible deterioration and primarily contains large vacant parcels of land, vacant buildings formerly occupied as warehouses and retail showrooms, used car lots, wholesale and distribution businesses, and some retail stores.
- Proposed Redevelopment Actions
 - The environmental assessment and remediation of brownfield sites or sites where environmental conditions detrimental to redevelopment exist
 - The construction of storm water management infrastructure to support compliance with federal and local regulations for storm water discharge and to support private development.
 - In collaboration with property owners and other stakeholders, working with Boise City to amend the zoning regulations and standards and guidelines for the design of streetscape applicable to the Project Area as needed to support implementation of this Plan.
 - The provision of parking facilities that support a desired level and form of development and, by other measures, to enhance the vitality of the Project Area.
 - The installation, construction, or reconstruction of streets, utilities, including electrical distribution and transmission lines in underground configuration, fiber optic or other communication systems, parking facilities, and other public improvements, including, but not limited to, irrigation and drainage laterals and ditches, canal crossings, storm drain systems, water and sewer improvements, fire protection systems, and other public improvements.
 - The enhancement, construction, and possible realignment of streets, pathways, sidewalks, and related streetscape amenities.
 - The construction and financial support of infrastructure necessary for the provision of improved transit and alternative transportation.

Driveway Density

Originally HDR's research into driveway density was to determine the effect driveways have on traffic flow in an urban corridor. After reviewing several resources, it was determined that driveway density has a larger impact on safety than traffic flow.

The Federal Highway Administration (FHWA) *Highway Safety Manual* (HSM) provides some measures for determining the effect of driveways on safety. The HSM contains models for estimating expected average crash frequency for specific roadway features, including driveway density. These models, called safety performance functions (SPF), are equations that estimate predicted average crash frequency as a function of traffic volume and other roadway characteristics.



On urban arterials the frequency of driveway-related collisions on a roadway segment depends on the number and type of driveways. In general, higher driveway densities result in higher crash frequencies. The HSM reports that reducing the driveway density can reduce crashes by up to 31 percent.

The Iowa State University Center for Transportation Research & Education provides research on access management topics, including driveway density. In a document titled *Access Management Frequently Asked Questions: 3 Driveway Density and Driveway Consolidation*, they present evidence that driveway density is important because crash rates increase dramatically as the number of driveways per mile increases along urban arterial roadways as shown in **Table 1**.

Table 1. Crash Rate in Relation to Driveway Density

Driveways per Mile	Approx. Number of Driveway per 500-foot City Block	Representative Crash Rate for a Multilane, Undivided Roadway	Increase in Crashes Associated with Higher Driveway Density
Under 20	Under 2	3.4	-
20 to 40	2 to 4	5.9	+74%
40 to 60	4 to 6	7.4	+118%
Over 60	Over 6	9.2	+171%

Source: National Cooperative Highway Research Program Report 3-52.

ACHD has driveway spacing standards that should be applied with this project planning efforts.

Existing Physical Conditions

- Roadway Widths
 - Fairview Ave.
 - 65' width top back of curb (TBC) to TBC from Whitewater Blvd. to 27th St.
 - Narrows to 60.5' TBC to TBC from 27th St. to 23rd St.
 - 62' east of 23rd St.
 - Main St.
 - Approximately 60' TBC to TBC throughout corridor
 - Whitewater Park Blvd.
 - 80' TBC to TBC north of Main St.
 - 69' TBC to TBC south of Main St.
 - 29th St. & 28th St.
 - 44' TBC to TBC
 - 27th St.
 - 42' TBC to TBC north of Main St.
 - 51' to 54' TBC to TBC south of Main St.
 - 78' TBC to TBC south of Fairview Ave.
 - 25th St. & 24th St.
 - 30' TBC to TBC
 - 23rd St.

- 44' TBC to TBC north of Main St.
 - 40' to 50' TBC to TBC south of Main St.
 - 48' TBC to TBC south of Fairview Ave.
 -
 - 22nd St.
 - 30' TBC to TBC north of Main St.
 - 44' to 35' TBC to TBC south of Main St.
 - 18th St.
 - 40' TBC to TBC
 - 17th St.
 - 62' TBC to TBC north of Main St.
 - 52' TBC to TBC south of Main St.
 - 16th St.
 - 62' TBC to TBC north of Main St.
 - 52' TBC to TBC south of Main St.
 - Grove St.
 - 46' TBC to TBC
- Right-of-Way Widths
 - Fairview Ave.
 - 80' throughout corridor
 - Main St.
 - 100' throughout corridor
- Sidewalk Widths and Locations
 - Fairview Ave.
 - 5' attached sidewalk on north side from Whitewater Park Blvd. to 25th St. No sidewalk on south side until 27th St. Poor quality broken sidewalk on south side to 25th St.
 - 7' detached sidewalk on both sides from 25th St. to 22nd St.
 - 7' attached sidewalk on north side and 5' attached sidewalk on the south side from 22nd St. to 17th St.
 - 5' detached sidewalk on north side and 5' attached sidewalk on the south side from 17th St. to Main St.
 - Main St.
 - 5' detached sidewalk on north side from Whitewater Park Blvd. to 27th St. No sidewalk on south side.
 - 7' detached sidewalk on north side and intermittent 5' detached and 10' attached sidewalk on the south side from 27th St. to 25th St.
 - 7' detached piecemeal sidewalk on north side and 7' piecemeal attached sidewalk from 25th St. to 23rd St.
 - 5' detached sidewalk on both sides from 23rd St. to 22nd St.
 - 5' attached sidewalk on both sides from 22nd St. to 17th St.
 - All cross streets have sidewalk
- Driveway Density
 - Fairview Ave.

