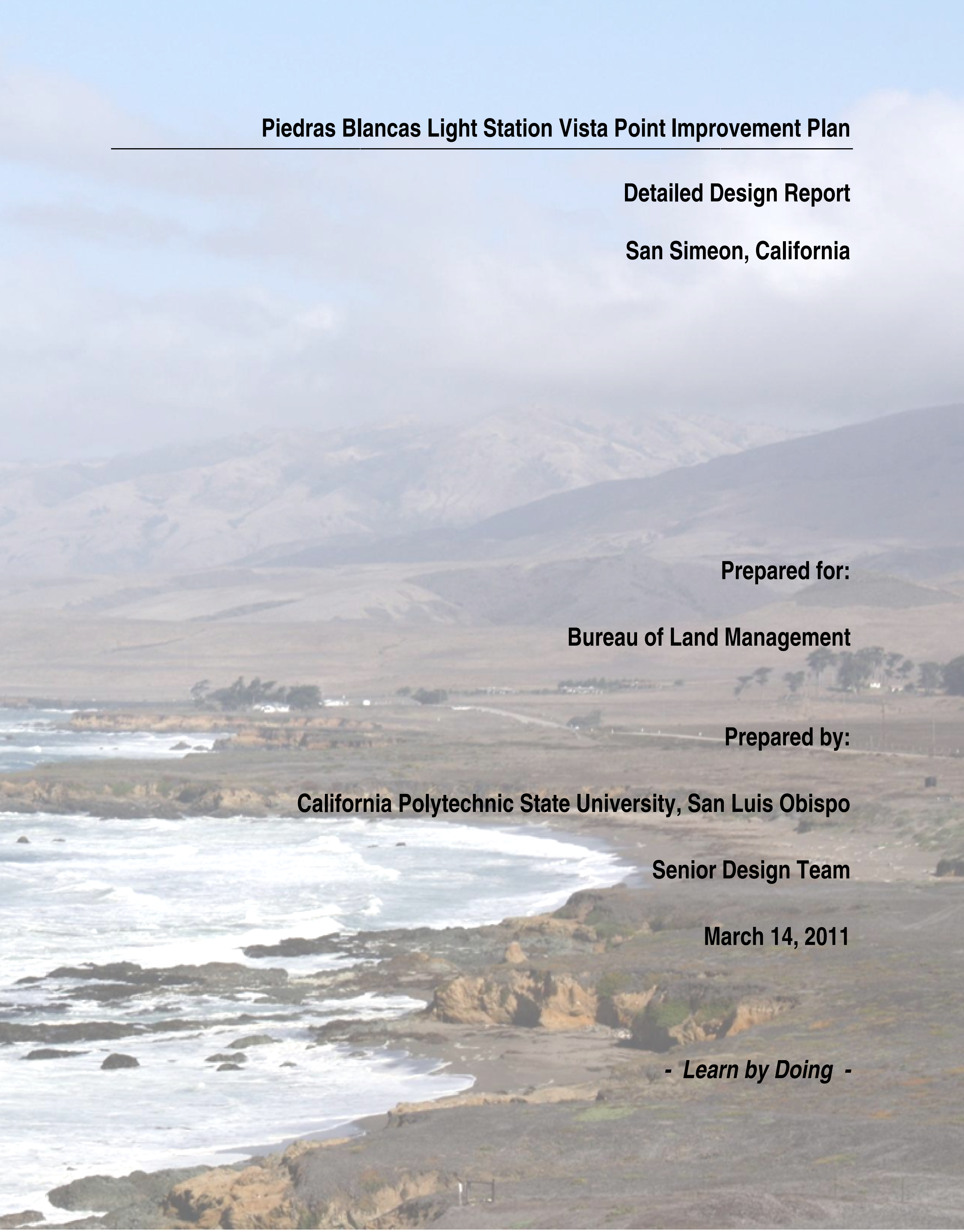

Piedras Blancas Light Station Vista Point Improvement Plan

Detailed Design Report

San Simeon, California

Prepared for:

Bureau of Land Management

Prepared by:

California Polytechnic State University, San Luis Obispo

Senior Design Team

March 14, 2011

- Learn by Doing -

PROPOSAL TEAM

CITY AND REGIONAL PLANNING:

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CIVIL ENGINEERING:

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MECHANICAL ENGINEERING:

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Nick Mitchell	nmitchel@calpoly.edu

STATEMENT OF QUALIFICATIONS

PROPOSAL TEAM SUMMARY

The proposal team is composed of unique and well qualified individuals who believe strongly in the objective of the project. The team builds off a synergistic balance of skilled scholastic knowledge. The diversity of the team is the dynamic factor for the success of this improvement plan design proposal. The team is composed of senior and graduate level students from City and Regional Planning, Mechanical Engineering, and Civil Engineering at California Polytechnic State University, San Luis Obispo.

LARISSA HEEREN

Larissa Heeren is in her second year of the Master's in City and Regional Planning program. She earned a BA from Sonoma State in Sociology with a minor in Environmental Studies and Planning. She recently interned in the Environmental Division of the San Luis Obispo County Department of Planning and Building. There she gained knowledge of County and State environmental regulations by compiling biology and geology information for projects seeking permits. Before returning to school, Larissa held three different jobs in the environmental education field. During this time she gained valuable knowledge of plant and animal identification techniques as well as an understanding of ecological principles.

REUBEN JUSTER

Reuben Juster is a fourth year civil engineering major with a concentration in transportation engineering. He has worked on many design projects in the past including a project where he realigned the Pacific Coast Highway in the Piedras Blancas area. He has finished all the required civil engineering classes and taken additional transportation classes including traffic engineering, highway geometrics, and transportation analysis. Next quarter, Reuben has also taken a pavement design class which will be vital for the group's effort in designing the vista point. Reuben will assist the group in creating different design alternatives for the project as well as researching their feasibility.

NICK MITCHELL

Nick Mitchell is currently pursuing a BS in Mechanical Engineering and is on pace to do so in the spring of 2011. Throughout his coursework at Cal Poly he has been exposed to practical welding and machining experience which will prove valuable in the scope of this project. Nick is a student board member of the Cal Poly ASHRAE chapter with which he remains steadily involved. His coursework in the future will include various HVAC specific Technical Electives. Nick will research the materials and processes necessary for construction of the gates and iron rangers.

JOHN ROSSI

John Rossi is a fifth year Mechanical Engineering student at Cal Poly University. During his years at Cal Poly, John has maintained an above 3.1 GPA. In addition to being a full time student, John has worked as a project manager at a local energy consulting firm for the last two years. As a project manager John has learned how to communicate with people and coordinate on complex projects. John has earned his EIT certificate and plans on one day becoming a licensed PE.

ANNAMARIE USHER

Annamarie Usher is completing a Bachelors of Science Degree in Civil Engineering from Cal Poly, San Luis Obispo in June 2011. With two years of industry work experience in engineering, she is specializing in geotechnical engineering. Annamarie has completed over 100 hours of work in a certified soils and materials testing laboratory and 60 hours of site investigation work including drilling expeditions and environmental and soil sampling. With experience in the direct application of engineering principles, some of her most pertinent course work includes Shallow Foundations, Slope Stability, Geoenvironmental Engineering, and Fundamentals of Transportation Engineering.

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1.0 INTRODUCTION

The Bureau of Land Management (BLM) maintains the Piedras Blancas Light Station and is interested in upgrading the facility entrance to improve safety and public access. The current arrangement has proven to be problematic in the past and is in desperate need of various forms of improvement. The main goal which this group will strive to achieve is the eventual construction of a vista point that would be accessed by an improved entranceway and a new left turn lane on the adjacent highway. It is hoped this improved entrance will also reduce impacts to a native plant re-vegetation program near the current parking area. A retrofitted vehicle gate, pedestrian access gate, and iron rangers will be linked to the completion of this vista point. Site visits and inspections, constant coordination with the BLM, and permitting evaluation with the regulatory agencies are crucial to a successful project conclusion. Though improvement plan is being pursued by the BLM, the project site is owned by California State Parks. Coordination and constant communication with both the Bureau of Land Management and California State Parks is critical for suitable proposal development.

2.0 BACKGROUND

2.1 PIEDRAS BLANCAS LIGHT STATION HISTORY

The area that is now Piedras Blancas was first used by Native Americans as a fishing center. When the United States began settlement on the West Coast, ships traveled up and down the coast transporting settlers and goods. Due to the infamous fog of the Pacific, ships began to crash into the coast. Thirteen lighthouses were authorized by President Andrew Johnson including Piedras Blancas to increase visibility along the coast.

The Piedras Blancas Light Station construction began in 1874 and was completed in 1875. When it was first constructed the full structure was 110 feet tall. The light station included the lighthouse, two Victorian houses, fog signal building, dock, and other support buildings.

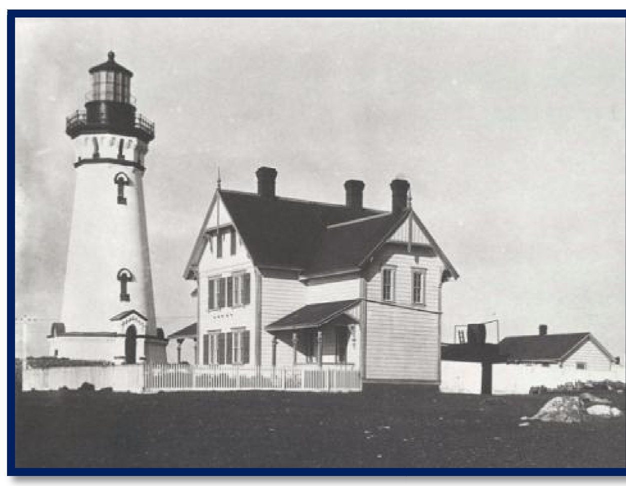


Figure 2.1-1 – Piedras Blancas Light Station (1894)

As time passed by, the top of the tower was determined to be structurally unsound and the top was removed decreasing the height of the tower to 74 feet. The whale oil powered Fresnel lens was replaced by electronic light. The Victorian homes were substituted with cinderblock houses. Invasive plants replaced the native species.

After the Coast Guard transferred the light station to the Bureau of Land Management, great progress has been made in restoring the light station to its original state. Volunteers have eradicated the invasive species and the native plants have returned. Many restoration projects are underway to replicate the original buildings.

2.2 VISTOR'S SITE IMPROVEMENT PLAN

Tours of the light station are given three times a week. Current visitors must park at the Piedras Blancas Motel north of the site and get shuttled by bus to the light station. The entrance to the light station is adjacent to the Pacific Coast Highway and features a solar power gate to keep unauthorized vehicles from entering the site. Many vehicles park by the entranceway to enjoy the light station views. This creates a significant safety hazard and accidents have been caused by parked motorist and site distance issues. The Piedras Blancas Senior Project Design Team is analyzing the feasibility of improving the entrance way to the light station. The improvements include a vista point development, redesigned solar powered gate, Highway 1 safety improvement, and Piedras Blancas entrance expansion.

2.3 VISTA POINT SUPPLEMENTARY STRUCTURES

The remote location of the Piedras Blancas Light Station Highway 1 entrance does have adjacent power lines; however they are high voltage and serve the onsite facilities power needs. This makes it necessary to have some sort of alternate energy source for vehicle gate operation. Currently a solar panel is utilized to charge a 12 volt battery located just below the drive mechanism. This system has met with several problems in the past and leaves quite a bit of room for improvement.

State and national parks throughout the country employ some sort of system for collecting money in the form of donation or rental payments; this is typically done using an iron ranger. Iron rangers are used in situations when park rangers are not permanently present yet services provided require or request some sort of monetary contribution. Typical iron ranger design consists of an approximately four foot steel pole that has a slot where envelopes can be inserted. This simplistic design stirred our desire for a more esthetically pleasing approach.

The BLM would like to see a separate pedestrian entrance gate incorporated into the vista point design. This pedestrian gate would provide a dual purpose allowing people to enter and exit the light station tour as well as excess the coastal trailhead.

2.4 GEOTECHNICAL SITE DESIGN

The soil conditions of the site area are critical to the function, maintenance, and lifetime of the vista point. Investigating, identifying, and analyzing the subsurface conditions yield proper parameters for the foundation and footprint of the vista point. Geologic maps create a historical and site specific visual representation of the geologic complexes that will be encountered. The

area primarily consists of marine terrace deposits, specifically silty, sandy soil. Soil sampling allowed for soil classification to identify the types of soils with respect to depth of the in situ material. A complete geotechnical soil exploration was based on the geologic maps, field results, and local parameters to create final specifications.

Geosynthetic products are being researched for installation between the in situ material and the sub base foundation of the vista point. Currently, geosynthetic products are being researched based on function, installation requirements, durability, cost, and performance. The proper geosynthetic is critical to the performance of the final vista point design. The heterogeneous and dynamic nature of soils requires careful and complete investigation to determine the site specific engineering parameters.

The field investigation is consisting of a percolation testing and hand augering exploration. Figure 6 on page F-6 is an image description of the percolation testing. The percolation testing consisted of timing the water infiltration rate for the onsite soil. The 14 inch diameter hole at 15 inch depth was lined with plastic on the sides and filled with 3 gallons of water. The time it took for the 3 gallons of water to infiltrate was timed. The infiltration rate for the site is 0.21 inches per hour. With the year rainfall average, this infiltration rate shows no issues for the site. The permeability of the sub base creates simple natural drainage for the vista point; however, the use of a geocomposite (geogrid geotextile combination) is recommended for placement between the soil and the sub base layer. The geogrid allows for proper drainage while the geotextile allows for separation and filtration between the soil and aggregate. Overall, the use of the geocompositie improves the site drainage and maintenance of the site.

Figure 7 on page F-7 is an image description of the hand augering technique. The hand augering results are a detailed description of the subsurface soil characteristics. The field exploration yields the appropriate and vital soil classifications for the design of the vista point. The site has no large variations within the footprint of the vista point. Silty, sand is the common soil with layers of mineral deposits and clay pockets. The clay was found on the west side of the vista point where the wetlands border. The soil is a good foundation experiencing a same consolidation during construction phase with little to no settlement for the life of the vista point.

Figure 2.5-1 – Sample of Permeable Pavement

2.5 VISTA POINT PAVEMENT SELECTION

The vista point improvement site is currently covered with coastal shrub vegetation. To provide reliable and safe parking for all vehicle types,

the vista point parking lot and entrance design is partially paved in conjunction with a gravel-type cover. In San Luis Obispo County, it is mandatory to use a permeable surface for parking. Manufactured products such as concrete boxes and plastic grids were researched as an alternative to crushed gravel. In the paper, "Long-Term Storm Water Quantity and Quality Performance of Permeable Pavement Systems," by Benjamin O. Brattebo and Derek B. Booth, the long-term effects of permeable pavement as a storm water control method are investigated. Specifically how the pavement would perform structurally, if the permeability of the pavement would ever fade away, and what the runoff water quality is. The researchers used eight parking stalls that had different types of permeable pavements and one stall that was paved with traditional pavement. After six years, the wear on the permeable pavements was considered to be minor. Most of the rainwater went through the pavement with the exception of a leak in the equipment. The quality of the storm water from the permeable surface was much less toxic than the runoff from the asphalt surface. One of the concerns of the experiment was that the experiment occurred in the Pacific Northwest where rainfall intensities are low and temperatures do not usually go below freezing. These concerns do not apply to the Piedras Blancas Light Station because the weather is similar to the study area.

