Railroad Safety Trail Alignment Study

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Executive Summary

The Railroad Safety Trail Alignment Study suggests potential alternative alignments to an uncompleted section of the preferred Railroad Safety Trail route. The purpose of this effort is to provide the City of San Luis Obispo with resources to help determine the preferred trail alignment in the event that the City’s originally-planned alignment cannot be achieved. This study is the result of a student-led collaboration with the City of San Luis Obispo to determine potential alternative alignments for the middle section of the Railroad Safety Trail project. The analysis reveals that Alignment 3 via Mill Street and Toro Street is most suitable for the Railroad Safety Trail. This conclusion is based on the route’s elevation change, low levels of traffic, and future plans for integration into the City’s cycling network.
Chapter 1:

Introduction

The Northern Segment of the Railroad Safety Trail in San Luis Obispo, CA
Introduction

An urban area’s transportation network is possibly one of the most vital elements in the continued growth and success of a region. The quality of transportation in and around a city can directly affect community members’ quality of life, the economic productivity of a city, and the environmental health of the surrounding region. Every day, people rely on public transit, bicycle and pedestrian infrastructure, roadways, and other modes of transportation to achieve their daily goals. Without a well-maintained and modern transportation network, it can become difficult for a city to stay attractive and ahead of the curve.

In order to strengthen San Luis Obispo’s transportation network, the City has constantly been investing in access to safe active transportation infrastructure (City of San Luis Obispo, 2016, p. 14). This effort has included projects like the Madonna Inn Bike Path, Bill Roalman Bike Boulevard, and constant work to improve existing streets and intersections for pedestrians and cyclists (City Bike Map, n.d). One of the City’s most anticipated active transportation improvement projects is the completion of the Railroad Safety Trail. Once the intermediate section of this project is finished, community members will then have a dedicated corridor linking the Cal Poly campus with the Mill Street Historic District, Amtrak station, Sinsheimer Park, and neighborhoods in between (City of SLO, 2008, p. 1-1).

Background

The Railroad Safety Trail is currently one of the most utilized bicycle routes in the City of San Luis Obispo. This project was originally conceived as a means to help connect San Luis Obispo’s many neighborhoods with major destinations in the city, provide opportunities for citizens to utilize modes of active transportation, and help reduce the number of bicycle conflicts with motor vehicles (City of SLO, 2008, p. 2-3). Since the project’s plan was adopted in 2001,
several segments of the trail have been constructed and have been successful in achieving the plan’s initial goals. Today, the current path is 1.4 miles long, with an additional 0.7-mile segment connecting Cal Poly to Highway 101 (as seen in Figure 1.1). To unite these two segments and complete the initial route of the trail, a route must be constructed between the Amtrak station and Highway 101. A map of this proposed connection is displayed below in Figure 1.2.

Currently, the City of San Luis Obispo is going forward with plans to construct two bridges in the area surrounding California Blvd. and Highway 101. One bridge would extend the existing Class I bike path on California Blvd. from California and Taft over Highway 101. From there, the trail would continue along the Union Pacific Railroad right-of-way to Pepper and Phillips. There, the trail would connect to the second bike and pedestrian bridge. This bridge would allow community members to access the current dead-end block of Phillips Street by crossing above the railroad track. At Pepper and Phillips, these extensions would meet with all three alternative Railroad Safety Trail alignments.

These three alternative alignments have been chosen based on travel time, local traffic volumes, elevation change, and potential cost. Each route would include a pair of bike lanes, proper signage, appropriate lighting, and improved street and intersection design. The paths split at the intersection of Pepper and Mill and converge at Toro and Phillips. From there, all three would
continue on Toro Street to the Amtrak station. Once implemented, the Railroad Safety Trail would provide a central north-south link through the city for cyclists and pedestrians to use. Each alignment will be covered in detail in Chapter 2.

**Problem**

The design plans for the construction of the Railroad Safety Trail’s Phase II extension, approved in June 2001, have experienced several alterations since its adoption. In particular, the proposed trail alignment between the Amtrak station and Highway 101 has experienced several setbacks due to an extensive permitting process and a lack of approval from the Union Pacific Railroad. The original path would have run adjacent to the railroad from the Amtrak station to the Cal Poly campus. These factors have contributed significantly to this section of the project becoming increasingly unlikely to be built on its original route. Additionally, for many community members living in the vicinity of this route, the current pedestrian and bicycle infrastructure along this route does not provide adequate access to satisfy community needs. To complete the planned extension to Cal Poly, the City has begun exploring different alignments to connect the existing terminus of the railroad trail at the Amtrak station to the Class I bike path on California Boulevard.
Study Purpose

The purpose of this study is to determine the optimal alignment of the Railroad Safety Trail extension between the Amtrak station and Highway 101. As mentioned previously, this section of the project has experienced several adjustments and setbacks since its inception in May 2000. As a result, the City has begun to pursue alternative routes for this section of the proposed trail extension. The alignment of this trail section will be a key component in creating a crosstown link for cyclists and pedestrians between the Cal Poly campus, Mill Street Historic District, downtown San Luis Obispo, Old Town Historic District, the Historic Railroad District, and other nearby points of interest (as seen in Figure 1.4). The trail could potentially serve as a backbone for future biking infrastructure in the city, improving community health and access in the process. To help achieve this vision, I have decided to determine which alignment would be the most optimal for the City to use for this project.

Figure 1.4: Points of Interest Near the Three Potential Alignments
Study Methodology

This study took a step-by-step approach to determine what potential routes would be best suited for the Railroad Safety Trail. The following process was used to help determine the compatibility of each alignment, as well as what steps would need to be taken in order to create an ideal addition to San Luis Obispo’s transportation network.