- 33 driveways
 - Average 5 per block
 - Main St.
 - 49 driveways
 - Average 5 per block
- Transit Facilities and Service
 - Bus stops
 - Fairview Ave.
 - Southwest corner of 27th St. intersection, bench
 - Southwest corner of 23rd St. intersection, bench
 - Southwest corner of 18th St. intersection
 - Main St.
 - Northeast corner of 18th St. intersection
 - Northeast corner of 23rd St. intersection, shelter
 - Northeast corner of 27th St. intersection
 - Northeast corner of Whitewater Park Blvd. intersection
 - Existing Routes
 - Route 6, Orchard – 30 minute headways, stops along Fairview Ave. and Main St., 2 buses in both the AM and PM peak hours
 - Route 7A, Fairview-Ustick – 60 minute headways, stops along Fairview Ave. and Main St., 1 bus in both the AM and PM peak hours
 - Route 7B, Fairview-Towne Square Mall – 60 minute headways, stops along Fairview Ave. and Main St., 1 bus in AM peak hour and PM peak hour each
 - Route 8x, Five Mile - Chinden – 30 minute headways AM, 80 minute headways PM, stops along Fairview Ave., 2 buses in AM peak hour and 1 bus in PM peak hour
 - Route 11, Garden City – 60 minute headways in off peak times, stops along Fairview Ave. and Main St., no buses in AM and PM peak hours
 - Route 40, Nampa – Meridian Express - 30 minute headways in peak hours, no stops along Fairview Ave. or Main St., 2 buses in both the AM and PM peak hours
 - Route 42, Nampa – Meridian Limited Stop - 60 minute headways in peak hours, no stops along Fairview Ave. or Main St., 1 bus in both the AM and PM peak hours
 - Route 43, Caldwell Express - 30 minute headways in peak hours, no stops along Fairview Ave. or Main St., 2 buses in both the AM and PM peak hours
 - 11 buses in the AM peak hour, 5 of which are inter-county and do not load or unload in the study area
 - 10 buses in the PM peak hour, 5 of which are inter-county and do not load or unload in the study area
 - Future Routes



- Discussion with Jake Hassard at VRT, with current long range planning, assume:
 - 2040 AM Peak, 22 buses, 10 of which are inter-county and do not load or unload in the study area
 - 2040 PM Peak, 20 buses, 10 of which are inter-county and do not load or unload in the study area

Travel Times

- ACHD Study
 - Travel times on Idaho St. and Main St. from 6th St. to Chinden Blvd.
 - Noon hour
 - 1st Run= 4:38, 28 mph average speed
 - 2nd Run= 4:27, 29 mph average speed
 - 3rd Run = 4:35, 28 mph average speed
 - PM peak hour
 - 1st Run= 5:45, 22 mph average speed
 - 2nd Run= 5:32, 23 mph average speed
 - 3rd Run = 5:46, 22 mph average speed
- HDR Measurements
 - Travel times on Main St. from 16th St. to Whitewater Park Blvd.
 - AM peak hour
 - 1st Run 7:20 AM = 1:39, 28 mph average speed
 - 2nd Run 7:27 AM = 1:42, 26 mph average speed
 - 3rd Run 7:40 AM = 2:31, 21 mph average speed
 - 4th Run 7:50 AM = 4:56, 18 mph average speed
 - 5th Run 8:02 AM = 1:43, 26 mph average speed
 - 6th Run 8:15 AM = 1:46, 26 mph average speed
 - PM peak hour (4:45 – 5:45 p.m.)
 - 1st Run 4:53 PM = 1:35, 28 mph average speed
 - 2nd Run 5:01 PM = 2:15, 20 mph average speed
 - 3rd Run 5:10 PM = (invalid due to construction delays)
 - 4th Run 5:20 PM = (invalid due to construction delays)
 - 5th Run 5:33 PM = (invalid due to construction delays)
 - 6th Run 5:42 PM = 2:42, 20 mph average speed
 - Travel times on Fairview Ave. from Whitewater Park Blvd. to 16th St.
 - AM peak hour (7:30 – 8:30 a.m.)
 - 1st Run 7:22 AM = 1:44, 28 mph average speed
 - 2nd Run 7:30 AM = 2:37, 19 mph average speed
 - 3rd Run 7:44 AM = 2:44, 19 mph average speed
 - 4th Run 7:56 AM = 2:36, 20 mph average speed
 - 5th Run 8:05AM = 1:46, 27 mph average speed
 - 6th Run 8:17 AM = 1:43, 28 mph average speed
 - PM peak hour (4:45 – 5:45 p.m.)



- 1st Run 4:56 PM = 2:07, 22 mph average speed
- 2nd Run 5:05 PM = 1:20, 29 mph average speed
- 3rd Run 5:15 PM = (invalid due to crash delay)
- 4th Run 5: 27 PM = 1:33, 27 mph average speed
- 5th Run 5:36 PM = 1:23, 29 mph average speed
- 6th Run 5:45 PM = 1:50, 24 mph average speed

Existing Transportation System

Roadways

The roadway network is described below.

- Fairview Ave. is functionally classified as a principal arterial and as a Town Center Arterial on the Ada County Master Street Map. It is posted with a 35 mph speed limit throughout the study area and has four one-way travel lanes for eastbound traffic and a dedicated bicycle lane on the south side of the roadway. It has curb, gutter, and sidewalk on both sides of the roadway in the study area.
- Main St. is functionally classified as a principal arterial and as a Town Center Arterial on the Ada County Master Street Map. It is posted with a 35 mph speed limit throughout the study area and has four one-way travel lanes for westbound traffic and a dedicated bicycle lane on the north side of the roadway. It has curb, gutter, and sidewalk on both sides of the roadway in the study area.
- Whitewater Park Blvd. is functionally classified as a minor arterial and as a Town Center Arterial on the Ada County Master Street Map. It is posted with a 35 mph speed limit throughout the study area and has two travel lanes and a bicycle lane in each direction. It has curb, gutter, and sidewalk on both sides of the roadway in the study area.
- 27th St. is functionally classified as a minor arterial and as a Neighborhood Arterial north of Main St. and a Town Center Arterial south of Main St. on the Ada County Master Street Map. It is posted with a 25 mph speed limit north of Fairview Ave. and 30 mph speed limit south of Fairview Ave. South of Fairview Ave. 27th St. has two lanes in each direction, between Fairview Ave. and Main St. it has one travel lane in each direction with one dedicated left turn lane in each direction, and north of Main St. it has one lane in each direction with a painted two-way left turn lane median. There is a bicycle lane in each direction along 27th St. in the study area. It has curb, gutter, and sidewalk on both sides of the roadway in the study area.
- 16th St. is functionally classified as a minor arterial and as a Town Center Arterial on the Ada County Master Street Map. It is posted with a 35 mph speed limit throughout the study area and has four one-way travel lanes for southbound traffic north of Main St. South of Main St. it has three one-way travel lanes. There is a bicycle lane on the east side of the road north of Main St. and a bicycle lane on each side of the road south of Main St. It has curb, gutter, and sidewalk on both sides of the roadway in the study area.
- 23rd St. is functionally classified as a local street. North of Main St. it is a two-lane, two-way street with on-street parking posted with a 30 mph posted speed limit. Between Fairview Ave. and Main St. it has one travel lane in each direction with one dedicated left