3.0 OBJECTIVE

3.1 PERFORMANCE OBJECTIVES

The improvement plans require an integrated design process of the civil engineering and mechanical engineering performance objectives. An overall design process includes the construction of vista point and bus turnout, expansion of highway turnout area at the lighthouse entrance, design and fabrication of a vehicle entrance gate, and incorporation of a handicap accessible pedestrian gate. The final design will include signage regarding the native plant and animal species as well as historical information. The main objective of all proposal improvements is critical safety augmentation.

3.2 RESULTS OF PERFORMANCE OBJECTIVES

The design for the improved site will result in realigned access to the Piedras Blancas Light Station. This realigned entrance and vista point will improve the site safety and ease of access. The site distance improvement objective correlating to highway safety will result in a possible realignment of Highway 1, grading adjacent to Highway 1, and/or entrance widening. The intention of the highway integration with this site improvement plan is to research and develop a feasibility study of the possible improvements. The final proposal will included a comprehensive, detailed design process of the Piedras Blancas Light Station Visitor's Site Improvement Plan. The final proposal will also include the site analysis and final design recommendation complete with supporting documentation and pertinent background information.

3.3 MECHANICAL ENGINEERING COMPONENTS

Currently, the Piedras Blancas Light Station entrance operates by use of a solar powered vehicle gate. This gate is located one and one-half car lengths from Highway 1 which presents a safety hazard for automobiles entering and exiting the location, as well as travelers along the coast. With that said, one of the main objectives from a mechanical standpoint is relocating this entrance to a more sensible location. In addition to relocating the gate, improvements will be made on the aesthetic qualities relative to structure and design of the gate. Matching the natural beauty of the surrounding landscape is a significant requirement of the BLM. Retrofitting as many of the existing components of the current gate system into the new design is desirable goal. This comes mainly from an economic perspective considering the BLM relies heavily on private donations. If at all possible, the solar panel, gate drive track, and existing control system will be implemented into the relocated gate. Based on the harsh environment elements this system must withstand, corrosion resistant materials need to be used on the primary gate components. The constant sea breeze and mist at this specific location wears down structural material at a much higher rate than standard specifications tolerate. The four aspects which will drive our design include safety, aesthetics, fiscal limitations, and durability.

The scope of this project will also include a pedestrian access gate, iron ranger, and a site information signage. The pedestrian gate shall serve two separate purposes. First, the gate shall be the main access point for patrons going on the light station guided tours. Also, the gate will serve as access for the California Coastal Trail. Wheelchair accessibility is another main objective for this pedestrian access gate. Making the gate wheelchair accessible will assist in meeting ADA regulations required whenever designing to meet a public need. The iron ranger will serve as a collection point for monetary donations. In addition to the functional purpose, the iron ranger will serve as vista point décor. Keeping true to the Piedras Blancas impression, the iron ranger will emulate the lighthouse. This decorative beacon must be able to stand up to the possibility of vehicular damage. The threat of damage will drive our material selection, design, and final placement. Lastly, a site information sign will provide a brief summary of the location and the existing protected wildlife. In order to uphold the view shed regulations set forth by the Coastal Commission, the sign must only be thirty inches off the ground at the highest point. The sign must sustain the extreme coastal conditions. Thus, a corrosion resistant material will have to be used for the sign construction.

3.4 CIVIL ENGINEERING COMPONENTS

The first civil engineering objective is to create a vista point for the visitors of the light station, coastal trail, and coastal views. The vista point will include 66 parking spaces including four ADA compliant parking spaces and possible four recreational vehicle spaces. Multiple designs or alternatives must be created for the proposal design team to evaluate to determine the best design. For the parking portion of the project, alternatives will be made based on the following criteria:

Footprint of the Vista Point — The vista point will be in an environmentally sensitive area and the less space and environmental impact the vista point makes, the better the alternative.

Vista Point Maneuverability — Vehicles using the facility should be able to travel around the vista point easily and safely.

Pavement Performance — The pavement needs to have adequate strength to support the parked vehicles and properly drain rainwater to prevent flooding. The pavements must be permeable as mandated by San Luis Obispo County.

Maintenance and Capital Costs — The project must meet the budget of the Bureau of Land Management who will be funding the project.

Figure 3.4 -1 – Current Light Station Entrance

The entrance of the Piedras Blancas Light Station is accessed by California State Highway 1. Due to the frequency of travel and the poor sight distance, Highway 1 requires modification. Possible plans include one or a combination of the following:

- Widening the highway onto both adjacent properties which includes Heart Ranch.
- Grading part of the small hills next the highway to increase the sight distance.
- Constructing a left turn lane into the light station entrance.
- Constructing merge lanes on the highway.
- Not changing the current highway conditions.

A small 15 passenger bus will be shuttling people from the vista point to the light station, approximately a one-half mile distance. A bus turnaround is included in the design proposal allowing the bus to switch directions on the narrow road leading to the light station from the vista point.

4.0 DESIGN DEVELOPMENT

4.1 METHODOLOGY

In order to effectively meet all requirements and objectives, a systematic approach must be taken. Before the problem can be resolved, it is critical that the current situation and required improvements are taken into consideration. After understanding where improvements are necessary, research is conducted for each proposal team member's area of study. Once research is completed, a proposal is concluded outlining the best solution for each aspect of the project. It is important to generate alternative solutions to allow the proposal team to analyze the best design result to be implemented. It is important to note that the best design decision includes the

client's input. A scale model of the entrance area shall be designed to be presented at the senior project fair and to the BLM in June 2011. The anticipated duration of complying with the regulatory agencies will likely prevent actual on-site construction within the time constraints of this interdisciplinary senior project. However, the final proposal document will serve as a comprehensive guide to the complete construction of the vista point improvement plan.

4.2 SUPPLEMENTARY STRUCTURES DESIGN TECHNIQUES

Upon our second visit to the site we performed a more thorough investigation on the size, function, structure, and inner workings of the vehicle entrance gate. We discovered the initial approximations on the size of the gate were considerably off. The true size of the existing vehicle gate 18 feet by 5 feet, while our initial estimate was 10 feet by 4 feet. This change in sizing of the gate will most likely result in the usage of two side by side stainless steel plates. As of now there are two possible viable options that we are investigating for precision cutting of the stainless steel plates. The simplest and cheapest cutting technique would be performed using the Cal Poly Agricultural Engineering CNC plasma cutter. One concern with this technique involves warping and loss of material corrosion resistance. Utilizing a water jet cutting technique is the second option we have for cutting the stainless steel plate. No water jet systems exist on Cal Poly property, as a result choosing this technique would prove to be more costly and travel arrangements would have to be made. Some of the benefits to water jet cutting technology include untarnished surface finish and absence of residual heat effects. A decision will be made within the next coming weeks on which technology to use pending further research.

The design of the iron ranger has also introduced a series of unique situations that need to be resolved. As an initial step towards creating a full size iron ranger, we have decided to create a scaled down model of the lighthouse which will be approximately 5 inches tall. Professor McFarland provided us with detailed drawings that have been used to create a solid model which is pictured to the right. Utilizing the mold/shell tool within SolidWorks accompanied with a rapid prototype machine we construct a mold. This mold will not only provide us with valuable experience which we will use towards creating the full size concrete iron ranger prototype, but will also possibly serve as a method for producing souvenir paper weights that could be sold in the gift shop. As far as the concrete prototype is concerned we are planning on consulting with professors within the Civil Engineering department. We are aware that some type of reinforcing matrix will be necessary to a rigid and durable iron ranger design.

4.3 REGULATORY AGENCIES

This section summarizes the major regulatory requirements that apply to the proposed project. The full report of applicable regulations is attached as Appendix 1. Only agencies and

regulations with major roles were included however additional agencies and other stakeholders may be involved to varying degrees with the process. The major agencies included here were California State Parks, San Luis Obispo County Planning and Building and Caltrans.

Support for project goals from these agencies is likely; the type of project is not in and of itself seen as causing a risk to project completion. The project goal of public access goal fits with established goals of each of the regulatory agencies, to varying degrees. State Parks and the County are more interested in providing public access to open space than is Caltrans. However, the Conservation Easement signed by Caltrans for this area included specific provisions for public facilities.

Possible environmental impacts do pose some risk to project completion as there are potentially significant environmental impacts. If any of the impacts are determined to be significant, an Environmental Impact Report (EIR) is required. The cost of conducting such a process may be financially infeasible or undesirable from a management perspective. This is especially the case because it is anticipated that State Parks would provide the CEQA project management. That said, BLM staff knowledgeable of existing studies for the project site stated that no ‘positive findings’ archeology or red-legged frog studies is the possibly classification for the project site. However, there may not have been any wetlands delineation studies conducted to date.

While the project is funded by the BLM, project management for CEQA requires substantial staff time. This is not a significant risk for two reasons. One is that the project fits well with State Parks goals and with State Parks future planned projects (i.e. the California Coastal Trail.) Second, county staff stated that they could manage the initial study for a fee.
The most significant risk posed to project implementation is the scenic easement covering the project area. While the easement makes allowances for public facilities, it will be very difficult to keep the parking area from blocking views of the ocean based on the topography. Additionally, Caltrans is somewhat less interested in the project goals than the other two agencies. There is however, a formal process for reviewing the project stipulated in the Conservation Easement and careful consultation with them early on is likely to alleviate possible problems.

4.4 VISTA POINT DESIGN

Two rough alternatives were created for the vista point preliminary design. Each alternative has forty parking spaces, four ADA accessible spaces, a expanded main entranceway, a thirty foot wide aisle and an option extra entrance way. The difference between the alternatives is that one alternative has the ADA parking with the other parking and the other alternative has the ADA parking on the other side of the driveway. See figure 5 for the layout of the alternatives.

5.0 PROJECT PLAN

5.1 INFORMATION GATHERING

An important part of information gathering will be the gathering of permit requirements for the project and all of the proposed iterations. This will occur in tandem with the project development and will inform the project development process just as the development of project alternatives will inform the type of permits and requirements necessary for the project.

5.2 DOCUMENTATION OF OVERALL PROJECT PROGRESS

The overall project schedule is shown in Figure 5.2-1.

Once most of the team had been recruited, the proposal team members have completed one site visit thus far. This initial site visit served as a means to get acquainted with the project environment. Many photographs were taken for documentation, research, and design development.

During the fall quarter, the project team met three times a week to assign work and to keep all members updated on the progress of the project. Meetings for the future quarters will be of similar nature to the fall quarter meetings.
A preliminary presentation of the project was presented on October 18, 2010 to the multidisciplinary senior project class. This presentation outlined the engineering problem, objectives of the project, and project plan.

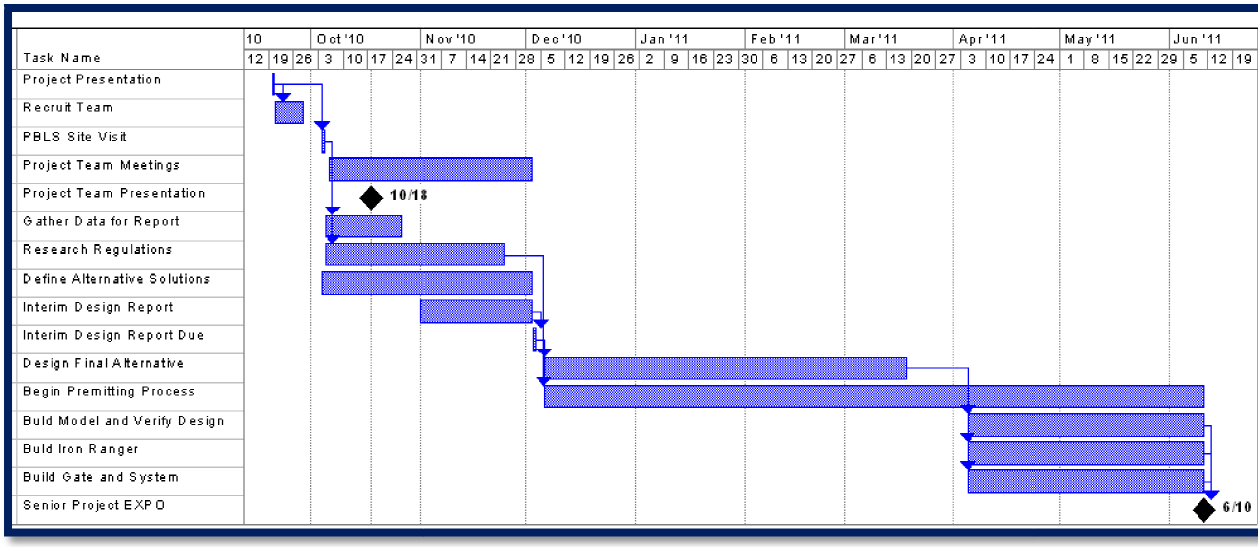
The city planning team member researched the different regulatory agency requirements that affect the design of the project. These requirements will assist in the design process. The civil engineering team will come up with alternatives for the vista point, bus turnaround, and highway realignment. Only preliminary designs will be made at this stage. The mechanic engineering team will research different types of materials for the gates and iron ranger. Designs for the gates and iron ranger will be done by the mechanical and civil engineering teams. The interim design report contains the preliminary designs from the parks and recreation, civil engineering and mechanical engineering teams.

For the final design alternatives, the mechanical engineering team will test materials for the gates and iron ranger, and create the final designs for them. The civil engineering team will perform the necessary tests and simulations to pick the best design alternative. This alternative will then get a complete constructible design. The parks and recreation team member will create final designs for the auxiliary structures.

The city planning team member will work with all of the relevant agencies compiling all permit requirements necessary for project approval. All other teams will supply necessary information to aid in the permitting process.

A scaled replica of the design will be recreated as an aid to visualize the entrance. All teams will assist in creating the model. With the mechanical engineering team leading the construction process, all teams will help in the building of the iron ranger and gates.

The final design proposal will be presented at the Cal Poly senior design expo and also in a final meeting with BLM.



5.3 CIVIL ENGINEERING DESIGN PROCESS

The vista point design requires careful and fluid processes creating a comprehensive timeline. It is important to create several design alternatives representing the client's interests. The process begins with the alternative designs noting the particular characteristics and parameters with respect to the various designs. The vista point and bus turnaround designs become more developed and characterized through ADA research in order to incorporate the proper requirements in the designs. The soils testing and percolation testing create a technical understanding of the foundation and site specifications for the vista point. Researching proper and economical geosynthetic products to separate the sub base from the in situ soil is critical for the longevity and ease of maintenance of the vista point. A soil analysis report as well as an environmental analysis report will guide the exact specifications of the final alternative designs as well as lending as a valuable reference tool for the client. Along with the vista point design process, a Highway 1 redesign process is carried out. The current stopping sight distance and a traffic count or survey of light station tourist cars is investigated for a safe and thorough redesign. With the assistance of a traffic simulation model (VISSIM), feasible realignment

options will be design. Finally, the complete design with critical parameters will be integrated into Civil 3D. A cost estimate and safety analysis must be performed on each design alternative to ensure the best alternative. See Figure 4 for the flow chart of the civil engineering design process.

