2016

Jerome Marking, Parking, and Signage Modifications

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Client:	Albert Sengstock (Arizona Zoning Administrator) and The Town of Jerome
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1.0 Project Understanding

Before defining the team's scope of work, background research was done on topics related to this project. The team has researched the project background, analyzed the project purpose, researched previous work done, contemplated technical considerations and potential challenges, and considered who the stakeholders might be for this project. The following sections detail these topics.

1.1 Project Background

Jerome is a town located in Yavapai County, Arizona, adjacent to Verde Valley on Cleopatra Hill. The town was founded in 1876 and was once the fourth largest city in the Arizona Territory. It is approximately 5,000 feet above sea level and 100 miles north of Phoenix. Jerome was a mining camp between the late 1880's to early 1950's, with a population of about 15,000 at its peak. Now, the population is only about 440 people; however, it is a major tourist attraction, bringing in about 3 million tourists annually and approximately 1500 vehicles per day during peak seasons. Today, Jerome is widely known as America's most vertical city and the largest ghost town (Jerome AZ, 2015).

1.2 Project Purpose

The current infrastructure in Jerome is in need of repair and requires maintenance improvements to its internal road system. The increase in tourism has put pressure on parking and traffic services throughout the town, and as a result, pavement markings have faded over time. The town's main arterial road, State Route 89A, is generally well maintained; however, traffic flow has the potential to be more efficient through improvements such as paving on street parking areas with additional striping, pavement markings, and signage (Town of Jerome, 2015). It is understood that one of the main concerns of the town is that the existing parking space is not sufficient to sustain the high demand for parking as tourism increases and affects the traffic circulation throughout Jerome (Sengstock, 2016).

Additionally, it is understood that another main concern is to design parking stalls considering the turning radiuses of vehicles approximately 50' in length (Sengstock, 2016). Fire engines are unable to successfully make some turns throughout the town due to vehicles parking along the sides of the street and around corners. An increase in clearer signs are also needed throughout the town, and can aid in creating smoother traffic flow and decrease problematic parking (Sengstock, 2016). The purpose of this project is to modify the existing parking in Jerome in order to meet the increasing demand brought on by local tourism and to enhance the traffic flow along State Route 89A.

1.3 Previous Work

No previous striping or paving work has been completed in recent years. There are three main parking lots available for use and the existing lower parking lot near the commercial district was recently covered with debris after the slope adjacent to it collapsed. Figure 1.1, as shown on the following page, shows the parking lots and on-street parking under consideration for the project. As a result, the lot was closed for service; no improvements were made to the area. Additionally, multiple individual signs have been implemented in recent years to assist with parking flow, but no major changes have been made to the network (Sengstock, 2016).