1. Site analysis of existing alignment corridors
2. Identification of potential conflict areas
3. Find case studies that helped alleviate similar issues and can feasibly be implemented
4. Propose street and intersection design changes needed to accommodate the Railroad Safety Trail.

Definition of Terms

This section presents a definition of key terms used in this document.

Arterial street

A high capacity urban street that serves as a major traffic thoroughfare in an urban area. An example of an arterial street can be seen in Figure 1.5.

Collector street

A medium capacity urban street that serves as a link between arterial and local streets in an urban area. An example of an arterial street can be seen in Figure 1.6.

Figure 1.5: An Arterial Street (Johnson Street) in San Luis Obispo, CA

Figure 1.6: A Collector Street (Monterey Street) in San Luis Obispo, CA.
Local street
A low capacity urban street that is designed to serve adjacent land uses only. An example of a secondary segment can be seen in Figure 1.7.

Class I bike path
Facilities with exclusive right of way for cyclists and pedestrians that are completely separate from roadways (Caltrans, 2017). An example of a Class I bike path can be seen in Figure 1.8.

Class II bike lane
One-way bike lanes established along streets that are defined by pavement striping and signage (Caltrans, 2017). An example of a Class II bike lane can be seen in Figure 1.9.

Class III bike lane
Specifically designated streets that permit bicyclists to share the roadway with auto traffic (Caltrans, 2017). An example of a Class III bike lane can be seen in Figure 1.10.
**Class IV bike lane (cycle track)**
A bike lane that is physically separated from motor traffic with a vertical feature and designed to be used exclusively by cyclists (Caltrans, 2017). An example of a Class IV bike lane can be seen in Figure 1.11.

Figure 1.11: A Class IV Bike Lane in Seattle, WA (Fucoloro, 2013)

**Bulb-out**
An extension of a sidewalk that helps increase pedestrian visibility and shortens the distance needed for a pedestrian to cross a street. An example of a bulb-out can be seen in Figure 1.13.

Figure 1.13: A Bulb-Out at Toro and Pismo Streets in San Luis Obispo, CA

**Bicycle boulevard**
A shared roadway that gives cyclists priority over motor vehicle travel on a local street (City of SLO, 2013, p. 27). An example of a Class IV bike lane can be seen in Figure 1.12.

Figure 1.12: An Example of a Bicycle Boulevard on Morro Street in San Luis Obispo, CA
**Sharrow (shared-lane marking)**

A marking in a travel lane that indicates the presence of a Class III bike lane (Caltrans, 2017). An example of a sharrow can be seen in Figure 1.14.

**Bike boxes**

A designated area on the approach to a signalized intersection that allows cyclists to wait in front of stopped vehicles during a red light, allowing for more visibility (Caltrans, 2017). An example of a bike box can be seen in Figure 1.15.

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Figure 1.14: A Sharrow on Pepper Street in San Luis Obispo, CA.

Figure 1.15: An Example of a Bike Box in Portland, OR (Enwemeka, 2015)
Chapter 2:
Site Documentation

A Segment of Mill Street in San Luis Obispo, CA
Alignment 1: Pepper-Marsh

Route Overview

The route of the Pepper-Marsh Alignment would follow the existing railroad right of way by continuing on Pepper St. to Marsh St. Once the route reaches Marsh St., cyclists would travel west on Marsh towards downtown. At the intersection of Marsh and Johnson, the bike lanes would converge on the northern side of Marsh to form a protected two-way cycle track. This track would continue for one block until the intersection of Marsh and Toro Streets. Here, the trail would turn south onto Toro and continue to the Amtrak station.

Existing Conditions

*Pepper Street*

Pepper St. is a local two-way street with a relatively low amount of vehicle traffic. The land uses present along this stretch include medium and medium-high density residential, commercial-retail, and office. In addition to following the railroad corridor, the street also provides residents access to Mill St, Monterey St, and Marsh St. There is a noticeable amount of landscaping present to minimize the presence of the railroad corridor. Along a majority of the street, there is a noticeable lack of pedestrian infrastructure. In some sections, pedestrians are forced to walk in the street to travel. This segment of Pepper St. is also located on a hill. Despite the presence of a steep incline, a Class III bike lane is located on the street. The speed limit is 25 miles per hour.

Figure 2.1: Pepper Street (Looking Southeast between Palm and Monterey Streets)
Marsh Street
Marsh St. is an arterial street that is both one-way and two-way along this alignment. This street is one of the main arteries for traveling out of downtown San Luis Obispo. The land uses present are limited only to community commercial and office developments. In addition to crossing Pepper St, Marsh St. also intersects with Johnson Ave. and Toro St. along this alignment. East of Johnson, Marsh St. contains a set of Class II bike lanes. West of the intersection, only one Class II lane is present. The speed limit is 25 miles per hour.

Toro Street
Like Pepper St, Toro St. is a local two-way street with little vehicular traffic. This block, located behind the aforementioned shopping center, consist of medium density residential, community commercial, and office land uses. The presence of a community garden and San Luis Obispo Creek provide a noticeable amount of landscaping. This section of Toro St. has also been included as a part of a future “bike boulevard” by the City of San Luis Obispo. To prepare for this future project, a Class III bike lane has been implemented along this street. Additionally, the intersection of Toro St. and Pismo St. has been reworked to become more accessible for cyclists and pedestrians. The speed limit is 25 miles per hour.

Challenges

Establishing a two-way bike lane on Marsh Street
One of the biggest drawbacks to the feasibility of this route is that a two-way bike lane would need to be installed on Marsh St. A block of the route that runs on Marsh St. is a one-way street. To minimize conflicts between cyclists and vehicles, a two-way protected cycle track will need to be installed on the northern side of Marsh St. Requiring cyclists to travel against the flow of traffic could discourage the use of this path.