turn lane in each direction, and south of Fairview Ave. it has one lane in each direction with a posted speed limit of 25 mph.

- The remaining streets are all classified as local streets.
 - 29th St., 28th St., 25th St., 22nd St., 18th St., and 17th St. north of Main St. are two-way, two-lane roadways with on-street parking and a posted speed limit of 20 mph.
 - 17th St. between Fairview Ave. and Main St. has two one-way lanes for northbound traffic. North of Main St. it is a two-way, two-lane roadway with on-street parking and a posted speed limit of 20 mph.
 - Grove St. is a two-way, two-lane roadway with a posted speed limit of 20 mph. There is a bicycle lane in each direction along Grove St. with a painted buffered bicycle lane on the north side of the street. It has curb, gutter, and sidewalk on both sides of the roadway in the study area.

Intersections

The intersections are described below.

- Fairview Ave. intersections
 - Whitewater Park Blvd. - This intersection is signal controlled with two southbound left turn lanes. Fairview Ave. has one shared left/through lane and three through lanes.
 - 27th St. - This intersection is signal controlled. The southbound approach has one left turn lane controlled with a protected permitted flashing yellow arrow indication and two through lanes. The northbound approach has one right turn lane and two through lanes. Fairview Ave. has one left turn lane, two through lanes and one shared right turn/through lane.
 - 25th St. & 24th St. – These intersections are stop controlled on the local street approaches. The local street northbound approaches have one shared through/right turn lane. The local street southbound approaches have one shared left turn/through lane. The Fairview Ave. approaches have one shared left turn/through lane, two through lanes and one shared right turn/through lane.
 - 23rd St. - This intersection is signal controlled. The southbound approach has one left turn lane and one through lane. The northbound approach has one shared right turn/through lane. Local street left turns are permitted. Fairview Ave. has one shared left turn/through lane, two through lanes and one shared right turn/through lane.
 - 22nd St. – This intersection is stop controlled on the 22nd St. approach. The southbound approach has one shared left turn/through lane. Fairview Ave. has one shared left turn/through lane and three through lanes.
 - Grove St. – This intersection is signal controlled. The northbound approach has one shared right turn/through lane. Fairview Ave. has one left turn lane, two through lanes and one shared right turn/through lane.
- Main St. intersections
 - Whitewater Park Blvd. - This intersection is signal controlled. The southbound approach has two through lanes and one right turn lane. The northbound

- approach has a left turn lane and two through lanes. Main St. has a shared left turn/through lane, two through lanes and one right turn lane.
- 29th St. & 28th St. – These intersections are stop controlled on the local street approaches. The local street southbound approaches have one shared left turn/through lane. Main St. has three through lanes and one shared right turn/through lane.
 - 27th St. - This intersection is signal controlled. The southbound approach has one shared through/right turn lane. The northbound approach has one left turn lane and one through lane. Main St. has one shared left turn/through lane, two through lanes and one shared right turn/through lane.
 - 25th St., 24th St., & 22nd St. – These intersections are stop controlled on the local street approaches. The local street northbound approaches have one shared left turn/through lane. The local street southbound approaches have one shared through/right turn lane. The Main St. approaches have one shared left turn/through lane, two through lanes and one shared right turn/through lane.
 - 23rd St. - This intersection is signal controlled. The southbound approach has one shared through/right turn lane. The northbound approach has one left turn lane and one through lane. Local street left turns are permitted. Main St. has one shared left turn/through lane, two through lanes and one shared right turn/through lane.
 - 18th St. – This intersection is stop controlled on the 18th St. approach. The southbound approach has one shared through/right turn lane. Main St. has three through lanes and one shared through/right turn lane.
 - Merge point – Between 17th St. and 18th St. the two southbound lanes from 16th St. merge with the two northbound lanes from Grove St. to form the four westbound Main St. lanes.
 - 17th St. – This intersection is stop controlled on the 17th St. approaches. The northbound approach has one left turn lane and one through lane. The southbound approach has one shared left turn/right turn lane. Main St. has one through lane and one shared through/right turn lane.
 - 16th St. – This intersection is signal controlled. The southbound one-way approach has two free flowing right turn lanes, two through lanes, and one left turn lane. The eastbound Main St. approach has two through lanes and one shared through/right turn lane.

Sidewalks/Pathways

Sidewalks exist along most of the study streets in a mix of attached and detached sidewalk. Sidewalk widths in the corridor vary from 5' to 10' in width. There is a gap on the south side of Fairview Avenue between Whitewater Park Blvd. and 27th St. The sidewalk on the south side of Fairview Ave. from 27th St. to 25th St. is in poor quality.

A paved Greenbelt pathway currently runs along the east side of the Boise River under the Fairview Ave. and Main St. Bridges. A new paved connection for the Greenbelt is being constructed on the west side of the Boise River under the Fairview Ave. and Main St. Bridges.



