Special Meeting
Bicycle Advisory Board

Wednesday March 24, 2021 – 6:00 PM to 7:30 PM

TELECONFERENCE

Staff Liaisons:	Colin Quinn-Hurst	(509) 625-6804	cquinnhurst@spokanecity.org
	Inga Note	(509) 625-6331	inote@spokanecity.org

	Board Briefing Session:
6:00 – 6:20	1) Approve February 2021 Minutes 2) Liaison Reports 3) Chair Report 4) Staff Report
	Workshops:
6:20 – 7:30	1) Ray-Freya – Alternatives for bicycle accommodations - Inga Note, Senior Traffic Planning Engineer, Integrated Capital Management 2) Washington Bicycle Safety Stop Law Research - Gonzaga Civil Engineering Senior Design Studio, ENSC 20 3) Centennial Trail Connector & Bridge Design - Gonzaga Civil Engineering Senior Design Studio, ENSC 22
	Next BAB meeting is scheduled for Tuesday April 20, 2021

When it's time, join your Webex meeting here.

Join meeting

More ways to join:

Join from the meeting link
https://spokanecity.webex.com/spokanecity/j.php?MTID=mabab24c643f1cecdead4853a563bb7f5

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Meeting number (access code): 187 641 7522

Meeting password: wV6Ke2hKst6

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+1-408-418-9388,,1876417522## United States Toll

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Bicycle Advisory Board – Draft Minutes

February 16, 2021
City Council Briefing Center
Meeting Minutes: Meeting called to order at 6:00 PM by Jessica Engelman

Attendance:

- *Board Members Present:* Jessica Engelman (Vice-Chair), Harrison Husting, Pablo Monsivais, Rhonda Young, Mike Bjordahl, Taylor Stevens, Satish Shrestha, Rian Hidalgo, Charlie Greenwood
- *Board Members Not Present:* Grant Shipley (Chair), Jason Oestreicher
- *Quorum Present: Yes*
- *Staff Members Present:* Colin Quinn-Hurst, Kevin Picanco, Kyle Twohig

Public Comment:

None

Briefing Session:

Minutes from the January 19, 2021 meeting approved unanimously.

1. **Liaison Report –**
   - Rhonda Young reported that the Plan Commission Transportation Subcommittee (PCTS) met on February 2nd and held workshops for the 6 Year Street Program Update and the Ray and Freya Alternatives.
   - Shauna Harshman reported that the Citizen Transportation Advisory Board approved a 2 Year Residential Street Plan in which 1.2 million dollars that have been set aside for a sidewalk maintenance plan and paving unpaved streets.
   - Jessica Engelman reported that Council President Beggs will attend Bicycle Advisory Board in March to talk about Traffic Calming.
2. **Chair Report –**
   - Jessica Engelman mentioned that Spokane Regional Transportation Council (SRTC) Division Connects webpage had a live survey on it and she recommended that members of the BAB and of the public should fill it out and to give SRTC feedback on the walking and bicycling experience.
3. **Staff Report –**
   - Colin Quinn-Hurst reported that the City is conducting a Transit Oriented Development study that will be focused on biking and walking access to high performance transit stations focusing initially on the City Line, along with design standards, land use standards, and zoning for compact development around those high-frequency transit corridors.
   - Mr. Quinn-Hurst also reported that Spokane City Downtown plan continues to be developed and bicycle routes are a large part of the plan.

Workshops:

1. Ped-Bike Additions to Six-Year Streets Program
   - Presentation provided by Kevin Picanco
   - Questions asked and answered
   - Discussion ensued

2. Priority Bike Network Planning – Current Plans and Studies
   - Presentation provided by Colin Quinn-Hurst
   - Questions asked and answered

Note: Minutes are summarized by staff. A recording of the meeting is on file with Planning Services.

- Discussion ensued

3. West Central Routes – Upcoming Projects
   - Presentation provided by BAB Committee Report
   - Questions asked and answered
   - Discussion ensued

Meeting Adjourned at 7:44 PM

Next Bicycle Advisory Board Meeting scheduled for Tuesday, March 16, 2021

Note: Minutes are summarized by staff. A recording of the meeting is on file with Planning Services.

Ray-Freya Alternatives Analysis

Feb 17, 2021

Inga Note – City of Spokane

Shea Suski – David Evans and Associates

Agenda

- Project history
- Current conditions
- Planned projects
- Design alternatives
- Results
- What comes next?

Use Q&A feature for questions

Project Webpage - Links to storymap and survey

https://my.spokanecity.org/projects/ray-freya-alternatives-analysis/

History

1966 Arterial Street Plan –
Ray Street bisected school campus

School District request for realignment of Ray Street

RESOLUTION

A Resolution amending the Arterial Street Plan as adopted by the City Council on April 19, 1986.

WHEREAS, on June 30, 1986, the City Council approved the future realignment of Ray Street generally between 36th Avenue and Freya Street as described on the attached map; and

WHEREAS, the Arterial Plan is intended to provide a master plan to guide future development and public improvements throughout the city, and

WHEREAS, the Arterial Plan will benefit all city areas by promoting orderly development with adequate arterial access, and encouraging investment and rehabilitation; and

WHEREAS, an environmental review has been completed and it has been determined that the Arterial Plan will not have an adverse impact on the environment; and

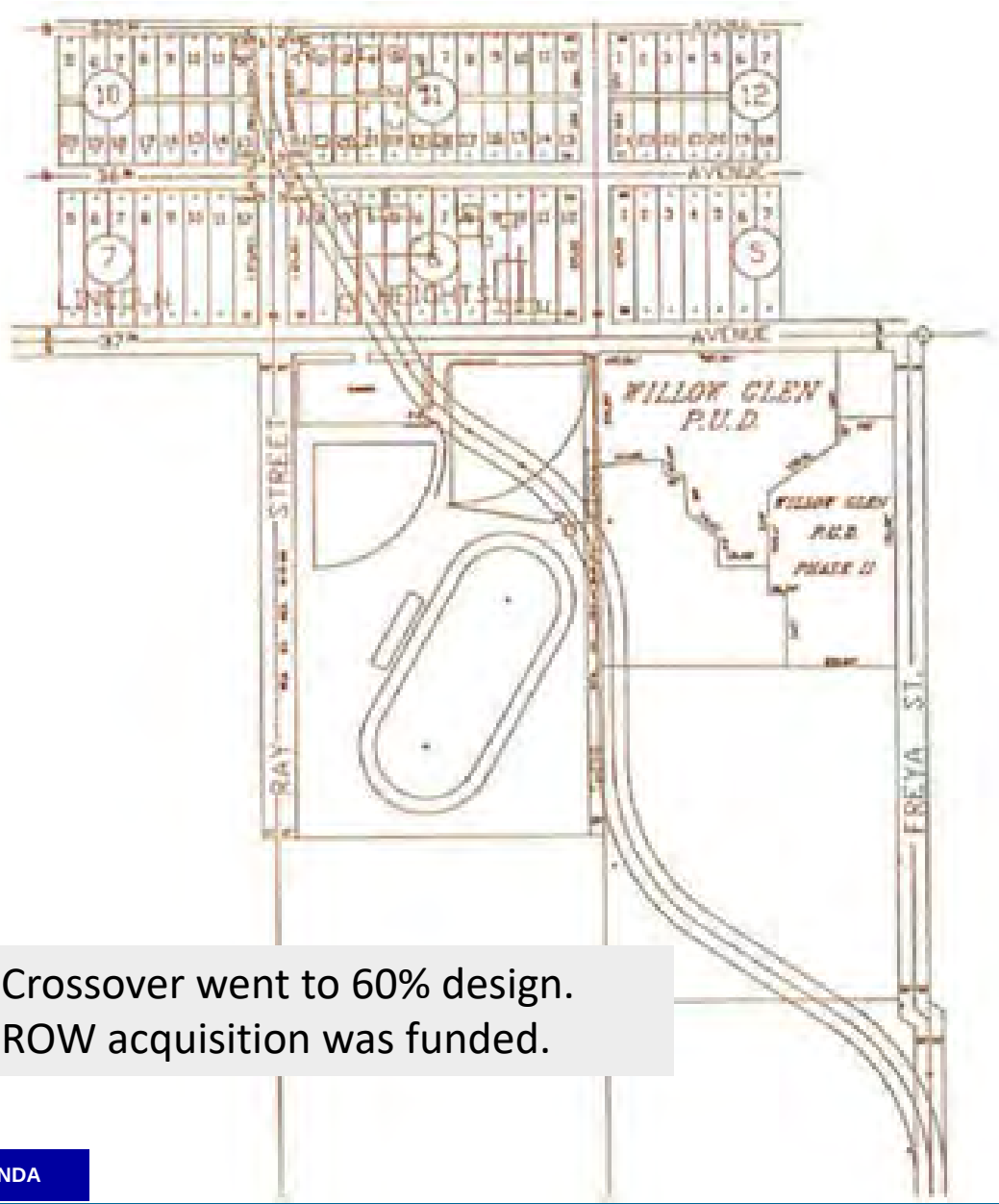
WHEREAS, public workshops, meetings, and hearings held on the Arterial Plan have provided substantial comment on the plan's contents that have been considered and incorporated in the final draft; and

WHEREAS, the City Council has determined to amend the Arterial Plan to avoid dividing the Ferris High School campus by an arterial, and to avoid dividing the Berkeley-Woods Plat by an arterial;

NOW, THEREFORE, be it resolved by the City Council of the City of Spokane that the Arterial Plan is hereby amended to realign Ray Street diagonally in a southeasterly direction beginning at the intersection of 36th Avenue and Ray Street and extending to Freya Street and the Palouse Highway as generally indicated on the arterial map.

Adopted by the City Council this 7th day of July, 1986.

History



Crossover went to 60% design.
ROW acquisition was funded.

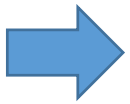
History

City-owned homes

Right-of-way dedicated through plat actions.

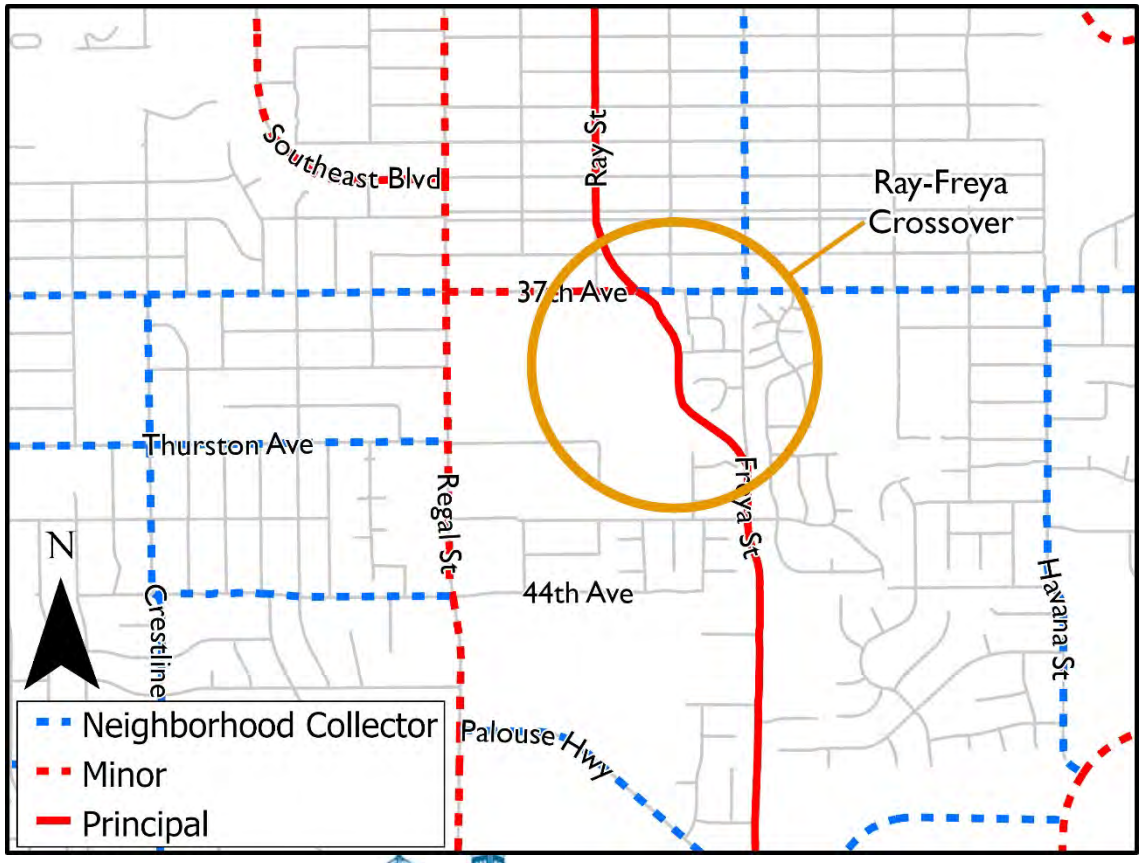
History

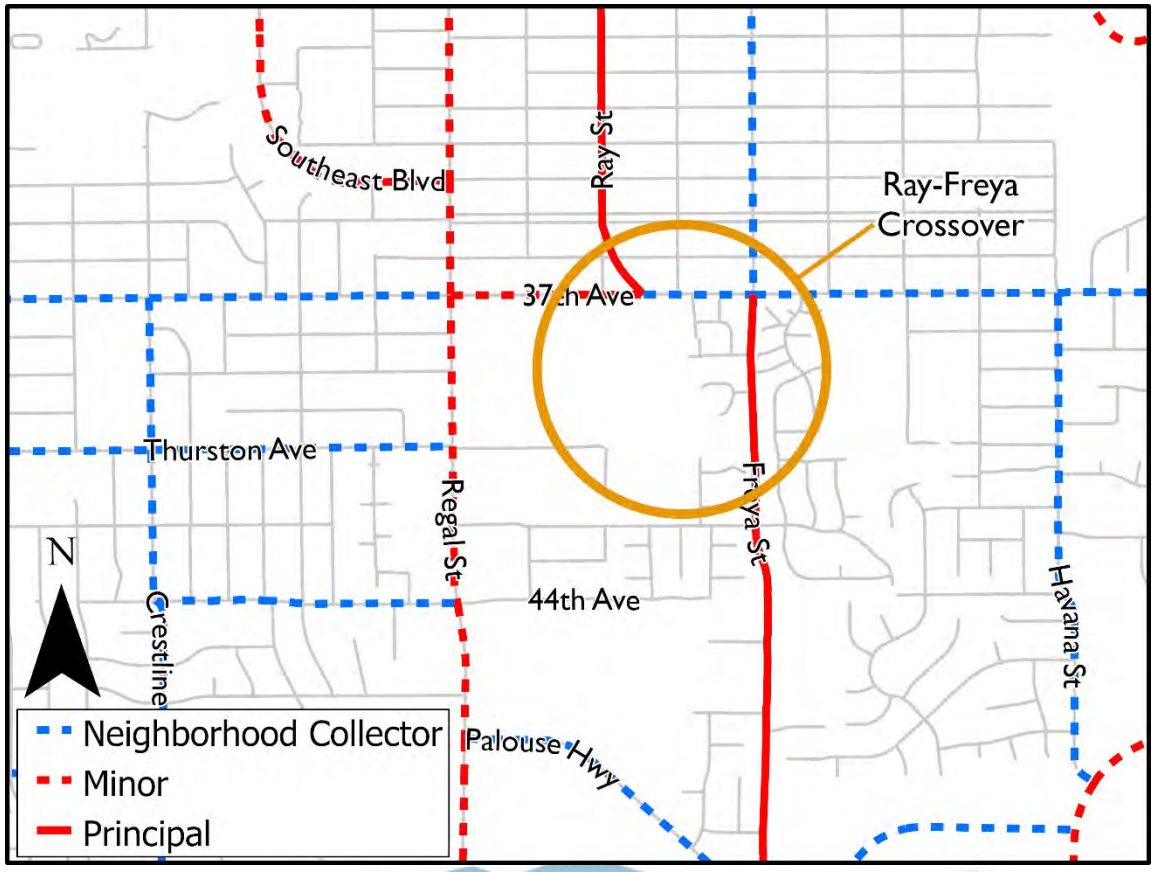
- Impact fee rates
- Concern from neighborhood
- School district