5.4 MECHANICAL ENGINEERING DESIGN PROCESS

The design process involved with building and implementing the vehicle gate at the light station is one that must be evaluated thoroughly. Multiple design alternatives will be made in order to accommodate any change in project scope that comes up throughout the design process. Because our funding is coming directly from the BLM we must present our designs to them for approval before any manufacturing takes place. It is important that they are informed of the advantages and disadvantages of each of our design alternatives so that they are aware of our intentions. In addition to keeping the customer informed it is also important to communicate with relevant industry contacts. We have decided to utilize the local company Motive Systems in Paso Robles to perform the necessary decorative machining of the stainless steel plates for the gate design. A water jet cutting CNC machine performs this process on site for them. SolidWorks is a well-known mechanical engineering tool which can be utilized in order to design the decorative gate to be manufactured out of the stainless steel plate.

The iron ranger design is one which will be completed in two unique forms. A small more detailed design will be constructed in SolidWorks to be rapid prototyped in one of the machines on campus. The purpose of this part is to present to the BLM as well as to serve as a sort of proof of concept which can also be mass-produced and possibly sold at the Piedras Blancas gift shop. Further evaluation on the validity of this part will lead us to decide whether or not to continue with rapid prototyping or stray more towards some type of casting solution. The larger of the two iron ranger prototypes will be constructed as a concrete composite with some sort of metal mesh/matrix. Consultation with knowledgeable ME and CE professors in the field of composites and concrete is a priority. Research concerning the most desirable concrete material and metal reinforcement must be done in order to ensure the quality of the original prototype considering the limited amount of time and resources. It may become apparent that more than one prototypes needs to be built so that the best alternative can be chosen and duplicated. Cost estimation is a key in the design process of both the vehicle gate and the iron. See Figure 5 for the flow chart of the mechanical engineering design process.

6.0 CIVIL ENGINEERING DESIGN

The creation of the vista point requires many components including a parking lot for visitors, a driveway to access the light station and parking lot, and realignment of the adjacent highway to increase visibility and safety. An optional entrance only driveway for the highway's southbound

approach will also be designed. Before any design begins, a demand forecast must be performed to ensure the designs will be adequate for future patronage.

6.1 DEMAND FORECAST

A demand forecast is necessary for the project to ensure that the parking lot is large enough to handle visitors on a busy day and cross-sections of the components are thick enough to prevent deterioration associated with fatigue. The design of the parking lot requires a short term worst case scenario which would be the maximum possible automobiles requiring parking in an hour. The design of the cross-sections of the driveways and the parking lot is dependent on the yearly usage of the facilities. The visitor counts for 2009 and 2010 will be used to estimate the short term worst case scenario for the parking lot size and annual usage of the components for the cross-section design. The demand forecast for the cross-sections is in section 6.7 with the load calculations.

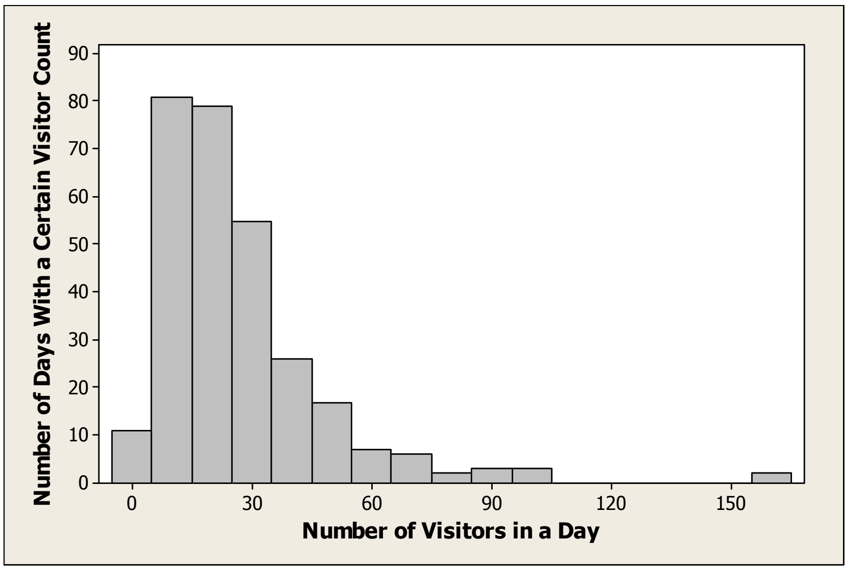


Figure 6.1-1 – Number of Visitors per Day for 2009 and 2010

Standard automobiles (SUV's and below) are the vehicles typically used by visitors and volunteers, and constitute the largest demand of space for the parking lot. The number of standard parking spaces is reliant on the number of visitors on the busiest day of the year, typical occupancy of a visitor's vehicle, number of volunteers, and typical occupancy of a volunteer's vehicle. The tourists usually come during one part of the day and therefore the amount of daily visitors is used as a substitution for hourly visitor count. Based off the two year visitor count, which is summarized in figure 6.1-1, the 95th percentile of daily tourist counts (T) is seventy five people. Assuming that the tourist to car ratio (C_T) is 1/2.5, the volunteers to tourist ratio (V) is 1/6, the fact that volunteers drive alone (C_V), and adding 30% additional spaces for passerby's, the number of standard vehicles can be calculated.

Standard Parking Spaces=$(T*C_T+T*V*C_V)*1.3$

$$\text{Standard Parking Spaces} = (75\ \text{Tourists} * \frac{1\text{Car}}{2.5\ \text{Tourists}} + 75\ \text{Tourists} * \frac{1\text{Volunteer}}{6\ \text{Tourists}} * \frac{1\ \text{Car}}{1\ \text{Volunteer}})(1.3)$$

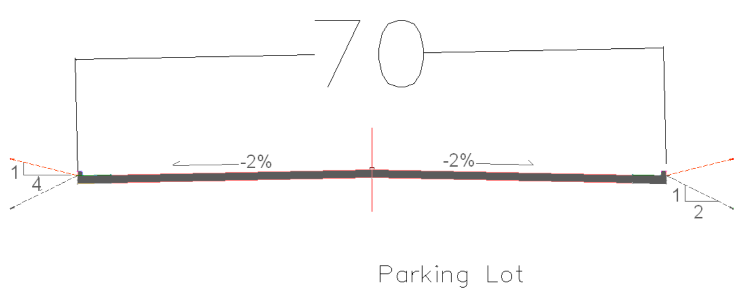
Standard Parking Spaces =55
To make the parking lot symmetrical, the amount of parking spaces will be bumped up to fifty six.

The Americans with Disabilities Act (ADA) requires two parking spaces for a parking lot of fifty six spaces. Four spaces will be made ADA compliant to be cautious.

While standard vehicles are the primary vehicles of visitors and volunteers, recreational vehicles (RVs) and buses must be considered for the design of the parking lot. The Bureau of Land Management will allow buses to drive directly to the light station because it would be redundant for a BLM bus to shuttle the passengers of a school or tour bus from the vista point to the light station. RVs will park at the new parking lot and based on one of the volunteer's testimony, four RV spaces would be ideal.

6.2 PARKING LOT DIMENSIONS

The parking lot was originally envisioned to have room for forty standard cars including four ADA accessible parking spots, but based on the demand forecast; the amount of parking spaces was increased to fifty six. Figure 8 shows the possible parking lot plans. All parking space dimensions are compliant with San Luis Obispo County Code 23.04.164. Alternative A is a standard rectangular lot without RV parking. Alternative B substitutes four of the standard parking spaces for four RV parking spaces. There is empty space on the other side of the RV parking to allow for the RVs to maneuver out of the parking lot.



6.2-1- Cross-Section of Parking Lot

The super elevation or the slope of the transverse dimension was set to -2% from the center to match up with slope of the driveways and highways. This conforms to San Luis Obispo County Code 23.04.168.e, which states that the super elevation of parking lots cannot exceed five percent. Berms line the longitudinal sides of the parking lot to prevent cars from moving off the parking lot. The daylight for the parking lot and all parts of the project is a minimum width daylight which is set at a default cut slope of 4:1 and fill slope of 2:1. In the event that the daylight is less than 8 feet, the slope will be made gentler until the length of the daylight is 8 feet long. See figure 6.2-1 for the cross-section of the parking. The thickness of subbase layer, as talked about in section 6.7, can be calculated once soil resistance tests are performed.

The horizontal alignment of the parking lot starts at a perpendicular T intersection with the improved existing driveway. The alignment continues straight until the parking lot comes to the second driveway. The vertical profile slopes downwards at a grade of -0.66% from the existing driveway towards the second driveway. The parking lot at some sections is more than 2 feet above and below the existing terrain and will require substantial ground work. See figures 9 – 15 for the vertical profile and horizontal alignment of the parking lot and other other components.

6.3 PRIMARY DRIVEWAY DESIGN

The primary driveway for Piedras Blancas is on the southern end of the parking lot and will be expanded toward the north to accommodate more lanes. At Highway 1, the driveway will be three lanes with the entrance and left turn lanes being 10 feet wide while the right turn lane is 12 ft wide to allow for a curb radius of 154 feet. Near the parking lot, the driveway will narrow to two ten foot lanes lanes, and near the gate it will narrow to the existing single 12 foot lane. The right turn lane near the intersection will only be 15 feet long with a 10 foot transition, but together with the larger curb radius, at least 4 vehicles will be able to queue.

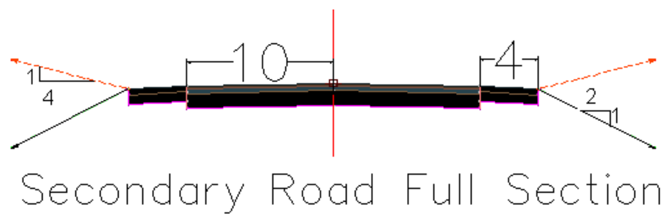


Figure 6.3-1 Cross-Section of Driveway

Before the gate, there is a potential for a bus turnaround for the Piedras Blancas shuttle bus and proposed bus that will transport tourists to nearby sites such as the Piedras Blancas Hotel and Hearst Castle. The driveway, as shown in figure 6.3.1, uses a typical road cross-section except that lane width changes as indicated above and the shoulders will shrink from 8 feet at the intersection to highway to 4 feet. The driveways horizontal alignment closely matches its current alignment. The driveway also closely matches the existing terrain at a slope of 4.16%.

6.4 INTERSECTION AND HIGHWAY 1 IMRPOVEMENTS

The intersection between the Piedras Blancas driveway and Highway 1 will be modified to make the intersection more visible and therefore safer for drivers. Highway 1's northbound approach to the intersection will be widened by a lane to accommodate a left turn lane. Piedras Blancas's driveway will be widened to allow lanes for movements into the parking lot, right turns onto Highway 1, and left turns onto

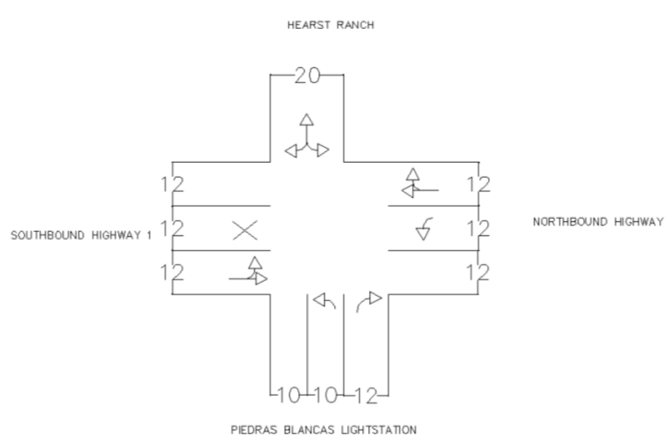


Figure 6.4-1 – Highway 1 & Piedras Blancas Lane Assignment (Not to Scale)

Highway 1. Hearst Ranch's driveway does not get enough traffic to justify widening it, but the widened shoulder on northbound Highway 1 before the intersection will be widened to assist in Hearst Ranch vehicle movement.

Highway 1's southbound approach will be aligned to keep symmetry, but no left turn lane will be added because left turn movements are too rare for their own lane. Right turns from Highway 1 south will occur on the optional driveway. See figure 6.4-1 for the lane assignments and widths for the intersection. The cross-section of the highway uses the same dimensions as nearby's section of the highway. See figure 6.4-2 for the cross-section of the highway.

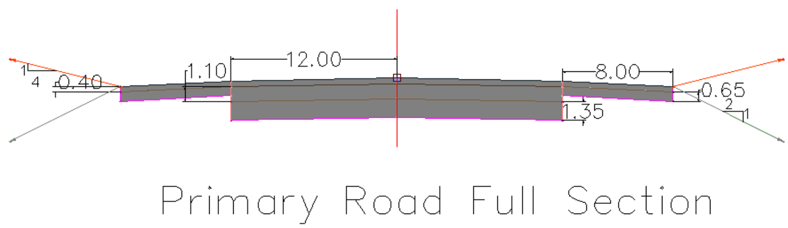


Figure 6.4-2 Cross-Section of Highway

The intersection has a skew of 73.9°, which is below the minimum 75° as required section 403.3 of the California Highway Design Manual. Since this project is improving a preexisting intersection, the skew can be grandfathered in. The highway's northbound left turn lane into Piedras Blancas is 530 feet long with a 780 foot transition length as recommended by section 405.2 of the California Highway Design Manual. Since the southbound approach of the highway does not have a left turn lane, the extra width of the highway will start its 780 foot taper directly after the intersection. See figure 16 for a visual of the turn lanes.

The new horizontal alignment of the highway is east of the existing alignment. The radius of curvature of the highway was increased from 750 to 1638 feet to allow motorist to safely drive at 55 mph. The new alignment quickly converges and diverges with the old alignment to minimize overlap with the existing alignment and therefore make construction easier. The new alignment will still be close to the old alignment to minimize land acquisition from Hearst Ranch. The vertical profile starts as cut below a preexisting hill, which had been a hinder for visibility at the driveway. After the hill and before the driveway, the highway is mostly above the existing terrain with some portions being 8 feet above the ground. This fill required for the above ground segment will be compensated by the cut generated from the below ground highway segment after the driveway.