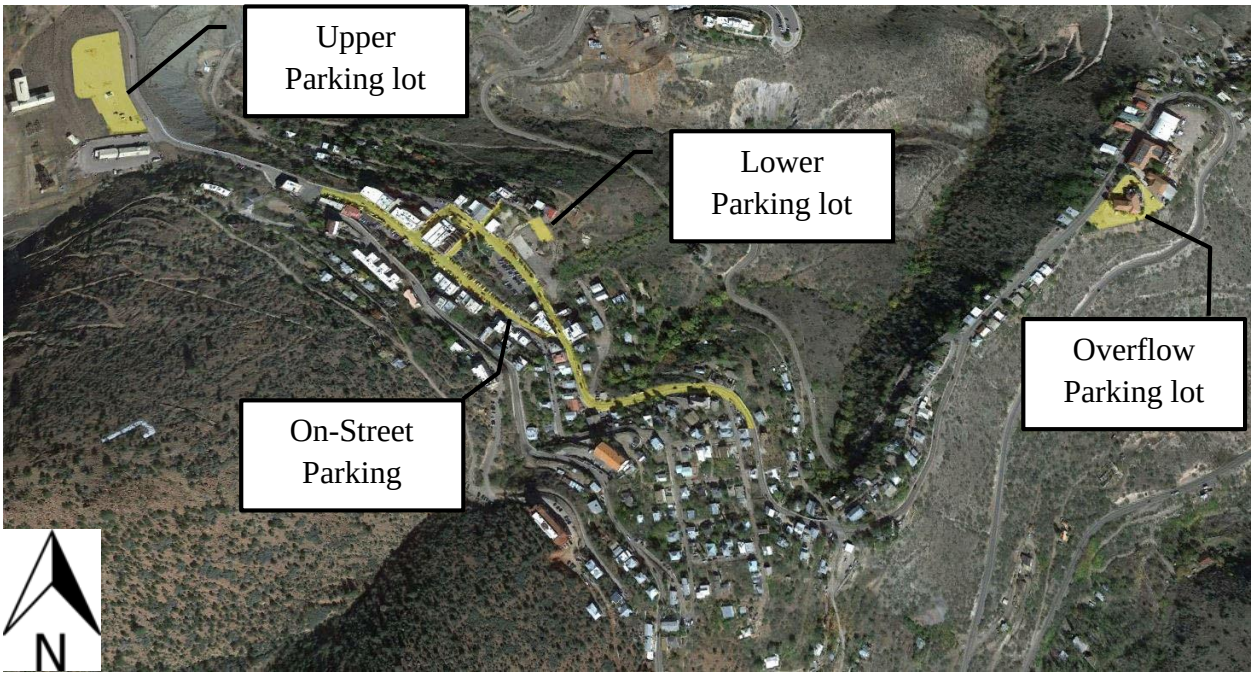

Figure 1.1: Parking Lots and On-Street Parking Locations

1.4 Technical Considerations

It is understood that no new parking facilities will be implemented in the near future; the scope of the project will solely be to modify parking and striping. The team will consider the implementation of new striping, modification of the parking lot layouts, and clear signage throughout the city. The use of modeling software, such as AutoCAD Civil 3D, will be considered to analyze the current and alternative design conditions of striping, parking lot layout, and signage. Additionally, the uses of a vehicle path software, such as AutoCAD Vehicle Tracking, will be considered to predictably evaluate vehicle movements on the existing roadway. Furthermore, turn radiuses will be considered when designing parking stalls and evaluated using the software programs stated above.

1.5 Potential Challenges

Jerome's unique topography is the primary reason that road configuration options are limited. The town itself sits on a mountainside at a 30-degree incline, which often causes infrastructure to slide down the slope due to the pull of gravity. Most of the existing streets are lined with retaining walls, many of which are in need of repair. The local government's primary objective is to keep the historic streetscape while keeping the streets safe and optimizing parking opportunities (Town of Jerome, 2015). The team will need to optimize the use of existing space, rather than base designs off of expanding the surrounding area. These potential challenges will have an influence on designs; however, the historic streetscape will be the only challenge affected by possible modifications. The challenge of keeping the historic streetscape will be addressed by making minimal but impactful modifications that will support the local government's primary objective.

1.6 Stakeholders

Our client's name is Albert Sengstock, and he is the Arizona Zoning Administrator in the town of Jerome. Stakeholders who could possibly be affected by the proposed project would be local residents, businesses, and also tourists. The local city government is considered the main stakeholder in this project because it is the main source of funding for the project. The Arizona Department of Transportation is another key stakeholder in the modification of parking along State Route 89A.

2.0 Project Scope

The scope details the tasks required in order to complete the project. The following sections will describe the actions that will be carried out by K.A.S.T. throughout the duration of the project.

2.1 Background Information

Jerome has been considered a major touristic attraction in the state of Arizona. Because of the increase in tourism, there has been an increasing need for parking spaces throughout the city. KAST Engineering must perform a field visit to assess the existing parking facilities for maintenance needs in order to provide the local community with an adequate solution that can handle the large amount of vehicles coming into the town, particularly during the Fall festivities when visitors from all around the world come to visit and enjoy its fabulous views. In addition, traffic flow throughout the city must be analyzed in order to apply adequate improvements such as restriping existing lots and on-street parking, as well as adding signage that is clearer to multimodal users. The recommended improvements would be intended for an immediate modification to the existing parking stalls and traffic signs within the project area.

2.1.2 Task 1: Field Evaluation

The team will conduct a field evaluation in order to gain a better understanding of the existing conditions in Jerome. The sections below describe the existing conditions of different components throughout the town that will need to be analyzed before data collection can begin.

2.1.2.1 Parking

KAST Engineering must perform a field evaluation to determine the number of existing parking stalls and the existing conditions of the parking facilities within the project area, both lots and on-street parking.

2.1.2.2 Signage

KAST Engineering must perform a field evaluation to determine the number of existing traffic signs and their existing condition within the project area. The team will also look at the relevancy of the signs and whether they provide clear guidance to users. Irrelevant signs will be noted and recommended for removal.

2.1.2.3 Striping/Curb and Pavement Markings

KAST Engineering must perform a field evaluation to analyze the existing striping and markings as well as their existing condition within the project area. The team will also look at areas where additional striping and markings should be placed to provide clear guidance to users and enhance the flow of vehicles.

2.2 Data Collection

The team will need to collect data throughout the town in order to begin the design process. The sections below describe the different data collection methods that will be needed.

2.2.1 Task 2: Surveying

Surveying will need to be done in order to determine the existing conditions of parking stalls, signage, and parking lot dimensions.

2.2.1.1 Parking Lots and On-Street Parking

Surveying will be conducted in order to determine the area of existing parking lots and dimensions of existing roadways.

2.2.1.3 Signage Location

Surveying will be conducted in order to determine the exact locations of existing signs in relation to the existing roads and parking lots.

2.2.1.4 Parking Location

Surveying will be conducted in order to determine the exact location of existing parking stalls and the dimensions of said parking stalls.

2.2.2 Task 3: Parking Use

A study will be performed to determine the average time a parking stall is occupied. This will be done to ensure the appropriate regulatory parking signs are applied.