Bicycle Facilities

There are existing bicycle lanes on Fairview Ave., Main St., Whitewater Park Blvd., 27th St., Grove St., and 16th St.

Existing Traffic Volumes

Existing AM and PM peak hour turning movement volumes at the signalized study intersections and daily traffic volumes on study roadways are presented in **Figure 3**.

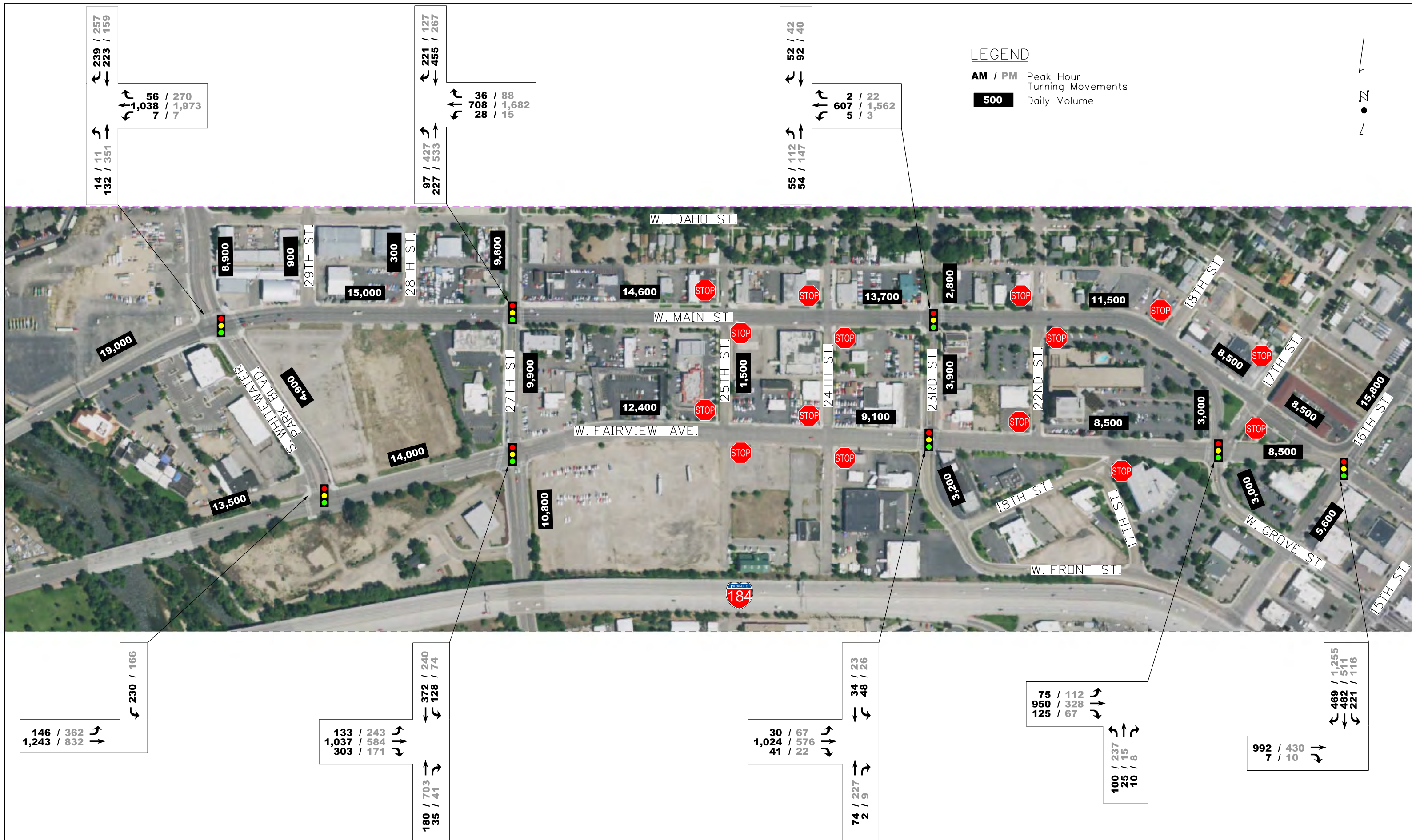
Capacity Analysis

VISSIM Model

Model Refinement

The VISSIM model provided by ACHD included all of downtown Boise. The PM peak period model produced a gridlock condition that brought simulated traffic to a standstill in the study area. The following refinements were made to alleviate this issue:

- **Point to point routing.** Point to point routing gives each vehicle a new route after each intersection. This creates problems with closely spaced intersections, such as in a downtown central business district, because vehicles do not have space to change lanes in advance of their next turn. It would be time consuming to eliminate point to point routing throughout the model, but several key routes were replaced in order to provide more time for vehicles to make routing decisions in advance of intersections.
- **Connector lane change distance.** This distance defines the location where vehicles anticipate a connector. The default in VISSIM is 656.2 feet before the connector. All connector lane change distances were increased to 1,500 feet to allow vehicles more space to change lanes. The “per lane” option was selected so that the lane change distance is multiplied by the number of lane changes required. Additionally, the emergency stop distance was set to 50 feet. This more accurately reflects where vehicles stop to change lanes if they were unable to change lanes farther in advance.
- **Driving Behavior.** In spite of the routing and connector refinements, vehicles still exhibited excessive lane changing. To reduce the disruption to traffic flow, cooperative lane change was turned on in the urban driving behavior parameter set.
- **Turn lanes.** Since a lane change occurs over a certain distance, the effective length of a turn lane is reduced if there is no connector leading directly into the lane. Connectors were added into turn lanes that exhibited inadequate storage.
- **Right turn on red.** Most intersections were already set up with right turn on red control, but the right turn connector started beyond the through signal. Right turn connectors were moved upstream of the through signal so that vehicles would obey the right turn on red control.