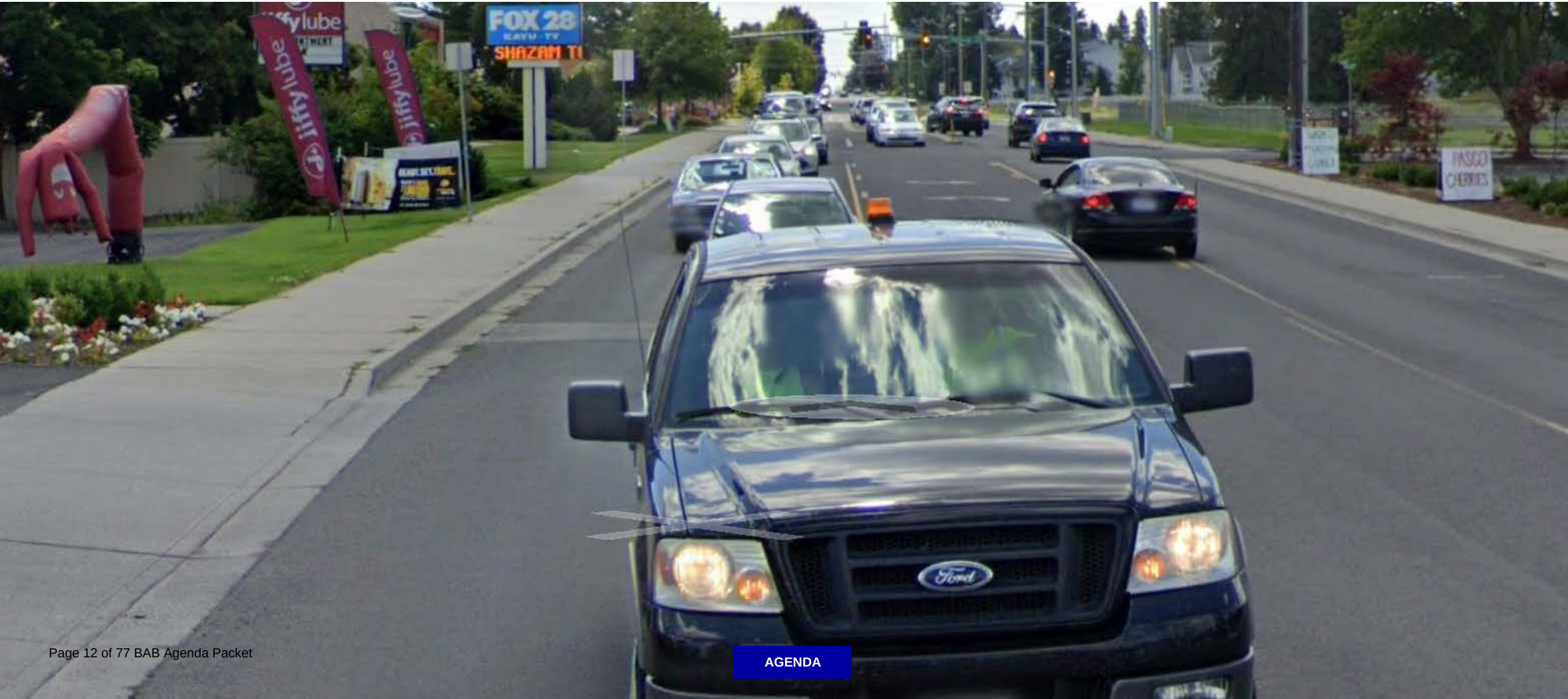
In 2011 Council removed the project from the impact fee list.

History – 2017 Revision to Map





Current Conditions



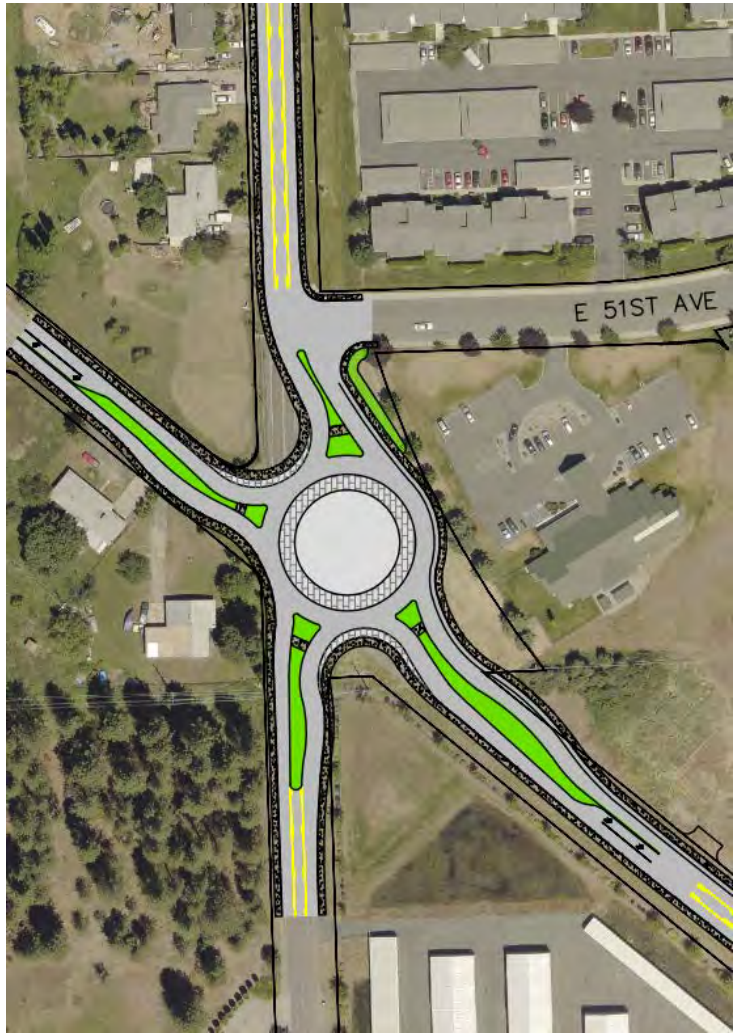
AGENDA

Areas of Concern

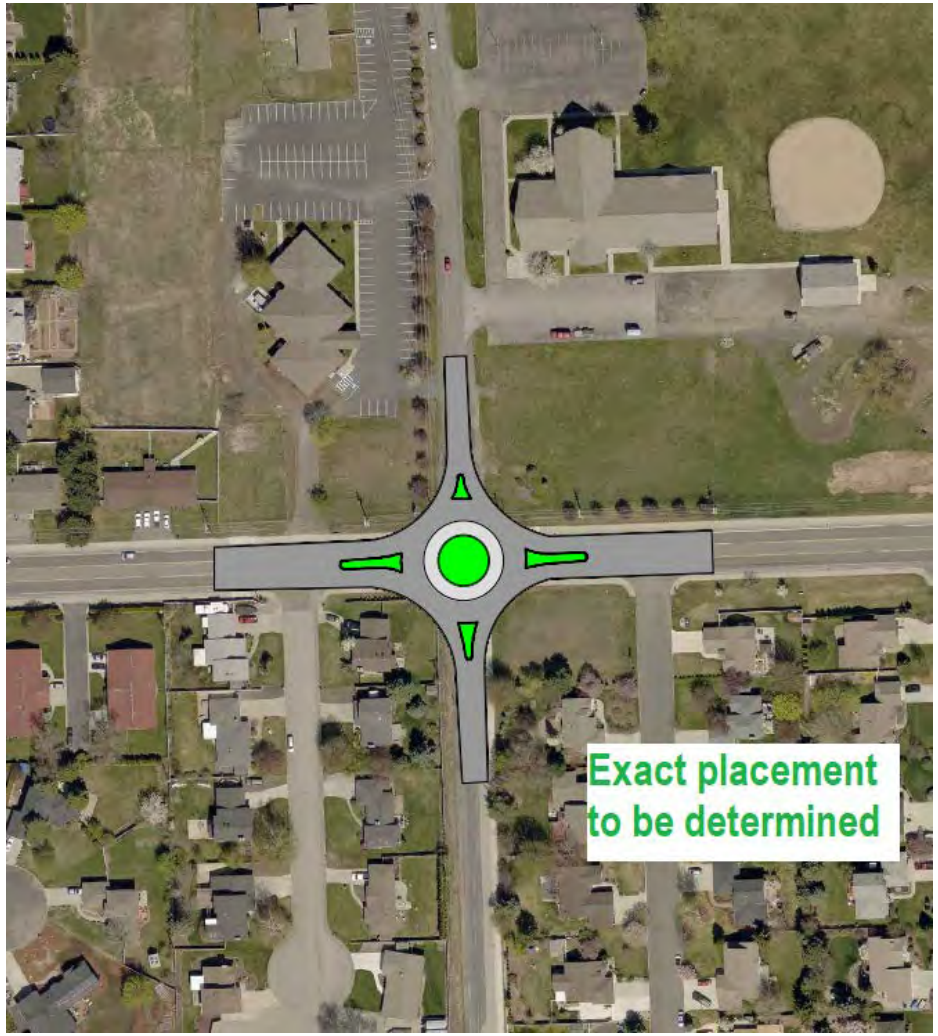
From early survey results

- Lack of safe bike/ped crossings
- 29th/Regal
- Regal south of 44th
- 37th/Ray
- Lack of bicycle facilities
- 37th/Regal

Other Planned Improvements



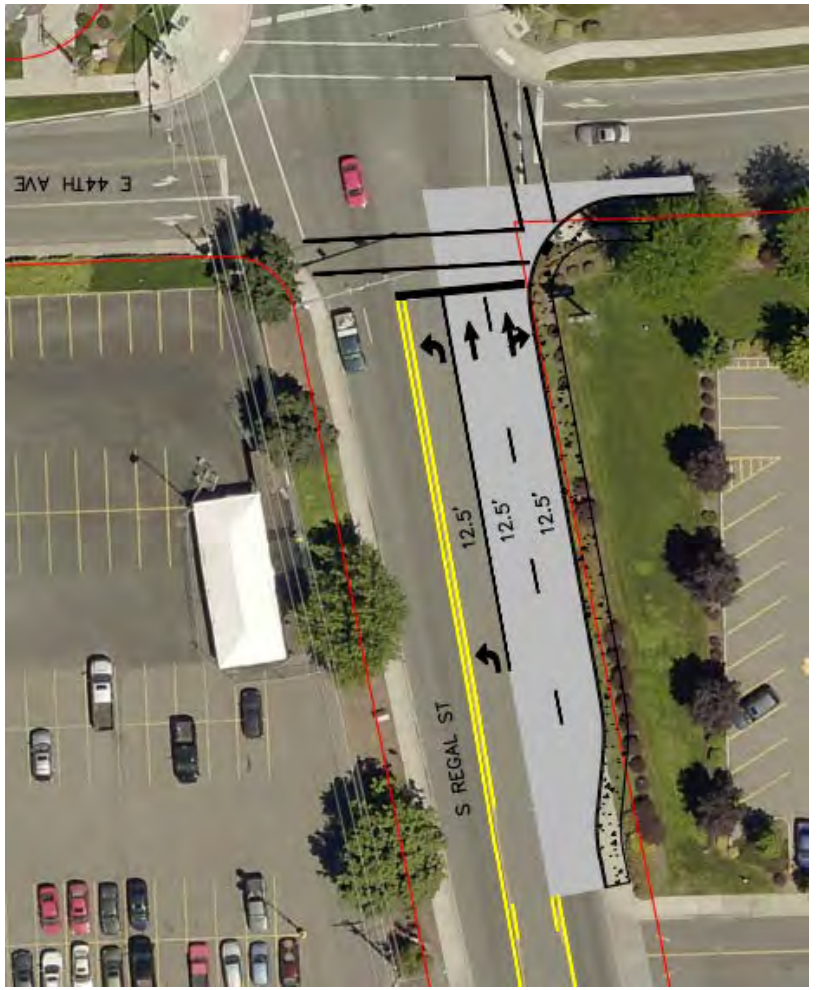
Palouse/Freya



57th/Freya

Other Planned Improvements

44th Avenue Collector
Crestline to Altamont

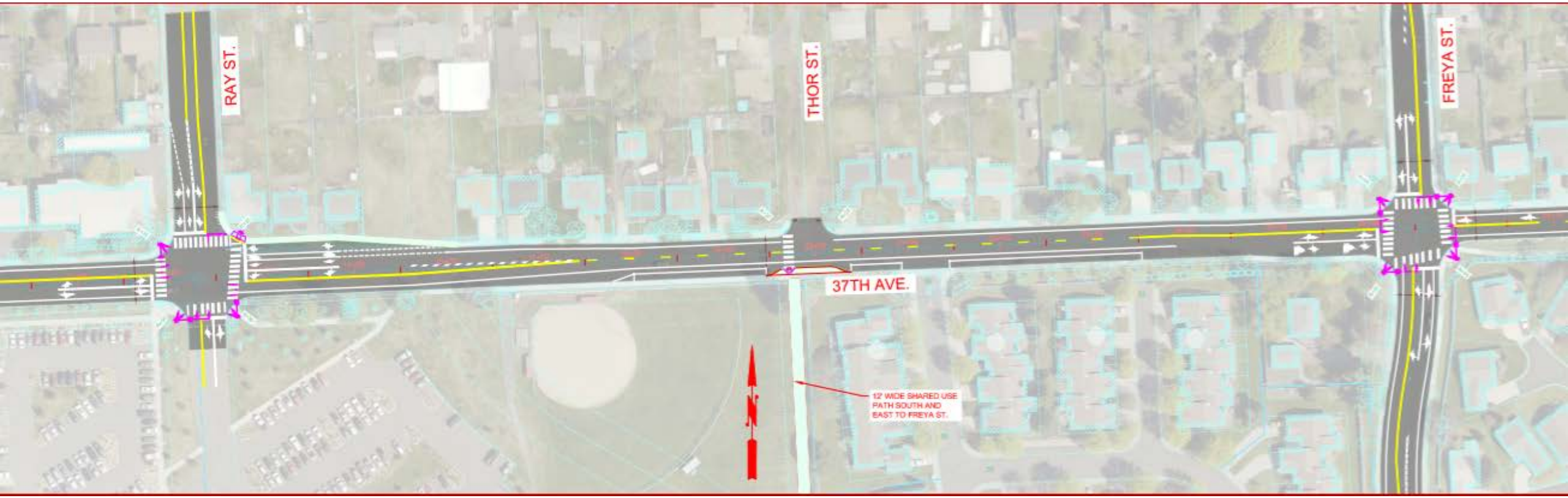


44th Ave/Regal

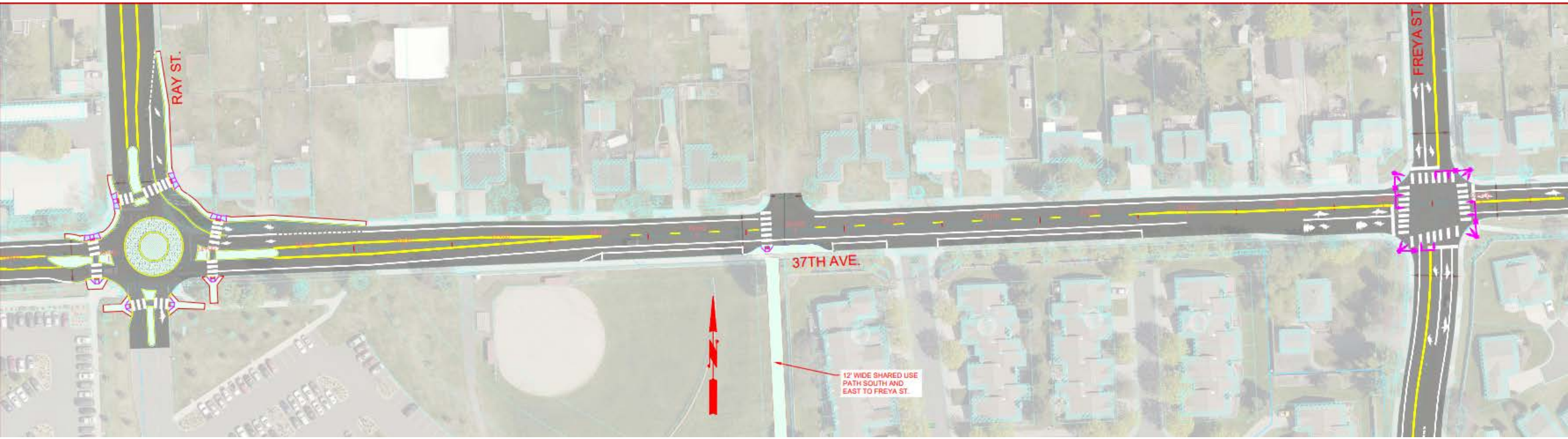
Study Goals

- Estimate 20 year growth
- Evaluate future conditions on Freya, Ray, Regal
- Alternatives to improve traffic flow
  - Shift traffic from Regal => Freya
  - 37th Avenue intersections
  - Other network improvements (local streets)
- Pedestrian and Bicycle improvements