6.6 OPTIONAL DRIVEWAY

The Bureau of Land Management has expressed interest in an entrance only driveway from southbound Highway 1. The feasibility of the driveway is based on its cost, environmental impact, and Caltrans's permission. Unforeseen extra costs to the project can jeopardize the implementation of the optional driveway. The cross-section is the same as the primary driveway

except that there is only one 10 foot lane. The second driveway diverges from the southbound side of the highway at skew of 16.7°, which is allowable because it is an entrance only driveway. The driveway then curves with 500 foot radius until it ends at the parking lot. The vertical profile of the driveway starts by sloping up from the highway at a grade of 8.23% and then sloping down at a grade of 1.77% towards the parking lot.

6.7 PAVEMENT ANALYISIS

The driveways and the ADA parking will be made out of flexible pavement, while the rest of the parking lot will be made out of a Class 2 Subbase layer, which is acceptable according to county code 23.04.168.a. The thickness of each of the layers in each component's cross-section is dependent on the facilities' expected yearly traffic. Based on the information and assumptions in section 6.1, the design load can be estimated. If the design load is below the Asphalt Institute's Traffic Class I designation (parking lots/ driveway), then the load will be increased to meet that designation. Table 6.7-1's calculation yields the amount of cars expected to visit the Piedras Blancas each year as well as their equivalent axle load factor (EALF). The EALF is based on the gross weight and the number of axles with respect to individual vehicles.

Table 6.7-1 – EALF Calculations

Person Type	Regular	Group	Personal	Admin	School	College	Events	Service	Volunteers
2010 Total People	3950	160	108	242	280	131	227	104	658.3333
People to Car Ratio	2.5	30	1	2	40	2.5	2.5	1	1
Number of Vehicles	1580	5	108	121	7	52	91	104	658
Design Vehicle	Ford Escape	Class C School Bus	Ford Escape	Ford Escape	Class C School Bus	Ford Escape	Ford Escape	Garbage Truck	Ford Escape
Gross Weight (lb)	4400	25000	4400	4400	25000	4400	4400	50000	4400
EALF Factor (F)	3.25E-03	3.53E+00	3.25E-03	3.25E-03	3.53E+00	3.25E-03	3.25E-03	4.86E+00	3.25E-03

Table 6.7-2 shows how many times (repetitions) each type of person's vehicle is expected to use each facility per visit. There are numbers greater than one because entering and exiting are considered different repetitions.

Table 6.7-2 – Facility Usage Per Person Per Visit

	Person Type								
Facility	Regular	Group	Personal	Admin	School	College	Events	Service	Volunteers
Parking Lot	2.00	2.00	2.00	2.00	0.00	2.00	2.00	0.00	2.00
Main Driveway	1.75	0.00	1.75	1.75	2.00	2.00	2.00	2.00	2.00
Optional Driveway	0.25	0.00	0.25	0.25	0.00	0.00	0.00	0.00	0.00

The pF's of each person type at each facility is calculated in table 6.7-3. The p in pF is the proportion of the total traffic that the person type causes and F is the EALF. The equivalent single axial load (ESAL) is the design load needed for the cross-section calculations. It uses the sum of the pF's and expected amount of vehicles over a twenty year period assuming 5% growth to get a yearly design load.

Table 6.7-3 – pF's and Final ESAL

	pF of person type									ESAL Calc	
Facility	Regular	Group	Personal	Admin	School	College	Events	Service Trucks	Volunteers	Sum of pF's	ESAL
Parking Lot	0.0020	0.0072	0.0001	0.0002	0.0000	0.0001	0.0001	0.0000	0.0008	0.0104	942
Main Driveway	0.0018	0.0000	0.0001	0.0001	0.0099	0.0001	0.0001	0.2026	0.0009	0.2156	19433
Optional Driveway	0.0028	0.0000	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0033	293

Table 6.7-3's calculations show that the parking lot and optional driveway's design load (ESAL) will need to be increased to traffic class I's ESAL value of 5000. The main driveway has an ESAL of 19,433 which is just above the typical value of rural farm roads and therefore won't be adjusted.

The cross-section thicknesses cannot be calculated until substantial soil resistance tests are performed and specific pavement materials are selected.

7.0 MECHANICAL ENGINEERING DESIGN

7.1 LIGHTHOUSE MODELING

The scope of the iron ranger design has morphed into a dual objective project in itself. The original plan to model and construct an approximately 4' high concrete iron ranger prototype emulated after the on-site light station is still in effect. This of course will serve as a means for touring patrons to give donations as well as provide a unique ornamental piece to populate the parking lot. Successful completion of an initial prototype will eventually lead to the manufacturing of multiple replicas. Consulting with Professor McFarland has surfaced the notion of modeling and building smaller models of the light station in order to serve as keep sakes and/or paperweights to be sold at the PBLS gift shop. The original SolidWorks file of this part which was completed as a deliverable for fall quarter had to be completely altered to account for the octagonal features of the light house itself.

The process of building the newly improved and revamped part file was not intuitive at all. Incorporating the octagonal features around the base of the structure as well as around the upper railing took some serious contemplation. Contrary to the initial part which was built using single revolved circular pattern, this part was actually built in several layers in order to accommodate for the intermeshed circular and octagonal features. The method which was ultimately utilized involved making a single "pie piece" that equated to 1/8 of the octagon. By rotating the model to look at this piece from the side, cuts were made along the entire profile to match the design of the actual lighthouse. The pie piece and the extrusion were both then revolved around the central axis 8 times to construct one solid octagonal piece. Once this process was grasped, completion of the entire SolidWorks file followed without any trouble. Now that an authentic part file has been modeled with the aid of a CAD program, the manufacturing of 20 - 30 lighthouse models is on

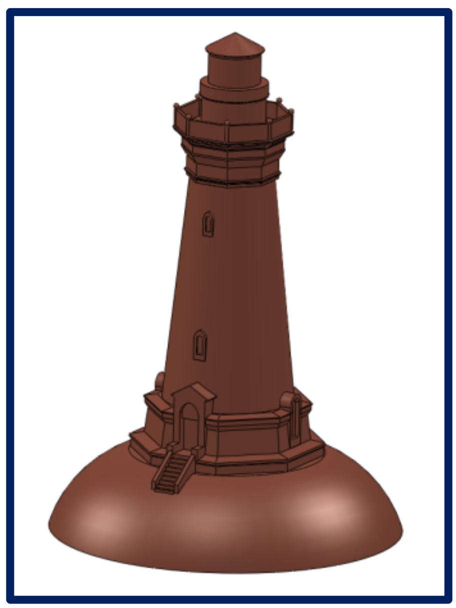


Figure 7.1 -1 – 6" Prototype Model

the horizon.

Research towards various casting methods has revealed that such an endeavor is not necessarily as easy as anticipated. Coordination with a company with the proper resources to perform some type of metal casting method will be desirable. The on campus casting lab run by Professor Koch is definitely an option yet such an intricate part may be beyond the capabilities of this local resource. Ideally, the final development of this part would be cast out of bronze to accentuate the nautical feel of a piece modeled after a historic marine landmark. As an alternative to this, a proposal for a plaster modeling technique will also remain a certain possibility. A master part could be made on the rapid prototype machine located in Building 13 on campus. Silicone rubber would then be poured over the entirety of this part to form the mold halves. Making sure to use plenty of mold release, the silicone negative of the part could easily produce the number of models the project proposal calls for.

7.2 IRON RANGER MODELING

The concrete iron ranger is a concept that has been modified on numerous accounts based on the input of the PBLS senior Project team, Professor McFarland, and the concrete expert Dr. Jansen of the Civil Engineering Department. The main purpose this 4' tall prototype will be to provide a unique, physically appealing alternative to the typical steel post design found on common iron rangers. Hopefully this unconventional design will further promote visiting patrons to donate to the BLM in order to make improvements to the existing site location. The existing plan is to eventually make several concrete rangers and scatter them around the vista point along the highway. In order to reach this goal a prototype must first be constructed utilizing the knowledge presented to the team by Professor Jansen. He provided useful suggestions and propositions based on years of experience working with concrete.

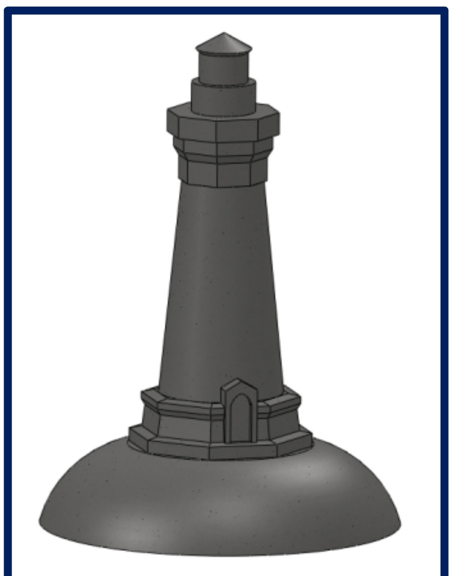


Figure 7.2 -1 – 4' Concrete Model

The complexity of the concrete SolidWorks part is greatly decreased from that of the miniature version. The fact that concrete is a somewhat brittle material does not allow for the amount of detail initially desired. Any piece with small geometry would run the risk of chipping off of the main body and thus diminish the overall aesthetic quality of the finished prototype. This will be of the most concern when constructing the wooden mold pieces supplementary to the octagonal features of the design. It will be imperative to reduce the intricacy involved in these both to ease the construction of the wooden mold as well as to ensure a feasible concrete shape. The main tapered cylindrical body of the lighthouse will be molded using a product called a

Sonotube®. These ready-made concrete forms are available at Home Depot and will only require slight modification in order to be implemented into our mold design. Integrating the Sonotube® between the two octagonal mold sections will be the biggest challenge in the process of creating the concrete mold. Once this is done the concrete will be poured into the mold upside down for ease of removal. A 1.2'' mesh-hardware layout will be placed into the mold before the concrete is poured to serve as the matrix material considering concrete structures are in fact composites. This will provide exact support and rigidity to the prototype to prevent damage to the final product over its entire life. Once the concrete dries there will be post holes drilled into the circular slab on which it will sit and epoxy bolts will anchor it to the ground. This will prevent tipping and ensure the concrete lighthouse model is securely fastened in position.

The portion of the mold above the railing will now be constructed from either ABS plastic or possibly even aluminum and fastened to the concrete. The donations will reside in the portion of the prototype where the light would be if it was an actual lighthouse. The upper cone section will utilize some sort of latch mechanism in order to easily take it on and off when the volunteers collect the daily donations. The exact materials and process for making this upper section have not yet been determined. It is evident that a similar process of anchoring the prototype to the slab will have to be implemented in attaching this upper section to the top of the concrete section. A slit will have to be machined into the cylindrical money slot in order for donations to be placed into. The contrast between the concrete and this upper section will provide a distinctive look to this model which will further set it apart from typical iron ranger designs.

7.3 CONCRETE IRON RANGER

The main deliverable associated with the Mechanical Engineering portion of this project is the concrete model of the lighthouse which has been poured on site, directly in front of the gift shop. Considering this is an area of high traffic throughput for touring patrons, we figured it would be a great spot to place an item which is intended to collect donations. The approximately 4 feet high structure is at the perfect level for both observation and ease of use for placing money into the cylindrical collection bin. The concept, design, and materials for this structure are due in large part to Professor Jansen from the Civil Engineering Department. He was out main correspondent during brainstorming and construction and should be utilized as much as possible in the future.

Figure 7.3 -1 – Re-bar support frame in slab

The current design of the iron ranger involves four separate concrete pours, joined together by cold joints.

The slab is the first section poured and it is crucial to be sure that it is as level as possible. The rest of the structure will rest upon it and any alteration from a perfectly level surface will only be exaggerated once the model is built up. We decided to add some brown concrete die to the slab potion of the pour in order to blend it better with the surrounding dirt as well as provide some

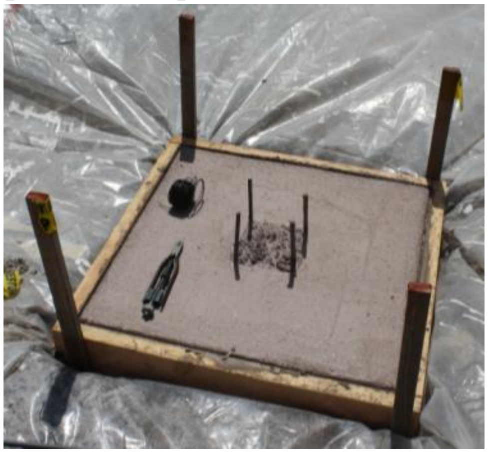


Figure 7.3 -2 – Re-bar support frame in slab

contrast between it and the actual lighthouse concrete sections which are grey. We decided to make the slab 28”x 28”x 6” in order to fully encompass the base octagon piece as well as provide us with enough material to ensure its longevity and strength. The strength of the slab is due in a large part to the re-bar assembly which we designed and built. The 24’’x 24’’ re-bar square with diagonal supports, as well as the four attached right angled vertical supports, is pictured on the right. This piece was sandwiched between two sheets of 1” square mesh within the concrete slab to provide further strength. The volume of concrete used for this section totaled approximately 2.2 cubic feet and unfortunately had to be mixed using a wheelbarrow in two separate batches due to the lack of a cement mixer on site. Considering the amount of concrete needed for the slabs, future pours should be done with an actual mixer on site especially if students attempt to make four or five models simultaneously in the proposed parking lot. After the slab in front of the gift shop was poured we were left with a perfect cold joint containing four pieces of re-bar spaced approximately 8 inches diagonal in a square formation. It was advised to by Professor Jansen to “rough up” the concrete in which the next layer is to be poured upon; in between and around where the re-bar sticks out of the slab. The brown slab with the extruding re-bar pieces is pictured above. The prep work involved with designing the re-bar for the cold joint did a great deal to assist in the next phase of construction.

The bottom octagon was the next section of the four piece assembly to be poured. This is where the wooden mold we constructed was put into use. The Iron Ranger SolidWorks model provided

Figure 7.3 -2 – Re-bar support frame in slab

a set of drawings which were used to dimension and build the mold piece. Professor Lee was able to make wooden glue layups to match the drawing out of a single long piece. This piece was then cut into eight separate pieces with reciprocating 22.5° angles at each end. The mold was constructed by joining four of these pieces in two sets in order to create the two mold halves. Multiple passes with sandpaper were required to smooth the surface of the mold interior before several layers of fiber glassing resin were applied. This resin was again a suggestion by

Professor Jansen and proved to be a valuable asset in retaining the concrete from seeping into the wood as well as aiding in the ease of the mold removal. The fiber glassing resin was found at Home Depot and worked just as a two part epoxy in that a separate hardener had to be added in order to start the reaction process. The completed mold was then centered around the extruding re-bar from the slab and aligned along the edges with the square slab frame. The seams of the mold halves were adjoined using long wood screws and sealed with standard duct tape to prevent water from leaking. Before the actual pouring of this first octagon piece we built up a re-bar and mesh structure to accompany the tapered cylinder section, which was to be poured next. These four pieces were attached to the extruding re-bar from the slab using re-bar tie wire and a unique tool provided by Professor McFarland. Once everything was set into the desired position we secured the mold using a couple of makeshift brackets using ground stakes. We screwed the octagon mold to the brackets and then the brackets to the square frame of the slab which was adequate enough to proceed with concrete pouring.