EXISTING TRAFFIC VOLUMES
 FAIRVIEW AVE. & MAIN ST. LOCAL STREETS IMPROVEMENT PLAN

FIGURE 3



- Conflict areas.** Some conflict areas caused vehicles to stop or slow down even when there was no apparent conflict. This occurred most often in conflict areas between a vehicle lane and a pedestrian crossing. Since most vehicle-pedestrian conflicts were already protected by signal control, these conflict areas were removed if they produced erratic vehicle behavior.

With all of these refinements, the Myrtle St. and 13th St. intersection still caused queue spillback that affected the study area. Because of this, the model was reduced to include only the study area and one intersection beyond the study area to the east and west, allowing vehicles to platoon before entering the study area. This required new volume inputs since volumes are generated only on links that enter the network. Routing decisions from the original model provided a close approximation of the actual volume assigned to the new volume inputs. Original routing proportions were maintained.

Model Calibration

The first step to model calibration was to compare simulated volumes with the 2015 PM peak hour volume estimates that COMPASS provided. The average volume over 10 simulation runs produced 300 fewer vehicles entering on Main St. than shown in the COMPASS volumes. Routing decisions from Idaho St. and 16th St. were adjusted to route less traffic to the south and more traffic onto Main St. The next iteration of simulation runs resulted in volumes within 50 vehicles, or 3%, of COMPASS volumes on Main St. east of the 23rd St. intersection. It should be noted that the model produced 250 fewer vehicles on Main St. between 23rd St. and 27th St., but the existing turning movement counts suggests the model is only 100 vehicles low on this segment.

The next step in model calibration was to compare simulated travel times with the average travel times that were measured in the field during the PM peak hour. **Table 2** shows this comparison. While several segments were noticeably different, the total travel time for both directions was relatively consistent between field measurements and the model.

Table 2. Observed and simulated travel times

	Travel Time (sec)	
	Observed	VISSIM
Westbound		
16 th St. to 23 rd St.	43	44
23 rd St. to 27 th St.	62	74
27 th St. to Whitewater Park Blvd.	34	22
Total Westbound	139	141
Eastbound		
Whitewater Park Blvd. to 27 th St.	21	28
27 th St. to 23 rd St.	39	38
23 rd St. to Grove St.	23	23
Grove St. to 16 th St.	26	15
Total Eastbound	109	103



Capacity Analysis Results

Roadways

The roadway segment volumes were compared to applicable values in the *ACHD Capital Improvements Plan* Table C-4: ACHD Street Capacity Guidelines. The Florida Department of Transportation (FDOT) has developed a multi-modal level of service (LOS) policy and set of application tools (ARTPLAN) for highway and arterial streets planning, consistent with the *Highway Capacity Manual 2010* (HCM 2010). These applications were used to establish LOS thresholds for ACHD's arterial streets presented in this table. The threshold values identify capacity deficiencies and street improvement needs based on peak hour directional volumes and the functional classification of the roadway. To identify capacity deficiencies and street improvement needs, ACHD capacity thresholds are adopted at LOS D for Minor Arterials and LOS E for Principal Arterials. **Table 3** presents the results of this analysis.



Table 3. Roadway Capacity Analysis Results

Roadway	Segment	Functional Classification	# of Directional Lanes	AM Peak Flow	LOS	PM Peak Flow	LOS
Fairview Ave.	West of Whitewater Park Blvd.	Principal Arterial	4	1,389	D or better	1,194	D or better
	West of 27th St.			1,473	D or better	998	D or better
	West of 23rd St.			1,095	D or better	665	D or better
	West of 17th St./Grove St.			1,150	D or better	507	D or better
	West of 16th St.			960	D or better	336	D or better
Main St.	West of Whitewater Park Blvd.	Principal Arterial	3	1,291	D or better	2,241	E
	West of 27th St.		4	1,026	D or better	2,236	D or better
	West of 23rd St.			714	D or better	1,716	D or better
	West of 18th St.			614	D or better	1,587	D or better
	West of 16th St.		2	454	D or better	1,173	D or better
Whitewater Park Blvd.	North of Main St.	Minor Arterial	2 with median	462	D or better	621	D or better
	North of Fairview Ave.			230	D or better	362	D or better
27 th St.	North of Main St.	Minor Arterial	1 with painted median	676	D or better	621	D or better
	North of Fairview Ave.		2	483	D or better	960	D or better
	South of Fairview Ave.		2	675	D or better	844	D or better
23 rd St.	North of Main St.	Local Street	1	144	D or better	169	D or better
	North of Fairview Ave.		1 with painted median	109	D or better	259	D or better
	South of Fairview Ave.		1	75	D or better	236	D or better
17 th St./Grove St	North of Main St.	Local Street	1	25	D or better	15	D or better
	North of Fairview Ave.		2	100	D or better	127	D or better
	South of Fairview Ave.		1	135	D or better	260	D or better
16 th St.	North of diverge	Minor Arterial	4	1172	D or better	1,882	D or better
	North of Main St.		2	703	D or better	627	D or better
	South of Main St.		3	489	D or better	521	D or better



All of the roadway segments are estimated to operate at LOS D or better except for Main St. west of Whitewater Park Blvd., which operates at LOS E. **Table 4** presents the estimated LOS for the Fairview Ave. and Main St. segments reduced to three travel lanes. All of the segments are estimated to operate at LOS D or better except the segments of Main St. west of 27th St., which are estimated to operate at LOS E, which is acceptable under ACHD policy as described above.