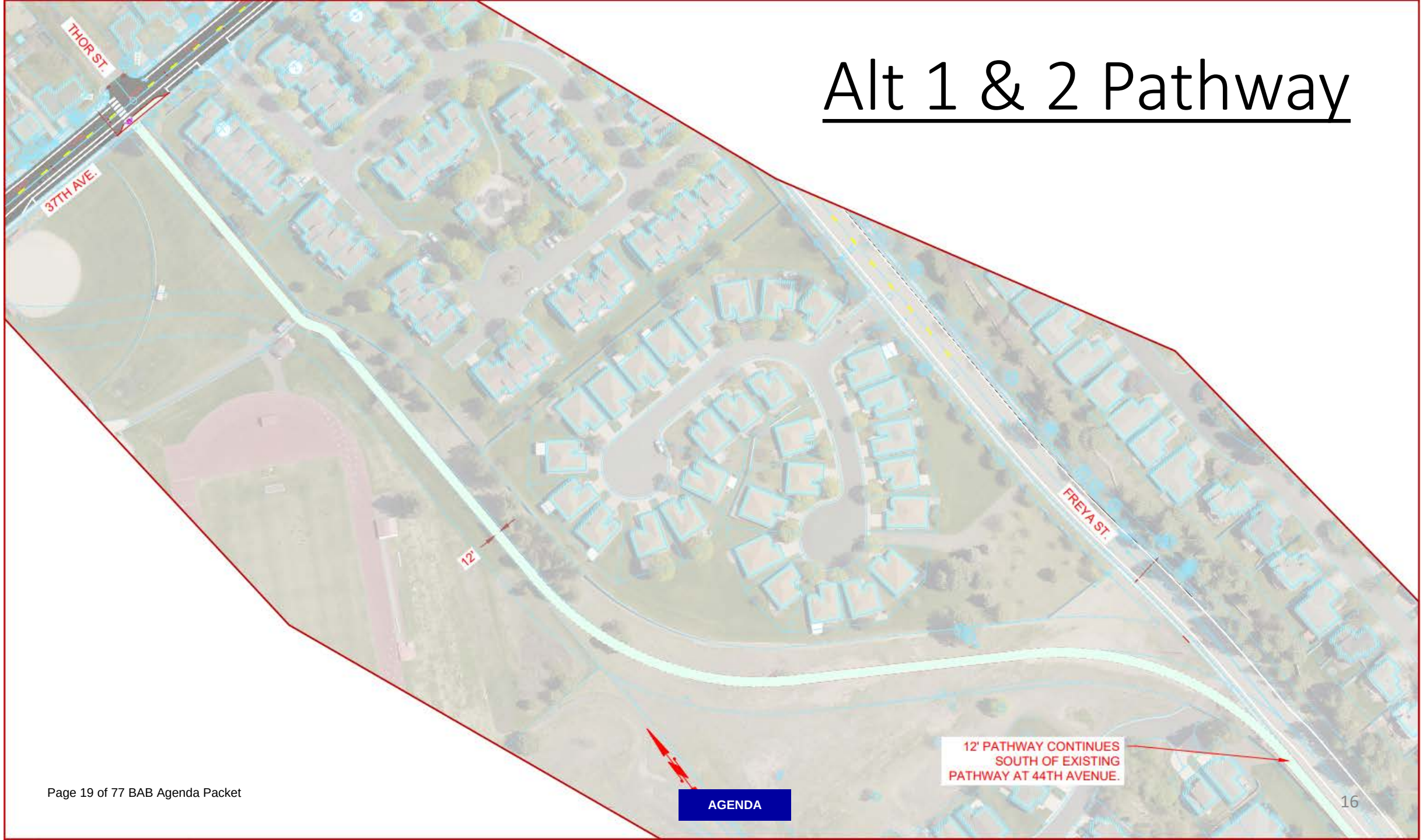
Alternative 1



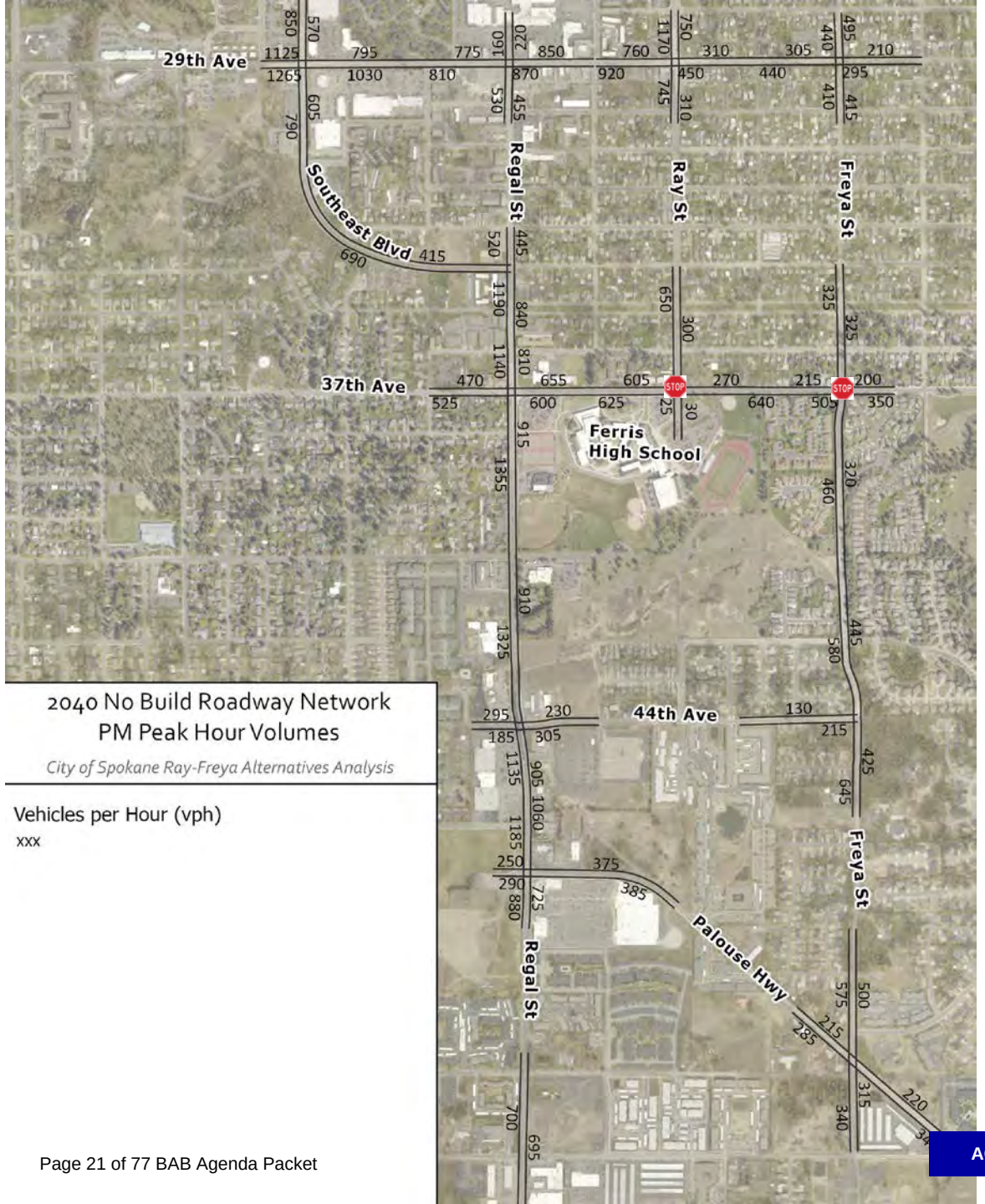
Alternative 2

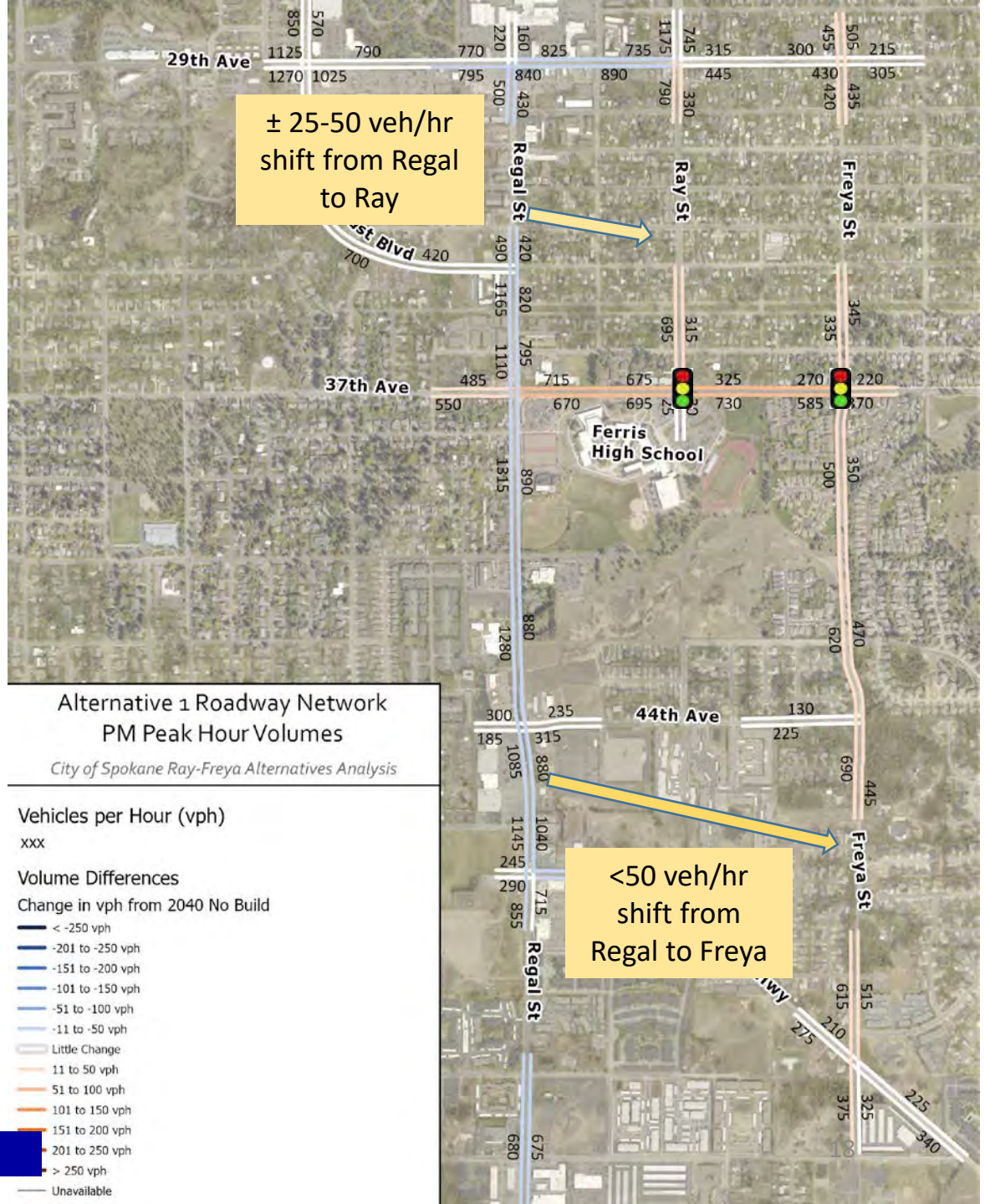


Alt 1 & 2 Pathway



Original Concept


29th Ave
37th Ave
44th Ave
Regal St
Ray St
Freya St
Southeast Blvd
Ferris High School
Palouse Hwy
2040 No Build Roadway Network
PM Peak Hour Volumes
City of Spokane Ray-Freya Alternatives Analysis
Vehicles per Hour (vph)
xxx


29th Ave
37th Ave
44th Ave
Regal St
Ray St
Freya St
Ferris High School
± 25-50 veh/hr shift from Regal to Ray
<50 veh/hr shift from Regal to Freya
Alternative 1 Roadway Network
PM Peak Hour Volumes
City of Spokane Ray-Freya Alternatives Analysis
Vehicles per Hour (vph)
xxx
Volume Differences
Change in vph from 2040 No Build
< -250 vph
-201 to -250 vph
-151 to -200 vph
-101 to -150 vph
-51 to -100 vph
-11 to -50 vph
Little Change
11 to 50 vph
51 to 100 vph
101 to 150 vph
151 to 200 vph
201 to 250 vph
> 250 vph
Unavailable


29th Ave
37th Ave
44th Ave
Regal St
Ray St
Freya St
Southeast Blvd
Ferris High School
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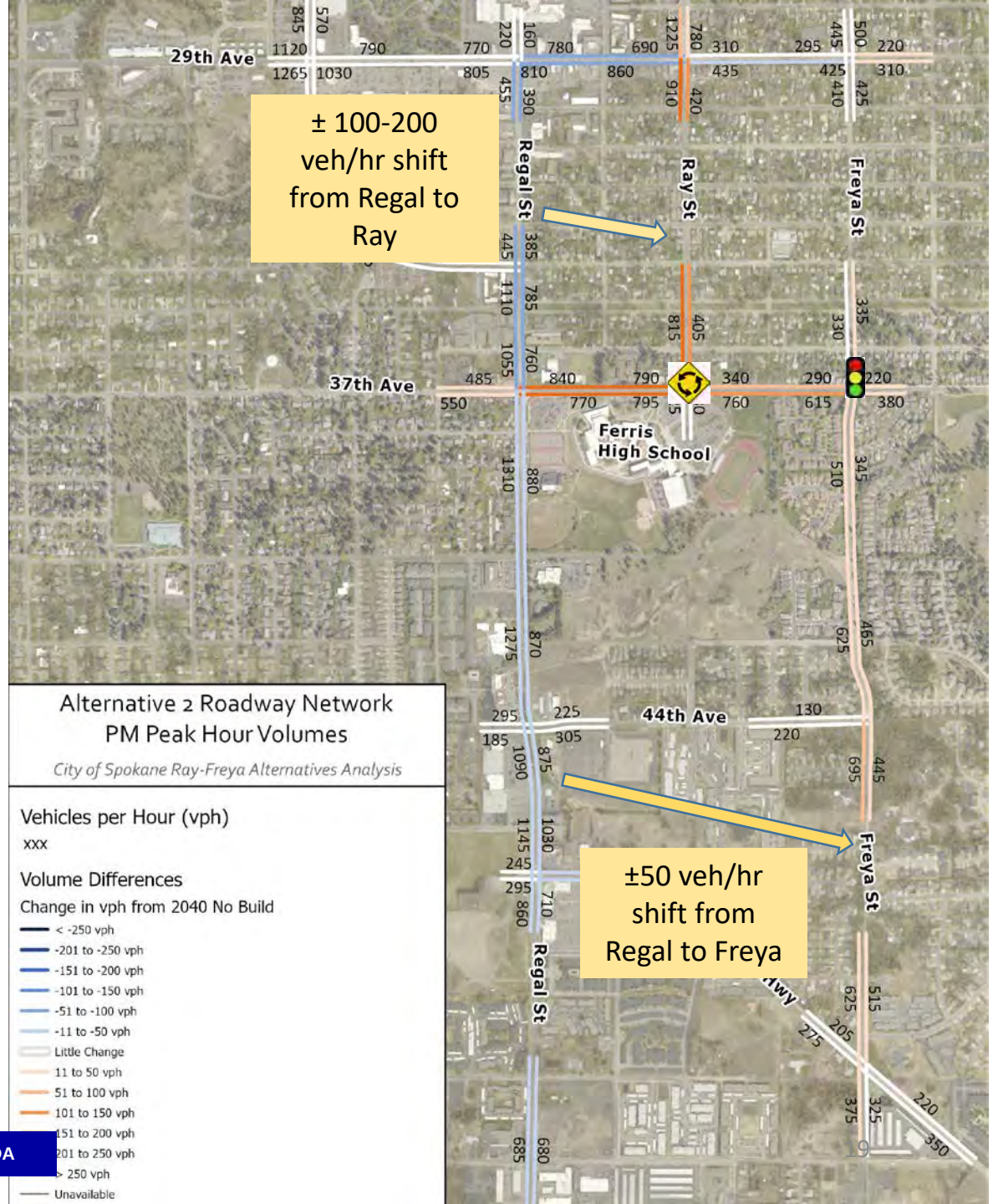
± 100-200 veh/hr shift from Regal to Ray
±50 veh/hr shift from Regal to Freya
29th Ave
37th Ave
44th Ave
Regal St
Ray St
Freya St
Ferris High School
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Alternative 2 Roadway Network
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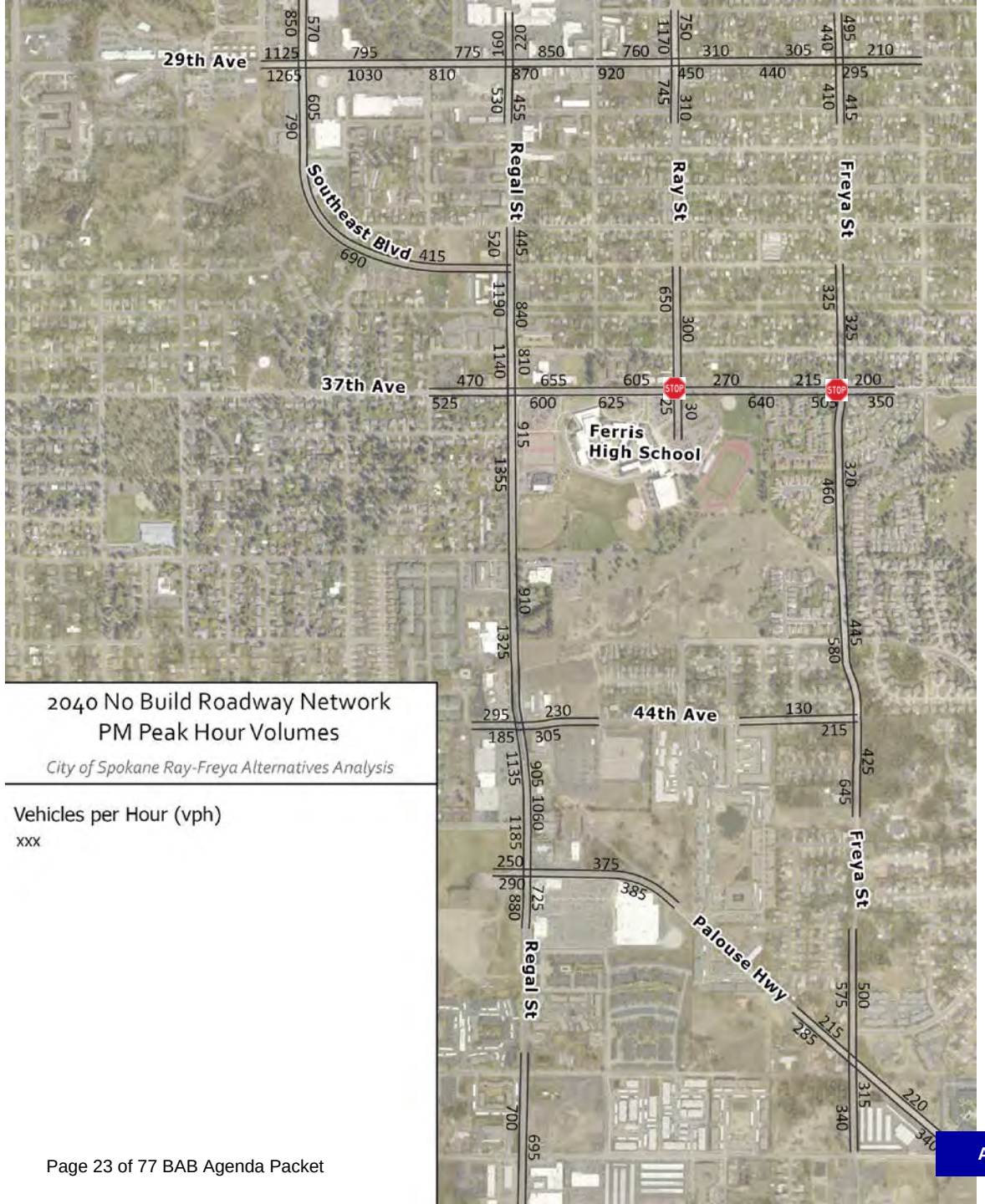