2.3 Standards and Codes

Throughout the duration of the project, the team will need to reference multiple different traffic standards and codes. The following sections will detail the different manuals that will need to be referenced by the team during the design process.

2.3.1 Manual of Uniform Traffic Control Devices (MUTCD)

The MUTCD provides uniformity of traffic signs, signals, and pavement markings in order to promote highway safety and efficiency on the Nation's streets and highways. This manual will be used throughout the project to ensure that all of the implemented signs and pavement marking meet MUTCD standards.

2.3.1.1 Chapter 2B-Regulatory Signs

As per the MUTCD, regulatory signs shall be used to inform road users of selected traffic laws or regulations and indicate the applicability of the legal requirements.

2.3.1.1.1 Section 2B.46-Parking, Standing, and Stopping Signs (R7 and R8 series)

As per the MUTCD, signs governing the parking, stopping, and standing of vehicles cover a wide variety of regulations, and only general guidance can be provided. General guidelines can be seen below:

- Parking signs shall comply with the standards of shape, color, and location.
- Where parking is prohibited at all times or at specific times, the basic design for parking signs shall have a red legend and border on a white background.
- Where only limited-time parking or parking in a particular manner are permitted, the signs shall have a green legend and border on a white background
- Where parking spaces that are reserved for persons with disabilities are designated to accommodate wheelchair vans, a VAN ACCESSIBLE (R7-8P) plaque shall be mounted below the R7-8 sign. The R7-8 sign shall have a green legend and border and a white wheelchair symbol on a blue square, all on a white background. The R7-8P plaque shall have a green legend and border on a white background.

2.3.1.1.2 Section 2B.48-Placement of Parking, Stopping, and Standing Signs

As per the MUTCD, general guidelines for placement of parking, stopping, and standing signs can be seen below:

- When signs with arrows are used to indicate the extent of the restricted zones, the signs should be set at an angle of not less than 30 degrees or more than 45 degrees with the line of traffic flow in order to be visible to approaching traffic.
- Spacing of signs should be based on legibility and sign orientation.
- If the zone is unusually long, signs showing a double arrow should be used at intermediate points within the zone.

2.3.1.2 Chapter 2D-Guide Signs-Conventional Roads

As per the MUTCD, guide signs are essential to direct road users along streets and highways. They are also used to inform drivers of intersecting routes, to direct them to cities, towns, villages, or other important destinations, and to identify nearby historical sites. These signs are generally used to provide information that will direct drivers to their destination in the simplest manner possible.

2.3.1.2.1 Section 2D.47-Parking Area Guide Sign (D4-1)

As per the MUTCD, the parking area (D4-1) guide sign may be used to show the direction to a nearby public parking area or parking facility. The general guideline for the parking area guide sign can be seen below:

- If used, the parking area guide sign should be installed on major thoroughfares at the nearest point of access to the parking facility and where it can advise drivers of a place to park. The sign should not be used more than four blocks from the parking area.

2.3.1.2.2 Section 2D.50-Community Wayfinding Signs

As per the MUTCD, community wayfinding guide signs are part of a coordinated and continuous system of signs that direct tourists and other road users to key civic, cultural, visitor, and recreational attractions and other destinations within a city or a local urbanized or downtown area. General guidelines can be seen below:

- The use of community wayfinding guide signs shall be limited to conventional roads. Community wayfinding guide signs shall not be installed on freeway or expressway mainlines or ramps.
- Community wayfinding guide signs shall not be used to provide direction to primary destinations or highway routes or streets.
- Because regulatory, warning, and other guide signs have a higher priority, community wayfinding guide signs shall not be installed where adequate spacing cannot be provided between the community wayfinding guide sign and other higher priority signs. Community wayfinding guide signs shall not be installed in a position where they would obscure the road users' view of other traffic control devices.
- Community wayfinding guide signs shall not be mounted overhead.

2.3.1.3 Chapter 3B-Pavement and Curb Markings

As per the MUTCD, markings provide guidance and information for the road user. Typically, markings are used to supplement other traffic control devices such as signs, signals, and other markings.

2.3.1.3.1 Section 3B.19-Parking Space Markings

As per the MUTCD, the marking of parking space boundaries encourages more orderly and efficient use of parking spaces where parking turnover is substantial. Parking space markings are intended to prevent encroachment into fire hydrant zones, bus stops, loading zones, approaches to intersections, curb ramps, and clearance spaces for islands and other zones where parking is restricted. The general guideline for the parking space markings can be seen below:

- Parking space markings shall be white.

2.3.1.3.2 Section 3B.23-Curb Markings

As per the MUTCD, curb markings are most often used to indicate parking regulations or to delineate the curb. General guidelines can be seen below:

- Where curbs are marked to convey parking regulations in areas where curb markings are frequently obscured by snow and ice accumulation, signs shall be used with the curb markings.
- When curb markings are used without signs to convey parking regulations, a legible word marking regarding the regulation (such as "No Parking" or "No Standing") should be placed on the curb.