Table 4. Fairview Ave. /Main St. Roadway Capacity Analysis Results with 3 Lanes

Roadway	Segment	Functional Classification	# of Directional Lanes	AM Peak Flow	LOS	PM Peak Flow	LOS
Fairview Ave.	West of Whitewater Park Blvd.	Principal Arterial	3	1,389	D or better	1,194	D or better
	West of 27th St.			1,473	D or better	998	D or better
	West of 23rd St.			1,095	D or better	665	D or better
	West of 17th St./Grove St.			1,150	D or better	507	D or better
	West of 16th St.			960	D or better	336	D or better
Main St.	West of Whitewater Park Blvd.	Principal Arterial	3	1,291	D or better	2,241	E
	West of 27th St.			1,026	D or better	2,236	E
	West of 23rd St.			714	D or better	1,716	D or better
	West of 18th St.			614	D or better	1,587	D or better
	West of 16th St.	2	454	D or better	1,173	D or better	

Intersections

ACHD has set intersection measures and thresholds based on the volume-to-capacity (v/c) ratio are applied based on the HCM 2010 and FDOT LOS Handbook. Table C-5: Intersection Capacity and Analysis Methods in the *ACHD Capital Improvements Plan* identifies the adopted ACHD method for intersection capacity analysis. ACHD capacity thresholds are adopted at LOS D = v/c ratio of 0.90 and LOS E = v/c ratio of 1.00. The measurements for each intersection include a v/c ratio = 0.90 for the total intersection and a v/c ratio = 1.00 for each lane group.

Intersection performance was calculated from node results averaged across 10 simulation runs. **Figures 4 and 5** show the average delay by movement, intersection LOS, and maximum approach queue length. Main St. and 27th St. showed the worst overall intersection performance, with 37 seconds of average delay (LOS D) and long approach queues. Given that the 27th St. segment between Main St. and Fairview Ave. is about 400 feet long, the longest queues appear to back up that entire distance and likely contribute to queues on Fairview Ave.



for vehicles attempting to turn north onto 27th St. The worst performing movement was the southbound left turn at Fairview Ave. and 27th St., with an average delay of 74 seconds (LOS E). Even though the delay was high on this movement, the queue length was short enough to suggest it cleared on each signal cycle, operating at or below capacity.

Figure 4. Delay, LOS, and Maximum Approach Queue Length (Main St.)

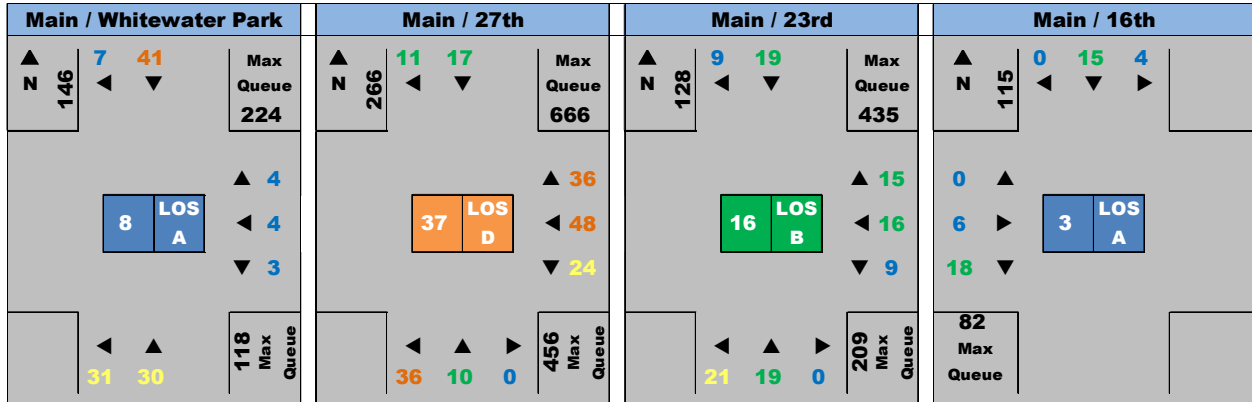
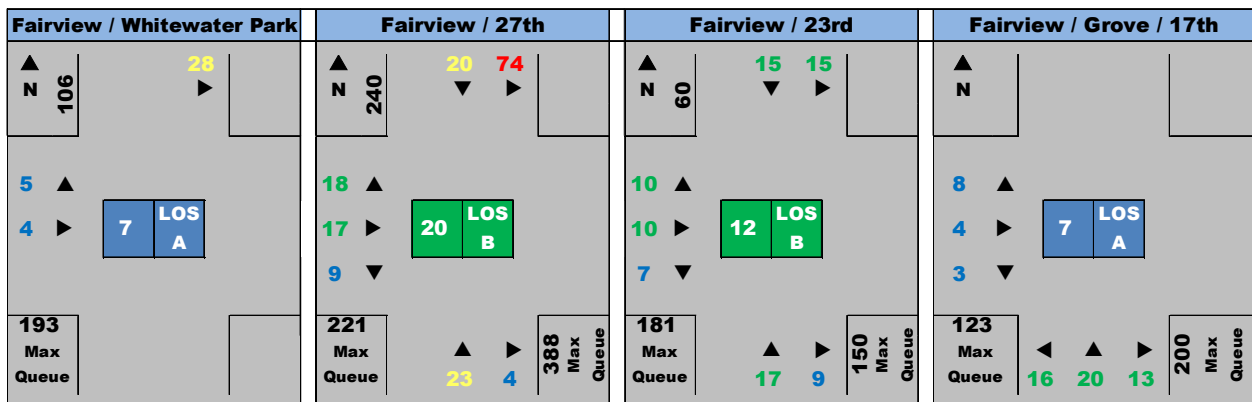


Figure 5. Delay, LOS, and Maximum Approach Queue Length (Fairview Ave.)



Pedestrians

Pedestrian counts were only available at two study intersections. Main St. and 16th St. had 29 pedestrians travel through the intersection during a two-hour morning count. Of these, 17 crossed Main St. on the east approach. At Fairview Ave. and 23rd St. there were 18 pedestrians observed during an hour and 45 minutes in the afternoon. Pedestrian activity is expected to increase around bus stops, which are located along the couplet every two or three intersections. On Main St. bus stops are located on the north side of the road at 18th St., 23rd St., 27th St., and Whitewater Park Blvd. On Fairview Ave. bus stops are located on the south side of the road at 27th St., 23rd St., and between 18th St. and Grove St.