Existing Intersection Improvements (Pepper and Monterey / Marsh Street)
The intersections of Pepper and Mill, Pepper and Monterey, Pepper and Marsh, Marsh and Johnson, and Marsh and Toro would all need to be improved to help increase the safety of cyclists and reduce the amount of conflict with other modes of transportation.
Railroad Right-of-Way

The presence of the railroad corridor may require the addition of more security fencing to prevent trespassing. Additionally, the Union Pacific Railroad might deter the implementation of the project because of the project’s proximity to the railroad right-of-way.

Parking

Existing street parking would likely need to be reduced in order to accommodate a set of Class I, II, or IV bike lanes. This challenge applies to the entirety of the corridor.

Lighting

The current street light configurations on Pepper and Toro Streets do not meet City standards (one street light every 200-250 feet) and will need to be reworked to provide a safer nighttime riding environment for trail users.

Opportunities

Low Traffic Volume on Pepper

Currently, the amount of daily vehicle traffic on Pepper Street is relatively low. This level of traffic can help contribute to a safe environment for bike travel.

Proximity to Destinations

This alignment would provide riders with increased access to the Monterey Street commercial district and the shopping center at Marsh Street and Johnson Avenue.
Alignment Statistics

Table 2.1 summarizes pertinent information on the physical, operational, and usage characteristics of Alignment 1.

Table 2.1: Alignment 1 Statistics

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<table>
<thead>
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<tr>
<td><strong>Alignment Length</strong></td>
<td>0.6 miles</td>
</tr>
<tr>
<td><strong>Estimated Travel Time</strong></td>
<td>8 minutes northbound (uphill)</td>
</tr>
<tr>
<td></td>
<td>5 minutes southbound (downhill)</td>
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<td><strong>Elevation Change</strong></td>
<td>47.5 feet</td>
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<td><strong>Vehicle Counts</strong></td>
<td></td>
</tr>
<tr>
<td>(City Traffic Counts, n.d.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pepper: data not available</td>
</tr>
<tr>
<td></td>
<td>• Marsh:</td>
</tr>
<tr>
<td></td>
<td>o East of Johnson: 2,427 vehicles/day</td>
</tr>
<tr>
<td></td>
<td>o West of Johnson: 5,805 vehicles/day</td>
</tr>
<tr>
<td></td>
<td>• Toro: data not available</td>
</tr>
<tr>
<td><strong>Bike and Pedestrian Counts</strong></td>
<td></td>
</tr>
<tr>
<td>(City Traffic Counts, n.d.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pepper: data not available</td>
</tr>
<tr>
<td></td>
<td>• Marsh:</td>
</tr>
<tr>
<td></td>
<td>o East of Johnson: 305 pedestrians/day, 169 bikes/day</td>
</tr>
<tr>
<td></td>
<td>o West of Johnson: 570 pedestrians/day, 114 bikes/day</td>
</tr>
<tr>
<td></td>
<td>• Toro: data not available</td>
</tr>
<tr>
<td><strong>Calculated Bicycle Level of Service (LOS)</strong></td>
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</table>
**Alignment 2: Johnson-Pismo**

**Route Overview**

The Johnson-Pismo Alignment would start on Pepper St. After one block, the trail would continue west on Mill St. for another block. Once reaching Johnson Ave, cyclists would then turn left and continue south on Johnson. After passing the shopping center and San Luis Obispo Creek, trail users would then turn right onto Pismo St. From there, the route would stay on Pismo for one block. At the intersection of Toro St. and Pismo St, cyclists would continue to the Amtrak station by turning south onto Toro.

**Existing Conditions**

*Pepper Street*

As mentioned in the summary of Alignment 1, Pepper St. is a local two-way street with a relatively low amount of vehicle traffic. On this block of Pepper St, medium and medium-high density residential land uses are the only classifications present. There is a noticeable amount of landscaping present to minimize the presence of the railroad corridor on the eastern side of the street. There is no development on the eastern side of the street because of the presence of a steep cliff overlooking the tracks. Unlike other sections of Pepper St, there is a well-maintained sidewalk on the western side. The speed limit is 25 miles per hour.

*Mill Street*

Mill St. is classified as a two-way residential collector street by the City of San Luis Obispo. The street is well-known for its numerous lofty trees, as well as its location within the Mill Street Historic District. The buildings along Mill St. are all historic medium density residential buildings from the 20th century. The creation of the historic district in 1983 has preserved the unique architecture of these houses, as well as the surrounding streetscape. Mill St. is readily served by SLO Transit services, and currently contains a Class III bike lane. The speed limit is 25 miles per hour.
Johnson Avenue

Johnson Ave. is one of the city’s most travelled streets, providing a vital connection between central and eastern San Luis Obispo. Unlike other roads in this study, Johnson Ave. has two different street classifications. Between Mill St. and Monterey St, Johnson Ave. is classified as a two-way local street with a speed limit of 25 miles per hour. This classification changes to a two-way arterial street from Monterey St. to Pismo St, with the speed limit increasing to 30 miles per hour. Medium-high density residential land uses are the focus of the local section, whereas commercial-retail, community commercial, and office uses can be found along the arterial segment. A Class II bike lane can be found along the entirety of the arterial segment, but terminates at the intersection of Johnson Ave. and Monterey St.

Landscaping along both segments can be limited at times, but is adequate to sustain a pleasant biking and walking environment.

Pismo Street

Pismo St. is classified as a one-way residential collector street. It receives a steady amount of traffic from Johnson Ave. This block consists of medium density residential and office land uses. Part of the northern side of the block is not developed because of the presence of San Luis Obispo Creek. Additionally, the creek helps contribute to the noticeable amount of vegetation along the street. Currently, a Class II bike lane is present on ¾ of the block. The road narrows when adjacent to the creek, limiting room for the bike lane. The intersection of Toro and Pismo has been upgraded in preparation for the future addition of the Toro Street Bike Boulevard. This has helped make the intersection more accessible for cyclists and pedestrians. The speed limit is 25 miles per hour.