The tapered portion, or body, of the lighthouse was created using a modified Sonotube. The Sonotube used was 12 inches in diameter and originally 4 feet long. First, the Sonotube had to first be cut to length, approximately 22 inches. Second, a wedge had to be cut from the tube so that the taper could be created. Once the wedge was created and the tube manipulated properly into shape, the top diameter was 7 and 3/8th of an inch. The figure to the right shows the Sonotube in place over the cold joint and circular cut outs that were used to maintain the circular shape.

Figure 7.3-3 Tapered Cylinder with Supports

The top octagon portion was completed in a fashion quite similar to that of the bottom octagon. The small details in the mold prompted us to strike the side of the mold with a mallet to stimulate the removal of air pockets. The mold housing was centered on the top of the cylinder by using three separate pieces of wood cut to the proper length. The clear Lexan portion of the cylinder has a base circular piece that is epoxied to the cylinder. Three holes drilled in the Lexan base will be used with screws to secure to the top octagon portion. The Lexan also has a slit that was cut into the side so that donations could be made. A metal top portion that goes over the Lexan cylinder was found at Home Depot and was expected to be used as a flume cover. A photograph of the nearly complete product can be seen below with the actual lighthouse in the background. A close up of the model is also pictured below.

Figure 7.3-4 Finished Iron Ranger

Figure 7.3-5 Finished Iron Ranger Close Up

7.4 VEHICLE GATE

The modification of the existing vehicle gate at the Piedras Blancas Light Station site has recently become a top priority. Multiple malfunctions of the current set-up have brought about an undoubted need for change. Altering of the control system will be on the forefront of our research and development for the upcoming spring quarter. A more efficient assembly of the solar panels and controller should do a great deal towards the overall everyday operations at the Piedras Blancas site location. As for the deliverables for winter quarter we have compiled two possible gate design options for the BLM to review and choose between. Both designs will require a 5’ x 18’ square tubing fabrication for the machined stainless steel plates to be attached to. Anti-corrosive mounting hardware will be used for this in order to maintain the pristine quality of the gate for years to come. There is a qualified metal worker willing to perform the necessary welding of the stainless steel square tubing considering experience is a much needed commodity. Vertical supports and gusset brackets are to be added for rigidity as the weight of the stainless steel will have to be supported by this frame. This frame will be constructed in the same manner regardless of the decision regarding the decorative gate design.

The first gate design option was modeled after the wooden decorative piece found on a wall on site during the initial BLM meeting. This piece harks back on the history of the light station when it was fully operational aiding in the safe return of sea-going ships. This design will be encompassed by a single sheet of 4’ x 10’ sheet of stainless steel. According to our source at Water Jet Central located in Paso Robles, the material as well as the process will amount to about $1000 each. This of course means that every sheet of machined stainless steel will equate to about $2000 billed to the BLM. It will be up to them whether or not they would like to simply

Figure 7.3 -1 – Single Sheet Gate Design with BLM and State Parks Logos

use this one sheet centered on the 18’ gate with a 4’ void on either side. A proposal to fill these voids with SolidWorks modeled BLM and State Parks logos on either side have been provided in this report. Considering these are the two main agencies in control of the site, it seems like a logical and unique way to fill these voids if this single sheet design is chosen. Of course it will cost another approximately $2000 to have these two logos implemented as well. The flexibility of this design does allow for these logos to be either included or not, which does require a decision to be made. If it is in fact decided that these logos not be included in the final design, consideration of the framework on these 4’ voids must be made. Whether or not to include lateral gussets instead of vertical square tubing supports will be the main concern. It has come to the attention of the group to stray away from 4’’ gaps in supports as this lends itself to problems with

children getting their body parts stuck, mainly their heads. It also would be somewhat less visually appealing to have these voids on either side which could be a reason to include these logos. Again this will be a decision made based on the amount of funding the BLM is willing to put into this updated gate design.

The second proposed gate design builds upon the first design while adding the famous Piedras Blancas rock as a centerpiece. Second to the lighthouse, this rock proves an extraordinary landmark to volunteers and touring patrons alike. Including Piedras Blancas rock into the design will show the important roll natural beauty plays into the site. The additional space along the

Figure 7.3 - 2 – Double Sheet Gate Design with Rock Centerpiece and Site Location Text

bottom of the decorative design allows for the site location text to be added. This will remind visitors of where exactly they are touring upon entering this gate before they make their way onto this beautiful location. It could also be an additional form of signage which seems to be currently absent at the proposed vista point location. This dual piece would of course run at about $4000 to manufacture yet it may be determined that the cost is worth the final outcome. Again it will be up to the final say of the BLM which design is to be implemented. If they become torn between the two designs it could be possible to edit either of these designs to something more suitable to their liking.

The approximate cost for the gate assembly and installation was researched at local gate supply stores and internet distributors. Fence Factory in Atrashcadero was kind enough to provide a quote with a majority of the components necessary for the gate. A summary of the approximate pricing is broken down in Table 7.3.1 below.

Table 7.3.1: Gate Quote Breakdown

Item	Price
4' by 14' Gate Frame	$680
V-Track with Jolts and Wheels	$396
Brackets, Supports, Etc.	$336
Gate Drive	$1,500
Gate Drive Professional Installation	$500
Decorative Gate Material-2 S.S. Sheets	$2,000
Decorative Gate Water Jet Machining	$2,000
Total:	**$7,412**

FIGURES

FIGURE 1 – Vicinity Map

Source: Google Earth

FIGURE 2 – Site Plan

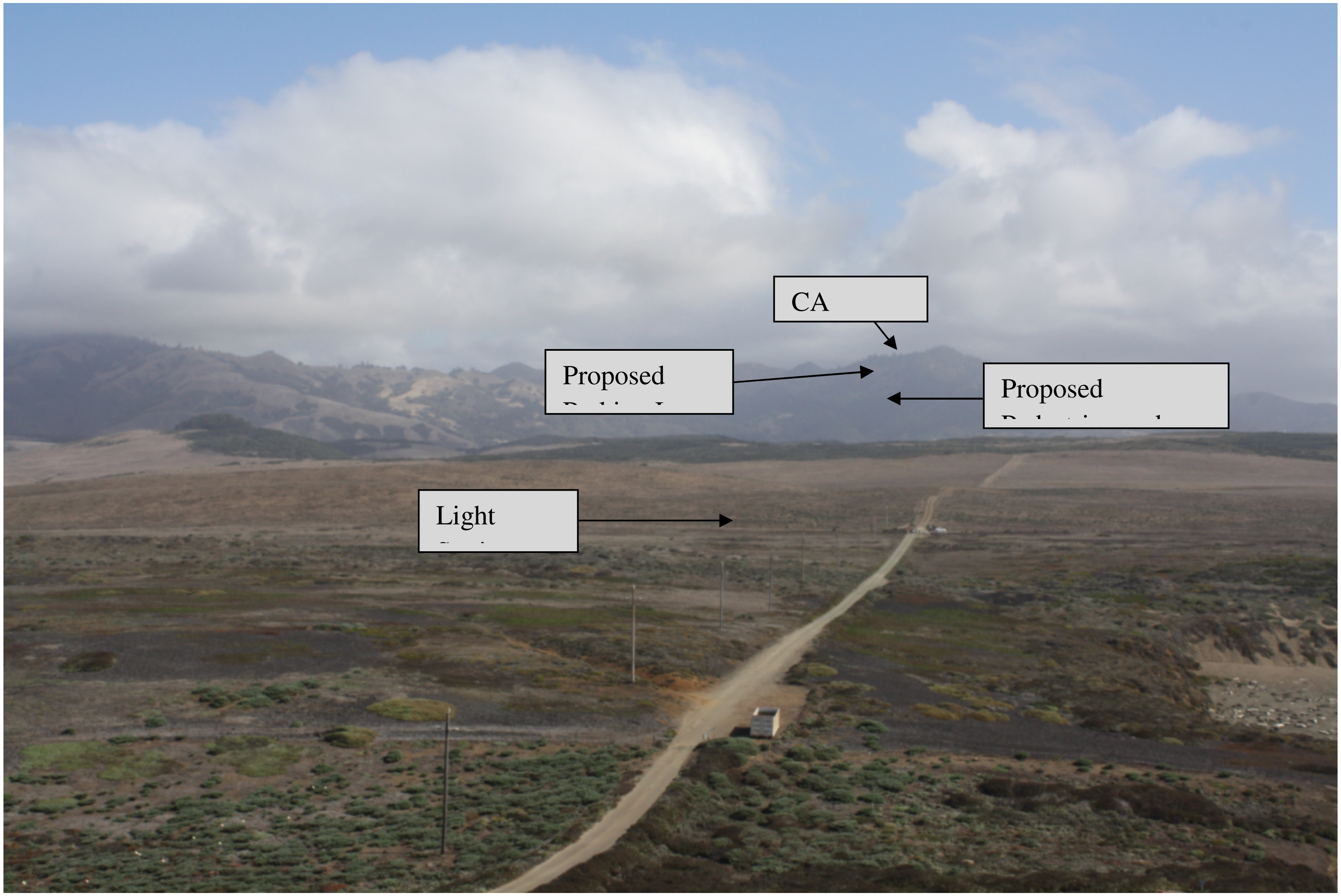


FIGURE 3 – Civil Engineering Design Process

FIGURE 4 – Mechanical Engineering Design Process

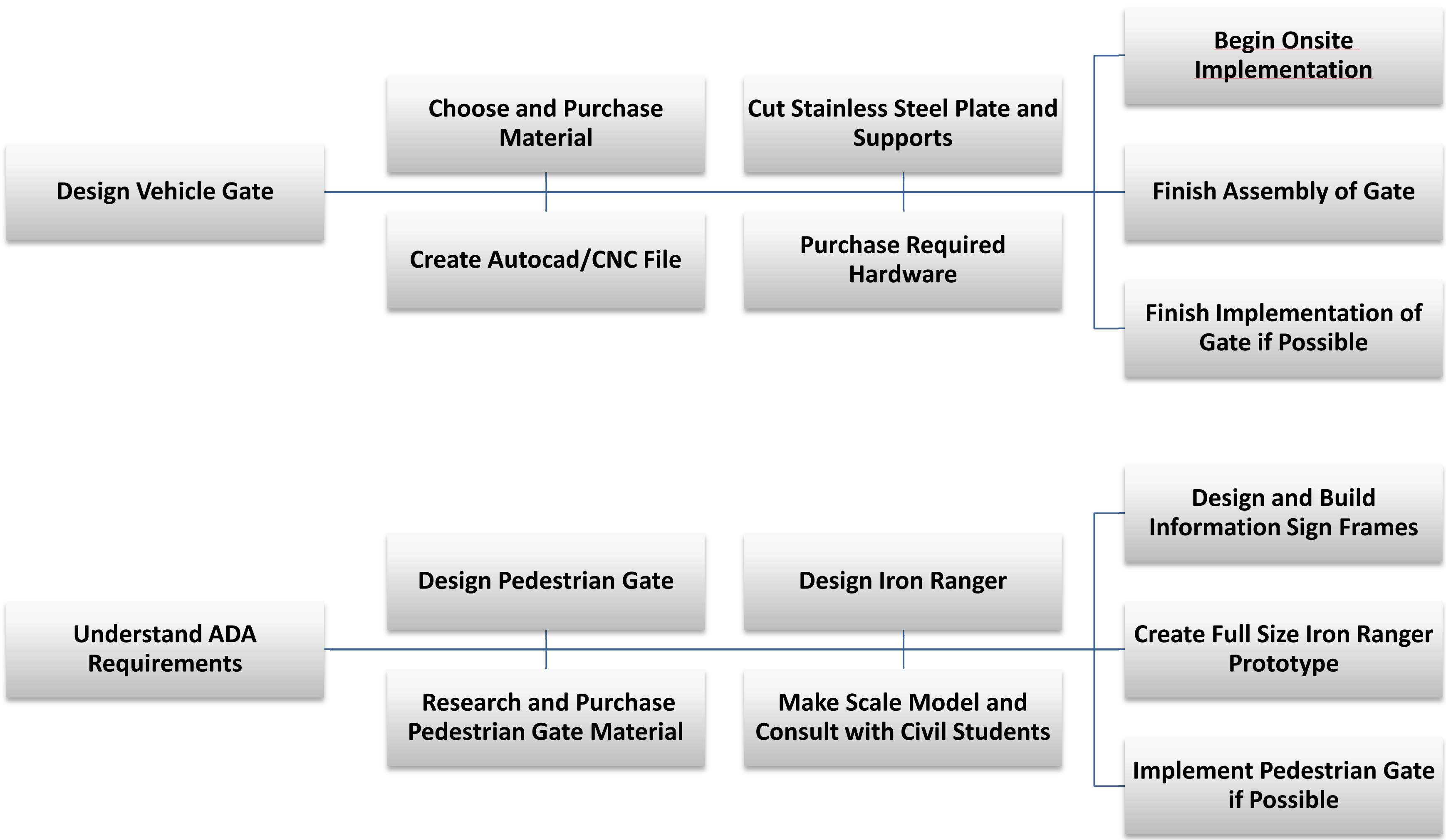
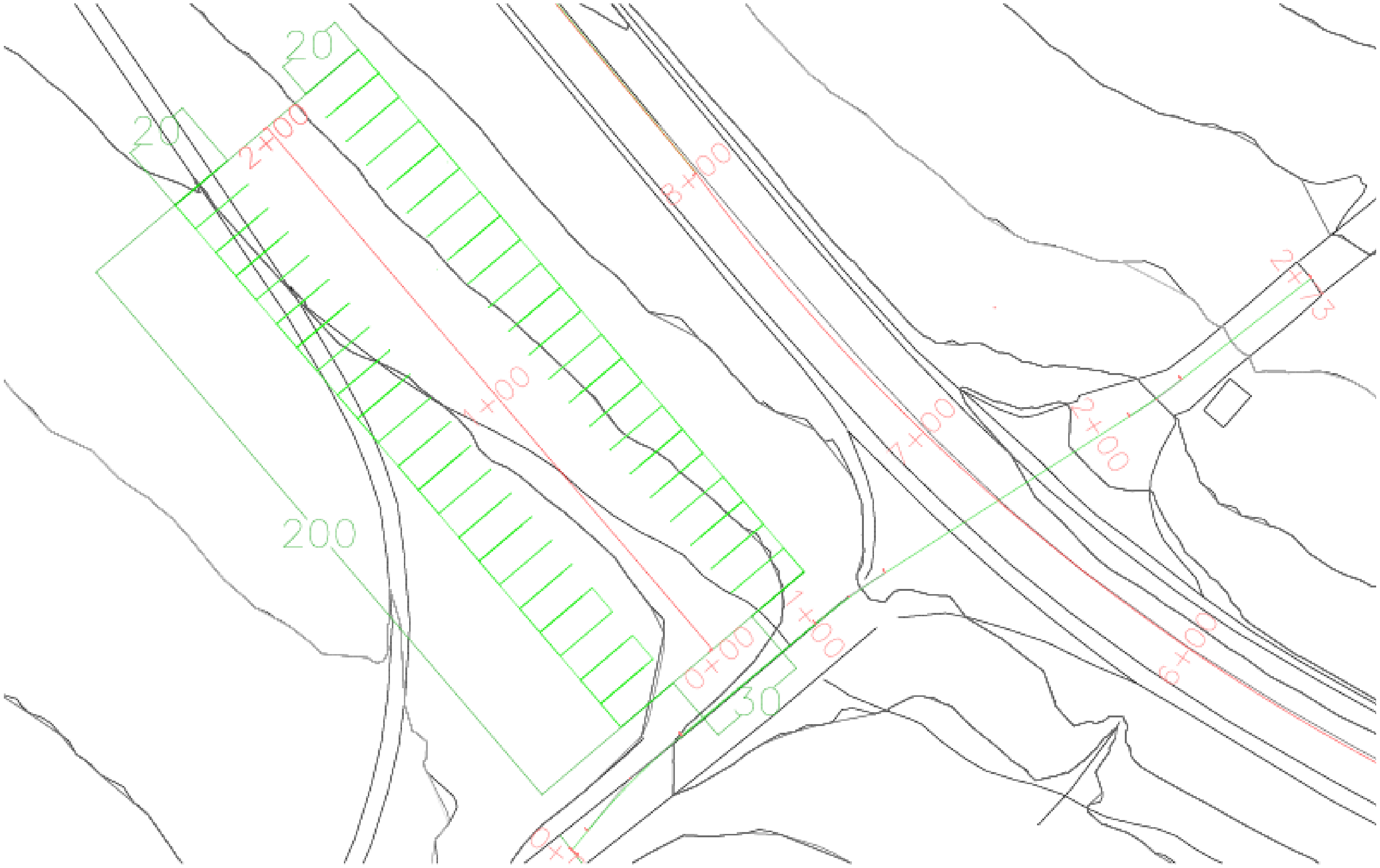