2.3.2 Yavapai County Planning and Zoning Ordinances Manual

The Yavapai County Planning and Zoning Ordinance Manual will provide guidance on the county regulations of sign codes, parking and off-street loading, and handicap parking guidelines.

2.3.2.1 Americans with Disabilities Act (ADA) Requirements

As per the Americans with Disabilities Act, the following guidelines must be met to provide adequate handicap parking:

- Each parking lot provided for employees or visitors is required to have accessible (handicap) parking spaces.
- Accessible parking spaces must be the closest spaces to the building's accessible entrance.
- Accessible spaces must be at least ninety-six inches (96") wide with a clearly marked adjacent access aisle of sixty inches (60"). Two (2) spaces may share a common aisle.
- The access aisle must connect directly to the accessible route.
- Spaces and aisles must be level with no slope greater than 1:50.
- All accessible parking spaces must have an unobscured vertical sign that shows the universal symbol of accessibility.
- For every 25 parking spaces, there should be one (1) handicap accessible parking space.

2.3.2.2 Chapter 6, Section 601 Sign Code

As per the Yavapai County Planning and Zoning Ordinances Manual, the sign codes regulate the uses, locations, types, heights, sizes and illumination of signs in order to enhance tourism, to promote traffic and pedestrian safety, and to protect the general welfare. General guidelines that are applicable to the project can be seen below:

- No sign, nor any portion of a sign, shall rotate, move, or simulate movement by means of fluttering, spinning, or reflection devices, nor shall it contain an electronic message device except for time and temperature signs, nor shall it flash, blink, be audible, or be animated by any means, including banners, pennants, or devices affected by movement of air.
- No sign may encroach upon or overhang adjacent property or public right- of-way. No sign shall be attached to any utility pole, light standard, bridge, or any other public facility located within the public right-of-way.
- In no case shall any sign exceed thirty feet (30') in height.
- No sign shall be painted on or affixed to any natural object in its natural location such as a boulder, tree or cliff face.
- Signs may be painted directly onto structural surfaces (walls or buildings) but not onto any roof.
- No sign shall be located in such a manner as to obstruct or otherwise interfere with an official traffic sign, signal or device or obstruct or interfere with a driver's view of approaching, merging or intersection traffic.
- New signs exceeding six (6) square feet in area or exceeding eight feet (8') in height shall follow the permitting requirements specified in Subsection L. (Sign Permits) of the Yavapai County Planning and Zoning Ordinances Manual.
- Signs that are not permitted in a residential zone shall not be placed closer than twenty feet (20') to any Residentially Zoned lot.
- All signs shall be stable.

2.3.2.3 Chapter 6, Section 602 Parking and Off-Street Loading

As per the Yavapai County Planning and Zoning Ordinances Manual, the parking and off-street loading regulations are intended to minimize congestion of the public streets and to promote the safety and welfare of the public. General guidelines that are applicable to the project can be seen below:

- Required off-street parking shall be located on or off the site within three hundred feet (300') of the building or use it is intended to serve, the distance being measured from the nearest point of the building or use; provided, however, that parking facilities for sports assembly, public assembly for outdoor entertainment, sports, and recreational activities, resorts and group camps, or similar uses shall be located not farther than one thousand three hundred feet (1,300') from the nearest point of such building or use.
- Each parking space shall contain a rectangular area at least twenty feet (20') long and nine feet (9') wide. Lines demarcating parking spaces may be drawn at various angles in relation to curbs or aisles, so long as the parking spaces so created contain within them the rectangular area required by this Section.
- In parking areas containing ten (10) or more parking spaces, up to twenty percent (20%) of the parking spaces may contain a rectangular area of only seven and one-half feet (7½') in width by fifteen feet (15') in length. If such

spaces are provided, they shall be conspicuously designated as reserved for small or compact cars only.

- Parking area aisle widths shall conform to the following table, which varies the width requirement according to the angle of parking:

Table 2.1: Parking Aisle Widths

	PARKING ANGLE				
	0˚	30˚	45˚	60˚	90˚
REQ. AISLE WIDTH					
One-Way Traffic	13 ft.	11 ft.	13 ft.	18 ft.	24 ft.
Two-Way Traffic	19 ft.	20 ft.	21 ft.	23 ft.	24 ft.

- Unless no other practicable alternative is available, vehicle parking areas shall be designed so that vehicles may exit such areas without backing onto a public street.
- Vehicle parking areas for all developments shall be designed so that sanitation, emergency, and other public service vehicles can serve such developments.
- Every vehicle parking area shall be designed so that vehicles do not extend beyond the perimeter of such area onto adjacent properties or public rights-of-way.

2.3.3 Arizona Department of Transportation Traffic Engineering Guidelines and Processes (ADOT TGP)

The Arizona Department of Transportation Traffic Engineering Guidelines and Processes Manual provides guidance on traffic studies, signs, pavement marking delineation, traffic signals, illumination, traffic control plans, and pedestrian crosswalks. This manual will be used to ensure Wayfinding Sign regulations and procedures are followed.

2.3.3.1 Sections 300 Signs, Sub-Section 338 Wayfinding Signs

As per the ADOT TGP, these guidelines establish procedures for the installation of wayfinding guide signs within the State highway right-of-way. Also, these guidelines include eligibility requirements, design, location and installation requirements, and maintenance. The general guidelines can be seen below:

- Wayfinding signs shall only be allowed under an approved encroachment permit issued by the Department, and shall be installed and maintained by the local public agency or designated permittee at no cost to the Department.

- Wayfinding signs shall only be installed on ADOT highways where the public agency has already developed and implemented its own wayfinding sign program.
- Wayfinding signs shall be placed outside the clear zone or, if placed within the clear zone, shall be crashworthy.
- The placement of wayfinding signs shall conform to the location criteria defined in the MUTCD chapter on guide signing for conventional roads.
- No more than one wayfinding sign shall be placed in advance of a given approach to an intersection.
- A wayfinding sign shall not display more than three destinations.
- In addition, the public agency shall provide ADOT with detailed information on the sign design, including foundations and posts. These details shall be in accordance with ADOT specifications and standard drawings.

2.4 Task 4: Design

The team will split up the design process into four different sections: parking, signage, striping, and curb and pavement marking design. The following sections describe the design process that will be conducted for each section.

2.4.1 Parking

Design work will be performed to show current parking conditions on the roads and parking lots of Jerome. Additional design work will be performed to include a recommended layout of parking stalls intended to improve the amount of available parking. The designs will include analysis of large vehicle turning radiuses to ensure parked vehicles will not be struck by a turning vehicle.

2.4.2 Signage

Design work will be performed to include additional signage to the recommended parking layout as deemed fit by the engineering team per the Standards and Codes to provide better direction to road users.

2.4.3 Striping

Design work will be performed to include additional striping to the recommended parking layout as deemed fit by the engineering team per the Standards and Codes to provide better direction to road users.

2.4.4 Curb and Pavement Markings

Design work will be performed to include additional curb and pavement markings to the recommended parking layout as deemed fit by the engineering team per the Standards and Codes to provide better direction to road users.

2.5 Task 5: Project Management

Project management for the Jerome Parking Analysis and Design Project is a critical task. The timely submittal of project documents is essential in the overall success of the project. The main deliverables can be seen below.

2.5.1 Client Meetings

There will be multiple meetings with the client throughout the duration of the project. The purpose of these meetings will be to provide progress updates to the client, as well as ask for his guidance on tasks.

2.5.2 Team Meetings

Team meetings will occur frequently throughout the semester in order to ensure that the team finished deliverables accurately and on time.

2.5.3 Schedule & Staffing

The project schedule will be an integral part of the overall project success. The schedule will detail all start and end dates as well as milestones. It will also cover the dependencies of each task and the critical path to the completion of the project.

2.5.4 50% Submittal

The 50% design report will include preliminary aspects of the final design. The report will be submitted to the client and reviewed for any final changes or suggestions that should be included in the design before the final design report is presented.

2.5.5 Client Deliverables

An un-approved plan set will be provided for the client on November 18, 2016.

2.5.6 Final Design Report

The final report will include all design drawings and specifications for modifying and installing new parking stall markings, signs, and pavement and curb markings in designated areas around the Town of Jerome.

2.5.7 Final Presentation

The final presentation must supply a technical level explanation of the Jerome Parking Analysis and Design Project sufficient for an audience of “general” engineers. It must disclose the scope of the project and how it relates to the needs of the project. The final design along with relevant details should be thoroughly explained within the final presentation. The team will provide a final presentation of the project on December 9, 2016.

2.5.8 Website

A website will be created to provide a detailed project description that includes design specifics and team related information. This website will be viewable on the NAU College of Engineering Forestry and Natural Sciences (CEFNS) capstone webpage. The first part of the webpage will be completed along with the proposal. The team will complete the website that displays the project on or before December 9, 2016.

2.6 Exclusions

There are multiple components that were considered for this project, but will not be under the scope of the team. The following sections describe such exclusions.

2.6.1 Geotechnical Engineering Studies

The team will not be responsible for conducting or providing geotechnical services for this project. The soil composition or strength values will not be considered by the team in any form throughout the design process.

2.6.2 Approved Plans and Permits

The team is not responsible for acquiring any form of permit for signage, striping, or pavement markings. In addition, plans approved by a Professional Engineer as well as plans ready to be reviewed by a permitting office of any transportation agency will be excluded from this project.

2.6.3 Parking Lot Pavement Design and Electrical Components

The team is not responsible for designing pavement mixtures for any parking lot or roadway. The team will not consider parking lot drainage design or modification of pavement landscaping. In addition, any electrical components of the parking lots will be excluded from this project.

2.6.4 Vertical Clearance

The team will not consider vertical clearance for vehicle bumpers on roadways.

2.6.5 Residential Street Parking/Striping

The team will not be responsible for a parking analysis in residential areas.

2.6.6 Structural Support

The team will not be responsible for designing structural support for headwalls, buildings, or parking lots.