Figure 2.2: Pismo Street (between Johnson Avenue and Toro Street)
Challenges

*Johnson Avenue Hill*

The hill between Mill St. and Johnson Ave. is the largest elevation change for any of the three alignments. This hill can be a challenge for cyclists to climb, especially during weather events (rain, high winds, etc.). Additionally, the intersection at the bottom of this hill (Johnson Ave. and Monterey St.) could see an increase in cyclists who travel through the intersection without checking for auto traffic. To reduce the possibility of this occurring, the current intersection will need to be reconfigured.

*Existing Intersection Improvements (Johnson and Monterey / Higuera / Marsh St.)*

The intersections of Pepper and Mill, Johnson and Monterey, Johnson and Marsh, and Johnson and Pismo would all need to be improved to help increase the safety of cyclists and reduce the amount of conflict with other modes of transportation.

*Parking*

Existing street parking would likely need to be reduced in order to accommodate a set of Class II bike lanes on these streets. This challenge applies to the entirety of the corridor.

*Lighting*

The current street light configurations on Pepper St, Mill St, sections of Johnson Ave, and Pismo St. do not meet City standards (one street light every 200-250 feet) and will need to be reworked to provide a safer nighttime riding environment for trail users.

Opportunities

*Existing Cycling Infrastructure*

The majority of Alignment 2’s streets are already a part of the City’s cycling network. Pismo Street and most of Johnson Avenue contain Class II bike lanes. Mill Street is also designated as a Class III bike lane. These conditions could potentially make the process of upgrading streets and intersections for the Railroad Safety Trail easier to accomplish.

*Proximity to Destinations*

This alignment would provide riders with increased access to the Monterey Street commercial district and the shopping center at Marsh Street and Johnson Avenue.
**Alignment Statistics**

Table 2.2 summarizes pertinent information on the physical, operational, and usage characteristics of Alignment 2.

<table>
<thead>
<tr>
<th>Alignment Length</th>
<th>0.6 miles</th>
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<tbody>
<tr>
<td>Estimated Travel Time</td>
<td>8 minutes northbound (uphill)</td>
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<tr>
<td></td>
<td>5 minutes southbound (downhill)</td>
</tr>
<tr>
<td>Elevation Change</td>
<td>48 feet</td>
</tr>
<tr>
<td>Vehicle Counts (City Traffic Counts, n.d.)</td>
<td>Mill: 2,151</td>
</tr>
<tr>
<td></td>
<td>Johnson:</td>
</tr>
<tr>
<td></td>
<td>Mill to Monterey: 3,318</td>
</tr>
<tr>
<td></td>
<td>Monterey to Marsh: 10,902</td>
</tr>
<tr>
<td></td>
<td>Marsh to Pismo: 12,435</td>
</tr>
<tr>
<td></td>
<td>Pismo: 2,723</td>
</tr>
<tr>
<td>Bike and Pedestrian Counts (City Traffic Counts, n.d.)</td>
<td>Mill: 179 pedestrians/day, 194 bikes/day</td>
</tr>
<tr>
<td></td>
<td>Johnson:</td>
</tr>
<tr>
<td></td>
<td>Mill to Monterey: 187</td>
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<tr>
<td></td>
<td>pedestrians/day, 49 bikes/day</td>
</tr>
<tr>
<td></td>
<td>Monterey to Marsh: 110</td>
</tr>
<tr>
<td></td>
<td>pedestrians/day, 30 bikes/day</td>
</tr>
<tr>
<td></td>
<td>Marsh to Pismo: 311 pedestrians/day, 180 bikes/day</td>
</tr>
<tr>
<td></td>
<td>Pismo: 152 pedestrians/day, 55 bikes/day</td>
</tr>
<tr>
<td>Calculated Bicycle Level of Service (LOS)</td>
<td>C</td>
</tr>
</tbody>
</table>
Alignment 3: Mill-Toro

Route Overview

As mentioned in the summary of Alignments 1 and 2, Pepper St. is a local two-way street with a relatively low amount of vehicle traffic. On this block of Pepper St, medium and medium-high density residential land uses are the only classifications present. There is a noticeable amount of landscaping present to minimize the presence of the railroad corridor on the eastern side of the street. There is no development on the eastern side of the street because of the presence of a steep cliff overlooking the tracks. Unlike other sections of Pepper St, there is a well-maintained sidewalk on the western side. The speed limit is 25 miles per hour.

Existing Conditions

Mill Street

Mill St. is classified as a residential collector street by the City of San Luis Obispo. The street is well-known for its numerous lofty trees, as well as its location within the Mill Street Historic District. The buildings along Mill St. are all historic medium density residential buildings from the 20th century. The creation of the historic district in 1983 has preserved the unique architecture of these houses, as well as the surrounding streetscape. Mill St. is readily served by SLO Transit services, and currently contains a Class III bike lane. The speed limit is 25 miles per hour.

Toro Street

Like Pepper St, Toro St. is a local two-way street with a relatively low amount of vehicle traffic. This stretch consists of medium and medium-high density residential, community-retail, community commercial, and office land uses. The presence of a community garden and San Luis Obispo Creek provide a noticeable amount of landscaping on the block between Marsh and Pismo. This section of Toro St. has also been included as a part of a future “bike boulevard” by
the City of San Luis Obispo. To prepare for this future project, a Class III bike lane has been implemented along this street. Additionally, the intersection of Toro St. and Pismo St. has been reworked to become more accessible for cyclists and pedestrians. The speed limit is 25 miles per hour.

Challenges

*Existing Intersection Improvements (Toro St. and Monterey / Higuera / Marsh)*
The intersections of Pepper and Mill, Johnson and Monterey, Johnson and Marsh, and Johnson and Pismo would all need to be improved to help increase the safety of cyclists and reduce the amount of conflict with other modes of transportation.