The signalized intersections in the study area generally have marked pedestrian crossings, with some exceptions. At Whitewater Park Blvd, there is one marked crossing across Fairview Ave. leading to a pedestrian ramp but no sidewalk. At 27th St. there is no marked crossing on the east side of Fairview Ave. There is also no marked crossing on the north side of Fairview Ave.



at 17th St. and Grove St. This would be a long crossing since it crosses two streets and would require the eastbound left turn signal phase to operate separately from the eastbound through phase. Most unsignalized intersections have unmarked pedestrian crossings, with the exception of two approaches at Main St. and 17th St. No mid block crossings exist in the study area.

The majority of pedestrian ramps appear to be ADA compliant, although no measurements were taken. On Main St. it appears that ramps have not been upgraded on the west side of 17th St. and the southeast corner at 23rd St (note that there is a bus stop on this approach). Fairview Ave. appears to lack ADA-compliant ramps on the south side at 25th St., the northeast corner at 23rd St., and the northwest corner at Grove St. and 17th St.

Bicycles

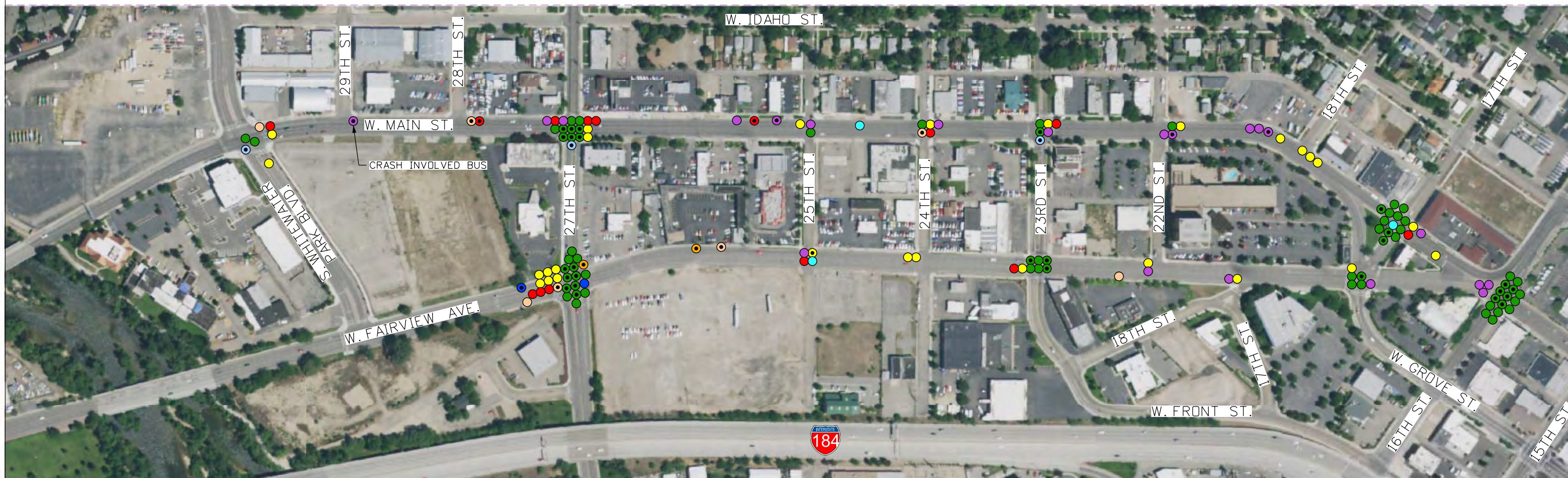
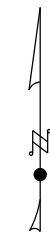
Bicycle counts revealed a high bicycle volume on 16th St. At the Idaho St. intersection, 48 bicycles were observed southbound during two hours in the morning, and 28 during two hours in the afternoon. At Main St. on a different day, 53 were observed southbound (70 total at the intersection) during two hours in the morning, and 35 during two hours the afternoon. Between 25-40% of cyclists used the sidewalk.

A bicycle lane runs along the north side of Main St. from 18th St. and through the study area to Garden St. On the south side from 17th St. to Whitewater Park Blvd., the shoulder may attract some cyclists, although it is not marked for bicycles and has a number of manholes. Additionally, left turning drivers may be less aware of cyclists on the left side of the road. Fairview Ave. has a bicycle lane on the south side of the road that begins at Garden St. and spans the study area to 17th St. Again, there is a shoulder on the other side of the road that some cyclists may use. On the side streets, bicycle lanes exist in both directions on Whitewater Park Blvd., 27th St., and south of Main St. on 23rd St.

Crash Analysis

HDR requested crash data for the most recent available 5 years (2010-2014) from the ITD Office of Highway Safety. The resulting data had 57 total crashes along Fairview Ave. and 90 along Main St. The analysts at the ITD Office of Highway Safety found no reported crashes at the intersection of Fairview Ave. with Whitewater Park Blvd. **Figure 6** shows the type, severity, and location of all the reported crashes.

Only 12 of the 147 crashes were not at intersections. Forty-five of the crashes were injury crashes (31% of total). By far the most common type of crash was angle crashes at intersections, accounting for almost half of all crashes (47%), followed by same direction turning crashes (18%), sideswipe same (14%), and rear-end crashes (10%). Over three-quarters of all crashes occurred in daylight and 86% occurred under dry conditions. The most common contributing circumstances include inattention (24%), failure to obey signal (21%), improper lane changes (14%), and failure to yield (12%). These crash types and contributing circumstances are consistent with those expected with one way operations and signalized intersections. A critical crash rate or threshold value is calculated for each site and compared to the observed crash rate. Sites with an observed crash rate greater than their critical crash rate are flagged for further investigation



NOTES:

- 1. INJURY CRASHES HAVE BLACK DOT IN CENTER OF SYMBOL

2010 - 2014 Crash History

Crash Type	Total	Injury	PDD
● Angle	70	27	43
● Same Direction Turning	26	2	24
● Side Swipe Same	20	4	16
● Rear-End	14	2	12
● Struck Object	7	3	4
● Head-On Turning	3	1	2
● Bicycle	3	3	0
● Overturn	2	1	1
● Pedestrian	2	2	0
	147	45	102





With the recent traffic counts and crash history, crash rates at the intersections were calculated and the HSM Critical Rate screening method was used to determine the intersections with the greatest crash concerns and thus the greatest need for improvement.

Tables 6 and 7 present the calculated crash rates and critical crash rates separated for signalized and unsignalized intersections in the study area and identify those intersections that exceed the calculated critical crash rates.

Table 6. Signalized Intersections Critical Crash Rate Analysis

Intersection	ADT		MEV ₅ (1)	2010-2014 Crash Total	R = Crash Rate (2)	R _{ASig} (3)	R _{CSig} (4)	Over/ Under Critical
	E/W Street	N/S Street						
Fairview/27 th	15,000	9,900	45.44	28	0.62	0.36	0.51	Over
Fairview/23 rd	9,000	3,500	22.81	8	0.35		0.58	Under
Fairview/Grove	8,700	3,000	21.35	6	0.28		0.59	Under
Main/Whitewater Park	19,700	8,500	51.47	7	0.14		0.50	Under
Main/27 th	15,700	9,400	45.81	17	0.37		0.51	Under
Main/23 rd	13,100	3,400	30.11	6	0.20		0.55	Under
Main/16 th	8,700	10,700	35.41	18	0.51		0.54	Under

Table 7. Unsignalized Intersections Critical Crash Rate Analysis

Intersection	ADT		MEV ₅ (1)	2010-2014 Crash Total	R = Crash Rate (2)	R _{AUnsig} (5)	R _{CUnsig} (6)	Over/ Under Critical
	E/W Street	N/S Street						
Fairview/25 th	10,000	1,400	20.81	4	0.19	0.17	0.34	Under
Fairview/24 th	9,300	300	17.52	2	0.11		0.36	Under
Fairview/22 nd	8,700	500	16.79	3	0.18		0.36	Under
Fairview/18 th	8,700	1,000	17.70	2	0.11		0.36	Under
Main/29 th	19,700	900	37.60	1	0.03		0.29	Under
Main/28 th	19,700	300	36.50	2	0.05		0.30	Under
Main/25 th	13,800	1,400	27.74	2	0.07		0.32	Under
Main/24 th	13,100	300	24.46	5	0.2		0.33	Under
Main/22 nd	11,500	500	21.90	4	0.18		0.34	Under
Main/18 th	10,000	3,000	23.73	3	0.13		0.33	Under
Main/17 th	8,500	3,000	20.99	17	0.81		0.34	Over

(1) MEV_n = Million Entering Vehicles = ADT x365xn/1,000,000, n = # of years

(2) R = Crash Rate = Crash Total/MEV₅

(3) R_{ASig} = Average Crash Rate for Signalized Int. = SUM(Signalized Int. Crashes)/SUM(Signalized Int. MEV₅)

(4) R_{CSig} = Critical Crash Rate for Signalized Int. = R_{ASig} + Confidence Levelx(R_{ASig} /MEV₅)^{1/2} +1/(2xMEV₅)

(5) R_{AUnsig} = Average Crash Rate for Unsignalized Int. = SUM(Unsignalized Int. Crashes)/SUM(Unsignalized Int. MEV₅)

(6) R_{CUnsig} = Critical Crash Rate for Unsignalized Int. = R_{AUnsig} + Confidence Levelx(R_{AUnsig} /MEV₅)^{1/2} +1/(2xMEV₅)



The ADT on each leg of the intersection was determined and tabulated. The million entering vehicles (MEV₅) for each intersection were estimated over the five years of the crash history. Then crash rates were calculated for each intersection. The intersections were separated into signalized and unsignalized groupings to compare similar intersections. The average crash rate was calculated for each group and the critical crash rate for each intersection was calculated following HSM guidelines. The actual crash rates for each intersection were compared to the critical crash rate to identify those intersections with excessive crash patterns. One intersection in each group was found to have a crash rate higher than the critical crash rate; Fairview Ave. and 27th St. and Main St. and 17th St.

Fairview Ave. and 27th St. had by far the most crashes at any intersection (28) with half being angle crashes with turning vehicles, six same direction turning crashes, and three rear-end crashes. Over one-third of crashes had injuries with the most common contributing circumstances being inattention (10) and failure to obey signal (10).

This intersection was identified as a high crash location by ACHD and in the summer of 2015 ACHD added lighting, repositioned signal heads, and updated signing and pavement markings to make things clearer for motorists. ACHD identified signal timing time of day plan changes was abrupt and adjusted the signal timing, all in effort to improve operations at the intersection.

The Main St. and 17th St. intersection is unique in that the Main St. westbound approach has two through lanes that are traveling from the free right turn at the Main St. and 16th St. intersection. The 17th St. northbound approach is one-way only while the southbound approach is two-way. The east leg of Main St. also has one lane in the eastbound direction between 17th St. and 16th St. This intersection has significant issues with vehicles turning from the 17th St. approaches onto Main St. Thirteen of the seventeen crashes at this intersection were angle crashes with the main contributing circumstances being inattention (5), failure to obey stop sign (5), and failure to yield (4). There is a perception issue where motorists try to turn onto Main St. and misjudge the approaching vehicles speed or turn into the wrong lane. Sight distance issues exist for both 17th St. approaches looking east with utility poles, landscaping, and buildings within the sight triangles.

ACHD has a project that will be constructed this year to install Accessible Pedestrian Signal crossings at the intersection of Fairview Ave., Grove St., and 17th St. In addition, an enhanced pedestrian crossing with accessible signal features will be installed at the intersection of Main St and 17th St. This project was originally requested by the ACHD ADA Advisory Committee.

Next Steps

HDR will develop traffic volume forecasts for the design year 2040 using the COMPASS regional travel demand model 2015 and 2040 outputs. We will develop a Methods and Assumptions memo describing the process to develop the forecasts. The resulting traffic forecasts will be analyzed for capacity and operations to determine whether the proposed lane reconfiguration on Fairview Ave. and Main St. is feasible under future conditions.