2.6.7 All-Inclusive Survey

The team is excluding an all-inclusive survey from the scope of this project. K.A.S.T will only survey the areas mentioned in Section 2.2.1.

2.7 Broader Impacts

The Jerome Parking Analysis Project will impact the town of Jerome in multiple different ways. The team will take these impacts into consideration when going through the design process. The specific components that could be affected by this project are listed below.

2.7.1 Regulatory

With the implementation of clearer directional signs and more optimized parking lots, it is possible that traffic flow may be smoother throughout the city than it is currently. Also, the direction of vehicle flow may be altered if new guide signs are implemented that direct traffic flow to different areas of town. This could regularly increase traffic congestion in parts of town that are currently experiencing lower traffic volumes.

2.7.2 Environmental

Since no new paving or construction will be conducted, the environment will most likely not be vastly affected by this project. However, there are some small impacts that could result from the team's design. When new striping is being conducted, paint fumes will temporarily affect the surrounding environment and could disrupt the wildlife. Also, when new signs are being placed, it is possible that new holes will need to be excavated in order to place the sign posts. This could also disrupt the wildlife and foliage in the area.

2.7.3 Economic

If the parking lots and on-street parking stalls are optimized, it is possible that more revenue will flow to local businesses and restaurants. More tourists and civilians will be able to park along the street directly next to businesses, as well as in the existing overflow parking lot. If there are more readable directional signs, international tourists might be able to find more attractions and eateries that they wouldn't have been able to find otherwise. Overall, having clearer signs and more functional parking lots has the possibility to bring in more tourists as well as encourage them to return.

2.7.4 Other Impacts

Health, social, political, and cultural impacts were considered but not applicable to this project.

3.0 Schedule

The team has put together a schedule for the project. Appendix A shows the schedule and Appendix B shows the Gantt chart, respectively. The sub sections below explain the tasks in more detail.

3.1 Task 1 Field Evaluation

The project is expected to begin August 14, 2016 with the KAST Engineering team preforming several field evaluations. The team will evaluate the existing parking, signage and striping conditions within the project focus areas. The parking, signage, and striping evaluations will take a total of five hours to complete over the course of one day. During this time, the team will determine the number of existing parking stalls and the existing conditions of the parking facilities within the project area, determine the number of existing traffic signs and their existing condition, and analyze the existing conditions of striping and markings.

3.2 Task 2 Surveying

The next step of our project is data collections which entails the surveying of parking areas, signage, striping, and markings as well as preforming a parking use study.

3.2.1 Task 2.1 Parking Area

The surveying of parking areas is expected to begin on August 15, 2016 and take approximately 24 hours over the course of 3 days. During this time, the team will determine the area of existing parking lots and dimensions of existing roadways.

3.2.2 Task 2.2 Signage

The surveying of signage is expected to begin August 19, 2016 and take approximately 24 hours over the course of 3 days. During this time, the team will determine the exact locations of existing signs in relation to the existing roads and parking lots.

3.2.3 Task 2.3 Striping & Markings

The surveying of striping and markings is expected to begin on August 23, 2016 and take approximately 45 hours over the course of 5 days. During this time, the team will determine the exact location of existing parking stalls and the dimensions of said parking stalls.

3.2.4 Task 2.4 Data Upload & Analysis

In addition, data upload and analysis will be taking place concurrently with the survey data collections from August 15, 2016 through August 28, 2016. The team estimates this will take in additional 26 hours over the course of 13 days.

3.3 Task 3 Parking Use Study

Following the survey data collection, a parking use study will be performed and expected to take approximately 56 hours over the course of 7 days. During this time, the team will collect data on the amount of vehicles occupying a parking space and the duration it is occupied.

3.3.1 Task 3.1 Data Upload & Analysis

In addition, data upload and analysis will be taking place concurrently during the parking use study from August 29, 2016 through September 5, 2016. The team estimates this will take in additional 30 hours over the course of 7 days.

3.4 Task 4: Design

The fourth step of our project is design, which entails AutoCAD design and analysis of existing conditions and recommended modifications to parking, signage, striping, and markings.

3.4.1 Task 4.1 Existing Conditions

The design of existing condition is expected to begin September 5, 2016 and take approximately 60 hours over the course of 14 days. During this time, the team will create the existing conditions in AutoCAD to serve as a foundation to our recommended designs. This is key because the team needs to optimize the use existing space, rather than base designs off of expanding the surrounding area.

3.4.2 Task 4.2 Parking

The design of recommended parking is expected to begin on September 19, 2016 and take approximately 52 hours over the course of 14 days. During this time, the team will design recommended layouts of parking stalls intended to improve the amount of available parking. The designs will include analysis of large vehicle turning radiuses to ensure parked vehicles will not be struck by a turning vehicle.

3.4.3 Task 4.3 Signage, Striping, and Markings

The addition of recommended signage, striping, and markings to the recommended parking layouts is expected to begin on October 3, 2016 and take approximately 84 hours total over the course of 7 days.

3.4.4 Task 4.4 Standards and Codes

In addition, standards and codes will be used as references concurrently during the design phase from September 5, 2016 through October 10, 2016. It's expected to take approximately 26 hours total over the course of 35 days.

3.5 Task 5 Project Management

The Project Management Task will commence at the beginning of the project and finish after the final deliverables are completed.

3.5.1 Client Meetings

Client meetings will be conducted on an as-needed basis throughout the semester.

3.5.2 Team Meetings

Team meetings will be held throughout the duration of the project. The team will also meet with the technical advisor every other week in order to ensure that the project is being conducted accurately.

3.5.3 Schedule & Staffing

The team will refer to the schedule periodically in order to ensure that deliverables are completed on time. Work hours will be logged throughout the semester in order to keep track of the hours completed by each staff member.

3.5.4 50% Submittal

On October 14, 2016, the KAST Engineering team will submit a 50% design submittal. The 50% design report will include preliminary aspects of the final design. The report will be submitted to the client and reviewed for any final changes or suggestions that should be included in the design before the final design report is presented. It's expected to take approximately 80 hours total over the course of 39 days.

3.5.5 Client Deliverables

An un-approved plan set of the design will be provided to the client by November 18th, 2016.

3.5.6 Final Design Report

The design of the 100% submittal is expected to begin October 17, 2016 and take approximately 96 hours over the course of 32 days. During this time, the team will make revisions to the 50% submittal based on suggestions from the client and technical advisors until all design recommendations are completed. On December 9, 2016, the KAST Engineering team will submit a final design report. The final report will include all design drawings and specifications for modifying and installing new parking stall markings, signs, and pavement and curb markings in designated areas around the Town of Jerome.

3.5.7 Final Presentation

In addition, the team will create a presentation on all components of the project and the final outcomes concurrently as revisions to the proposal are being made. This task is expected to take 12 hours over the course of 21 days. On December 9, 2016, the KAST Engineering team will submit the final presentation. The final presentation must supply a technical level explanation of the Jerome Parking Analysis and Design Project sufficient

for an audience of “general” engineers. It must disclose the scope of the project and how it relates to the needs of the project. The final design along with relevant details should be thoroughly explained within the final presentation.

3.5.8 Website

As the project is wrapping up, the team will finalize the Jerome marking, signage, and parking modifications project website from December 5, 2016 through December 9, 2016. This task is expected to take 8 hours over the course of 4 days. On December 9, 2016, the KAST Engineering team will complete the finalized website. The final website will be viewable on the NAU College of Engineering Forestry and Natural Sciences (CEFNS) capstone webpage.

4.0 Cost and Staffing

This section will provide an overview of the projected costs of staffing and engineering services.

4.1 Staffing Plan

The staffing plan provides an overview of the necessary staff needed for the project and their respective responsibilities.

4.1.1 Senior Engineer (SENG)

The senior engineer is responsible for project management tasks, as well as reviewing the draft documents and final submittals. The senior engineer must be an expert in traffic engineering with extensive experience in the field, and must be able to manage the project effectively and provide knowledgeable insight to the other workers. This worker will largely be responsible for overseeing the field evaluations, revisions, and approving the 100% submittal of the project.

4.1.2 Engineer (ENG)

The engineer is responsible for designing and providing assistance to the engineer in training (EIT) for the design analysis. This worker has ample experience in the field, and will provide guidance and give direction to the EIT and the intern (INT). They will largely be responsible for the design analysis, 50% submittal, the design revisions, and the 100% submittal.

4.1.3 Engineer in Training (EIT)

The engineer in training is responsible for performing the necessary field evaluations and completing designs for the project. The EIT will have enough experience in the field to complete designs and report to the ENG and SENG of their progress. The EIT will also give guidance to the intern and work alongside them throughout the project. The EIT will assist in surveying, and will be responsible for most of the design work.

4.1.4 Intern (INT)

The intern will largely be responsible for surveying in the field, uploading the data, and organizing it for the EIT and ENG. The intern will also aid in doing design revisions. The intern will shadow the EIT, ENG, and SENG to gain experience in different areas of specialization. This worker will have relative coursework experience and be able to organize and process technical information.

4.1.5 Administrative Assistant (AA)

The administrative assistant is responsible for coordinating meetings with the client and the team, as well as any activities related to the project itself. This worker will assist in compiling the 50% and 100% submittal, and will also assist in creating the website. The AA must be competent in programs such as Microsoft Word, Excel, and PowerPoint.

4.2 Projected Cost of Engineering Services

This section provides an overview of the projected person-hour breakdown, billing rate, and total project cost.

4.2.1 Person-Hour Breakdown

The project has been separated into 16 different tasks. Table 4.1, shown on the following page, displays the tasks with hours for the SENG, ENG, EIT, INT, and AA distributed between the tasks.

Table 4.1: Hourly Breakdown of Tasks for SENG, ENG, EIT, INT, and AA

Task	SENG Hours	ENG Hours	E.I.T. Hours	INT Hours	AA Hours
1.0 Field Evaluation	-	-	-	-	-
1.1 Parking	4	4	4	4	-
1.2 Signage	4	4	4	4	-
1.3 Striping/Markings	4	4	4	4	-
2.0 Surveying	-	-	-		-
2.1 Parking Area	-	-	12	24	-
2.2 Signage	-	-	12	24	-
2.3 Striping	-	-	12	45	-
2.4 Data Upload & Analysis	-	8	8	26	-
3.0 Parking Use Survey/Study	-	-	28	28	
3.1 Data Upload & Analysis	-	8	8	14	-
4.0 Design	-	-	-	-	-
4.1 Existing Conditions	-	20	40	-	-
4.2 Parking	-	12	40	-	-
4.3 Signage	-	12	24	-	-
4.3 Striping	-	12	24	-	-
4.3 Markings	-	4	8	-	-
4.4 Standards and Codes	-	10	16	-	-
5.0 Project Management	-	-	-		-
5.1 50 % Submittal	36	20	16	-	8
5.2 Final Design Report	20	24	52	-	-
5.3 Final Presentation	2	2	6	2	
5.4 Website	1	1	-	3	3
Hours	71	145	318	178	11
Total Hours			723		

The total hours for the SENG, ENG, EIT, INT, and AA are 71, 145, 318, 178, and 11, respectively. The total duration of this project is expected to take 723 hours which equates to 90 days.

4.2.2 Billing Rate

The billing rate includes the base pay rate for each position, the benefits provided by the company, and the overhead costs of the project. The billing rates for the SENG, ENG, EIT, INT, and AA are $200, $75, $50, $20, and $55 per hour, respectively. A comprehensive breakdown of the total billing rate can be seen below in Table 4.2.

Table 4.2: Billing Rate Breakdown for SENG, ENG, EIT, INT, and AA

Employees	Classification	Base Pay ($/Hr)	Benefit % of Base Pay	Actual Pay ($/Hr)	OH % of Base Pay	Billing Rate ($/Hr)
Senior Engineer	SENG	$88.00	26	$111	80	$200
Engineer	ENG	$41.25	50	$62	22	$75
Engineer in Training	E.I.T.	$24.50	70	$42	20	$50
Engineering Intern	INT	$11.00	50	$17	30	$20
Administrative Assistant	AA	$22.00	80	$40	40	$55

4.2.3 Total Project Cost

The total project cost consists of the personnel, travel, and overhead costs for the duration of the project. The personnel cost covers the billing rate for the SENG, ENG, EIT, INT, and AA. The travel cost covers the gas money required to travel to and from Jerome for the field evaluations and client meetings. The total cost is estimated to be about $46,289. A comprehensive breakdown of the total cost is shown in Table 4.3 below.

Table 4.3: Total Cost of Engineering Services

1.0 Personnel	Classification	Hours	Rate, $/Hr	Cost
	Seng	71	$200	$14,200
	Eng	145	$75	$10,875
	E.I.T.	318	$50	$15,900
	Int	178	$20	$3,560
	AA	11	$55	$605
	Total Personnel			$45,140
2.0 Travel	14 site visits @ 152 miles/visit	$0.54/mile	$82/visit	$1,149
3.0 Total				**$46,289**

5.0 Appendices

5.1 Appendix A: Project Schedule

Table 5.1: Project Schedule

Task	Hours of work (Combined Person-Hours)	Duration (days)	Start Date	End Date
1.0 Field Evaluation				
1.1 Parking	16	1	8/14/2016	8/15/2016
1.2 Signage	16	1	8/14/2016	8/15/2016
1.3 Striping/Markings	16	1	8/14/2016	8/15/2016
2.0 Surveying				
2.1 Parking Area	36	3	8/15/2016	8/18/2016
2.2 Signage	36	3	8/19/2016	8/22/2016
2.3 Striping	57	5	8/23/2016	8/28/2016
2.4 Data Upload & Analysis	42	13	8/15/2016	8/28/2016
3.0 Parking Use Survey/Study	56	7	8/29/2016	9/5/2016
3.1 Data Upload & Analysis	30	7	8/29/2016	9/5/2016
4.0 Design				
4.1 Existing Conditions	60	14	9/5/2016	9/19/2016
4.2 Parking	52	14	9/19/2016	10/3/2016
4.3 Signage	36	7	10/3/2016	10/10/2016
4.3 Striping	36	7	10/3/2016	10/10/2016
4.3 Markings	12	7	10/3/2016	10/10/2016
4.4 Standards and Codes	26	35	9/5/2016	10/10/2016
5.0 Project Management				
5.1 50 % Submittal	80	39	9/5/2016	10/14/2016
5.2 Final Design Report	96	32	10/17/2016	11/18/2016
5.3 Final Presentation	12	21	11/18/2016	12/9/2016
5.4 Website	8	21	11/18/2016	12/9/2016
Total Hours	723			
Total Days	90			

5.3 Appendix B: Gantt Chart

Table 5.2: Gantt Chart

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