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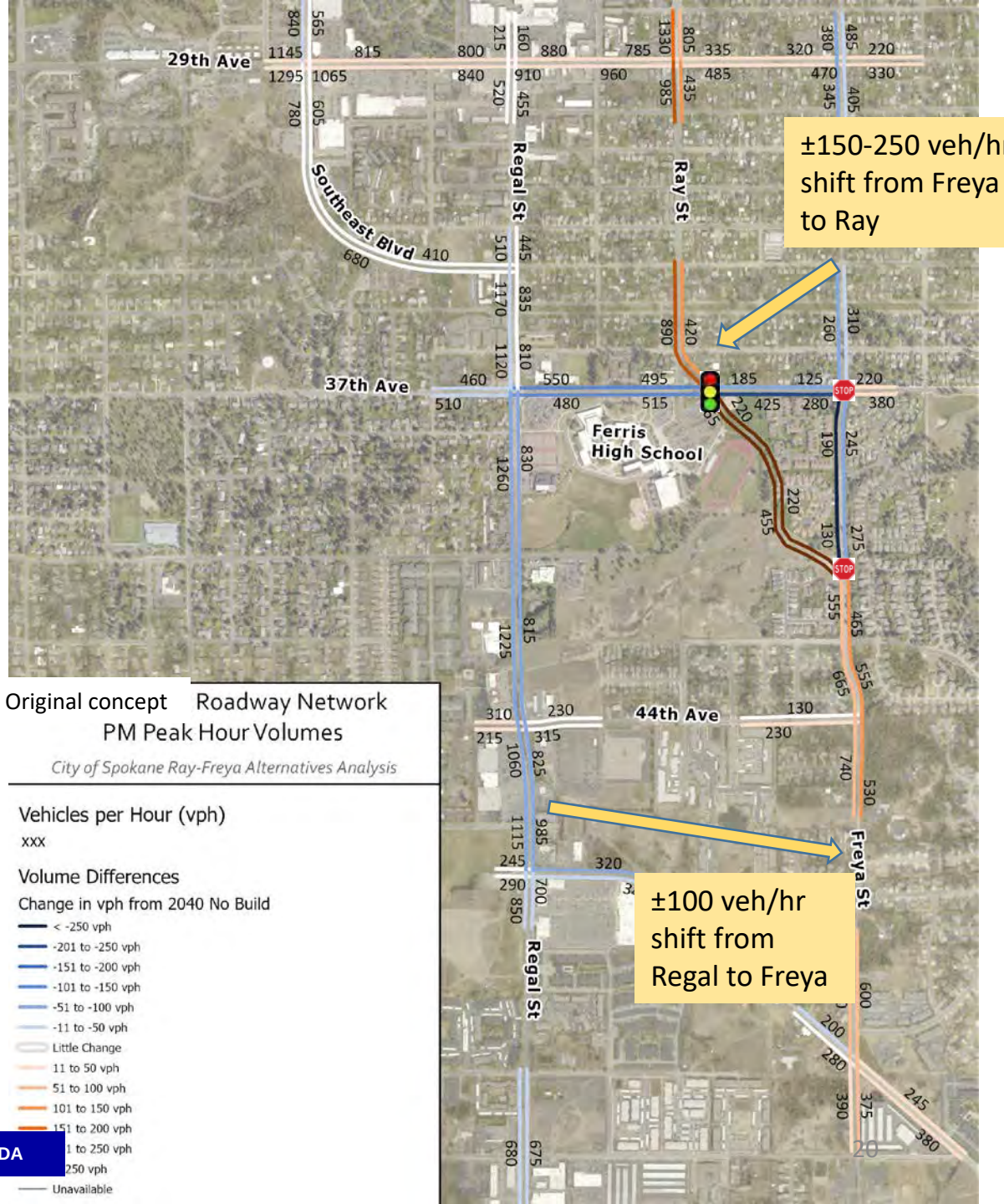


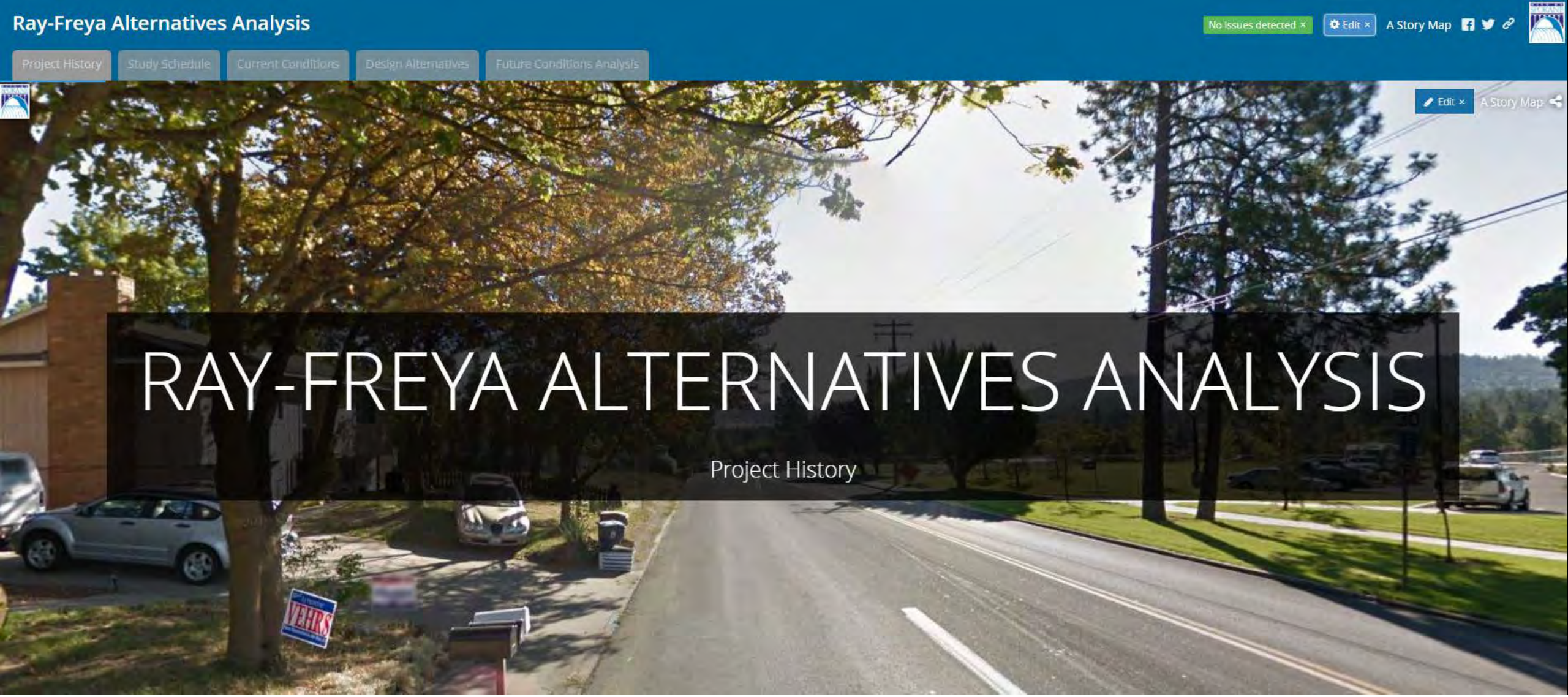
Non-motorized

- Enhanced crosswalks
- More shared-use pathways
- Sidewalk gaps
- Protected bike lanes
- Transit stop access

AGENDA

Schedule

- Compile survey results (end February)
- Evaluate feedback(March)
- Additional alternatives analysis (April)
  - Roundabout at 37th/Freya?
  - Crossover with roundabout?
  - Widen Regal?
- Finalize recommendations and study report (May)



Storymap

AGENDA

Ray-Freya Alternatives Analysis

1. Introduction

Transportation planning is now under way to analyze the capacities of several major arterials on the South Hill. The project will focus on the Ray, Freya and Regal corridors. The intent is to look for alternatives to the Ray-Freya Crossover project, which had historically been part of the City's 6-Year Arterial Street Plan, but was removed in 2017. The Ray-Freya Crossover would have moved traffic from Ray at 37th to Freya, running near Ferris High School, and was designed to ease traffic congestion. City staff is looking at other transportation improvements that could streamline traffic flow in the area.

Over the next few months, City of Spokane staff will hold online meetings to share the study results with the public and refine the alternatives. Any projects selected through this process will be added to the 20-year street projects list. Eventual construction work would be partially funded through Transportation Impact Fees, and the City would seek additional construction funding as needed.
Please answer the following questions so we can learn about your experience while accessing the study area:

1. Please tell us about your interactions with Regal, Ray or Freya Streets between 57th and 29th Avenues. Check all that apply.

- [ ] I live nearby.
- [ ] I work nearby.
- [ ] I shop nearby.
- [ ] I attend school nearby.
- [ ] I drive through this area on a regular basis.
- [ ] Other (please specify)
- [ ] I walk through this area on a regular basis.
- [ ] I bike through the area on a regular basis.
- [ ] I use public transit through the area on a regular basis.

Survey

Inga Note – City of Spokane

inote@spokanecity.org

Project Webpage - Links to storymap and survey

https://my.spokanecity.org/projects/ray-freya-alternatives-analysis/

SENATE BILL REPORT
SSB 6208

As Passed Senate, February 12, 2020

Title: An act relating to increasing mobility through the modification of stop sign requirements for bicyclists.

Brief Description: Increasing mobility through the modification of stop sign requirements for bicyclists.

Sponsors: Senate Committee on Transportation (originally sponsored by Senators Billig, Rivers, Liias, Randall and Wilson, C.).

Brief History:
Committee Activity: Transportation: 1/21/20, 2/03/20 [DPS].
Floor Activity:
Passed Senate: 2/12/20, 44-1.

Brief Summary of First Substitute Bill

- Authorizes a person operating a bicycle to treat a stop sign as a yield sign.

SENATE COMMITTEE ON TRANSPORTATION

Majority Report: That Substitute Senate Bill No. 6208 be substituted therefor, and the substitute bill do pass.

Signed by Senators Hobbs, Chair; Saldaña, Vice Chair; King, Ranking Member; Sheldon, Assistant Ranking Member; Cleveland, Das, Fortunato, Lovelett, Nguyen, O'Ban, Padden, Randall, Takko, Wilson, C. and Zeiger.

Staff: Kim Johnson (786-7472)

Background: Drivers of vehicles, bicyclists, and pedestrians must obey a traffic control device.

Every driver of a vehicle approaching a stop sign must stop.

A driver of a vehicle approaching a yield sign must slow to a speed reasonable for the conditions, and if required for safety come to a stop, and then after slowing or stopping, the

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This analysis was prepared by non-partisan legislative staff for the use of legislative members in their deliberations. This analysis is not a part of the legislation nor does it constitute a statement of legislative intent.

driver must yield the right-of-way to any vehicle in the intersection or approaching on another roadway so closely as to constitute an immediate hazard. If a driver is involved in a collision with another vehicle in an intersection or junction of roadways, after driving past a yield sign without stopping, the collision must be deemed prima facie evidence of the driver's failure to yield right-of-way.

There are at least four other states and some municipalities that have adopted a law allowing bicyclists to treat a stop sign as a yield sign. This movement is often referred to as a rolling stop.

Summary of First Substitute Bill: A person operating a bicycle approaching a stop sign must either stop, or follow the requirements for approaching a yield sign.

The provision allowing a person operating a bicycle to treat a stop sign as a yield sign is not applicable to:

- a stop sign at a rail road crossing; and
- a stop signal displayed by a school bus, when the rules of the road require an approaching vehicle to stop.

Appropriation: None.

Fiscal Note: Not requested.

Creates Committee/Commission/Task Force that includes Legislative members: No.

Effective Date: The bill takes effect on October 1, 2020.

Staff Summary of Public Testimony on Original Bill: *The committee recommended a different version of the bill than what was heard.* PRO: There is a lot to like in this bill, but what made me like it even more was the very different states that have all adopted this policy. Arkansas, Delaware, Idaho, and Oregon do not usually align on state policy, but they did see the merit of the policy for bicyclists being proposed in this bill. This really is an intuitive change. Allowing cyclists to keep some of their momentum increases safety and traffic flow. Bicyclists usually stop off to the right at a stop sign, which puts them in a blind spot for some motorists. It is the bicyclist's responsibility to yield if a vehicle is in the intersection or fast approaching the intersection, and this bill will not change that responsibility. The advocates worked hard over the interim, engaging the State Patrol and the Washington Traffic Safety Commission.

Biking is a regular form of transportation for me. The safety stop proposed in the bill is important for me because it is safer and more intuitive. Stopping and starting is the hardest and most vulnerable time for bicyclists. This helps reduce the speed difference between me and the cars around me, and when the car does overtake me, I am out of the intersection which removes some unpredictability and traffic. I prefer to plan my routes so I travel in protected bike lanes or on roads with less vehicle traffic. We have also learned a great deal from other state experiences. Bicyclist's injuries declined in Idaho after passage of this law. This legalizes typical behavior.

Persons Testifying: PRO: Senator Andy Billig, Prime Sponsor; Claire Martini, citizen; Alex Alston, Washington Bikes.

Persons Signed In To Testify But Not Testifying: No one.