FIGURE 5 – Vista Point Layout



CAL POLY
SAN LUIS OBISPO

FIGURE 6 – Percolation Testing

FIGURE 7 – Hand Augering Method

FIGURE 8 – Parking Lot Plan Alternatives

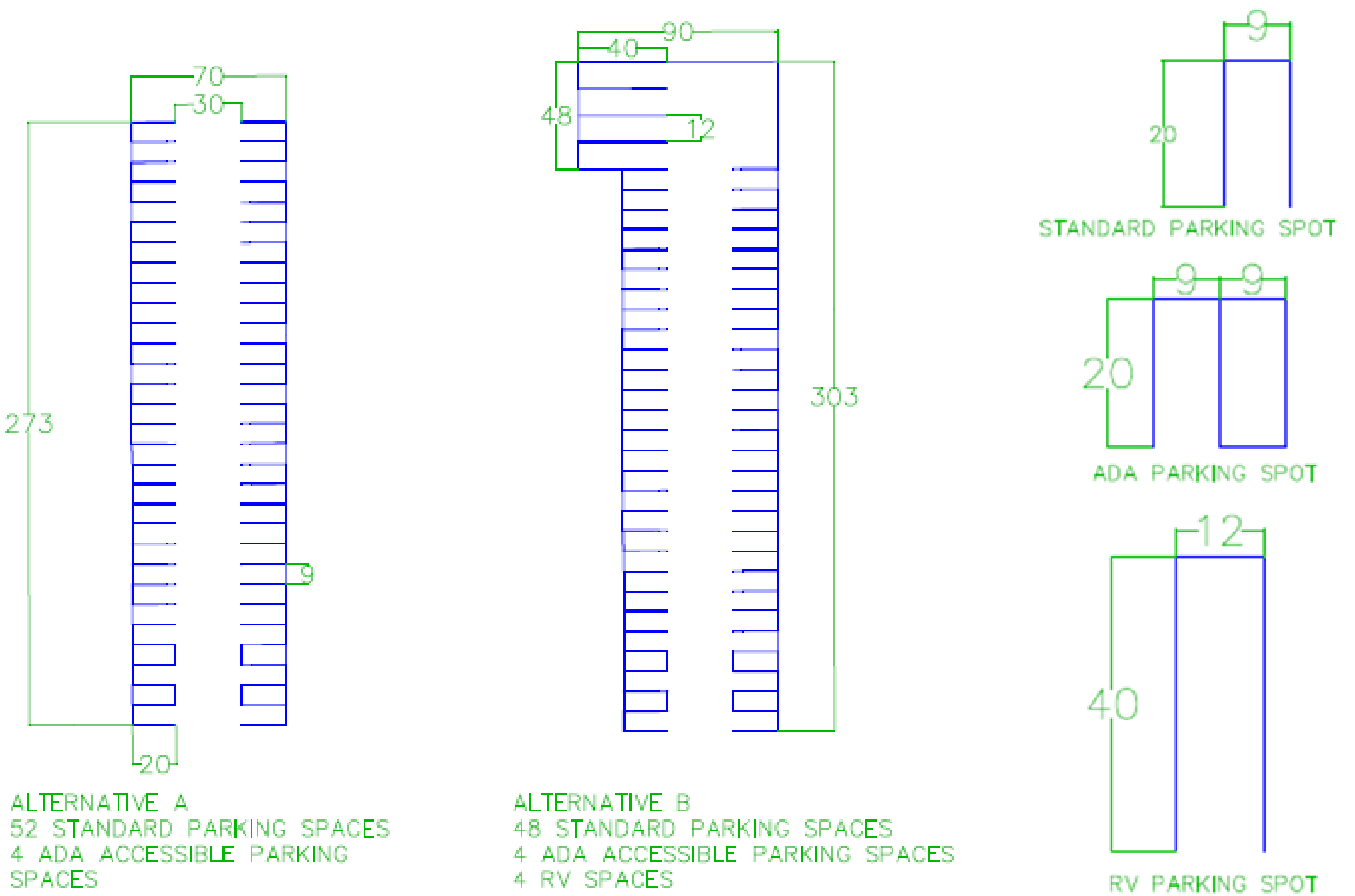


FIGURE 9 – Parking Lot Alignment

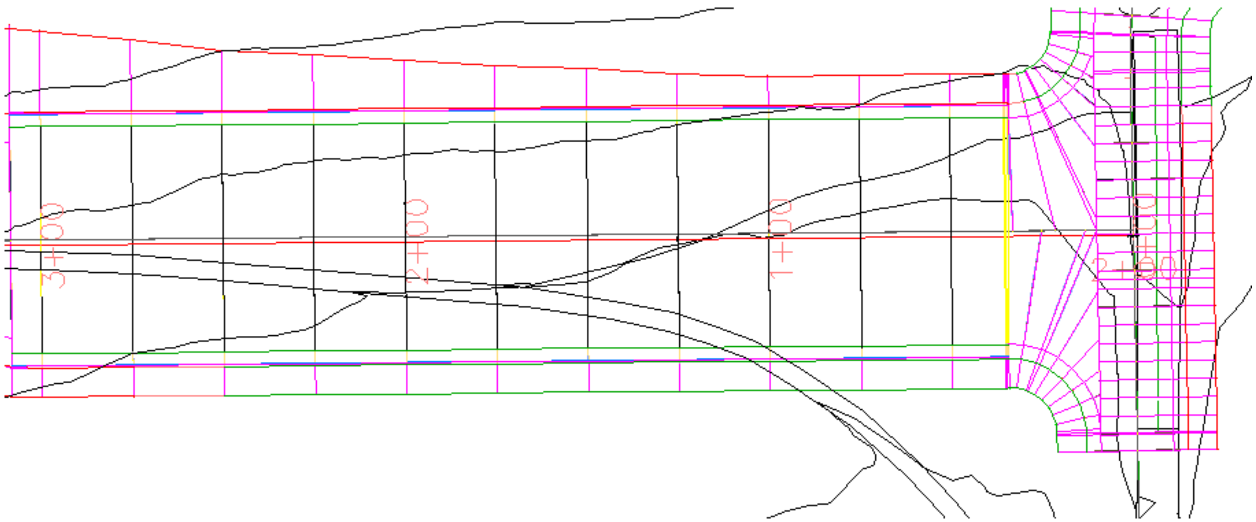


FIGURE 10– Parking Lot and Second Driveway Profile

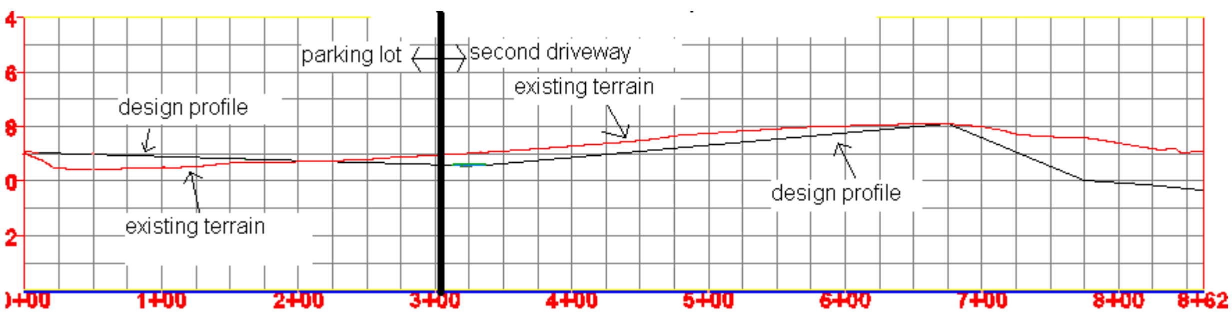


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FIGURE 11 – Driveway Alignment

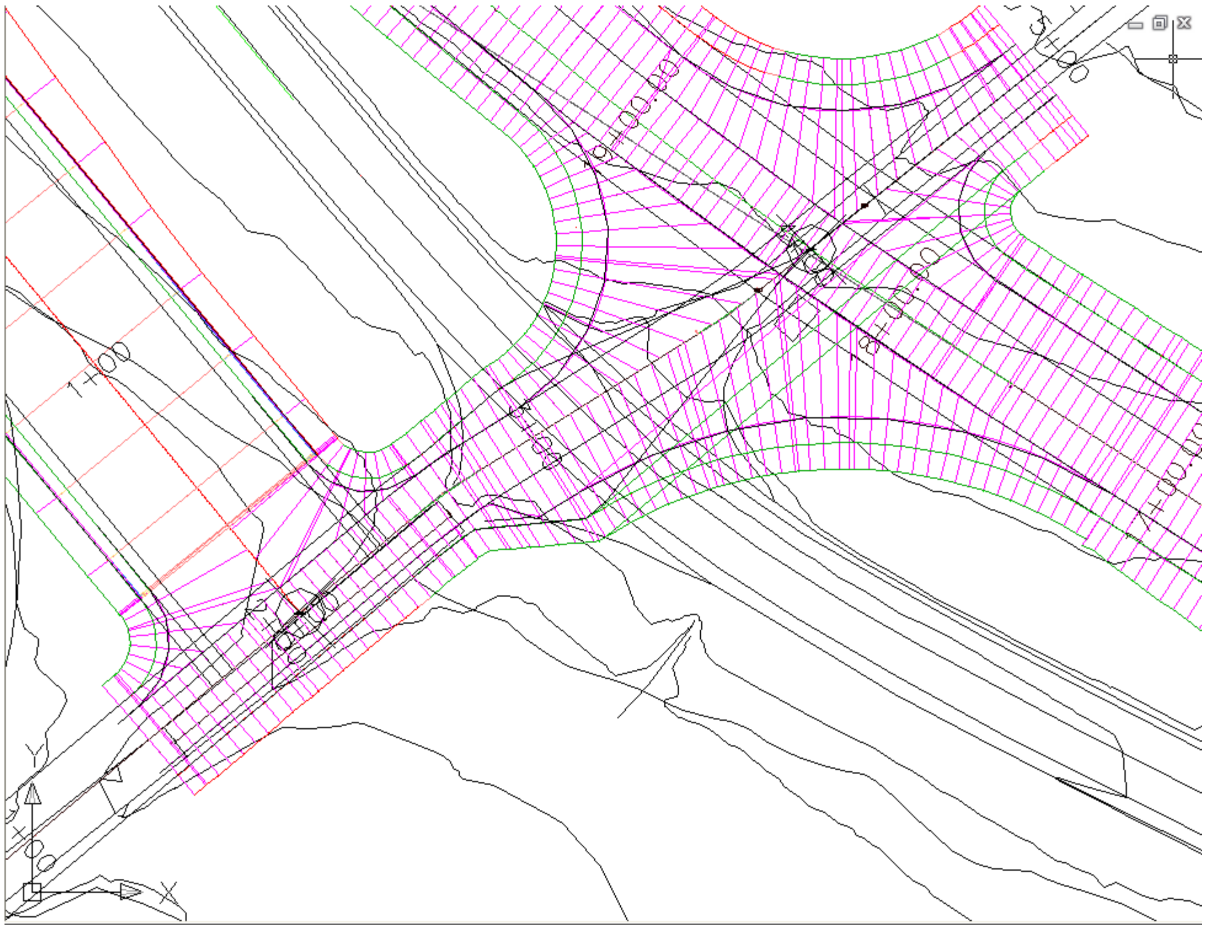

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FIGURE 12 – Driveway Profile