*Parking*
Existing street parking would likely need to be reduced in order to accommodate a set of Class II bike lanes on these streets. This challenge applies to the entirety of the corridor.

*Lighting*
The current street light configurations on Pepper St, Mill St, and Toro St. do not meet City standards (one street light every 200-250 feet) and will need to be reworked to provide a safer nighttime riding environment for trail users.

Opportunities

*Elevation Change*
The Mill-Toro alignment has the most gradual elevation change of the three alignments. As a result, a faster travel time can be achieved when traveling north (towards Cal Poly). Additionally, people would likely be more inclined to use this alignment compared to Alignments 1 and 2.

*Low Traffic Volume on Toro*
Currently, the amount of daily vehicle traffic on Toro St. is relatively low. This level of traffic can help contribute to a safe environment for bike travel.

*Proximity to Destinations*
This alignment would provide riders with increased access to the Monterey St. commercial district, the shopping center at Marsh St. and Johnson Ave, and the Dallidet Adobe and Gardens near Toro St. and Pismo St. Additionally, this alignment would likely be the most convenient option for cyclists travelling to and from downtown San Luis Obispo.
**Future Bike Boulevard Designation**

The majority of Toro St. is planned to be designated as a bike boulevard in the future. To help prepare for this eventual designation, the City has already started improving intersections and signage along this alignment (ex: Toro and Pismo). The majority of Alignment 3’s streets are already a part of the City’s cycling network. Pismo Street and most of Johnson Avenue contain Class II bike lanes. Mill Street is also designated as a Class III bike lane. These conditions could potentially make the process of upgrading streets and intersections for the Railroad Safety Trail easier to accomplish.

**Proximity to Destinations**

This alignment would provide riders with increased access to the Monterey Street commercial district and the shopping center at Marsh Street and Johnson Avenue.

**Alignment Statistics**

Table 2.3 summarizes pertinent information on the physical, operational, and usage characteristics of Alignment 3.

<table>
<thead>
<tr>
<th>Table 2.3: Alignment 3 Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alignment Length</strong></td>
</tr>
</tbody>
</table>
| **Estimated Travel Time** | 6 minutes northbound (uphill)  
5 minutes southbound (downhill) |
| **Elevation Change** | 48 feet |
| **Vehicle Counts** (City Traffic Counts, n.d.) | Mill: 2,151  
Toro: low |
| **Bike and Pedestrian Counts** (City Traffic Counts, n.d.) | Mill: 179 pedestrians/day, 194 bikes/day  
Toro: low |
| **Calculated Bicycle Level of Service (LOS)** | C |
Chapter 3: Potential Conflict Areas
Alignment 1: Pepper-Marsh

Pepper and Monterey Streets

In order to accommodate the Railroad Safety Trail, the intersection of Pepper and Monterey Street would need to be upgraded from its current condition. One of the main issues at this intersection is the high amount of auto traffic on Monterey Street. Monterey Street serves as a major link for auto traffic between the Grand Avenue corridor and downtown San Luis Obispo. Additionally, there are several land uses within the vicinity of this intersection that regularly attract vehicle traffic, such as a car dealership, places of lodging, and various restaurants. These factors help contribute to a continuous flow of vehicle traffic, making it difficult at times for cyclists and pedestrians to cross Monterey Street.

The high amount of vehicle traffic isn’t the only factor that impacts the mobility of cyclists and pedestrians at this intersection. Currently, there is no marked crosswalk for people wanting to cross both Monterey and Pepper Streets. The visibility around this intersection also complicates a person’s ease of

Figure 3.1: Map of Potential Alignment 1 Conflict Areas

Figure 3.2: The Current Intersection of Pepper and Monterey Streets, with Potential Alignment Travel Patterns
movement. For example, it can be difficult for drivers travelling west on Monterey to see people crossing because of the train bridge adjacent to the intersection. This is particularly a concern at night, due to the limited lighting in the area. These concerns will have to be addressed if the City decides to pursue Alignment 1 as an alternative route for the Railroad Safety Trail.

**Pepper and Marsh Streets**

Like the intersection of Pepper and Monterey Street, Pepper and Marsh Street also experiences a noticeable amount of vehicle traffic. This is mainly because Marsh Street is one of San Luis Obispo’s main arterial streets. On this segment, it serves as a link between California Boulevard and Johnson Avenue, two other heavily traveled corridors.

In addition to the large amount of auto traffic, there are other mobility challenges that need to be addressed at Pepper and Marsh Street. For example, there is no marked crosswalk for people wanting to cross either street. This could discourage cyclists from crossing Marsh Street to use the existing Class II bike lanes. Additionally, there is an at-grade railroad crossing located within feet of the intersection. This can complicate a person’s ease of movement, visibility, and potentially safety when a train passes by the intersection. All three of these conflicts should be addressed before the Railroad Safety Trail is implemented.

**Marsh Street and Johnson Avenue**

Like the previous two intersections, the intersection of Marsh Street and Johnson Avenue experiences a noticeable amount of vehicle traffic. However, the surrounding land uses, striping, and signaling surrounding this intersection make it one of the more complicated intersections along Alignment 1. First, the amount of traffic on both streets is relatively high compared to the
surrounding area. This is because both Marsh Street and Johnson Avenue serve as major travel corridors in San Luis Obispo. A nearby shopping center also attracts a large amount of auto traffic, contributing to the high amount of traffic present at the intersection.

To help control the flow of traffic at this intersection, a stop light has been installed to improve the mobility of cyclists and pedestrians trying to cross. However, the usefulness of this signalized intersection is undermined by the lack of a properly marked crosswalk across Johnson Avenue. Additionally, there is no clearly marked route in the intersection for cyclists traveling on Johnson or eastbound on Marsh. Considering the roles that Marsh Street and Johnson Avenue play in San Luis Obispo’s transportation network, I believe that the quality of this intersection is lacking for community members utilizing active transportation.

Figure 3.4: The Current Intersection of Marsh Street and Johnson Avenue, with Potential Alignment Travel Patterns
Marsh Street between Johnson Avenue and Toro Street

This section of Alignment 1 is particularly challenging due to the current conditions of Marsh Street and the adjacent shopping center. After crossing Johnson Avenue, Marsh Street becomes a three-lane one-way arterial street. This presents a major issue for cyclists wanting to continue traveling west on Marsh, since they would be cycling unprotected against the flow of traffic. There is currently one Class II bike lane on the south side of the street, but no existing cycling infrastructure for traveling west on Marsh. A solution for this predicament would also have to take into account the amount of traffic generated by the shopping center, the bus stop located on the south side of the street, and the amount of traffic that uses the far-left travel lane to turn left onto Johnson Avenue.

Figure 3.5: The Current Segment of Marsh Street between Johnson Avenue and Toro Street, with Potential Alignment Travel Patterns
Marsh and Toro Streets

As seen with several other intersections along Alignment 1, the intersection of Marsh and Toro Street experiences a large amount of traffic. In this case, a majority of this traffic continues east to the intersection of Marsh Street and Johnson Avenue. For cyclists and pedestrians wanting to cross Marsh Street, they often have to wait for a gap in the flow of traffic. The presence of a dedicated crosswalk and signage help create a safe crossing across Marsh Street, but the crosswalks for Toro Street are not fully marked. This intersection does serve the needs of its immediate land uses well, but can be improved to better accommodate the Railroad Safety Trail.

Figure 3.6: The Current Intersection of Marsh and Toro Streets, with Potential Alignment Travel Patterns
Alignment 2: Johnson-Pismo

Johnson Avenue Between Palm and Monterey Streets

This segment of Alignment 2 is located on a hill between Palm and Monterey Streets. As a result, cyclists travelling northwest towards Mill Street will likely have difficulty ascending the steep grade. Additionally, the steep slope could also create unsafe conditions for cyclists travelling down the hill towards Monterey Street. Possible safety risks could include unsafe travel speeds when travelling downhill, potential conflicts with pedestrians and vehicles at the intersection of Johnson and Monterey, and the potential inability for a cyclist to easily stop their bike. Additionally, the traffic signals, striping, and signage at Johnson and Monterey would need to be reconfigured to better connect this segment to the existing Class II bike lanes on the other side of the intersection. If this section were ever to be considered as a part of the San Luis Obispo bike network, there would need to be several alterations to improve the active transportation conditions on this stretch of Johnson Avenue.
Johnson Avenue and Marsh Street

An overview of the potential conflicts near the intersection of Johnson Avenue and Marsh Street can be found on Page 24.

Johnson Avenue and Pismo Street

Like a majority of Alignment 2, the intersection of Johnson and Pismo is located on one of San Luis Obispo’s main travel corridors. As a result, the intersection frequently experiences traffic traveling at or above the posted 25 mph speed limit. This traffic flow could make it difficult for cyclists and pedestrians to cross Johnson Avenue. Additionally, the width of the street (45 feet), lack of a crosswalk, and lack of a traffic signal all discourage cyclists and pedestrians from crossing Johnson Avenue at this intersection. In order to link the existing Pismo Street Class II bike lanes with those on Johnson Avenue, a redesign of this intersection will be needed to maximize the safety of cyclists and pedestrians.
Alignment 3: Mill-Toro

Toro and Monterey Streets

Toro and Monterey Street, like the other two intersections studied along Monterey Street, currently experiences a noticeable amount of auto traffic. The location on Monterey Street and proximity to downtown San Luis Obispo are the main factors for this level of auto traffic. Because this intersection doesn’t have a traffic signal, cyclists and pedestrians wanting to cross Monterey Street often have to wait for a gap in the flow of traffic. Additionally, the quality of active transportation infrastructure could be improved around the intersection. The only dedicated crosswalk present is on the north side of the intersection across Monterey Street. Additionally, the surrounding land uses and traffic on Toro Street are not ideal to install a dedicated traffic signal. In order to accommodate the Railroad Safety Trail, this intersection will need to be reworked to better serve cyclists and pedestrians.
Toro and Marsh Streets

An overview of the potential conflicts involving the intersection of Toro and Marsh Streets can be found on Page 26.

Figure 3.11: The Current Intersection of Toro and Monterey Streets, with Potential Alignment Travel Patterns
Chapter 4: Case Studies

A commuter using the Polk Street Contraflow Cycle Track in San Francisco, CA (SF Gate, 2017)
Polk Street Contraflow Cycle Track (San Francisco, CA)

One of the biggest obstacles faced in creating a potential bikeway for the Railroad Safety Trail is the amount of traffic present in the study area. The segment of Marsh Street between Johnson and Toro Streets is especially problematic because the street only accommodates one-way traffic. To help create a safer environment for cyclists and drivers, the City should look into implementing a protected cycle track on streets with high amounts of traffic.

Figure 4.1: The Polk Street Contraflow Cycle Track in San Francisco, CA (Yee, 2014)

In 2014, the City of San Francisco installed a contraflow cycle track on Polk Street to help fill a major gap in the city’s downtown cycling network. Along with the existing painted Class II bike lane on Polk Street, this addition to the city’s cycling network helped connect the Civic Center neighborhood with Market Street (San Francisco’s primary southwest-northeast transportation corridor), as well as the Mid-Market and Tenderloin neighborhoods. Additionally, the new Class IV path also gave cyclists an alternative to the nearby Van Ness Avenue. Previously, cyclists would have to brave this heavily traveled arterial road to travel north to the Civic Center area. This project has been well-received since its completion in 2014, garnering praise from non-
profit organizations like PeopleForBikes and the San Francisco Bicycle Coalition. In the words of Streetsblog SF writer Aaron Bialick, “The Polk contra-flow lane is the best segment of bicycle infrastructure in San Francisco, acting as a real-world showcase of what’s possible for a citywide network of high-quality bicycle routes” (Bialick, 2014).

Although the Polk Street Contraflow Cycle Track is located in an area with significantly more traffic than any of the proposed alignments, the similarities in street design and location make this project applicable to the Railroad Safety Trail. The signaling used for cyclists on Polk Street could easily be applied to Johnson Avenue, Monterey and Marsh Streets. On Marsh Street, the use of permanent barriers and green striping would help protect cyclists from the flow of traffic. At the same time, cuts in the barriers could be installed in the barriers to allow for access to adjacent buildings, as demonstrated on Polk Street. Bike boxes can also be used at signalized intersections to allow for more cyclist visibility.

**Bill Roalman Bicycle Boulevard (San Luis Obispo, CA)**

Another example of a successful bike corridor can be found within walking distance of the studied alternative alignments. The Bill Roalman Bicycle Boulevard, completed in October 2009, spans seven blocks of Morro Street between Marsh Street and Santa Barbara Avenue. This dedicated bike corridor provides the cyclists of San Luis Obispo with a direct link between downtown and the Amtrak station. Since the bicycle boulevard project was completed, the 85th percentile of recorded vehicle speeds has decreased by 15% (City Bicycling Highlights, n.d.). Additionally, the City has noted a decrease in cut-through traffic on Morro Street, as well as a growing number of cyclists.
of cyclists using this route (City Bicycling Highlights, n.d.). This project is also referenced as a model for bicycle boulevard design and implementation, as seen in the ALTA Planning and Design book Fundamentals of Bicycle Boulevard Planning and Design (City Bicycling Highlights, n.d.).

The Bill Roalman Bicycle Boulevard uses several strategies to maximize cyclist and pedestrian safety. First, the redesigns of the intersections at Morro and Buchon and Leff Streets now prioritize cyclists and pedestrians without major disruptions to the flow of vehicular traffic. This was achieved by installing traffic diverters and pedestrian safety islands in the middle of each intersection, as seen in Figure 4.2. This resulted in uninterrupted bike access through the intersection, a safer crossing for pedestrians, and a reduction in non-local vehicle traffic. A second strategy used to construct the Bill Roalman Bicycle Boulevard was the redesign of the Santa Barbara Avenue, Morro Street, and Upham Street intersection. Before the bike boulevard was implemented, this intersection hindered bicycle access to and from the Amtrak station parking lot. To alleviate the crossing for cyclists, the City installed a traffic signal with a bicycle-only phase. To complement this addition, marked sensors for bikes to activate the signal were also included in the upgrade. This greatly improved the ease of crossing Santa Barbara Avenue for cyclists. Other notable strategies used throughout the corridor include bulb-outs, sharrows, strategic striping, and bicycle signage.
This project was chosen because of the similarities in street design and traffic flow. Like Morro Street, the segments of Pepper and Toro Streets studied in this analysis are classified as local streets with low amounts of auto traffic. These types of streets provide an ideal urban environment for bicycling, as seen with the successful Morro Street project. All three streets are also located near a major crosstown corridor, providing cyclists with an alternative to driving in heavier traffic. These conditions illustrate the Bill Roalman Bike Boulevard’s design compatibly with the alternative alignments studied for the Railroad Safety Trail.

Table 4.1: A Table Illustrating the Applicability of Each Case Study to Each Alignment

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Alignment 1</th>
<th>Alignment 2</th>
<th>Alignment 3</th>
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<tr>
<td>Polk Street Contraflow Cycle Track</td>
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<td>X</td>
<td></td>
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<tr>
<td>Bill Roalman Bicycle Boulevard</td>
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Chapter 5:
Conclusion and Recommendations

The Upgraded Intersection of Pismo and Toro Streets
in San Luis Obispo, CA
This section details what types of cycling infrastructure and design measures would be most compatible with each proposed alignment, given the existing street conditions, surrounding land uses, levels of traffic, and other variables covered in this study. For each alignment, an overview of potential changes are covered for each route. In addition to this overview, several design strategies to alleviate the conflicts discussed in Chapter 3 will be showcased as well.

**Alignment 1: Pepper-Marsh**

Based on the analysis of the Pepper-Marsh corridor, I believe that a mix of Class II and III bike lanes would be best suited for implementation along Alignment 1. On Pepper Street, a Class III bike lane in each direction would be most compatible due to the street’s low volume of traffic. The existing street environment has encouraged cyclists and pedestrians to use this route as a connection between the Mill and Monterey Street corridors, as well as a means of accessing the Class II bike lanes on Marsh Street.

If the trail were to be located on Marsh Street, several alterations will need to be made to the existing streetscape and travel lanes. As mentioned previously, the existing Class II bike lanes provide a well-positioned link between the major travel corridors of California Boulevard and Johnson Avenue. However, the segment connecting Johnson Avenue and Toro Street will need to be drastically altered to allow for westbound bicycle traffic. If Alignment 1 were chosen to be implemented, a Class IV cycle track would need to be installed to resolve this issue.

**Pepper and Monterey Streets**

Some potential strategies for improving the intersection of Pepper and Monterey Streets include:

- Installing a crosswalk with on-demand crossing lights
  - Include a sensor for bikes to be able to activate it as well
  - Would help improve nighttime visibility
  - Would help reduce the visual impairment of the railroad bridge
- Installing bulb-outs to reduce crossing length (this can be done on all 4 sides)
  - Utilized in Morro Street case study
- Improving lighting and signage in the immediate vicinity of the intersection
  - Utilized in both Polk and Morro Street case studies
Pepper and Marsh Streets
Some potential strategies for improving the intersection of Pepper and Marsh Streets include:

- Installing a crosswalk with on-demand crossing lights to avoid conflicts with traffic around the railroad crossing
- Potentially examining the feasibility of installing a turn pocket for bikes in the median
  - Has been implemented at Highland Blvd. and N. Chorro Street
  - Could cut into eastbound sidewalk to make room

Marsh Street and Johnson Avenue
Some potential strategies for improving the intersection of Johnson Avenue and Marsh Street include:

- Installing bike boxes on all sides of intersection
- Creating an easily navigable entrance to a Class IV bikeway on northern side of street
  - Stripping through intersection would help guide people to new Class IV
  - Utilized in Polk Street case study
- Adding bike signal sensors to other sides of intersection (only present on EB Marsh side)
  - Utilized in Morro Street case study
- Fully painting crosswalks to increase driver awareness
- Installing bulb-outs on northern side of intersection (on Johnson away from shopping center)
  - Utilized in Morro Street case study

Marsh Street between Johnson Avenue and Toro Street
Some potential strategies for improving the segment of Marsh Streets between Johnson Avenue and Toro Street include:

- Taking out the existing parking lane to install a Class IV bikeway (protected bike lane)
  - Allow cuts for access to houses / businesses
  - Similar strategy used in Polk Street case study
- Improving striping/safety of existing Class II bike lane
  - Designate a travel path for bikes around shopping center entrances/exits
Can install plastic barrier poles to avoid clipping in turn lane
Similar strategy used in Polk Street case study

Marsh and Toro Streets
Some potential strategies for improving the intersection of Marsh and Toro Streets include:

- Installing bulb-outs at intersection to decrease pedestrian crossing time
  - Utilized in Morro Street case study
- Fully painting Toro Street crosswalks to increase driver awareness

Alignment 2: Johnson-Pismo
After analyzing Alignment 2, I believe that changes in intersection design would be needed to fully accommodate the Railroad Safety Trail. As mentioned previously, much of this alignment already contains cycling infrastructure (Mill Street, a majority of Johnson Avenue, and Pismo Street). Given the flow of traffic on each of these streets, the quality of cycling infrastructure meets the current cycling demand in the immediate area. It would be beneficial to expand and enhance these corridors to attract new cyclists and strengthen cyclist safety.

However, the section of Johnson Avenue between Palm and Monterey Streets may not be compatible with the Railroad Safety Trail. As someone who has experienced riding down this steep grade, I believe that this hill is too much of a deterrent to cyclists, as well as a threat to their safety. If my bike’s brakes were to have failed, I would likely have sped out of control and crashed into an object at the bottom. This could include the various parked cars, pedestrians using the crosswalk, or moving traffic in the intersection of Johnson Avenue and Monterey Street. Additionally, new cyclists could likely be too discouraged by the steep incline to use this route in the first place. As an alternative, the trail could utilize Monterey Street’s Class III bike lanes to continue to the Amtrak station or to Cal Poly.

Johnson Avenue between Palm and Monterey Streets
I would not recommend investing in this segment due to the incompatible terrain. Instead, I believe that the addition of new signage directing cyclists to use Monterey Street as an alternative would be a more viable option.
Johnson Avenue and Monterey Street

Some potential strategies for improving the intersection of Johnson Avenue and Monterey Street include:

- Adding bulb-outs to the southern half of the intersection
  - Only side not impacted by existing turn lanes
  - Utilized in Morro Street case study
- Installing bike boxes at intersection
- Installing designated areas for bikes to change traffic signal

Johnson Avenue and Marsh Street

Potential strategies for this intersection can be found on Page 39.

Johnson Avenue and Pismo Street

Some potential strategies for improving the intersection of Johnson Avenue and Pismo Street include:

- Installing a crosswalk with on-demand crossing lights
  - A sensor for bikes to activate the signal would be helpful as well
  - Would help improve nighttime visibility
- Improving lighting and signage in the immediate vicinity of the intersection
  - Utilized in both Polk and Morro Street case studies
- Installing bulb-outs on eastern side of intersection
  - Utilized in Morro Street case study

Alignment 3: Mill-Toro

The analysis of Alignment 3 has reaffirmed my belief that this route is highly compatible with the Railroad Safety Trail. The route’s elevation change, low levels of traffic, and future plans for integration into the City’s cycling network all indicate that this alignment has untapped potential for cyclists around San Luis Obispo. The presence of cycling infrastructure on Mill Street (Class III bike lanes) and the renovation of existing intersections (Toro and Marsh, Toro and Pismo) also help this route’s viability.
To fully maximize this alignment’s effectiveness, changes to the intersections and travel lanes on Toro Street will need to be implemented. This process could also help achieve the City’s goal of converting Toro Street into a bicycle boulevard.

**Toro and Monterey Streets**

Some potential strategies for improving the intersection of Johnson Avenue and Pismo Street include:

- Installing bulb-outs on the eastern half of the intersection
  - Utilized in Morro Street case study
- Adding a least one crosswalk for pedestrians crossing Monterey Street
  - Eastern side would be more feasible, given the existing intersection layout
  - Should also come with on-demand crossing lights that can be activated by cyclists
- Improving lighting and signage in the immediate vicinity of the intersection
  - Utilized in both Polk and Morro Street case studies

**Marsh and Toro Streets**

Potential strategies for this intersection can be found on Page 40.
References:

Source Information:


Photos:
Yee, Diana. (2014). *Polk St. contraflow cycle track with bike traffic lights*. Retrieved from: [https://www.flickr.com/photos/23305535@N00/14611105810](https://www.flickr.com/photos/23305535@N00/14611105810)