Project Plan

Centennial Trail Connector & Bridge

ENSC 22

Project Members:

Madelyn Cayton

Oliver Crawford

Lindsey Evers

Suhib Hammad

Bernard Olewski

Maxwell Duke

Joseph Fountaine

Sponsored By:

City of Spokane

September 30, 2020

GONZAGA UNIVERSITY

School of Engineering and Applied Science

Center for Engineering Design and Entrepreneurship

Project Plan

ENSC 22

CENTENNIAL TRAIL CONNECTOR & BRIDGE

Prepared by: Gonzaga Trail Association

Madelyn Cayton
Project Engineer

Oliver Crawford
Project Engineer

Lindsey Evers
Project Engineer

Suhib Hammad
Project Engineer

Bernard Olewski
Project Engineer

Maxwell Duke
Project Engineer

Joseph Fountaine
Project Manager

Reviewed by:

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Gonzaga University
Faculty Advisor

Emily Sackmann, PE
Coffman Engineering
Faculty Advisor

Rhonda Young, PhD, PE
Gonzaga University
Faculty Advisor

Collin Quinn-Hurst
City of Spokane
Project Sponsor

October 14, 2020

Executive Summary

This proposal outlines the project schedule and deliverables to be provided by the Gonzaga Trail Association (GTA) required to design a bridge connection and trail segment for the Centennial Trail to cross the Spokane River. The City of Spokane is sponsoring the design to reroute the Centennial Trail from Pettet Drive and the T.J. Meenach Bridge, where users currently must utilize bike lanes alongside heavy vehicular travel. The existing conditions will be documented through site visits and data provided by the Washington Department of Natural Resources. GTA will provide a design document that will include hydraulic design to size the bridge, a bridge design based on the required loadings, and a trail alignment with typical cross-sections that connects into the existing trail at Summit Boulevard and Fort George Wright Drive, just south of the T.J. Meenach Bridge. The hydraulic design will be based upon both the existing hydraulics at the site, and scour of the planned bridge. The bridge design will include three parts the deck design, bridge superstructure design, and foundation design. The trail alignment and cross-sections will include the proposed horizontal and vertical alignment for the trail, along with drainage design, based upon the existing site conditions. The proposed alignments will be assessed using a decision matrix, allowing for a 50% design package to be completed. With that, a construction cost estimate can be drafted. This will provide the City of Spokane with the required documentation to secure the necessary grant funding to proceed with a full design of the bridge connection on the Centennial Trail, if desired. The projected design fee to complete this work is $166,600.

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1.0 Project Description

The Centennial Trail, currently 63-miles, stretches from Spokane, Washington to Coeur d'Alene, Idaho. The Washington portion of the trail, having a length of 40 miles, begins near Nine Miles Falls in Spokane, WA, and follows the Spokane River until reaching the state line with Idaho as seen in Figure 1. The trail continues for 23 miles in Idaho.

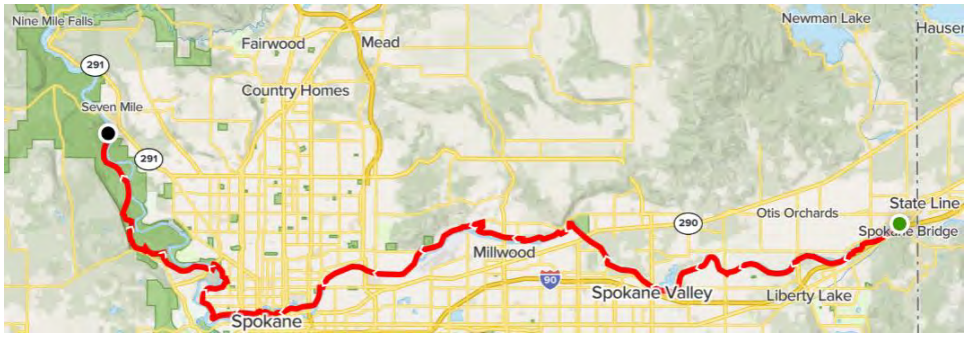

Fig. 1 Overview of Greater Project Area

The specific project area refers to the segment of the trail that falls near Summit Boulevard and Pettet Drive, where there is a non-separated bike lane alongside a heavy vehicular traffic road. This is an issue as Pettet Drive has a posted speed of 30 miles per hour, is classified as a minor arterial, and has no bike lanes. This is a situation that poses a threat for both bikers and vehicles, as bikers must merge onto a primary arterial (TJ Meenach Dr) which does not have bike lanes, and travel across a narrow bridge to reach the Centennial Trail. To avoid this, the City of Spokane has hired GTA to investigate a former streetcar alignment and river crossing area to design a trail and bridge that will connect the Centennial Trail on the east side of the Spokane River with the portion of the trail that is on the west side of the river. Figure 2 shows the exact project area. The green trail outline represents the existing Centennial Trail, the blue outline represents the current shared cyclist/vehicle road that cyclists currently use to reach the Centennial Trail, and the red outline represents GTA's proposed location of the Centennial Trail extension that connects with the trail on the west side of the Spokane River.

Fig. 2 Defined Project Area

2.0 Project Goals

2.1 Project Goals

Gonzaga Trail Association's primary goal for the Centennial Trail connector and bridge project is to:

1) Leverage GTA's multi-disciplinary team (Structures, Hydraulics, Transportation) to provide a comprehensive bridge/trail extension design that addresses the concerns associated with the existing trail route (shown as the blue line in Figure 2).

2.2 Project Objectives

The structures, hydraulics, and transportation teams of GTA have outlined below the objectives that we aim to accomplish during the duration of this project. The objectives of this project are centered around ensuring the design of the bridge/trail extension is safe and that it conforms to the design criteria specified by the client and the codes and regulations mentioned in Section 4.1.

1) Design the foundation and superstructure for a shared-use bridge that can safely withstand scour and a 100-year flood.
2) Determine the drainage locations and culvert designs necessary to effectively manage excess stormwater runoff in the project area.
3) Design a trail extension alignment/cross-section that is accessible, safe, and cost-effective for the client.
4) Ensure that the bridge/trail design safely conveys pedestrians and bicyclist trail users while fulfilling the design criteria outlined by the client.

3.0 Project Requirements

3.1 Sponsor Requirements

As GTA completes tasks for the project, Colin Quinn-Hurst, the City of Spokane sponsor, will ensure the tasks meet the requirements requested by the City of Spokane. GTA will attempt to adjust the material selection, calculations, and designs in adherence with the City of Spokane's preferences. The City will check and verify GTA's work throughout the project to ensure that GTA stays on track. The City has requested that GTA use the U-District bridge TS&L as a guideline for the design of the project and adjust them accordingly to be acceptable with the current codes.

3.2 Constraints

This project has several constraints pertaining to its location. Some of the constraints include a very limited knowledge of sub-surface conditions and steep terrain, which limits where the alignment will be placed. The terrain on the east side of the Spokane River is in part unsuitable for the trail due to the steepness and stability of the hillside. The typical trail design will have to be adapted considerable to site conditions. This may include additional earth retention/retaining walls, drainage, guard rails, signage, etc. Limitations to the bridge include its constructability. Due to the steep terrain and limited access to the site, additional considerations regarding material selection and the type of bridge will be included in the design.

3.3 Major Deliverables

The major deliverables that GTA will provide to the client via email at the end of this project are a project status report and a final report. The project status report will detail the project research and design options that have been evaluated for the trail alignment and bridge design. It will also

provide an opportunity for the client to suggest design alterations to the project. The final report will include the revisions suggested by the client and will discuss the completed project research and design options. GTA will discuss the project background, requirements/constraints, goals, schedule, and budget in the project status report and the final report. In addition to the project status report and the final report, GTA will provide drawings and sheets plan sets to the client to properly detail the proposed design. Each team will provide the client with design files in the appropriate format listed below. GTA will also provide 11x17 drawings to the client in .pdf form. The design documents that GTA will provide to the clients are listed below per discipline:

Structures

- Documents Provided: Sheet Set (Title, Profile, Typical Sections (i.e. Deck, Girder, Columns, Foundations, Detail, Connections) Calculations (Cost Estimate, Design Criteria, Member Design, and Analysis)
- Design File Formats: .dwg (AutoCAD Civil 3D 2019), .xlsx (Excel)

Hydraulics

- Documents Provided: Existing and Proposed Water Surface Profiles and Cross Section Plots and Tables, Scour Countermeasure Specifications and Plans if scour is determined to be an issue, Spreadsheet Calculations (Cost Estimate for Scour Countermeasures)
- Design File Formats: HEC-RAS Output Plots and Tables, .xlsx (Excel)

Transportation

- Documents Provided: Sheet Set (Title, Profile, Plan, Alignment, Typical Section, Detail, Drainage, Erosion and Sediment Control, Signing), Design Base Files (Horizontal/Vertical Alignment, Signing, Drainage), Spreadsheet Calculations (Cost Estimate, Pavement Design, Roadway Design)
- Design File Formats: .dwg (AutoCAD Civil 3D 2019), .xlsx (Excel)

4.0 Project Approach

4.1 Codes & Regulations

The design teams at Gonzaga Trail Association have determined the following codes apply to the project:

4.1.1 Transportation Codes & Regulations

- AASHTO Guide for the Development of Bicycle Facilities (2012)
- AASHTO Policy on Geometric Design of Highways and Streets, 7th Edition (2018)
- ADA Best Practices Tool Kit for State and Local Governments
- NACTO Urban Bikeway Design Guide (2011)
- Crime Prevention Through Urban Design (2003)

4.1.2 Structures Codes & Regulations

- AASHTO LRFD Bridge Design Specification, 9th Edition
- WSDOT Bridge Design Manual (2019)
- AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges (2009)

4.1.3 Hydraulic Codes & Regulations

- City of Spokane FEMA Flood Insurance Study (1980)
- WSDOT Bridge Design Manual (2019)
- FHWA HEC-18 Evaluating Scour at Bridges, Fifth Edition
- WAC Hydraulic Code Rules (2020)
- WAC Chapter 51-56 Uniform Plumbing Code (2019)
- Spokane Regional Stormwater Manual (2008)
- Stormwater Management for Eastern WA (2019)
- City of Spokane Stormwater Management Program (2019)

4.2 Project Research & Learning

4.2.1 Structural Research & Learning

The structures team will complete a literature review on construction materials to use for the bridge. The primary materials include concrete, steel, and wood. The literature review will cover material properties, the environmental impacts, and how the material is within the infrastructure. As a part of the literature review the structural team will complete a weighted decision-making matrix to determine the primary construction material. In addition to the materials, the structures team will also investigate the structure loading as well as various design types.

Deliverables: Summary of Design Codes, Summary of Material and Design Research

Effort Required to Complete: 20 hours

Responsible Team Member: Maxwell Duke

4.2.2 Hydraulic Research & Learning

The hydraulics team will research literature and regulations on hydraulic bridge design and stormwater swale and pipe design. The literature review on the bridge will focus on determining the hydraulic standards for the bridge including height and width. The hydraulics team will also conduct a scour literature review. The review will determine the equations and standards that will be used in the scour evaluation process, and if countermeasures will need to be developed. A review of Eastern Washington stormwater management practices will also focus on determining the standards for stormwater swale and pipe design.

Deliverables: Summary of Design Criteria, Summary of Scour Research

Effort Required to Complete: 15 hours

Responsible Team Member: Lindsey Evers

4.2.3 Transportation Research & Learning

The transportation team will complete a literature review of the transportation codes and regulations to review the design requirements and suggestions for designing a bike trail and shared-use path. This will include research into minimum radii and maximum grade requirements for accessibility. Research into methods for crime prevention will be completed to determine which features can be included in the trail alignment to prevent crime.

Deliverables: Summary of Design Criteria

Effort Required to Complete: 8 hours

Responsible Team Member: Madelyn Cayton

4.3 Design Options & Assessment of Design Options

4.3.1 Structures Assessment of Design Options

The structures team will create a decision-making matrix to decide the primary construction material and the type of bridge. The matrix will consist of various variables that would influence the decision such as environmental impact, maximum total span, pier requirements, etc. This decision will allow the structures team to begin the design of the bridge. Each of these variables

will be assigned a different weight based on the importance of the variable and after the completion of the design matrix the primary material for the bridge design will be decided.

The structures team will create a decision-making matrix to decide the type of design selected. Various design possibilities will be researched, such as cable, arch, tied arch, and truss. Similarly, the design possibilities will be evaluated based on various criteria such as, ease of construction, ease of design, aesthetics and ease of maintenance, and compatibility with material type selected. These criterium will be weighed based upon which criteria are most important. Upon completion and analysis of the decision-making matrix for both the material type and design type, a final design and material will be selected for the project.

4.3.1.1 Structures Aesthetic and Safety Design Options

The structures team will remain in regular contact with the City of Spokane to design a bridge that meets the requirements of the city. Any aesthetic requests from the City will be considered in the decision-making matrices. Additional safety features for the bridge, such as railings and bridge maintenance access will be included in the decision-making matrices to reduce danger to bridge users and increase the life span of the bridge.

4.3.2 Hydraulic Assessment of Design Options

The hydraulics team will conduct an alternatives analysis to select suitable scour countermeasures, if such measures are deemed necessary for the project. The scour analysis will be done in accordance with FHWA Scour Countermeasures and will include a decision matrix to select a scour countermeasure technique. The team's criteria for selection will be based on various criteria such as constructability, cost, environmental impact, and aesthetics.

4.3.3 Transportation Assessment of Design Options

The transportation team will use a series of weighted decision matrices to determine which design is best suited to the project. The matrices will compare the design alternatives of the preliminary horizontal/vertical alignments alongside the typical cross-section designs. The matrices will look at various variables, including projected construction costs, the design criteria specified by the City of Spokane, and the environmental impacts of each alignment.

4.4 Site Visit

All team members of the Gonzaga Trail Association attended an initial site visit to the eastern side of the Spokane River to observe and take photos of the existing conditions of the alignment previously used for a tram line, the Spokane River, bridge, and other trails to gain an understanding of these site conditions. The structures team will visit the site again to meet with the City of Spokane bridge engineer and review the possible bridge locations. The hydraulics team will need to visit the site to take measurements of existing conditions of the bridge including abutment length to build an existing conditions model of the river. The transportation team will visit the site a second time to observe the trail conditions on the western side of the Spokane River, and verify that the existing conditions match the lidar data provided by the Washington State Department of Natural Resources.

4.5 General Structural Analysis

4.5.1 Loading

The structures team will begin the bridge design process by performing a code search of the codes listed in Section 4.1.2 to determine the required loading for the structure. This loading will later be used in the material selection and design selection decision matrix. The team will consider location, site conditions, and code requirements when developing loading conditions.

Deliverables: Summary of Design Criteria.

Effort Required to Complete: 15 hours

Responsible Team Member: Bernard Olewski

4.5.2 Deck Design

The structures team will utilize applicable codes and standards in combination with applicable loading to produce a safe and efficient design of the bridge deck. The deck design will be completed first to determine the total load for the supporting elements such as the foundations and abutments. For the deck design, the structures team will investigate different materials and aesthetics and will briefly consider how the deck will be transported to the site. The selection of the final deck design will depend on the final length of the bridge, the low chord elevation set by the hydraulics team, the material analysis, and the client's preferences.

Deliverables: Deck Design Drawings and Calculations

Effort Required to Complete: 45 hours

Responsible Team Member: Suhib Hammad

4.5.3 Bridge Superstructure Design

The bridge superstructure design will require an understanding of the conditions of the environment surrounding the bridge, such as what the bridge is expected to support: people, bikes, small vehicles, etc. The structures team will utilize applicable codes and determine appropriate loading combinations to design the bridge superstructure. The superstructure will need to span approximately 250 to 400 feet depending on where the final location of the bridge is. The selection of the final girder design will depend on material type, whether piers will be utilized, loading combinations, and how the material will be transported to the site.

Deliverables: Girder Design Plan Sheet and Calculations

Effort Required to Complete: 45 hours

Responsible Team Member: Bernard Olewski

4.5.4 Foundation Design

The structures team members will utilize design loading from the bridge superstructure and any available geotechnical information to design the foundations. The structural team will research alternative foundation types as well as determine the number of foundations (piers) that will be required. Additionally, coordination with the hydraulics team will be required for designs that include piers or require scour analysis. The selection of the final foundation type will depend on loading, span, constructability, and scour requirements. The structures team will also research the use of abutments as an alternative to the traditional foundation design. The incorporation of abutments in the bridge's foundations will depend partially on the trail's alignment, surrounding ground condition, and the river's hydraulic conditions.

Deliverables: Foundation Design Plan Sheet and Calculations

Effort Required to Complete: 60 hours

Responsible Team Member: Maxwell Duke

4.5.5 Constructability Review

Throughout the design process for each structural component, the potential routes to the site and material availability will be evaluated to ensure compatibility with the project. Compatibility with the project entails materials and members being able to access the project or to be assembled on site with relative ease. Materials and members will be reviewed throughout the design process to ensure that they meet code and applicable standard specification requirements.

Deliverables: N/A

Effort Required to Complete: 12 hours

Responsible Team Member: Bernard Olewski

4.6 General Hydraulic Analysis

4.6.1 Bridge Hydraulic Design

Bridge hydraulic design will focus on the development of an existing and proposed hydraulic model, which will be used to set the hydraulic design conditions for the bridge, including span and low cord height. The tasks required to develop a bridge hydraulic design are detailed below.

4.6.1.1 Determine Design Requirements

The hydraulics team will determine design requirements by conducting a literature review utilizing WSDOT Bridge Design Manual and AASHTO Evaluating Scour at Bridges. Both documents will set the conditions and standards of the bridge model including the use of equations for scour.

Deliverables: Design Requirements Report

Effort to Complete: 40 hours

Responsible Team Member: Lindsey Evers

4.6.1.2 Hydrologic Analysis for Design Flows

After all pertinent design requirements have been collected a hydrologic analysis of design flows will be conducted by the hydraulics team using the City of Spokane FEMA Flood Insurance Study (FIS) and a flood frequency analysis of historic gage data on the Spokane River. Since the City of Spokane FEMA FIS was completed nearly 40 years ago (1982), the hydraulics team will check the FEMA FIS flow values for reasonableness under current flow conditions. To accomplish this, the hydraulics team will complete a flood frequency analysis of reach flow data at a stream gage

on the upstream end of the project reach and determine current peak flows in the Spokane River. The design peak flow values will then be determined based on a comparison of the 1982 FEMA FIS peak flows and the updated flows from the gage. The final selected peak flows will be used by the hydraulics team to create the existing and proposed conditions models and set the conditions for the bridge low cord height that will be used by the structural team as a design condition.

Deliverables: Design Flows

Effort to Complete: 24 hours

Responsible Team Member: Lindsey Evers

4.6.1.3 Selection of Hydraulic Model

The hydraulics team will select a hydraulic model to develop existing and proposed hydraulic conditions for the project. The model will include all design flows, design requirements, and utilize current conditions to determine the success of the potential bridge design. The model options that will be evaluated are AutoCAD MEP, Revit MEP, and HEC-RAS. The options will be evaluated on ease of use, accuracy, and cost.

Deliverables: Hydraulic Model Selected

Effort to Complete: 2 hours

Responsible Team Member: Lindsey Evers

4.6.1.4 Existing Conditions Hydraulic Analysis

Upon determining the design model and after completion of the hydrologic analysis, an existing conditions hydraulic model of the river will be developed by the hydraulics team. The purpose of the existing conditions model is to accurately represent the current hydraulic conditions of the Spokane River. The model will also be used to build a proposed bridge design that will be analyzed against the current conditions model and design standards for alterations in river geometry and flow levels. The existing conditions model will be built through the collection of data pertaining to the current river and bridge geometry. Cross-sections will be modeled using existing data of the riverbed provided by Spokane county and LIDAR data. Manning's roughness coefficients will be estimated by the team based on FEMA values used and observations of current roughness features in the river. The team will then calibrate the model using the roughness coefficient, river channel geometry features, and FEMA derived historic flow patterns.

Deliverables: Existing Conditions Model calibrated to FEMA Standards

Effort to Complete: 80 hours

Responsible Team Member: Lindsey Evers

4.6.1.5 Proposed Bridge Alternative Selection & Hydraulic Analysis

Upon completion of the existing conditions model of the project site, the hydraulics team will coordinate with the transportation team to determine where the bridge will be located. Based on the location of the bridge and the existing conditions model, preliminary bridge constraints including low chord height and span length will be determined. The team will also compare the water surface profile change to FEMA standards to determine if there is no-rise in water surface elevations. The low chord elevation and span will be communicated to the structures team for use in their design of the bridge deck. The hydraulics team will also communicate the required low chord elevation to the transportation team to ensure that the proposed trail alignment does not bring the bridge profile across the river below the required low chord elevation. If adjustments need to be made to the bridge geometry based on the structural team's calculations, the model will be adjusted until all design requirements are met.

Deliverables: Proposed Conditions Model

Effort to Complete: 50 hours

Responsible Team Member: Lindsey Evers

4.6.1.6 Stability Assessment

The hydraulics team will analyze a geotechnical investigation to gather sediment information and to determine the location of bedrock. The hydraulics team will then run the proposed conditions model to check for channel stability, channel bed degradation, channel widening, and lateral migrations. The effect of any channel instability can undermine the foundation of the bridge and will therefore be analyzed. If instability is expected to be a problem, the hydraulics team will select and design appropriate countermeasures to protect the bridge foundations.

Deliverables: Bridge Stability Assessment

Effort to Complete: 20 hours

Responsible Team Member: Lindsey Evers

4.6.1.7 Scour Literature Review and Assessment

The hydraulics team will conduct a scour analysis on bridge piers and abutment foundations using the selected hydraulic model and scour prediction methods described in the FHWA HEC-18 scour manual. The conditions for scour will be determined from hydraulic model output and used to analyze the degradation potential, lateral migration potential, abutment scour, and contraction scour of the proposed bridge foundations. In the case that the bridge has a pier, pier scour will also be researched using the proposed model and literature standards. If scour is an issue, scour countermeasures will be selected and designed as discussed in the hydraulics alternatives analysis in Section 4.3.2.

Deliverables: Bridge Scour Assessment and Scour Countermeasure Design (TBD Scour Countermeasures)

Effort to Complete: 50 hours

Responsible Team Member: Lindsey Evers

4.6.2 Stormwater Drainage Design

Stormwater drainage design will focus on the development of stormwater swales and pipes that will be used to reduce the impact of trail development on the region. The tasks required for stormwater drainage design is listed below.

4.6.2.1 Determine Design Requirements

The hydraulics team will determine design requirements by conducting a literature review utilizing WAC Hydraulic Code Rules, WAC Chapter 51-56 Uniform Plumbing Code, Spokane Regional Stormwater Manual, Stormwater Management for Eastern WA, and the City of Spokane Stormwater Management Program. These documents will set the conditions and standards for the stormwater pipe design.

Deliverables: Design Requirements Report

Effort to Complete: 10 hours

Responsible Team Member: Joseph Fountaine

4.6.2.2 Hydrologic Analysis for Design Flows

Upon completing a determination of design requirements, the hydraulics team will delineate watershed drainage to the trail vicinity and will conduct a hydrologic analysis of pre-developed drainage conditions using the rational method. The proposed drainage and flow conditions will also be analyzed using the rational method.

Deliverables: Design Flows

Effort to Complete: 20 hours

Responsible Team Member: Joseph Fountaine

4.6.2.3 Stormwater Swale and Pipe Design

The hydraulics team, working with the transportation team, will use design flows and Manning's equation to size and locate stormwater swales and pipes along the proposed trail alignment. The goal of the design of swales and pipes is to retain natural drainage patterns within the region and to limit the effect of stormwater on the trail, downstream infrastructure, and to prevent pollution of the Spokane River and Aquifer by treating water in place.

Deliverables: Swale and Pipe Design

Effort to Complete: 20 hours

Responsible Team Member: Joseph Fountaine

4.7 General Transportation Analysis

4.7.1 Create Surfaces from Lidar Data

The transportation team will utilize the lidar data provided by the Washington Department of Natural Resources to create a surface of the project area in Civil 3D. This surface will act as the base map throughout the project.

Deliverables: Civil 3D Surface

Effort Required to Complete: 12 hours

Responsible Team Member: Madelyn Cayton

4.7.2 Determine Preliminary Match Points

The transportation team will approximate match points connecting to either end of the new trail section based on the surface created in Civil 3D with the lidar data provided by the Washington Department of Natural Resources.

Deliverables: Match Points Exhibit

Effort Required to Complete: 12 hours

Responsible Team Member: Oliver Crawford

4.7.3 Preliminary Horizontal Alignment

The transportation team members will utilize the surface created in Civil 3D to draft a preliminary horizontal alignment. This alignment will be drafted by GTA based on the topography, extent of ROW, and cut/fill limits of the project area and the guidelines found in the transportation codes and regulations listed in Section 4.1.1 for minimum curve length and radius. The transportation team will consider multiple horizontal alignments for construction cost and feasibility, and compare them using a weighted decision matrix.

Deliverables: Horizontal Alignment Exhibit/s

Effort Required to Complete: 36 hours

Responsible Team Member: Madelyn Cayton

4.7.4 Preliminary Vertical Alignment

The transportation team members will cut profiles along the preliminary horizontal alignment to evaluate the slope of the trail. The maximum grade for the trail will be based on the codes and regulations mentioned in Section 4.1.1 to ensure trail safety. The team will evaluate potential vertical alignments based on construction cost estimates and the design criteria specified by the City of Spokane using a weighted decision matrix.

Deliverables: Vertical Alignment Profile Exhibit, Evaluated Alignments

Effort Required to Complete: 40 hours

Responsible Team Member: Oliver Crawford

4.7.5 Design Typical Cross-Sections

Prioritizing cost and the requirements detailed by the City of Spokane (TBD), cross-sections along the preliminary horizontal and vertical alignments will be created and modeled along the corridor by the transportation team using Civil 3D. If a conflict arises with the preliminary horizontal/vertical alignment designs and the cross-section, the alignments will be reworked to ensure compatibility with the cross-section.

Deliverables: Typical Section Exhibit

Effort Required to Complete: 24 hours

Responsible Team Member: Madelyn Cayton

4.7.6 Preliminary Pavement Design

As a part of the typical cross-section design, the transportation team will draft a preliminary pavement design based on the typical section standard drawings provided by the City of Spokane.

Deliverables: Pavement Design Exhibit

Effort Required to Complete: 8 hours

Responsible Team Member: Madelyn Cayton

4.7.7 Bridge Connection

After the transportation team determines the range of accessible locations for the bridge, the structures team will be responsible for providing the transportation team with the bridge deck elevation and the hydraulics team will check the hydraulics at the location. The transportation team will calculate the distance needed to maintain an acceptable grade along with the vertical profile to the point of connection with the bridge. This distance, along with the hydraulic conditions, will dictate the location of the bridge. These two variables will be used to design the connection of the bridge to the preliminary alignments. The horizontal and vertical alignment may have to be altered to ensure grade requirements are met.

Deliverables: Bridge Connection Exhibit

Effort Required to Complete: 20 hours

Responsible Team Member: Madelyn Cayton

4.7.8 Use As-Builts to Design Connection into Existing Sidewalk

We assume that the existing as-builts and project plans will be provided by the City of Spokane for the project area. These will be used by the transportation team in conjunction with the preliminary horizontal and vertical alignments, typical cross-sections, and pavement design to design the connections between the existing sidewalks on either end of the alignment.

Deliverables: Existing Sidewalk Connection Exhibit

Effort Required to Complete: 20 hours

Responsible Team Member: Oliver Crawford

4.7.9 Calculate Earthwork

The transportation team will use Civil 3D to calculate the amount of cut/fill required by the proposed trail alignment. The preliminary horizontal/vertical alignments and the typical cross-section will be used to determine the amount of earthwork needed.

Deliverables: Earthwork Exhibit

Effort Required to Complete: 8 hours

Responsible Team Member: Oliver Crawford

4.7.10 Identify Drainage Issues & Culvert Locations

The transportation team will work alongside the hydraulics team to determine the locations along the corridor that require additional drainage swales and culverts. The hydraulics team will be responsible for the design of these stormwater swales and pipes (See Section 4.6.2).

Deliverables: Drainage Exhibit

Effort Required to Complete:10 hours

Responsible Team Member: Madelyn Cayton

4.7.11 Evaluate Erosion

The effects of erosion along the trail/hillside will be evaluated by the transportation team using the codes mentioned in Section 4.1.1. The hillside will be evaluated to determine if the slope is stable to ensure it will not erode onto the trail or wash out the trail using slope stability calculations. Additionally, it will be determined if the trail will require cleaning/clearing of debris regularly.

Deliverables: Erosion and Sediment Control Plan

Effort Required to Complete: 7 hours

Responsible Team Member: Oliver Crawford

4.7.12 Evaluate Environmental Impacts

The transportation team will research the environmental impacts of the trail alignment (noise, cultural, water, air pollution) within the project area using the codes mentioned in Section 4.1.1 and scholarly journal articles. The applicable environmental impacts will be calculated based on the amount of proposed pavement included with the trail alignment. These impacts will then be discussed with the client, and detrimental impacts will be minimized wherever possible.

Deliverables: Environmental Impact Report

Effort Required to Complete: 10 hours

Responsible Team Member: Oliver Crawford

4.7.13 Finalize Alignment

After evaluating the preliminary alignments and cross-sections for cost, erosion, environmental impacts, and feasibility of construction, the transportation team will work with the City of Spokane to finalize the alignments along the corridor and create sheet sets detailing the corridor.

Deliverables: Sheet Set Package (Title Sheet, Profile Plan Sheets, Plan Sheets, Alignment Sheets, Typical Section Sheets, Details Sheets)

Effort Required to Complete: 42 hours

Responsible Team Member: Oliver Crawford

4.7.14 Signing Along Corridor

To ensure the corridor is properly signed, the transportation team will work with the City of Spokane to determine the signage needed along the trail. This task will also include locating each sign along the trail and determining the proper sign support. Signage may include but is not limited to recreational and cultural interest area signs, regulatory signs, and warning signs.

Deliverables: Signing Sheet Set/Signing Exhibit

Effort Required to Complete: 14 hours

Responsible Team Member: Madelyn Cayton

4.8 Construction Cost Estimate

4.8.1 Structural Construction Cost Estimate

The structures team will complete a construction cost estimate upon completion of the design. The construction cost estimate will include the demolition of the existing bridge (if applicable), pre-construction site development, material costs, heavy machinery costs, and manual labor costs.

4.8.2 Hydraulic Construction Cost Estimate

The hydraulics team cost estimate will include the cost and construction of scour countermeasures for the project. Scour countermeasure quantities will be compared to Unit Bid Analyses provided by WSDOT and other sources to calculate the approximate cost of materials and labor to implement the countermeasures on site.

4.8.3 Transportation Construction Cost Estimate

After the completion of the design process, the transportation team will calculate the quantities of the materials used within the design, including pavement quantities, required cut/fill costs, retaining walls, and railings. These quantities will be compared to the Unit Bid Analysis provided by WSDOT, and other sources to calculate the approximate cost of materials and labor to complete the trail.

4.9 Plans & Specifications

4.9.1 Structural Plans & Specifications

The designs developed for the bridge throughout the project by the structures team will be drafted and compiled into a preliminary plan set, included as an appendix to the final report. The structural plans for the bridge will include various sections for the deck, superstructure, foundations, and abutments.

4.9.2 Hydraulic Plans & Specifications

The hydraulics team has no independent plans and specifications. Bridge hydraulic specifications that were used to determine low cord height and the width of the bridge will be found in the structural plans and specifications. The design of stormwater pipes and swales will be included in

the transportation plans and specifications for the trail alignment. The hydraulics team will aid in the development of these plans and specs where appropriate.

4.9.3 Transportation Plans & Specifications

The designs and deliverables drafted throughout the project by the transportation team will be compiled into a Plan Sheet Set to be submitted after the project has been completed, following the City of Spokane Specifications. These plans will include the horizontal and vertical alignment with a connection to the bridge and the existing sidewalks at either end of the project area, pavement design and typical cross-sections, drainage plans, and signing plans.

4.10 Project Sustainability Evaluation

4.10.1 Structural Sustainability Evaluation

The structural team will utilize codes and research to develop an understanding of the environmental impacts of each material that could be used for the design of the bridge. Then, each material will be compared side by side to determine which material is the most sustainable. The team will analyze the three branches of sustainability: economic, social, and environmental impacts, which will help with the feasible design. Each branch of sustainability will be considered in the bridge and trail designs to reduce the overall environmental impacts. Overall, the environmental impact analysis will allow the team to ensure that the structure will not affect wildlife, will reduce total emissions, and will create a feasible bridge that can bring the community together.

4.10.2 Hydraulic Sustainability Evaluation

The hydraulics team will utilize FEMA standards to evaluate the sustainability of the bridge. FEMA standards dictate that the water level height must not be raised by the addition of a bridge. The bridge design must also cause no impact on floodway and floodplain width. These standards will be calibrated into the proposed conditions model and the bridge design will be altered until FEMA standards have been met. The use and design of stormwater swales and pipes will be determined as a part of the transportation sustainability evaluation.

4.10.3 Transportation Sustainability Evaluation

Throughout the design of this connection on the Centennial Trail, the transportation team will study the environmental impact to decide on an alignment to mitigate the environmental impact to the maximum extent practicable. The cost of each alternative will be analyzed to reduce the

construction costs for the trail. The goal of this project is to provide a safe and accessible trail for members of the Spokane community, improving social sustainability in the project area. This increase in accessibility throughout the project area will also benefit the areas surrounding the project area because users will not have to rely on a car to access the communities along the Centennial Trail. The sustainability due to the completion of this gap of the Centennial Trail will be studied throughout the project, to determine the impact on the Spokane community.

5.0 Project Management

Full-time Project Management tasks will be coordinated by Joseph Fountaine, and he will assume all management tasks by applying the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements.

5.1 Schedule of Design Work

The design teams at Gonzaga Trail Association have determined the following schedule to apply to the project (an enlarged version can be found in Appendix B):

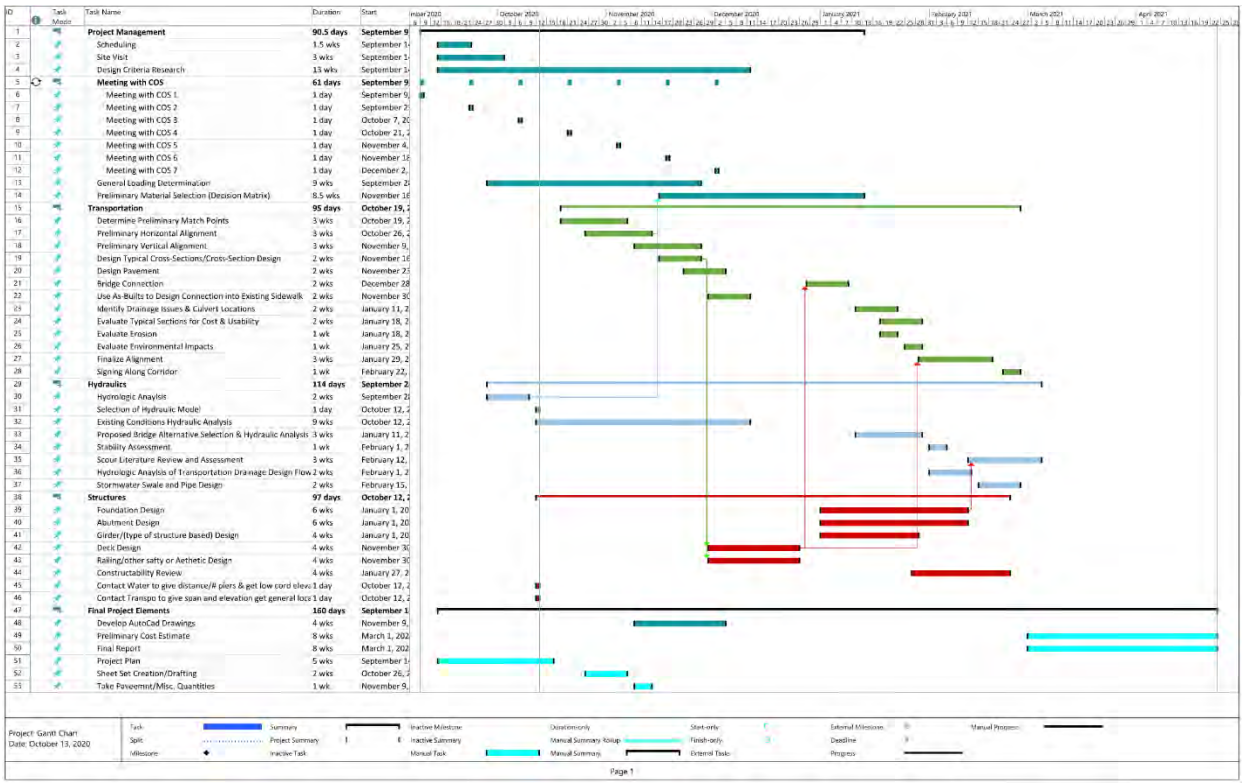

Fig. 3 Schedule of design work

5.2 Project Budget

The design budget, broken up by team, can be seen in Tables 1-3 below. The overall design budget is compiled in Table 4.

Table 1: Hydraulics Design Budget

Hydraulics Design Team Tasks	Lindsey Evers (Project Engineer)	Joseph Fountaine (Project Engineer)
Determine Design Requirements	20	20
Hydrologic Analysis	12	12
Selection of Hydraulic Model	1	1
Existing Conditions Hydraulic Analysis	50	30
Proposed Bridge Alternative Selection & Hydraulic Analysis	35	15
Stability Assessment	10	10
Scour Literature Review and Assessment	25	25
Hydrologic Analysis of Transportation Drainage Design Flows	5	15
Stormwater Swale and Pipe Design	8	12
Project Management (including meetings)	70	100
Site Visit	3	3
Rate ($/hr)	100	100
Total	**239**	**243**
Design Fee	**23,900**	**24,300**

Table 2: Transportation Design Budget

Transportation Design Team Tasks	Madelyn Cayton (Project Engineer)	Oliver Crawford (Project Engineer)
Project Plan	40	40
Create Surfaces from Lidar Data	6	6
Site Visit	2	2
Research Design Manuals & Requirements	2	2
Determine Design Parameters	4	4
Determine Preliminary Match Points	2	2
Preliminary Horizontal Alignment	18	18
Preliminary Vertical Alignment	20	20
Design Typical Cross-Sections/Cross-Section Design	12	12
Design Pavement	4	4
Bridge Connection	10	10
Use As-Builts to Design Connection into Existing Sidewalk	10	10
Identify Drainage Issues & Culvert Locations	10	2
Evaluate Typical Sections for Cost & Usability	10	2
Evaluate Erosion	2	7
Evaluate Environmental Impacts	2	10
Finalize Alignment	21	21
Signing Along Corridor	7	7
Sheet Set Creation/Drafting	14	14
Take Pavement/Misc Quantities	12	12
Bid Item List/Unit Cost Analysis	6	6
Compile Cost Estimate	10	10
Final Report	24	24
Total Hours	248	245
Rate ($/hr)	**100**	**100**
Design Fee	**24,800**	**24,500**

Table 3: Structures Design Budget

Structural Design Team Tasks	Engineer	Maxwell Duke	Suhib Hammad	Bernard Olewski
Overhead: (each person, COS meeting only Soup)	(hours)			
Project Plan (including meetings)	70			
Design Criteria Research	40			
Site Visit	3			
Meet with COS	10			
Literature Review	10			
	Sub Total	**123**	**133**	**123**
Foundation Design		25	15	20
Girder/(type of structure based) Design		20	10	15
Deck Design		10	20	15
Railing/other safety or Aesthetic Design		5	5	5
Constructability Review		4	4	4
Develop AutoCad Drawings		15	15	15
Final Report		30	30	30
TOTAL (including overhead)		232	232	227
	Design Rate ($100/hr)	**23,200**	**23,200**	**22,700**

Table 4: Team Design Budget

Team Budget Summary			
Team Member	**Hours**	**Rate ($/hr)**	**Design Fee/Engineer**
Madelyn Cayton	248	100	$ 24,800.00
Olliver Crawford	245	100	$ 24,500.00

Maxwell Duke	247	93.93	$ 23,200.00
Lindsey Evers	239	100	$ 23,900.00
Joseph Fountaine	243	100	$ 24,300.00
Suhib Hammad	257	100	$ 23,200.00
Bernard Olewski	247	100	$ 22,700.00
	Total Hours		**Total Design Cost**
	1726		**$ 166,600.00**

The total design budget for all work to be completed by GTA sums to $166,600.00.

5.3 Project Meetings & Communication

This project will require the team to provide documentation of the existing conditions as well as a proposed design solution for the Centennial Trail access and bridge over the Spokane River.

Communication Goals: The team will provide regular updates to the advisors weekly and keep all stakeholders informed of the project timeline, budget, and needs. Communication goals throughout the project includes establishing patterns and preferred modes of communication for all members. Student team members will use a cellular group chat method. Students and advisors will use Microsoft Teams and email when needed. Suhib will act as the primary contact to the Colin Quinn-Hurst at the City of Spokane. An organized chart outlining this information can be found below in Table 5.

Stakeholder Information:

Table 5: Team Contact Information

Stakeholder:	Contact:	Role & Title:	Frequency:	Channel:	Notes:
Dr. Sue Niezgoda	509-313-3642 niezgoda@gonzaga.edu	Advisor to Hydraulics Design Team	Weekly, As needed	Email	
Emily Sackmann	509-328-2994 emily.sackmann@coffman.com	Advisor to Structural Design Team	Weekly, As needed	Email	
Dr. Rhonda Young	509-313-5754 youngr1@gonzaga.edu	Advisor to Transportation Design Team	Weekly, As needed	Email	
Stu Barton	Stuart.Barton@jacobs.com	Mentor, and Advisor	Weekly, As needed	Email	Considered an advisor so make sure to include when deliverables are due to advisors.
Colin Quinn-Hurst	cquinnhurst@spokanecity.org	Client; City of Spokane	Twice a month, As needed	Email	Suhib Hammad will be the link to communicating with Colin.

Toni Boggan	509-313-3913 boggan@gonzaga.edu	CEDE Academic Director	As needed	Email	
Megan Weed	509-313-5751 weed@gonzaga.edu	CEDE Program Assistant	As needed	Email	
Dr. Juliane Mora	mora@gonzaga.edu	Communication Studies Professor	As needed	Email	Contact Dr. Mora to set-up time to discuss project presentations/ get feedback.

Team Information:

Table 4: Team Member Roles

Role:	Member:	Rotation:	Tasks:
Project Manager	Joseph Fountaine	Permanent Role	Coordinate meeting times, send out agenda, lead meetings, send post-meeting follow-up with tasks.
Communication with Client Lead	Suhib Hammad	Permanent Role	Communicates with client, takes notes during meetings, works closely with Project Manager to keep documents updated
Hydraulics Design Team Lead	Lindsey Evers	Permanent Role	Coordinate tasks to Hydraulics Design Team, stay in close communication with Project Manager to ensure communication between groups is efficient when needed
Structural Design Team Lead	Maxwell Duke, Bernard Olewski, Suhib Hammad	Monthly	Coordinate tasks to Structural Design Team, stay in close communication with Project Manager to ensure communication between groups is efficient when needed
Transportation Design Team Lead	Oliver Crawford, Madelyn Cayton	Monthly	Coordinate tasks to Transportation Design Team, stay in close communication with Project Manager to ensure communication between groups is efficient when needed

Communication Plan:

Table 5: Communication Plan

Type of Communication:	Audience:	Goals:	Frequency:	Method:	Responsibility:
Students Team Meeting	Student team members who can attend	Weekly progress on tasks, ensure readiness for Team and Advisor Meeting	Weekly, As needed	Zoom	Entire Team
Team and Advisor Meeting	Entire Team with Advisors	Review status, manage tasks, address issues, come with questions for discussion	Weekly	In-person and/or Zoom	Entire Team
Project Review	Team + Advisor + Client	Present project deliverables, gather feedback, and discuss next steps	At milestones	In-person and/or Zoom	Entire Team
Communicating with Client	Client	Show progress, communicate needs from client and team alike	As needed, at milestones	Email	Suhib Hammad
Update Presentations	Advisor, DAB, technical & general audience	Present on progress and get feedback	First: 10/21 Second: 12/9 Third: 2/24 Fourth: 4/28	First = 4-min. Video + Q&A Second = Team Presentation Third = 7-min. Video + Q&A Fourth = Team Presentation	Entire Team

There will be various types of meetings occurring dependent on the specific purposes, including discussions on milestones and project clarification. Following are the type of meetings, with details about what will be required to be communicated and shared.

Weekly Check-in meetings – Wednesdays: These meetings will be held weekly in-person or via Zoom with the advisors and student team members to go over progress, ask questions, gather feedback, share updates on work completed. The team will share the following: what has been completed, what needs to be completed this week, any deliverables needing consensus or approval, updates to be sent to stakeholders, timeline and budget.

Student Team Members meetings – Mondays/Tuesdays: These team meetings will be held weekly and as needed to go over progress, ask questions, gather feedback, share updates on work completed, and to ensure the team is prepared on what to present on at our weekly check-in meetings. The team will share what has been completed and what needs to be completed before the weekly check-meeting, including ensuring that deliverables are completed and have been approved by the entire team.

Communicating with Client – As needed/Twice monthly: Communication with the client will occur over email with one student, Suhib Hammad, to ensure effective and clear communication to the client. The team will share what has been completed, what needs to be completed this week, any deliverables needing consensus or approval, and any information or data needed from the client.

Update Presentations – As needed: This type of meeting will be a presentation to our peers and our DAB which require us to create videos to share on our progress as a team and receive feedback. Half of the presentations will be presented live and require the team to share the following: project progress, next steps, any information pertinent to advisors and DAB for them to understand our progress and receive feedback to better our project and answer questions to better our own and others understanding.

Major Milestone meetings -- Wednesdays (interchangeable with Weekly Check-in meetings if deliverable is due): These meetings will be set-up in advance for delivery of major project milestones deliverables, these meetings are similar to weekly meetings and can happen in place of the weekly meetings.

5.4 Project Data

Project management data includes project budgeting and hours. The design team will track their hours in EduSourced and provide documentation on actual hours spent on the project along with the difference from our estimated budget found in Tables 1 through 3.

5.5 Project Quality Assurance & Quality Control

Project quality assurance and quality control (QA/QC) will be coordinated by the Project Manager to be performed by other team members and the individual discipline advisors. To ensure material needs and other standards are met, standard specifications will be referenced and implemented using the codes and regulations highlighted in Section 4.1 of this project plan. Throughout the project the team will use the advisors for feedback. With this project plan multiple drafts were submitted for review; this will continue to be the case for other deliverables and reports due throughout the project.

6.0 Project Team

Gonzaga Trail Association (GTA) is a small consulting firm located in Spokane, Washington. It was founded in 2020 by seven 4th year students studying engineering at Gonzaga University. GTA's goal is to develop and improve access to the shared-use trails of the Pacific Northwest. GTA prides itself on high quality design solutions offered by our team of hydraulic, structures and transportation engineers. Figure 3 shows the management structure at GTA, followed by each team member's resumes. An enlarged view of Figure 3 has been provided in Appendix A.

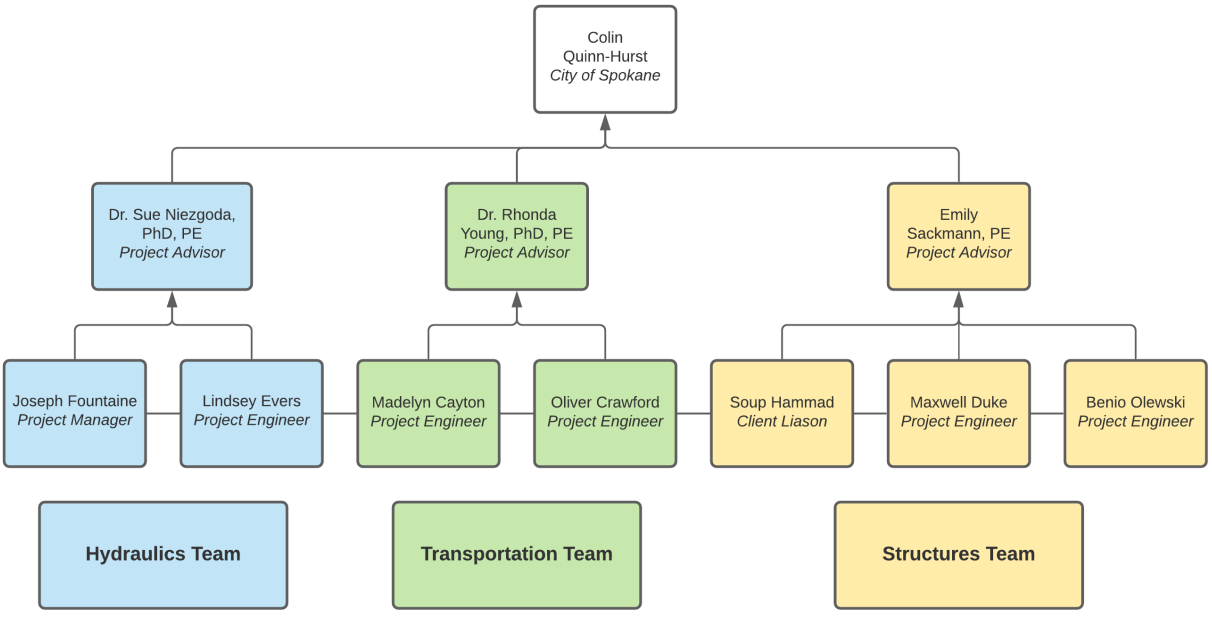

Fig. 4 Project Team Organization Chart

Maxwell Duke

Structures - Project Engineer
MDuke@zagmail.gonzaga.edu

Bachelor of Science in Civil Engineering - May 2021

Maxwell Duke is a student member of ASCE and SEI. In his time at Gonzaga University he has served as both a physics TA and a volunteer student researcher investigating the evolution of wind loading on tall buildings. Max has spent the last two summers working for Budinger and Associates and Quanta Subsurface gaining experience in the field of geotechnical and structural engineering. Most recently he has been working as a structural intern using concrete and steel design while learning foundation modeling software used to design and model deep foundations for power distribution and transmission structures.