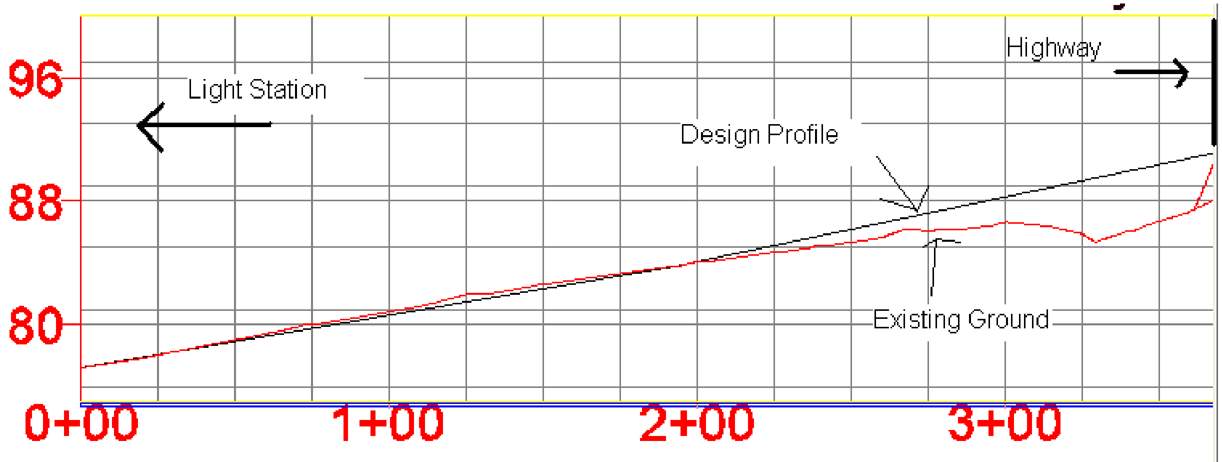


FIGURE 13 – Highway Realignment

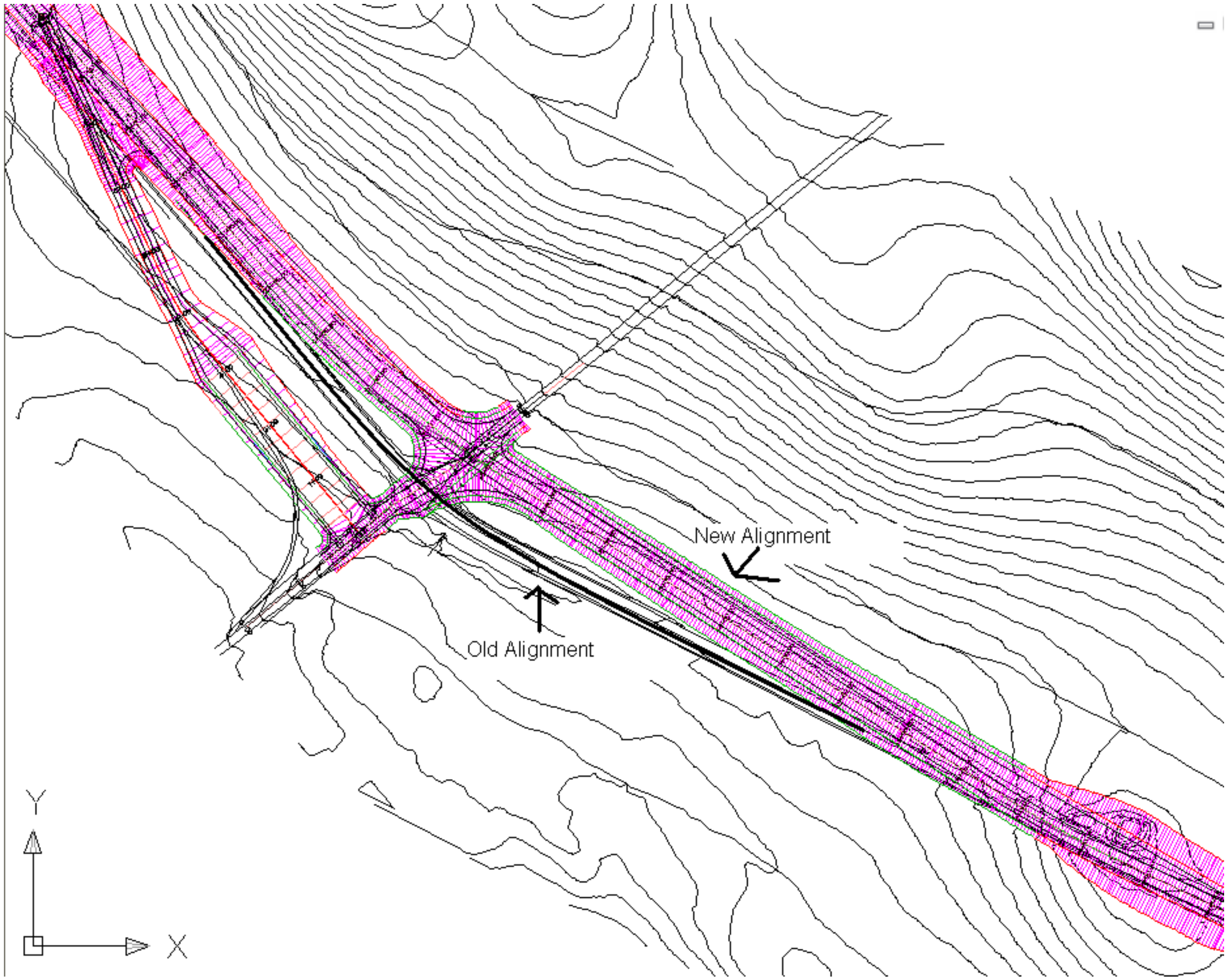


FIGURE 14 – Highway Alignment

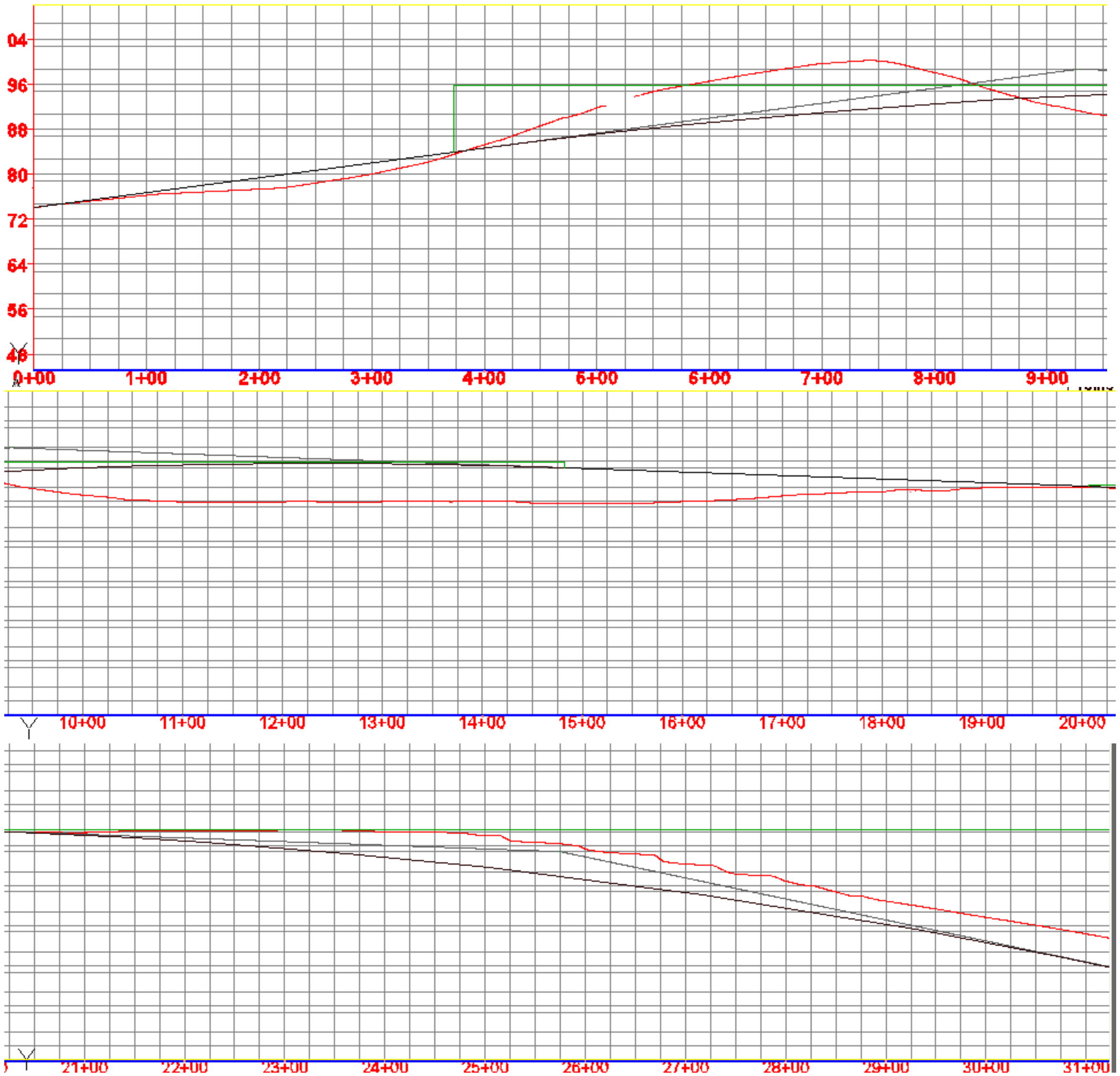
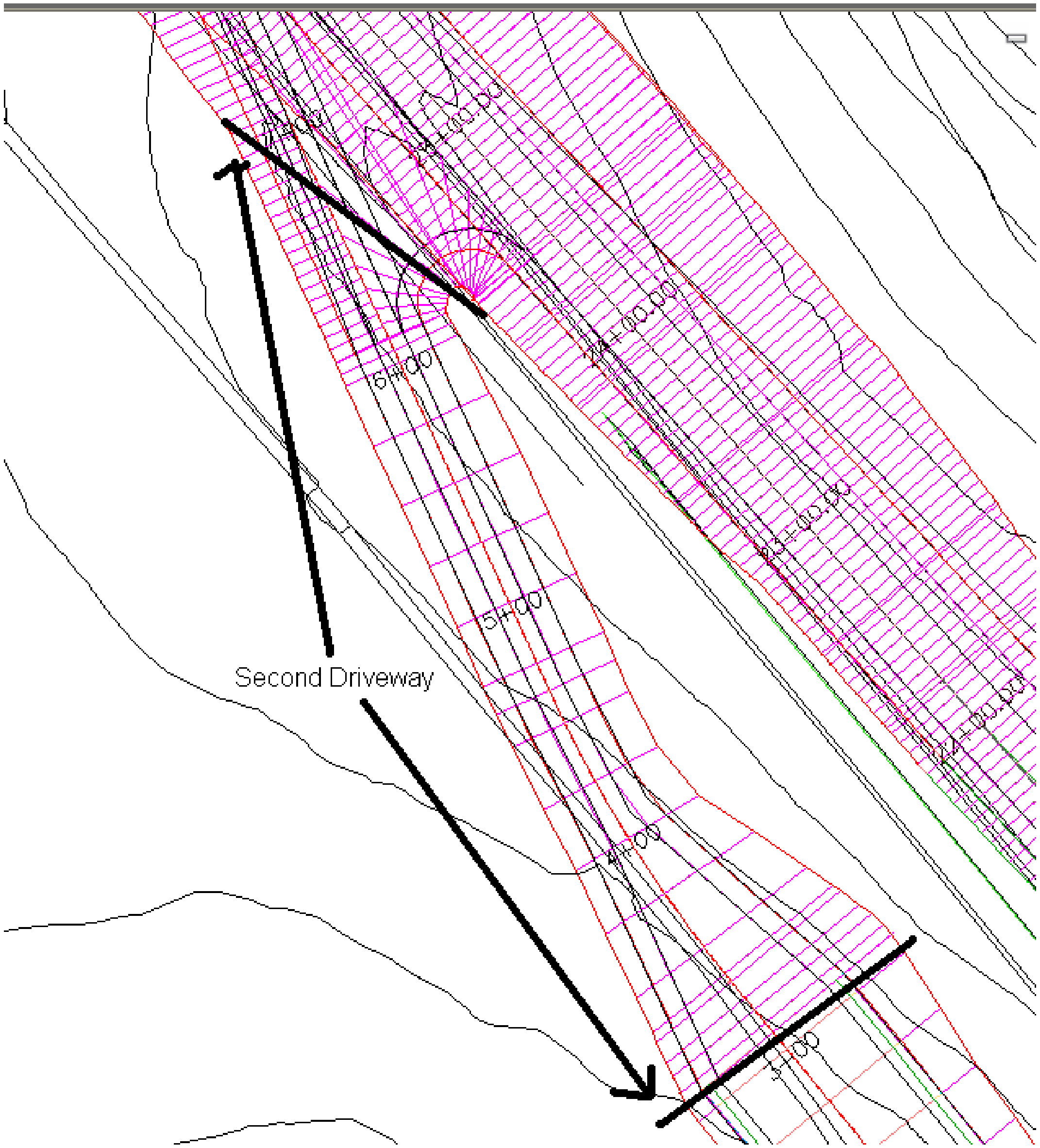


FIGURE 15 – Second Driveway Alignment



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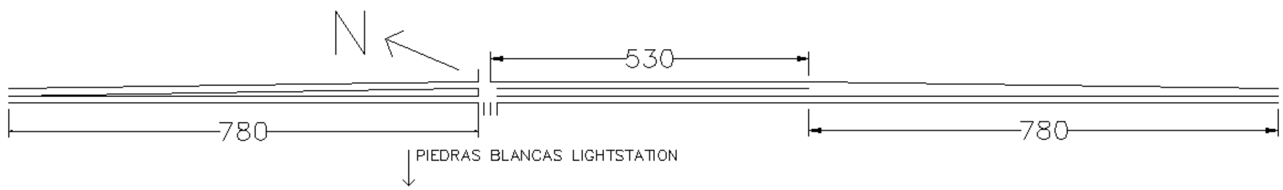
SAN LUIS OBISPO

FIGURE 16 – Turn Lanes



APPENDIX

COMPREHENSIVE REGULATORY REPORT

INTRODUCTION

The Bureau of Land Management (BLM) maintains the Piedras Blancas Light Station and is interested in upgrading the facility entrance for better safety and more public access.

Figure A-1 shows the project location and property boundary between BLM and California State Parks land. The BLM owns the property on which the light station stands and State Parks owns the land directly east of that.