Relevant Course Work: Structure Analysis, Mechanics of Materials, Concrete, Steel, Foundations, Soils, Structural Dynamics, and Finite Elements

Experience: Budinger and Associates (Spokane WA)
Geotech Laboratory Assistant (May 2019 – August 2019)

- Performed Geotechnical laboratory soil testing
- Worked in conjunction with laboratory and field technicians to perform testing in accordance with ASTM and AASHTO specifications.

Quanta Subsurface (Spokane Valley WA)
Structural Engineering Intern (May 2020 – current)

- Preparation of preliminary building and foundation designs for project bidding
- Perform calculations for various building and foundation components
- Review of calculations and drawings to ensure they meet specifications
- Analyzed alternative design solutions as a part of VE (value engineering) studies.
- Use analytical design software for deep foundation analysis

Oliver Crawford

Transportation - Project Engineer

ocrawford@zagmail.gonzaga.edu

Bachelor of Science in Civil Engineering - May 2021

Oliver Crawford has spent the last two years working on large transportation projects in the Portland, OR area, and learning about the field of transportation engineering at Gonzaga University. He is the vice president of the ITE student chapter at Gonzaga University and a student member of ASCE. As an intern for HDR, he worked with the roadway group, designing and drafting elements for various roadway widening and ADA projects around the state. Most recently, he interned with WSP supporting the traffic and civil groups with signal design, ADA design, and quantity calculations.

Relevant Coursework: Transportation Engineering, Transportation System Design, Stormwater Management, Civil Engineering Design & Practice, Geomatics, Construction Materials

Experience: WSP USA (Portland, OR)

Civil Engineering Intern (June 2020 - August 2020)

- Created temporary pedestrian accessible route plans/signing plans for an ADA project.
- Drafted traffic signal removal and utility plans.
- Built and updated highway ramp meter detection plans.
- Performed signal/detector conduit, wiring, and trenching calculations.
- Designed ADA curb ramps in Civil 3D.
- Gathered roadway bid item quantities in MicroStation.
- Analyzed unit bid costs and updated project cost estimates.

HDR (Portland, OR)

Roadway Intern (*June 2019 - August 2019)*

- Researched and designed roadway for a highway overpass with reversing curves using InRoads.
- Interpreted as-builts and adjusted survey datums to model an existing sewer pipe onto mainline cross-sections.
- Iteratively designed an ADA curb ramp in MicroStation.
- Built and maintained exhibits and sheet sets.
- Analyzed parking garage data to determine peak traffic congestion times in Excel.
- Created a signing exhibit and database with recommendations for proposed signage alterations.

Madelyn Cayton

Transportation - Project Engineer
mcayton@zagmail.gonzaga.edu

Bachelor of Science in Civil Engineering - May 2021

Madelyn Cayton is the president of the ITE student chapter at Gonzaga University, secretary of Gonzaga's ASCE chapter, and a member of SWE. She works in the Learning Studio at Gonzaga University, tutoring students in various engineering subjects. She has spent one summer interning at the Northwest Region of WSDOT in their Connecting Washington group. There, she gained experience working through the project process from scope drafting to construction. As an intern, she was involved with community engagement, analyzing cost estimates, comparing roadway alternatives, and reviewing plan sets.

Relevant Coursework: Transportation System Design, Transportation Engineering, Stormwater Management, Geomatics, Civil Engineering Design & Practice, Construction Materials

Experience: Washington State Department of Transportation (Shoreline, WA)
Transportation Engineering Intern (June 2019 – August 2019)

- Reviewed roadway plan sheets to see if they met the necessary specifications.
- Evaluated roadway alternatives to see the benefits of each option.
- Engaged with the community about projects that impact their community.
- Reviewed estimates of material costs and work to be completed.
- Compared the scope of projects to the work to be completed by the consultant.
- Utilized Microsoft Access to create a database.

Bernard Olewski

Structures - Project Engineer
bolewski@zagmail.gonzaga.edu

Bachelor of Science in Civil Engineering – May 2021

Bernard Olewski is the treasurer of the ASCE Student Chapter at Gonzaga University, and research assistant under Dr. Ganzerli at Gonzaga University. He has spent the last two summers interning for Graham Contracting Ltd on the SR 520 & Montlake Blvd Project as a Project Engineer. There, he gained experience in project management and the construction process. As an intern he was involved with contract management, construction management, creating working drawings, drafting proposed designs.

Relevant Coursework: Structural Analysis, Structural Dynamics, Concrete Design, Foundation Design, Steel Design, Civil Engineering Design & Practice, Construction Materials, Mechanics of Materials, Soil Mechanics

Experience: Graham Contracting Ltd (Seattle, WA)

Field Engineer (May 2019 – August 2019, May 2020 – August 2020)

- Created AutoCad drawings for proposed designs.
- Monitored weekend closures and various tasks to match plans.
- Maintained a tree inventory log of 300+ trees on the project. Kept track of their existing status as well as replacement trees needing planting by WSDOT requirements.
- Created working drawings and weather protection plans.
- Completed takeoff calculations for drainage structures as well as cut and fill calculations for construction.
- Ordering materials and working with Quality Assurance to bring in Worked with document control to closeout two projects.
- Tracked apprenticeship/journeyman hours to maintain the projected goal.
- Worked with WSDOT to create an MSVWBE tracking spreadsheet to provide MSVWBE subcontractors opportunities to perform work.
- Conducted field visits and pre/during construction inspections.

Lindsey Evers

Hydraulics - Project Engineer
levers@zagmail.gonzaga.edu

Bachelor of Science in Civil Engineering - May 2021

Lindsey Evers is a civil engineering student and a senior leader of Gonzaga's ROTC program. As a senior ROTC Cadet, she writes all orders and specifications for the program and designs field training events for the battalion. She has spent one summer in Fort Benning GA, attending paratrooper training. There, she gained experience working and managing a team of individuals in a high-stress environment. In addition to this Lindsey was selected to intern with the 11th ACR Engineers as a part of CTLT (Cadet Leader Training).

Relevant Coursework: Hydrology and Watersheds, Civil Fluid Mechanics, Hydraulics Engineering, Stormwater Management, Stream Restoration, Civil Engineering Design & Practice

Experience: Airborne Paratrooper Training (Fort Benning, GA)
Paratrooper Candidate (May 2019 – June 2019)

- Learned foundational communication strategies.
- Managed equipment and personnel for a team.

Cadet Battalion Staff (Spokane, WA)
S3 Cadet Staff Officer (May 2020-Present)

- Wrote operational orders.
- Designed, analyzed, and researched multiple courses of action for team projects and exercises.

Suhib Hammad

Structures - Project Engineer
shammad@zagmail.gonzaga.edu

Bachelor of Science in Civil Engineering - May 2021

Suhib Hammad is a student member of ASCE and the Vice president of Gonzaga Men's Club Soccer. While at Gonzaga University, he has served as both a Physics TA and a student researcher under Dr. Ganzerli investigating the optimizations of space trusses. Also, Suhib has done research on concrete properties and the use of it in structures. By working as a construction assistant at Habitat for Humanity, Suhib has advanced his knowledge of how to build aspects of homes as well as his ability to transform the engineers' and architects' designs into the construction of homes.

Relevant Course Work: Structure Analysis, Mechanics of Materials, Concrete, Steel, Foundations, Soils, Structural Dynamics, Civil Engineering Design & Practice, and Construction Materials.

Experience: Habitat For Humanity (Spokane WA)
Construction Assistant (August 2019 – March 2020)

- Lead teams of volunteers by delegating tasks and constructing aspects of a home, such as interior frames, doors, insulation, and basic trusses.
- Obtained a better understanding of the construction and design of homes and structures. Also, learned how to read construction drawings and build homes from them.

Undergraduate Researcher (Spokane WA)
Optimization of Space Trusses

- Researched optimization within the development of structures such as buildings, bridges, and homes
- Applied different methods of optimization to develop a of analysis using the beam truss analogy for a 3D truss

Joseph Fountaine

Project Manager
jfountaine@zagmail.gonzaga.edu

Bachelor of Science in Engineering Management; Civil Engineering Focus - May 2021

Joseph Fountaine is a member of ASEM. He has spent one summer interning at Jviation. There, he gained experience working through the construction project process. As an intern, he was involved with day to day field tasks, including data collection, overseeing QA/QC testing, reviewing product and material submittals, writing reports and other administrative tasks.

Relevant Coursework: Engineering Project Management, Principles of Management, Management Information Systems.

Experience: Jviation Inc. (Denver, CO)

Construction Management Field Intern (June 2020 – August 2020)

- Perform assignments requiring application of standard techniques, procedures, and criteria to carry out project-related tasks.
- Used computer-assisted engineering software and equipment to perform project-related tasks.
- Assist in the coordination of projects from conception through final plan preparations.
- Perform data collection and analysis.
- Responsible for carrying out day-to-day administrative and field work as directed.

7.0 References

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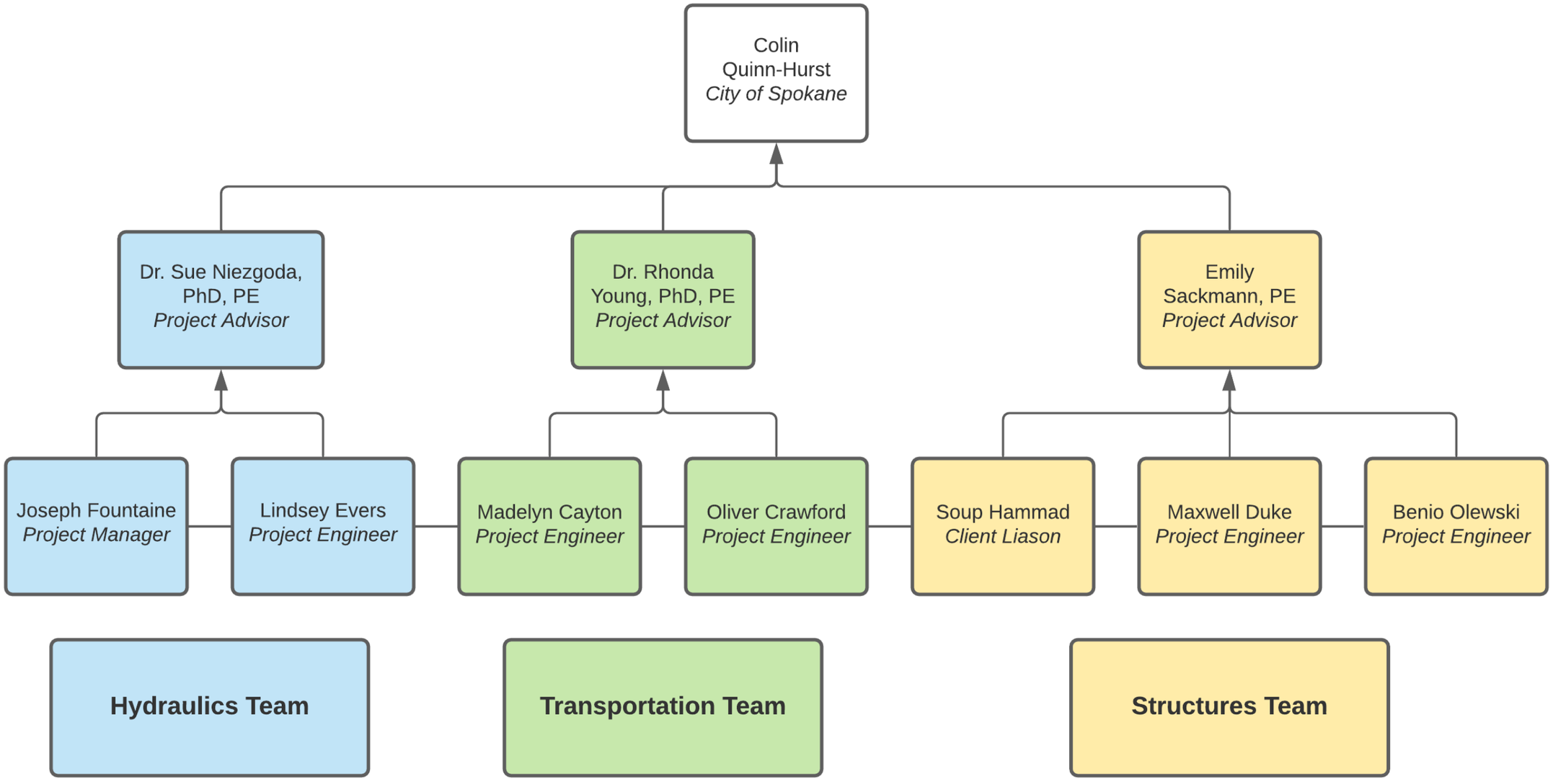
Appendix A: Enlarged Project Team Organization Chart



Appendix B: Enlarged Gantt Chart – Project Schedule

ID	Task Mode	Task Name	Duration	Start
1		**Project Management**	**90.5 days**	**September 9**
2		Scheduling	1.5 wks	September 1
3		Site Visit	3 wks	September 1
4		Design Criteria Research	13 wks	September 1
5		**Meeting with COS**	**61 days**	**September 9**
6		Meeting with COS 1	1 day	September 9,
7		Meeting with COS 2	1 day	September 2
8		Meeting with COS 3	1 day	October 7, 20
9		Meeting with COS 4	1 day	October 21, 2
10		Meeting with COS 5	1 day	November 4,
11		Meeting with COS 6	1 day	November 18
12		Meeting with COS 7	1 day	December 2,
13		General Loading Determination	9 wks	September 2
14		Preliminary Material Selection (Decision Matrix)	8.5 wks	November 16
15		**Transportation**	**95 days**	**October 19, 2**
16		Determine Preliminary Match Points	3 wks	October 19, 2
17		Preliminary Horizontal Alignment	3 wks	October 26, 2
18		Preliminary Vertical Alignment	3 wks	November 9,
19		Design Typical Cross-Sections/Cross-Section Design	2 wks	November 16
20		Design Pavement	2 wks	November 23
21		Bridge Connection	2 wks	December 28
22		Use As-Builts to Design Connection into Existing Sidewalk	2 wks	November 30
23		Identify Drainage Issues & Culvert Locations	2 wks	January 11, 2
24		Evaluate Typical Sections for Cost & Usability	2 wks	January 18, 2
25		Evaluate Erosion	1 wk	January 18, 2
26		Evaluate Environmental Impacts	1 wk	January 25, 2
27		Finalize Alignment	3 wks	January 29, 2
28		Signing Along Corridor	1 wk	February 22,
29		**Hydraulics**	**114 days**	**September 2**
30		Hydrologic Anaylsis	2 wks	September 2
31		Selection of Hydraulic Model	1 day	October 12, 2
32		Existing Conditions Hydraulic Analysis	9 wks	October 12, 2
33		Proposed Bridge Alternative Selection & Hydraulic Analysis	3 wks	January 11, 2
34		Stability Assessment	1 wk	February 1, 2
35		Scour Literature Review and Assessment	3 wks	February 12,
36		Hydrologic Anaylsis of Transportation Drainage Design Flow	2 wks	February 1, 2
37		Stormwater Swale and Pipe Design	2 wks	February 15,
38		**Structures**	**97 days**	**October 12, 2**
39		Foundation Design	6 wks	January 1, 20
40		Abutment Design	6 wks	January 1, 20
41		Girder/(type of structure based) Design	4 wks	January 1, 20
42		Deck Design	4 wks	November 30
43		Railing/other safty or Aethetic Design	4 wks	November 30
44		Constructability Review	4 wks	January 27, 2
45		Contact Water to give distance/# piers & get low cord eleva	1 day	October 12, 2
46		Contact Transpo to give span and elevation get general loca	1 day	October 12, 2
47		**Final Project Elements**	**160 days**	**September 1**
48		Develop AutoCad Drawings	4 wks	November 9,
49		Preliminary Cost Estimate	8 wks	March 1, 202
50		Final Report	8 wks	March 1, 202
51		Project Plan	5 wks	September 1
52		Sheet Set Creation/Drafting	2 wks	October 26, 2
53		Take Paveemnt/Misc. Quantities	1 wk	November 9,

Project: Gantt Chart
Date: October 13, 2020

Task | Summary | Inactive Milestone | Duration-only | Start-only | External Milestone | Manual Progress
Split | Project Summary | Inactive Summary | Manual Summary Rollup | Finish-only | Deadline
Milestone | Inactive Task | Manual Task | Manual Summary | External Tasks | Progress

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