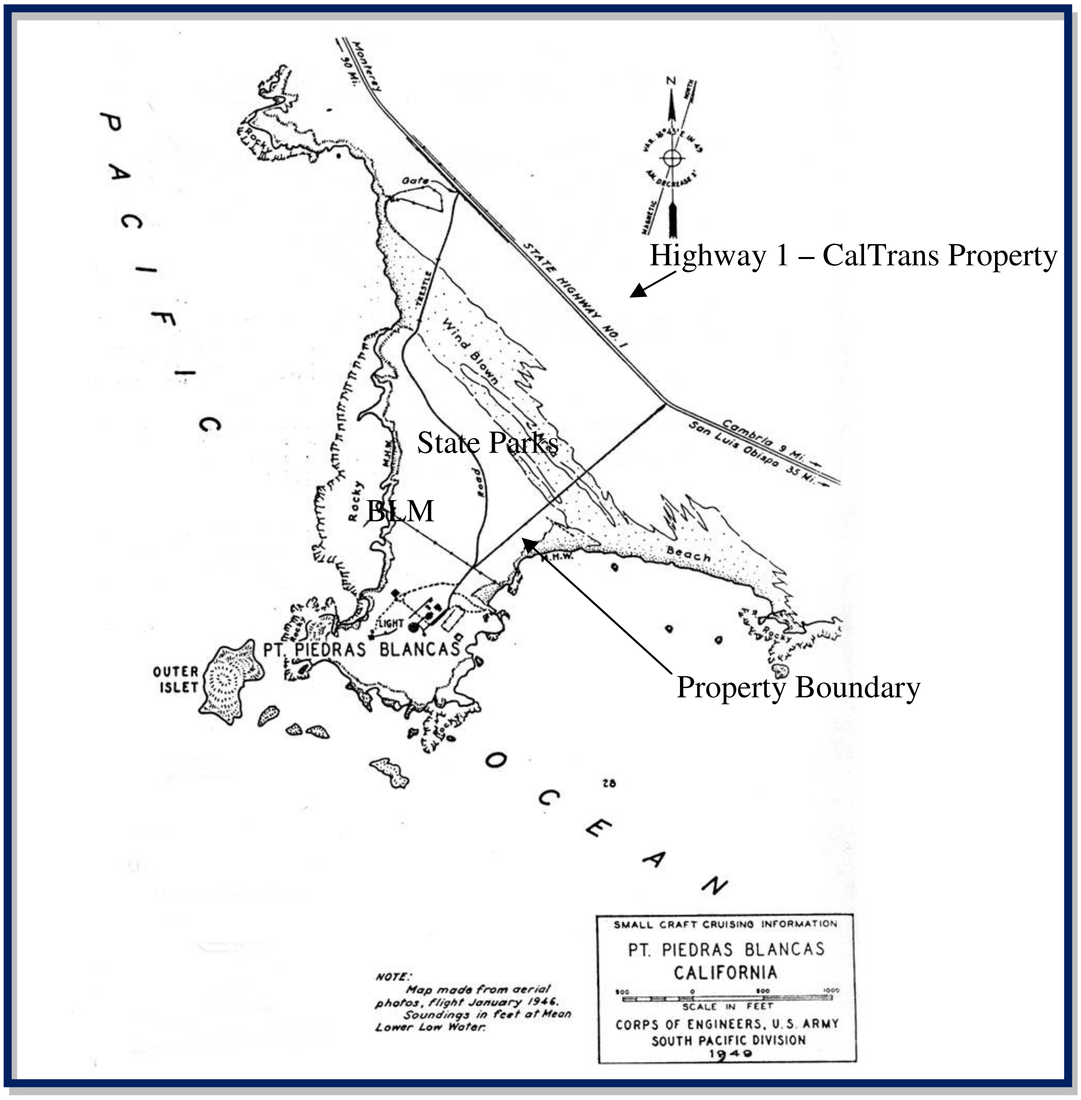


Figure A-1 – Property Boundaries
Source: US Army Corp of Engineers (1949)

Figure A-2 is a photo of the existing light station entrance. There limited stopping distance for cars turning off of Highway 1 and stopping at the gate to enter the access code (given to staff and volunteers only). Since there is no public parking and tours are infrequent, many people pull off here and catch a distant view of the light station. This area is not designed to accommodate such a use. Currently access to the light station and surrounding area is restricted to BLM led tours.

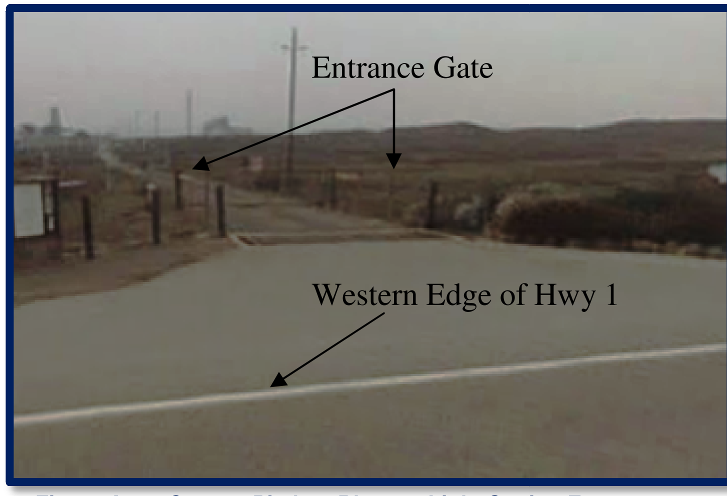


Figure A-2 – Current Piedras Blancas Light Station Entrance

This reminder of this report is divided into two sections. The first will summarize the major regulatory requirements that apply to the proposed project and the second will discuss risks to project implementation posed by regulations. Requirements are broken down by regulatory agency. Only agencies and regulations with major roles were included however additional agencies and other stakeholders may be involved to varying degrees with the process. For example, the California Department of Fish and Game may want to review the project for impacts to wildlife or adjacent land owners may want to register their opinions. The agencies included in this report were chosen based on their relatively high degree of regulatory power over the project site.

SUMMARY OF AGENCY REGULATIONS

CALIFORNIA STATE PARKS

State Parks is a public agency whose mission includes preservation of California's biological diversity and cultural resources and creation of outdoor recreation opportunities. This agency owns the land for the proposed project. Presuming that they do chose to participate in this project, they will take on a significant role.

Under California Environmental Quality Act (CEQA) Guidelines, the public agency that has jurisdiction over a proposed project site acts as 'lead agency' in the CEQA review process. This means they provide project management throughout the process and have authority to make final decisions about the project. For this particular area, there are several overlapping jurisdictions. When there are overlapping jurisdictions, the agency with the most discretionary authority is the lead agency and all other agencies are considered responsible agencies. In this case State Parks

has the most discretion because they own the land. Although State Parks may have additional requirements for this project, the discussion is limited to those laid out in the CEQA guidelines. Figure A-3 is a diagram of the CEQA flow chart. Beginning at the top of the flow chart, the proposed project qualifies as a ‘project’ under CEQA it will cause a “direct physical change in the environment” (California Environmental Quality Act, 1970, § 21065.) The project is not any of the statutory exemptions listed by the legislature and is unlikely to qualify for a categorical exemption as categorical exemptions presume no possible significant impact to the environment (California Environmental Quality Act, 1970).

Once it has been determined that no exemptions apply and that there is a possible significant impact to the environment, an Initial Study would be prepared. State Parks uses the Initial Study Check List provided in the CEQA Guidelines (Appendix A) with no modifications. The Initial Study is used to determine if a project has any significant environmental impacts. It is accompanied by professional studies that support the determination. Based on initial data collected GIS and interviews with agency staff, studies likely to be needed before a determination can be made on this project are Wetlands Delineation, Red-legged Frog survey and Archeological survey. There may be existing studies that will partially satisfy these requirements.

Once the studies have been conducted, State Parks, in consultation with other agencies, would determine if the project has significant environmental impacts. If so, an Environmental Impact Report (EIR) will be prepared. If not, the project will qualify for a Negative Declaration of significant impacts. It was indicated by County staff familiar with CEQA thresholds for significant impacts that this project would not have any significant environmental impacts. However, each public agency interprets the CEQA thresholds slightly differently and there is no to know precisely what the impacts are prior to viewing the professional studies of the project site.

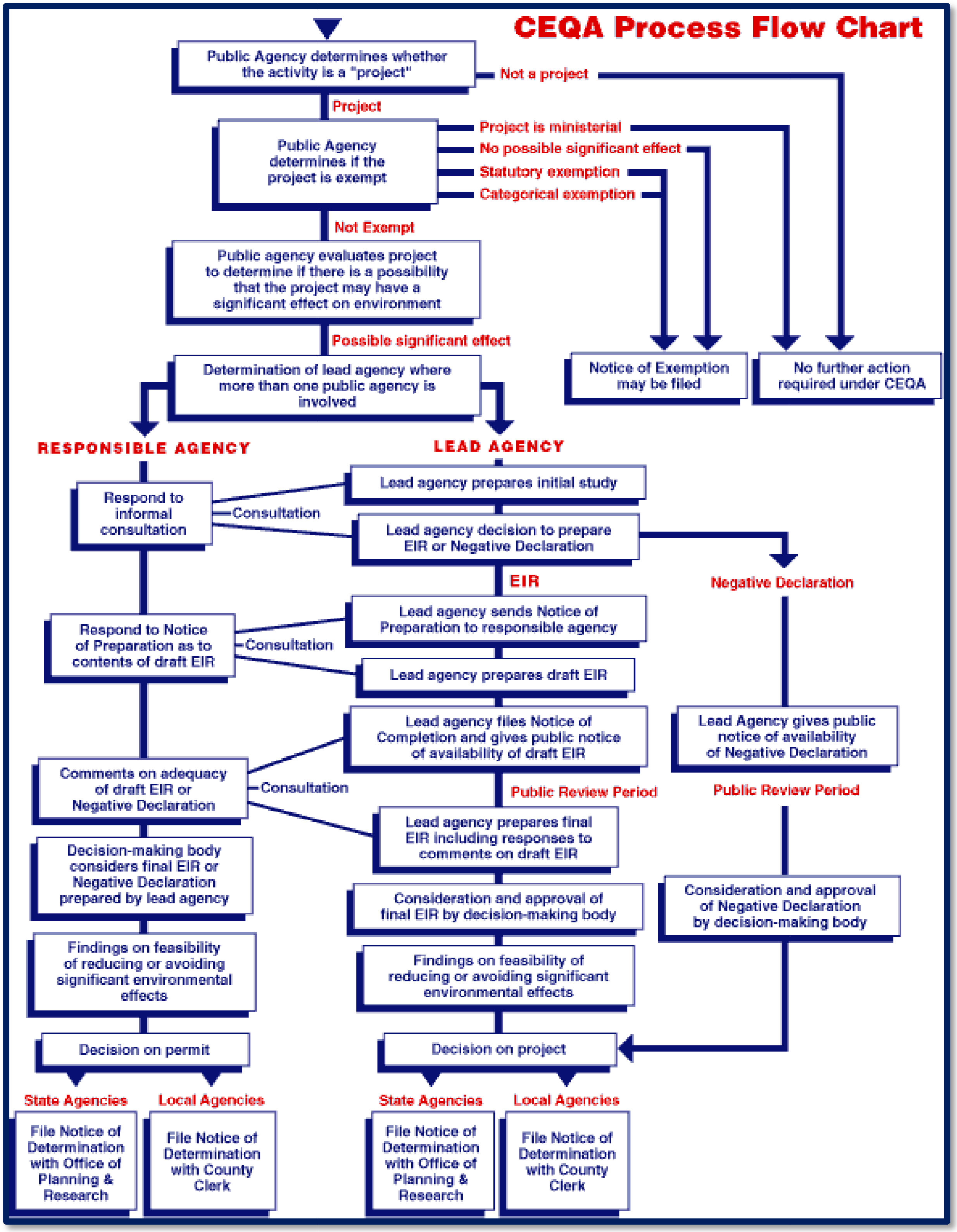


Figure A-3 – CEQA Flowchart
Source: http://ceres.ca.gov/ceqa/flowchart/

COUNTY OF SAN LUIS OBISPO

The project site is located within the California Coastal Zone and so is subject to additional permitting requirements under the California Coast Act. In San Luis Obispo County, the County Planning and Building Department is responsible for regulating most of the coastal zone. An interview was conducted with County staff in order to determine what the permitting process is likely to entail. Staff advised that a coastal development permit would be required and that the application form and fees are the same as for a minor use permit. The application packet (Appendix B) requires a general application form, a permit application form, site layout plan, an environmental description form and supplemental information, as required by the County. The fees for this application are approximately $5,800. However, the project may be eligible for a fee waiver due to the fact that it increases public access to open space. The land use permit application should be submitted with a complete Initial Study Checklist and supporting studies.

Staff suggested that environmental studies should be conducted for an area much larger than the proposed project site. This way, environmentally sensitive areas might be avoided when siting the parking area. Permit approval for the proposed project seems likely, given that the project fits with County goals and what environmental impacts do exist may be avoided. County staff emphasized the importance of consulting with CalTrans due to the scenic highway designation adjacent to the project site. They suggested some sort of vegetative screening for the parking area might suffice but that it would be best to discuss the project with CalTrans early on in the process.

CALTRANS

CalTrans is responsible for 50,000 miles of highway and freeway lanes in California including the section of Hwy 1 to the east of the project site. That portion of the Highway has been designated a scenic highway by CalTrans which has carries certain requirements. In furtherance of their goal of preserving scenic viewsheds, CalTrans negotiated a scenic easement for the area in and around the project site. The agreement was signed in 2005 with the Hearst Corporation directly prior to the purchase of the land by State Parks.

The agreement stipulates that "The installation, construction, reconstruction, replacement, operation or maintenance of any building, facility or structure of any type is prohibited throughout the Public Ownership Easement Area except as such permitted in accordance with the provisions of this Section 5" (Dead of Conservation Easement and Agreement Concerning Easement Rights from Hearst Holdings, Inc. to State of California Department of Transportation, 2005). However, one of the exceptions listed in Section 5 is related to public access facilities. State Parks may be allowed to construct public access facilities which include "new trails (including the California Coastal Trail), improved surface parking, roadway access to said parking, informational kiosks, signage, public restrooms, trash/recycling recepticles and directly related utilities" (Dead of Conservation Easement and Agreement Concerning Easement Rights from Hearst Holdings, Inc. to State of California Department of Transportation, 2005). The need

for factiles must first be evaluated based on several factors described in this section, and they are requried to submit plans for review and written approval of CalTrans. Another stipulation is that State Parks use existing topography and siting to screen facilities as much as possible. Where not possible, vegitation and grading may be used, provided that vegitaiton not block views of the ocean from Highway 1.

CONCLUSIONS AND RISK ASSESSMENT

Support for project goals from these agencies is likely; type of project is not in and of itself seen as causing a risk to project completion. The project goal of public access goal fits with established goals of each of the regulatory agencies, to varying degrees. State Parks and the County are more interested in providing public access to open space than is CalTrans. However, the Conservation Easement signed by CalTrans for this area included specific provisions for public facilities.

Possible environmental impacts do pose some risk to project completion as there are potentially significant environmental impacts. If any of the impacts are determined to be significant, an Environmental Impact Report (EIR) is required. The cost of conducting such a process may be financially infeasible or undesirable from a management perspective. This is especially the case because it is anticipated that State Parks would provide the CEQA project management. That said, BLM staff knowledgeable of existing studies for the project site stated that no ‘positive findings’ archeology or Red-legged Frog studies exist for the project site. There may not have been any wetlands delineation studies conducted to date however.

Another risk is posed by the dependence on State Parks for project management. While the project would be funded by the BLM, project management for CEQA requires substantial staff time. This is not a significant risk for two reasons. One is that the project fits well with State Parks goals and with State Parks future planned projects (i.e. the California Coastal Trail.) Second, County staff stated that they could manage the Initial Study for a fee.

The most significant risk posed to project implementation is the Scenic Easement covering the project area. While the easement makes allowances for public facilities, it will be very difficult to keep the parking area from blocking views of the ocean based on the topography. Additionally, CalTrans is somewhat less interested in the project goals than the other two agencies. There is however, a formal process for reviewing the project stipulated in the Conservation Easement and careful consultation with them early on is likely to alleviate possible problems.

REFERENCES

California Environmental Quality Act (1970). Association of Environmental Professionals.

Dead of Conservation Easement and Agreement Concerning Easement Rights from Hearst Holdings, Inc. to State of California Department of Transportation, 10 February 2005 (filed 18 February, 2005). San Luis Obispo County, California. County Recorder's Office, San Luis Obispo, California. Accessed by Larissa Heeren on November 30, 2010 at http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc