

Project Proposal and Development Plan for a New Security Gate at Swanton Pacific Ranch

A Senior Project

Presented to

The faculty and staff of The Agriculture Education and Communication Department

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In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science

By

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Abstract

The purpose of this project was to develop a prototype gate for Cal Poly's Swanton Pacific Ranch in Santa Cruz, CA. Swanton Pacific Ranch requested that the author design and build a 21'x5' single-retractable gate for Swanton Pacific Ranch to help decrease the security issues that have recently arisen at the facility. The design and format of this project are focused towards the desires and goals set forth by Swanton Pacific Ranch and the Operations Manager, Steve Auten in order to obtain a certain outcome. This project provides an outline of what needs to be done in order to produce a beneficial and easily replicable gate. By creating this outline, any individual or company has the ability to replicate and create an exact replica of the prototype gate.

Acknowledgements

Without the direction, support and unconditional love of my parents Phil and Kassy Perry, the completion of this project would not have been possible. Thank you for your continuous guidance and countless hours of encouragement. I hold the utmost respect and deepest gratitude for each of you. From the bottom of my heart, thank you.

I wish to express my sincere and grateful appreciation to three other individuals, Dr. Ben Swan, Dr. Mark Zohns, Mr. Virgil Threlkel and Mr. Tanner Tuttle. I appreciate your dedication, guidance and assistance throughout the project. Your constant motivation has contributed tremendously to the completion of this project and, for that, I am forever grateful.

Table of Contents

Abstract.....	2
Acknowledgments.....	3
Table of Contents	4
Chapter 1- Introduction	6
Statement of Problem	7
Importance of the Project.....	8
Purpose of the Project.....	8
Objectives of the Project	8
Definition of Important Terms.....	9
Summary	9
Chapter 2- Review of Literature.....	10
Ranch Security.....	10
Gate Design Requirements.....	11
Environmental Factors	12
Figure 1. Swanton Pacific Ranch Prototype Gate Location	12
Figure 2. Swanton Pacific Ranch Proposed Prototype Gate Location.....	13
Materials.....	13
Financial and Practical Considerations	14
Initial Cost	14
Figure 3. GateCrafters Sample Gate Quote	15
Figure 4. GateCrafters Sample Gate	15
Maintenance	16
Summary.....	16
Chapter 3- Methods and Materials	17
Project and Plan Approval.....	17
Figure 5. Approved SolidWorks Swanton Pacific Ranch Gate Design- Annotated.....	18
Price and Purchase of Steel.....	18
Plan and Cutting Gate Assembly	18
Figure 7. Planning Phase.....	19
Figure 8. Planning Phase.....	19
Figure 9. Plate Being Cut by PlasmaCam	19
Figure 10. Steel Tubing Being Cut at an Angle.....	19
Tack and Weld Assembly.....	20
Figure 11. Gate Assembly After Being Tacked.....	20
Figure 12a. Joint Weld Order- Stage One	21
Figure 12b. Joint Weld Order- Stage Two	21
Figure 12c. Joint Weld Order- Stage Three	21
Summary	22
Chapter 4- Results and Discussion	23
Results	23

Discussion	23
Figure 13a. GMAW Amperage and Voltage Settings	24
Figure 13b. GMAW Wire Speed Setting	24
Conclusion	24
Figure 14a. Final Gate Assembly- Overall	25
Figure 14b. Final Gate Assembly- End Piece	25
Figure 14c. Final Gate Assembly- Center Plate.....	25
Chapter 5- Summary, Recommendations and Conclusions.....	26
Summary.....	26
Recommendations	26
Conclusions.....	27
Appendix A- Figures and Pictures	28
Appendix B- SolidWorks Designs, Notes and Receipts.....	36
Reference List	40

Chapter 1

Introduction

Swanton Pacific Ranch (Ranch) is located in Santa Cruz County at the northern reaches of California's Central Coast and the Monterey Bay. The 3,200-acre property is composed of redwood forests, riverine ecosystems and coastal grasslands.

Due to its unique location, the Ranch is recognized for its high biodiversity and abundant resources, providing a unique and valuable opportunity for Cal Poly students, faculty, staff and the public to foster the Cal Poly Learn by Doing philosophy by providing educational experiences on a working ranch, supporting diversified agriculture and forest resources while maintaining the integrity of ranch operations. The Ranch provides students with the ability to live and learn on a working ranch while they work on a diverse range of research projects to develop career skills and become exposed to current ranch technologies. This educational and research facility is owned by the Cal Poly Corporation and managed by the College of Agriculture, Food and Environmental Sciences. Faculty, graduate students and undergraduates actively pursue research opportunities, utilizing the forest, range, and watershed resources within the ranch (Swanton Pacific Ranch, 2012).

Recently, the ranch has had problems with theft and vandalism; over \$10,000 of materials was stolen from Swanton Pacific Ranch during the summer of 2013 alone and, to look at the problem on a national scale, agricultural crime results in \$5 billion in economic losses annually (Swanson, Chamelin & Territo, 2002; Malone, 2005). Relatively little is known about rural crime. Since the early 1980s, property crime in urban areas has consistently trended downwards while in rural areas it has steadily increased.

Reviews and studies (e.g., Barclay, 2001; Barclay & Donnermeyer, 2002; Donnermeyer

& Barclay, 2005; Sugden, 1999; Weisheit & Donnermeyer, 2000) point to several agricultural crime generalizations: Large farms tend to experience more victimization than smaller ones; farmers use few security measures and are reluctant to report crimes; and the isolation of farms, their easy access, and the portability of commodities, machinery, and equipment on them all may contribute to victimization. The increased reliance on expensive equipment and technologies makes farms increasingly appealing targets, especially when there is little surveillance or likelihood that farmers will report the crime, or that law enforcement will take any reports seriously (Barclay, 2001).

One way to combat this victimization is to install gates in strategic places on the property. Gates are in use all over the world to keep things, animals and people in or out. Some gates have sophisticated automatic opening systems with features that include things like remote operation, allowing the user to open the gate with the push of a button. Due to the high traffic roads at Swanton Pacific Ranch (logging, cattle, cars, etc), and the proposed location of the gate, a solar powered, single-retractable gate is the best option.

Statement of the Problem

Over the summer of 2013, Swanton Pacific Ranch had over \$10,000 of materials stolen from the ranch. Because of the way the ranch is set up and divided, many people have easy access to the ranch and its equipment and this has led to a steady increase in agricultural crime at the ranch. Swanton Pacific Ranch needs gates to be built and placed in strategic locations throughout the ranch in order to deter future theft issues. Swanton Pacific Ranch also wants the gates to fit with the theme and lifestyle of the ranch by having the Swanton 'Starburst' emblazoned on the front. In addition to this prototype gate, there is the potential for five or more gates to be built, depending on the size and scope of the project.

Importance of the Project

The importance of this project is to increase security at the California Polytechnic State University managed ranch, Swanton Pacific Ranch. This project will benefit Swanton Pacific Ranch because they will have increased security and accountability at the ranch. They will also not have to put in the time and effort developing and building gates themselves, saving money in the process. The agriculture industry as a whole will also benefit because it will have an increased research and awareness about ranch security and what can be done to prevent agricultural crime problems.

Purpose of the Project

The purpose of this project is to design and build a 16'x5' single-retractable gate for Swanton Pacific Ranch, to be finished and implemented on Al Smith Road by June of 2014.

Objectives of the Project

The objectives of this project are to design and build a retractable gate for Swanton Pacific Ranch by:

- Separating the project into Financial and Physical segments
- Designing and building a 16'x5' single-retractable gate for Swanton Pacific Ranch on Al Smith Road
- Contacting Swanton Pacific Ranch faculty and staff regularly to confirm that the project is on the appropriate timeline

Definitions of Important Terms

1. Agricultural Crime- An industry-specific type of offense, one that affects commercial production. It thus includes theft of crops, livestock, equipment, and chemicals (e.g., pesticides), burglary, and vandalism (Barclay, 2001; Swanson et al. 2002)
2. Galvanized- Coat (iron or steel) with a protective layer of zinc.
3. HD- [Hot Dipped]; Steel run through a molten zinc coating bath, followed by an air stream “wipe” that controls the thickness of the zinc finish.
4. Swanton Pacific Ranch- Located in Santa Cruz County at the northern reaches of California's Central Coast and the Monterey Bay. The 3,200-acre property is a landscape composed of a majestic redwood forest, lush riverine ecosystems and expansive coastal grassland overlooking the bay and the Pacific Ocean. Swanton Pacific Ranch [SPR] is a research and demonstration property for California Polytechnic State University, San Luis Obispo, and in this capacity, serves to provide students, faculty, staff and the general public with a unique interdisciplinary learning opportunity.
5. Tack- A weld made to hold the parts of a weld in proper alignment before the final welds are made. Tack welds are also used to aid in preheating.

Summary

Installing gates in strategic places at Swanton Pacific Ranch is one of the best ways to reduce the agricultural crime that is taking place at the ranch and is an essential element for improving ranch security. Gates are in use all over the world to keep things, animals and people in or out because they are simple and effective. Due to the high traffic roads at Swanton Pacific Ranch (logging, cattle, cars, etc), and the proposed location of the prototype gate, the proposed gate design is a solar powered, 192” x 51” single-retractable gate, to be finished and implemented on Al Smith Road by June of 2014.

Chapter 2

Review of Literature

With any type of project involving time and money, there are questions to be asked and answers to be found. Prior to designing and building a gate, there are numerous questions to be answered, regarding ranch security, gate design requirements, environmental factors, materials and other financial and practical considerations. Designing and building a gate takes a great deal of time and capital and, with this being said, Swanton Pacific Ranch needs to be assured that the materials as well as the selected design requirements are best suited for the property.

Ranch Security

While agricultural crime results in \$5 billion in economic losses annually in the United States (Swanson, Chamelin & Territo, 2002; Malone, 2005), relatively little is known about rural crime. Agricultural crime is an industry-specific type of offense, one that affects commercial production. It thus includes theft of crops, livestock, equipment, and chemicals (e.g., pesticides), burglary, and vandalism (Barclay, 2001; Swanson et al., 2002). Although research on such crime is limited, evidence suggests that it is widespread, with one-third or more of all farms experiencing production-related property theft (Barclay, 2001).

The increased reliance on expensive agricultural equipment and technologies makes farms increasingly appealing targets, especially when there is little surveillance or likelihood that farmers will report the crime, or that law enforcement will take any reports seriously (Barclay, 2001). Research indicates that victimization was greater among farms that took fewer guardianship measures (e.g., locking or hiding equipment) or traditional protective steps (e.g., owning dogs), and were less able to see and monitor their property (Mears, Scott & Bhati,

2007).

While reducing the attractiveness, proximity, or exposure of agricultural targets has proven to be the greatest way of reducing agricultural crime (Mears, Scott & Bhati, 2007), but is largely unfeasible and unrealistic given the nature of agricultural production and the rural areas in which most farms operate. However, by incorporating such tactics as increased signage that post law enforcement and crime warnings, improving natural surveillance, placing equipment in secure buildings, disabling equipment that is not in use, marking equipment and livestock, and increasing fencing and gates can all lead to better security on a ranch (Swanson et al., 2002).

Gate Design Requirements

Gate and fence design needs to be in accordance with the legal codes of the area. It is important to note what laws, regulation, zoning and permits are necessary or will affect the construction of a gate at Swanton Pacific Ranch [SPR]. At SPR, the gate must be in accordance with the codes, laws and regulations set forth by the California State Fire Code.

Per the California State Fire Code, no gate may be installed across a required fire department access road or driveway without prior approval from the local fire agency and, when open, should not obstruct any portion of the required width of the driveway or access road and be operable by one person. A detailed plan of the project should be submitted for review and approval prior to commencing any work. Security gates equipped with an electronic or manual locking system must have an approved fire department override key switch or key that will allow for the operation of the gate during power outages. Sliding gates will slide parallel to the security fence and swing-style gates may swing in either direction, but need to open to a minimum of 90 degrees. Gate components shall be maintained in operable condition at all times and be replaced or repaired when defective (CFC, 2009).

Environmental Factors

Swanton Pacific Ranch sits in the coastal mountains, 15 miles north of Santa Cruz and overlooking the Pacific Ocean. The 3,200-acre ranch includes 2,100 acres of forest extending from steep mountain slopes down to grassy meadows. The elevation ranges from sea level to around 1,200 feet on the highest ridge north of Little Creek. Although the corrosive salt air coming from the ocean will affect the metal in the gate, the location will be set back further into the ranch valley and away from much of the ocean and its corrosive salt air [Figures 1 & 2].

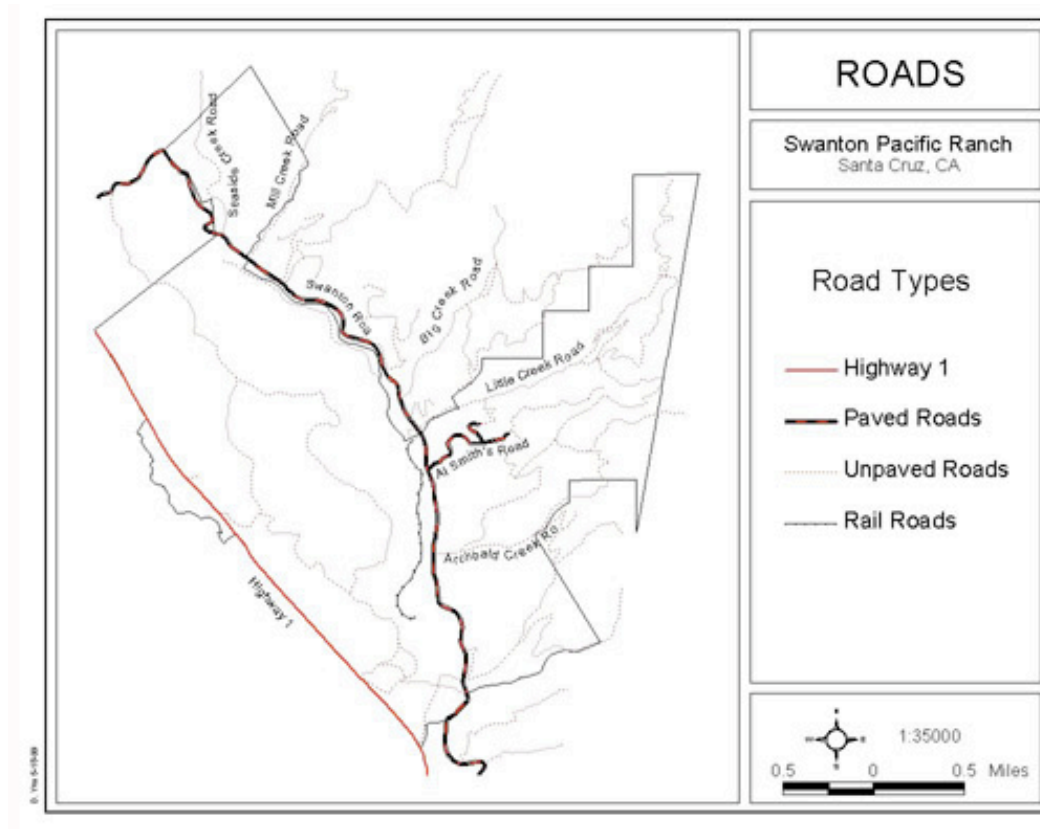


Figure 1. Swanton Pacific Ranch Prototype Gate Location



Figure 2. Swanton Pacific Ranch Proposed Prototype Gate Location

Materials

After considering what the cost parameters are for the project at hand, one must consider the materials necessary for project completion. Due to the weather at Swanton Pacific Ranch (Environmental Factors), it is highly recommended that HD steel nails and screws or Galvanized steel be used to prevent wear and to prolong the life of the gate (Beneke, 2005) against the highly corrosive salt in the air. It is also highly recommended that the posts used to stake the gate into the ground be set in concrete footings, to minimize construction issues if erosion becomes a problem later on in the life of the gate (East, 1993).

If wooden materials are to be used, it might be necessary to construct the gate with heartwood, as opposed to sapwood, so as to utilize the natural protective qualities of the wood (Beneke, 2005). Heartwood is a more expensive material, but both heartwood and sapwood would need to be covered with a waterproof, UV resistant finish, perhaps annually, and continue to be oiled regularly to prevent the wood from drying out (Beneke, 2005).

Financial and Practical Considerations

While the initial materials cost was discussed previously and is one of the primary concerns for those looking to build a new gate, it is important to note that farm fencing, and the gates that must accompany them, can represent up to 40% of the capital investment of a property (East, 1993). The initial cost is always the first and foremost thing that should be considered in design, but it is important to remember also the physical process of maintenance that will coincide with the construction, including, but not limited to, inspection, servicing, repairs, overhaul, improvements and replacement are also important financial aspects to consider (East, 1993). Meaning that it is important to remember that the initial cost will not be the only costs for the life of the gate; in addition to the initial cost, there will be maintenance, repair and/or improvement costs as well.

Initial Cost

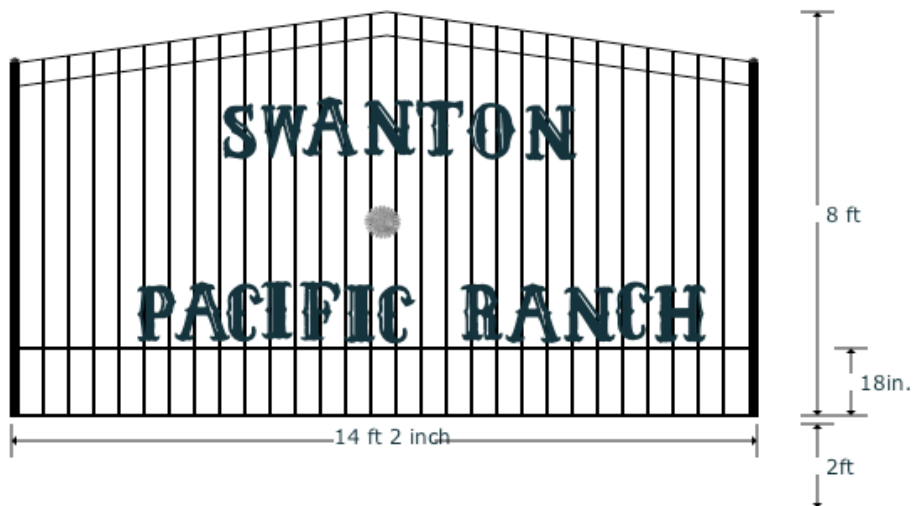
Equipment expenses include costs for transporting crews and material to the work sites and removal of previous fence-work. If the use of labor is a concern, planning projects for constructing and removing permanent wire fences may reduce the per-mile expense for unskilled labor. Labor for the gate construction will be about \$10 per hour, the industry average for a skilled craftsman (Quigley & Sanderson, 1989).

According to GateCrafters.com, their 192” single swing gates range in price from \$195 to \$1459 base costs, excluding shipping, tax, etc. The cheaper of these gate openers are the Mighty Mule brand and can be found on several different websites or retail stores. After using GateCrafters free gate quote program, the gate design for Swanton Pacific Ranch would cost \$2004.81 [Figure 3] for a single swing, 192” x 51” gate with the Swanton Pacific Ranch brand emblazoned on the front [Figure 4]. This cost does not include labor, travel or shipping expenses and does not include an opener.

	GatePrice:	1186 Per Unit	Quantity:1	Total:1186.00
	TopStyle:	75 Per Unit	Quantity:1	Total:75.00
	Two Top Bar:	150 Per Unit	Quantity:1	Total:150.00
	Ornament:	21.00 Per Unit	Quantity:1	Total:21.00
ABC	Letter:	16.99 Per Unit	Quantity:19	Total:322.81
	Hinge Plates:	50.00 Per Unit	Quantity:1	Total:50.00
	Flat Rate Shipping	200 Per Unit	Quantity:1	Total:200

Total Price: \$2004.81

Figure 3. GateCrafters Sample Gate Quote



Maintenance

The physical process of maintenance will include inspection, servicing, repairs, overhaul, improvement and replacement. Since farm fence and gate costs are substantial and represent an important farm input, they must be analyzed carefully if all parts of the farm business are to be considered (Beneke, 2005).

In addition to the initial start-up costs associated with gate and fence production, there are many other financial implications to consider as part of the gate design. Maintenance programs, emergency repairs, upkeep and overhauls are all important aspects of the financial implications of gate construction.

A regular maintenance program must be scheduled and should include the estimated costs and time necessary to complete the program. A regular maintenance schedule should be aimed at deferring replacements and expenditures on new materials on an emergency basis, but provisions for those emergency repairs must be accounted for. Checking and reappraisal is a continuous process and should be considered part of the overall cost of the gate construction (East, 1993).

Summary

It is apparent that the design and building of a gate is an extensively researched project. Coupled with this, the research, planning, preparation and execution of a successful gate have progressed over time in order to produce the most efficient and well-built product. There are many key elements that must be taken into consideration with careful thought and research.

Chapter Three

Methods and Materials

The purpose of this project is to design and build a gate for Swanton Pacific Ranch. A gate at the ranch will not only increase security at the ranch, but because the ranch is shared by multiple parties, it will also ensure that others know when they are transitioning from one individual's property to Swanton Pacific Ranch.

Project and Plan Approval

Fencing and gates are a long-term investment. Well-built gates should last from 25 to 50 years. Planning is the key to good fencing and gate-work. After Swanton Pacific Ranch had over \$10,000 of materials stolen over the summer of 2013, they approached me about building a gate to help increase on-property security. After consulting with individuals at the ranch and visiting the property to take a look at the proposed gate locations, it was decided that retractable gates would be the best option for everyone. As such, the project turned into a prototype for other gates that they want built later on.

Subsequent to consulting with the faculty and staff at Swanton Pacific Ranch, as well as researching and choosing the most appropriate resources to use, the gate was designed. It was important to keep in mind how often the gate was going to be used and the weather conditions in which the gate will be kept. It was also important to create a user-friendly gate to assist with maintenance and upkeep while keeping the design simple so that it would be easy to replicate at a later date. The final project design can be seen in Figure 5.

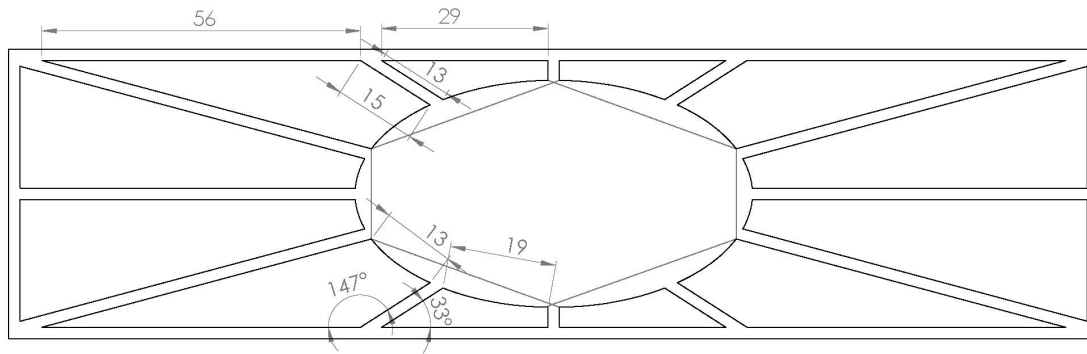


Figure 5. Approved SolidWorks Swanton Pacific Ranch Gate Design- Annotated

Price and Purchase of Steel

After Swanton Pacific Ranch approved the gate plan, the next task was to price and purchase the steel necessary to complete the project. After consulting with Cal Poly professors (Dr. Mark Zohns and Mr. Virgil Threlkel), and local industry professionals (Mr. Mike Fontes and Mr. Rob Thoresen), it was decided to that the materials needed to be purchased by B&B Steel of Santa Maria. The materials were priced at \$389.34 for 100 feet of 2"x2" square tubing and one 45"x75" 1/8" steel plate.

Planning and Cutting Gate Assembly

As stated earlier, fencing and gates are a costly investment. The location and arrangement may affect production efficiency, so it makes good sense to plan before you build. As such, prior to cutting and welding the gate, all the cuts needed to be planned out. Because of the difficulty of some of the cuts, practice cuts were made prior to the final cuts to ensure that the pieces all fit together properly. Images of the planning phase can be seen in Figures 7 and 8 below.



Figure 7. Planning Phase



Figure 8. Planning Phase

After all the practice cuts were finalized, the steel plate was cut on the PlasmaCam in BRAE shop 6 [Figure 9] and the tubing was cut on the band saw in labs 6 and 7 [Figure 10]. After the pieces were cut, they were welded in labs 6 and 7 at Cal Poly, San Luis Obispo.

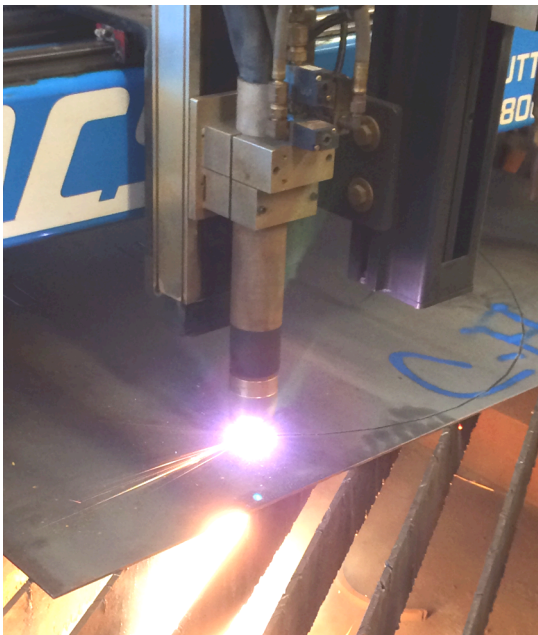


Figure 9. Plate Being Cut by PlasmaCam



Figure 10. Steel Tubing Being Cut at an Angle

Tack and Weld Assembly

Building a gate requires good materials, proper construction techniques and good common judgment. Every fencing and gate job presents slightly different problems, whether it be due to the location, materials or craftsman experience (or lack thereof). Due to the magnitude of this particular project, it couldn't just be welded together or the gate could warp and break. The gate needs to be square if it's going to work properly. The gate after being tacked together can be seen in Figure 11 below.



Figure 11. Gate Assembly After Being Tack Welded

After the tacks are in place and it is verified that the gate is indeed square, it can be welded the rest of the way. While welding, it is important to move along the gate so as to ensure that the gate doesn't warp from the heat while welding i.e. you around an entire joint and then move to a different location. Figure 12 (a, b, c) shows the three stages in which the welding should be done, and then the order of the welds within each stage.

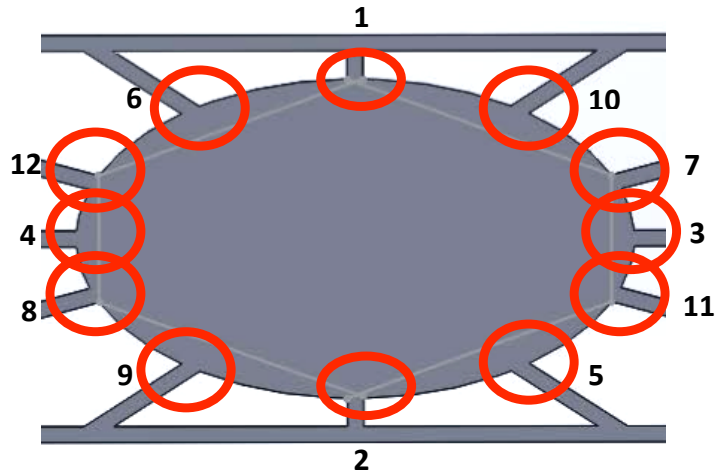


Figure 12a. Joint Weld Order- Stage One

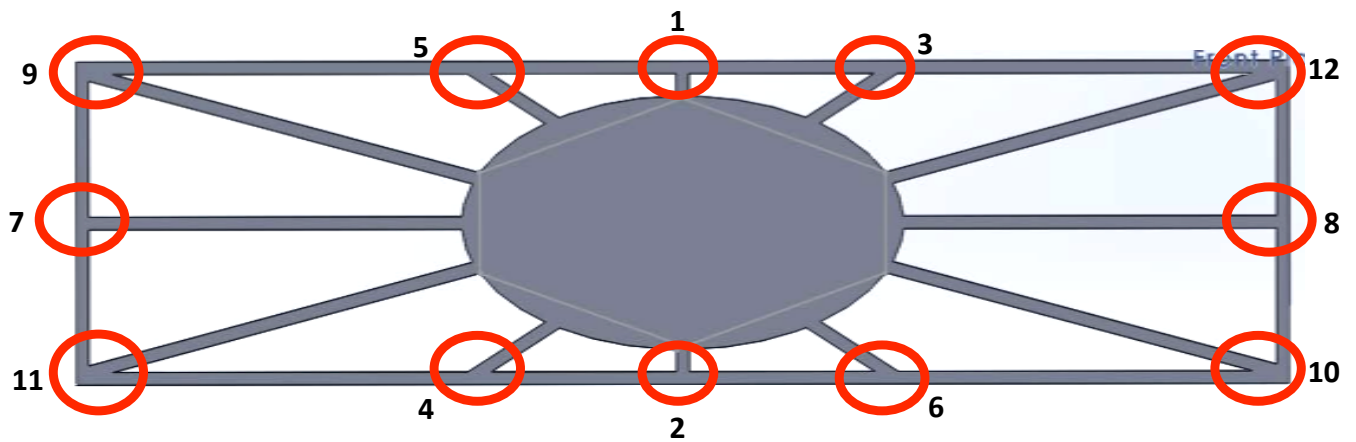


Figure 12b. Joint Weld Order- Stage Two

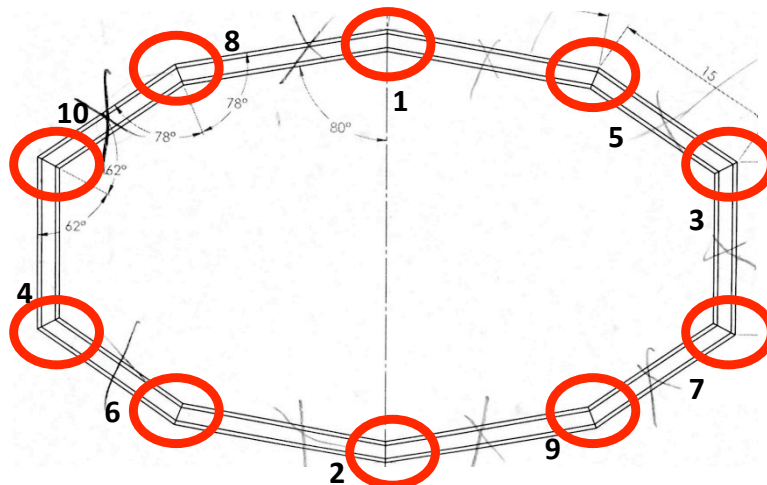


Figure 12c. Joint Weld Order- Stage Three

Summary

The purpose of listing the methods was to inform the readers about the different decisions that were made throughout compiling this project. It is essential when working with other individuals to ensure communication between both parties is clear and concise. Working with Swanton Pacific Ranch, it was expressed that updates and further information would be shared on a regular basis. Full disclosure of any new information that may arise would be discussed and deliberated.

When properly designing and building a gate, one must be sure to complete the extensive research needed in order to have the proposal plan meet the accepted criteria, not only for the gate itself, but for the particular location as well. Outside resources play a key role as well, so having other information available that will assist in the continuous success of the final project is necessary.

Chapter 4

Results and Discussion

The goal of the project was to design and build a 192" x 51" single-retractable gate for Swanton Pacific Ranch, to be finished and implemented on Al Smith Road with a corresponding manual should the Ranch wish to replicate the project. In this chapter, the finished gate will be presented, as well as a discussion of the results.

Results

This chapter presents the findings from the project proposal. The author created a manual and prototype gate for the California Polytechnic State University (Cal Poly) Swanton Pacific Ranch as requested by the Operations Manager Steve Auten. Swanton Pacific Ranch will receive both an electronic copy of the manual as well as a bound hard-copy for use by management should they want to build another gate, based on the prototype. It is important to note that while the prototype gate assembly is complete, Swanton Pacific Ranch has taken it upon themselves to complete the project by powder-coating and hanging the gate on Al Smith Road.

Discussion

The most difficult portion of the project was physically building the gate. This was due to the time crunch that the project was under and the challenging design of the prototype gate. The final design was modified as fabrication occurred when certain problems surfaced, such as difficult or impossible assembly. When these problems were encountered, a solution was quickly developed while in the shop, and then the SolidWorks model was updated with the solution.

Upon final assembly, there were some minor clearance and gap issues between the different gate pieces due to fit-up error. These issues were addressed by running a tack weld pass, grinding the weld down and running a final weld pass over the top.

It was also found that during final assembly that the original welding process would not work. The 1/8" E7018 SMAW process continues to run too hot and blow through the steel tubing. When testing alternatives to SMAW, GMAW was the only process that ran cool enough to not melt the tubing. The correct GMAW settings can be seen in Figures 13a and 13b.

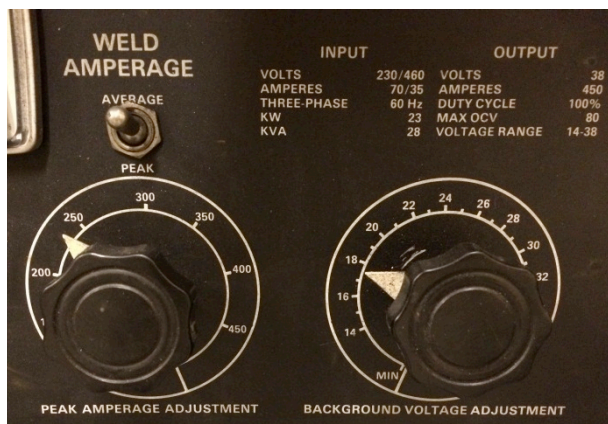


Figure 13a. GMAW Amperage and Voltage Settings



Figure 13b. GMAW Wire Speed Setting

Conclusion

The final prototype gate can be seen in Figure 14. There were some challenges that arose during fabrication, but were promptly solved during the process. Upon completion, the 192" x 51" gate took 52 hours of labor to plan, cut, assemble, weld and clean. Also, the final prototype gate cost \$389.34 for materials [Appendix B], \$500.00 for labor and \$50.62 for miscellaneous expenses [Appendix B].



Figure 14a. Final Gate Assembly- Overall



Figure 14b. Final Gate Assembly-
End Piece



Figure 14c. Final Gate Assembly- Center Plate

Chapter 5

Summary, Recommendations and Conclusions

Summary

This gate project proposal and development plan was designed in order to create a prototype gate that fit the needs and goals of Swanton Pacific Ranch. In view of the many different facets that must be considered when designing and building a gate, one must take a structured approach to address as many of the variables (metal distortion from heat, craftsman errors, etc.) as possible. The specific plan that is being proposed is based on the conclusions reached during the research process. This plan covers the start to finish process of correctly and efficiently developing a prototype gate.

Recommendations

A properly built and well-maintained gate will give one the most trouble-free service for your money, so a maintenance program is a must. There are four possible recommendations after reviewing the entire process of creating a manual and gate prototype for Cal Poly's Swanton Pacific Ranch:

1. It is recommended that this newly created gate be immediately implemented.
Management should make this gate immediately operational on-site so as to ensure that the gate works properly.
2. Keep the fence wires that attach to the gate assembly properly stretched. Fences will naturally loosen over time or with seasonal changes. If tighteners are placed in the fence, check at least twice per year. Other fences may be tightened by resetting or by putting several small kinks or creases in the wire using pliers, a hammer or special tool designed for this purpose. Splice broken wires when necessary.

3. Repair or replace anchor post assemblies whenever they show signs of weakness.
Refasten loose wires to posts.
4. Use herbicides or manual clearing to keep weeds and vines from covering the gate and gate tracks. Grass and weeds touching the wire can ground it and make the gate ineffective for controlling livestock and vehicle traffic.

When Cal Poly's Swanton Pacific Ranch implements these recommendations, they will have a complete and all-encompassing gate-building manual and prototype in which to replicate. It is anticipated that they will build at least five more gates across the Ranch.

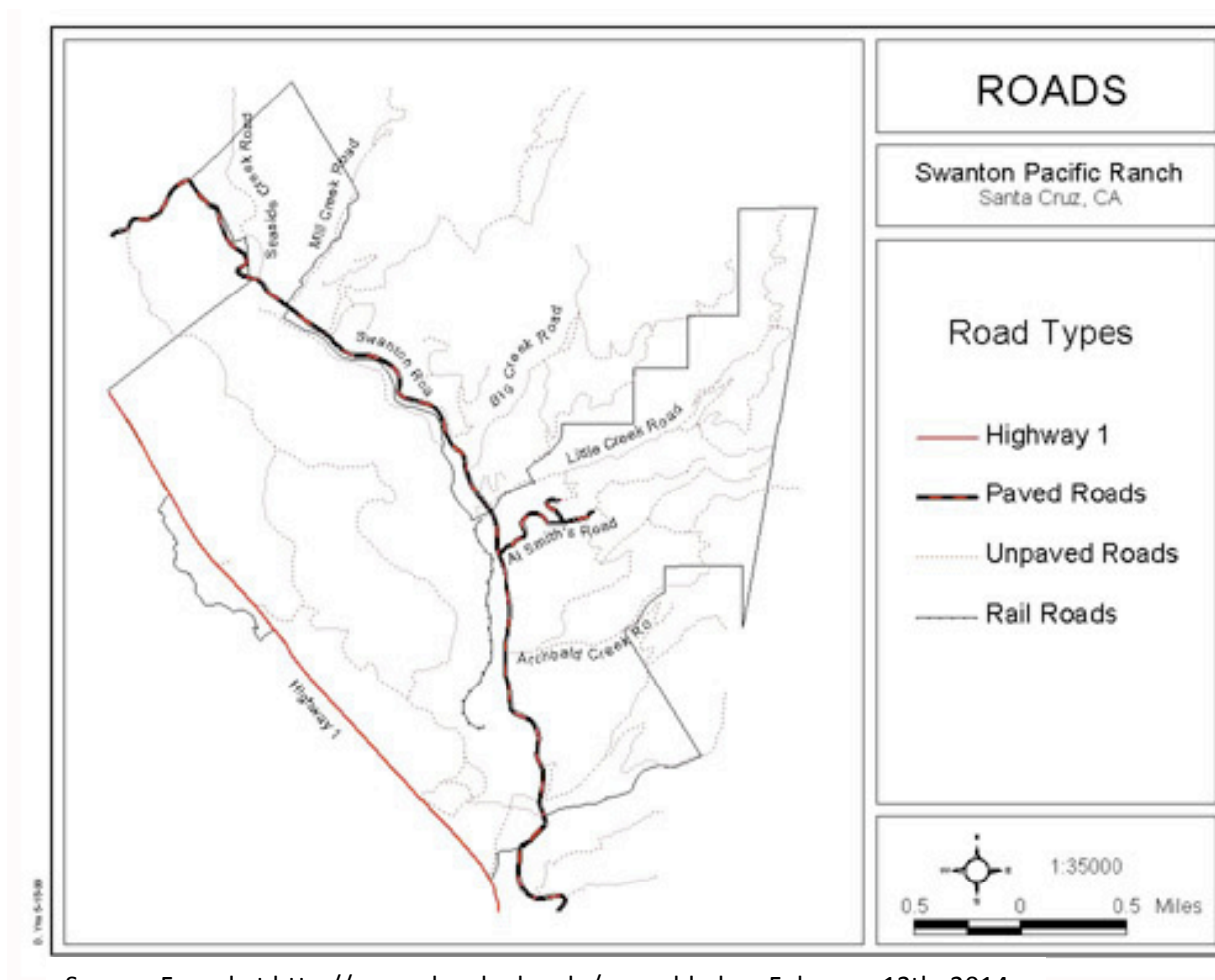
Conclusions

This project resulted in a high quality, individualized manual and prototype gate for Cal Poly's Swanton Pacific Ranch that fulfilled Operations Manager, Steve Auten's goals. These goals were: to create a building manual and a workable, prototype gate with simple to follow instructions that will be replicable in the future, should the ranch want to build more gates.

Cal Poly's Swanton Pacific Ranch management was pleased and impressed with the prototype gate and manual. Dr. Brian Dietterick stated, "...looks great. Thank you for taking on this project. This will last for decades."

Appendix A- Figures and Pictures

Figure 1. Swanton Pacific Ranch Prototype Gate Location



Source: Found at <http://spranch.calpoly.edu/maps.ldml> on February 12th, 2014

Figure 2. Swanton Pacific Ranch Proposed Gate Location



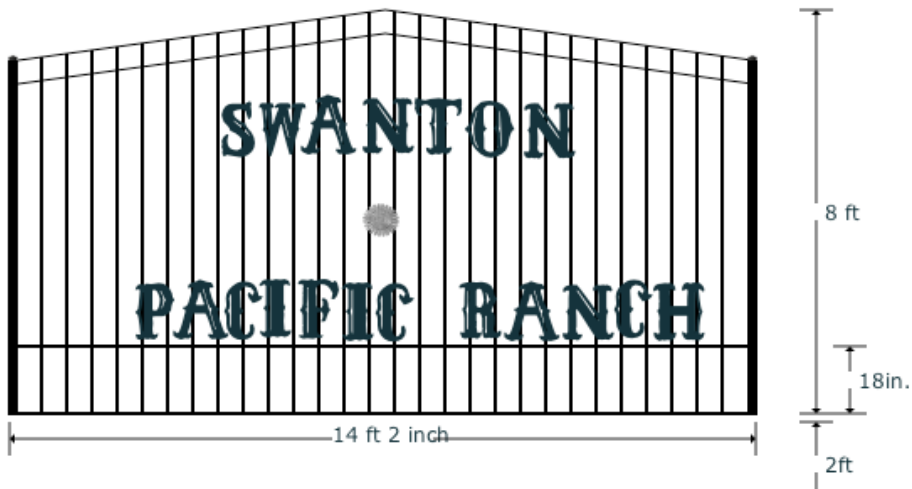
Figure 3. GateCrafters Sample Gate Quote

	GatePrice:	1186 Per Unit	Quantity:1	Total:1186.00
	TopStyle:	75 Per Unit	Quantity:1	Total:75.00
	Two Top Bar:	150 Per Unit	Quantity:1	Total:150.00
	Ornament:	21.00 Per Unit	Quantity:1	Total:21.00
ABC	Letter:	16.99 Per Unit	Quantity:19	Total:322.81
	Hinge Plates:	50.00 Per Unit	Quantity:1	Total:50.00
	Flat Rate Shipping	200 Per Unit	Quantity:1	Total:200

Total Price: \$2004.81

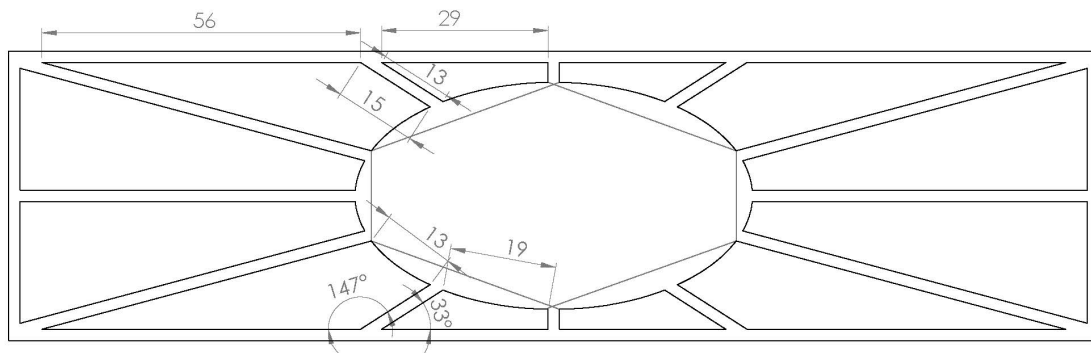
Source: Found at <http://www.gatecrafters.com/> on November 3rd, 2013

Figure 4. GateCrafter Sample Gate



Source: Found at <http://www.gatecrafters.com/> on November 3rd, 2013

Figure 5. Approved SolidWorks Swanton Pacific Ranch Gate Design-Annotated



Figures 7 & 8. Planning Phase Pictures



Figure 9. Plate Being Cut by PlasmaCam



Figure 10. Steel Tubing Being Cut at an Angle



Figure 11. Gate Assembly After Being Tack Welded



Figure 12a. Joint Weld Order- Stage One

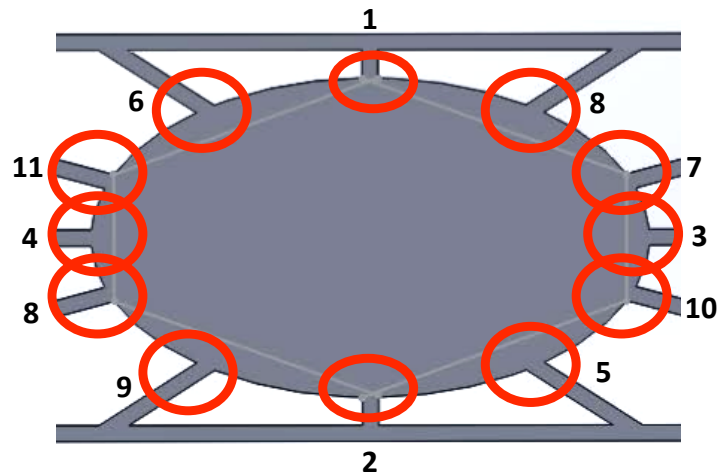


Figure 12b. Joint Weld Order- Stage Two

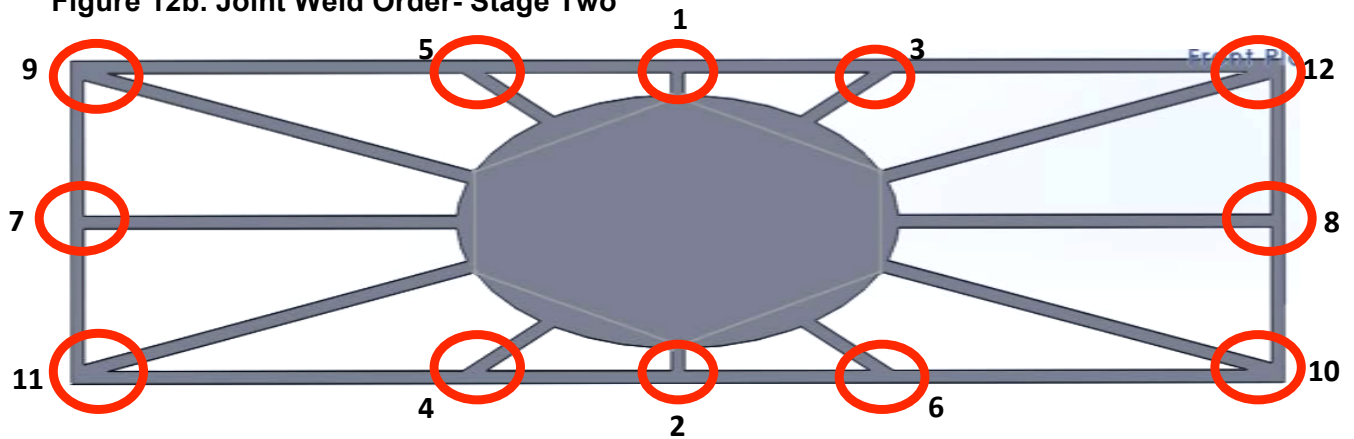


Figure 12c. Joint Weld Order- Stage Three

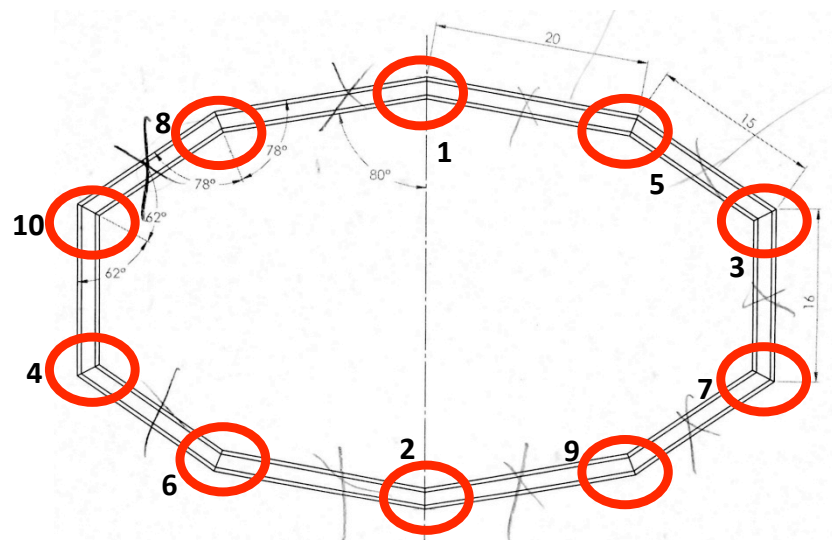


Figure 13a. Correct GMAW Amperage and Voltage Settings

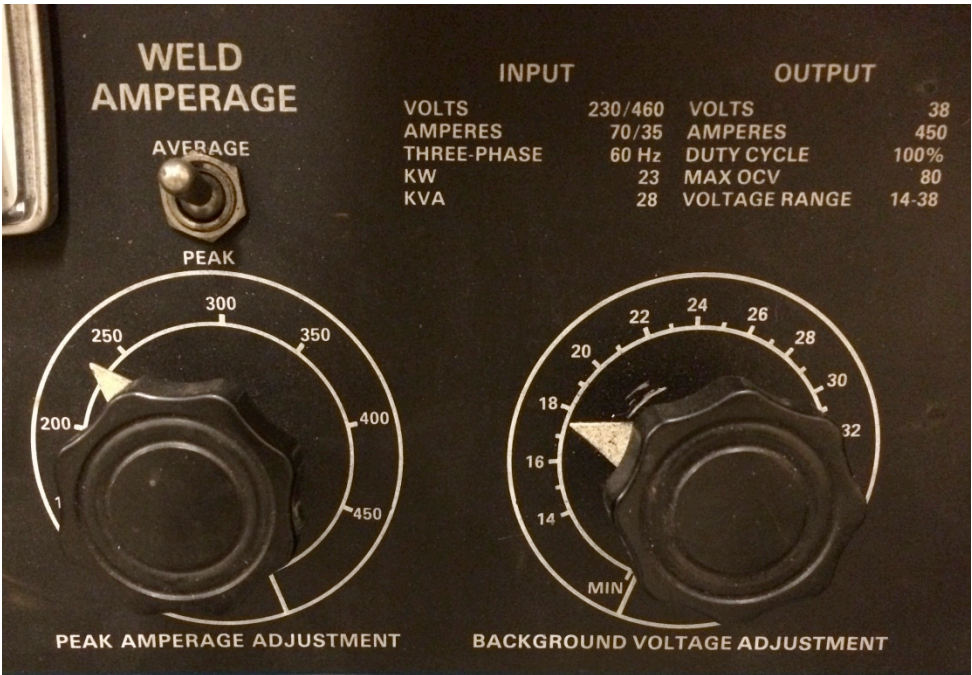


Figure 13b. Correct GMAW Wire Feed Speed Setting



Figures 14a, 14b and 14c. Finished Prototype Gate Pictures



Appendix B- SolidWorks Designs, Notes and Receipts

Figure 15. Original Swanton Pacific Ranch Prototype Gate Design

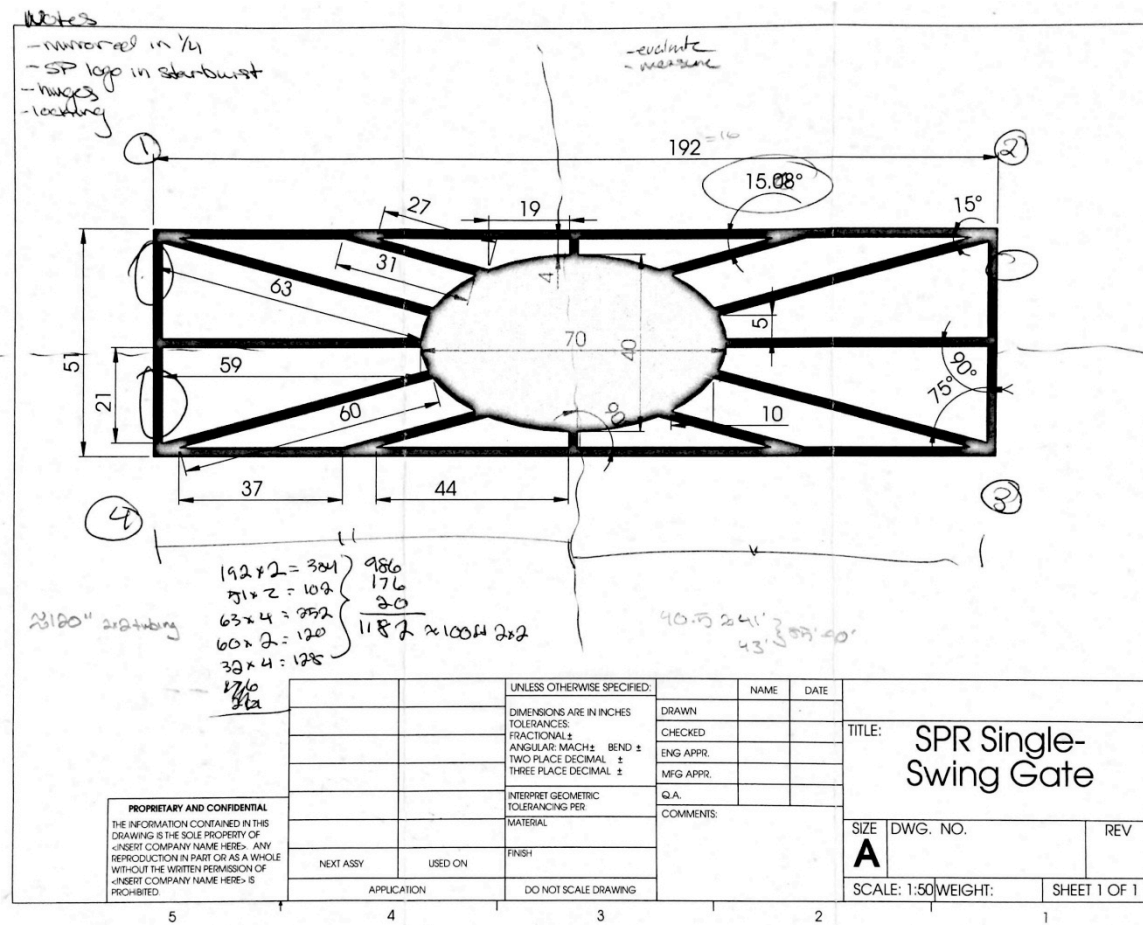


Figure 16. Final Swanton Pacific Ranch Prototype Gate Design

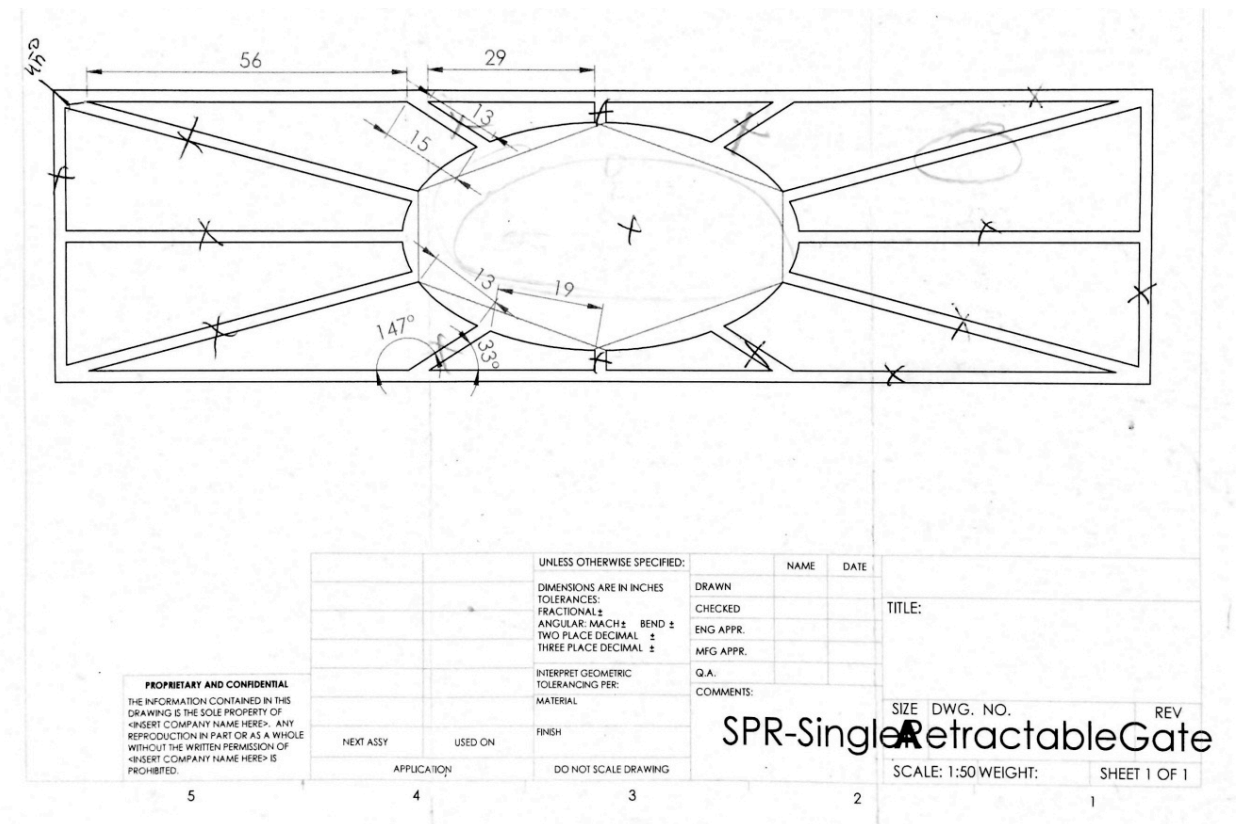


Figure 17. Swanton Pacific Ranch Prototype Gate, Corner Design

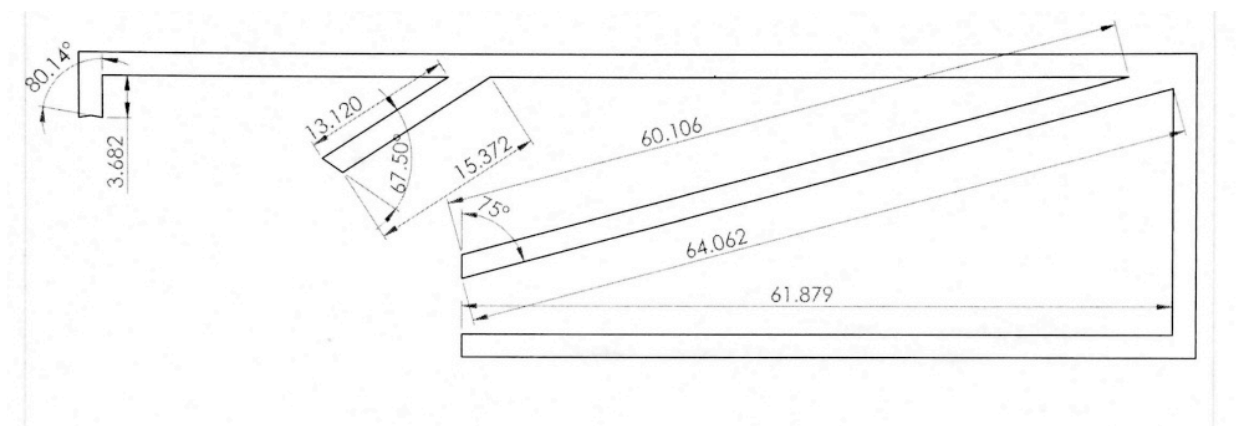
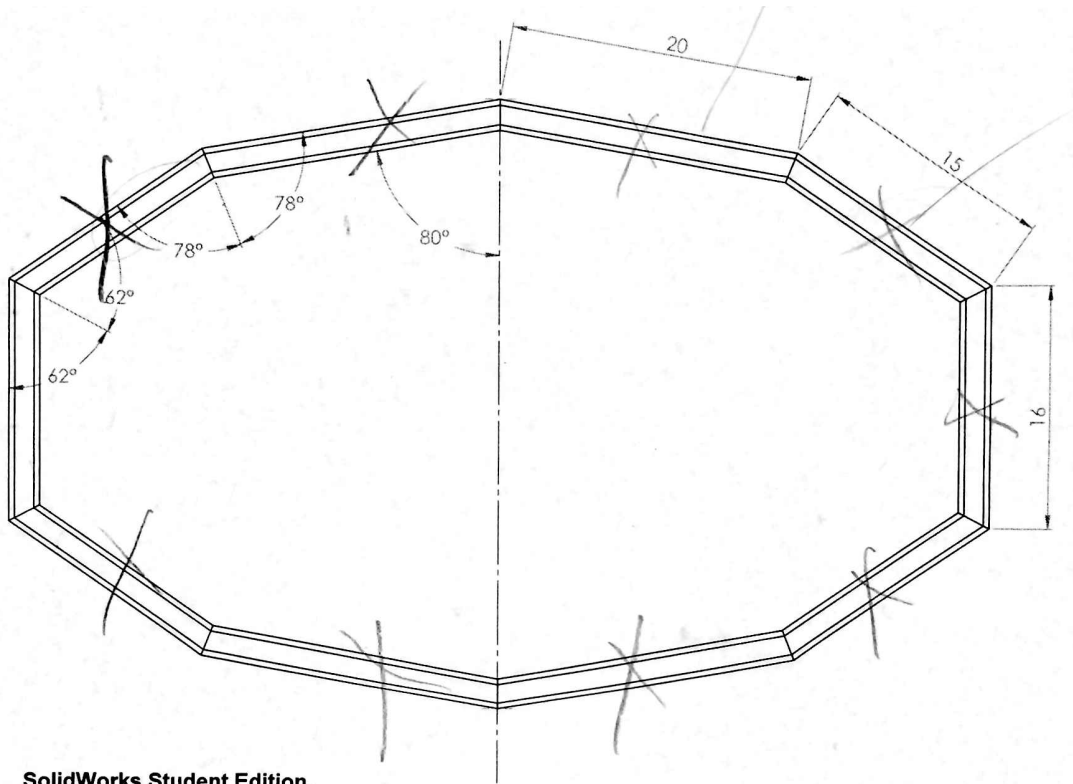


Figure 18. Swanton Pacific Ranch Prototype Gate, Plate Backing Design



**SolidWorks Student Edition.
For Academic Use Only.**

Figure 19. AirGas Materials Purchase Receipt

<h1>Airgas</h1>		<h2>DELIVERY ORDER</h2>		<div>FOR LOCATION NEAREST YOU VISIT WWW.AIRGAS.COM</div>			
SHIPPER: AIRGAS USA, LLC 205 TANK FARM RD SAN LUIS OBISPO, CA 93401-7509		SOLD BY: AIRGAS USA, LLC 205 TANK FARM RD SAN LUIS OBISPO, CA 93401-7509 805-544-4433		DELIVERY ORDER # 8028813636 PAGE 1 OF 1 ORDER DATE: 05/28/2014 SCH SHIP DATE: 05/28/2014 PRINTED: 12:22 05/28/2014 SALES ORDER: 1025995386			
SHIP TO: CAW033 CASH SALE - SAN LUIS OBISPO CA, BRA 205 TANK FARM RD SAN LUIS OBISPO, CA 93401-7509 US 805-544-4433		SOLD TO: CAW033 CASH SALE - SAN LUIS OBISPO CA, BRA 205 TANK FARM RD SAN LUIS OBISPO, CA 93401-7509 US		CUST PO # RELEASE # ORD BY ENT BY MIADGRUWEL			

Order Type	Payment Terms	Incoterm	Route	Sales Office	Plant	Sales Org	Total Containers Ship	Return
Cash Front Counter	CASH/ CHECK/ CREDIT CARD	Customer Pick Up	Customer Pick Up	W033	W103	WE00		

Qty Shipped	UOM Type	HM	Description & Hazard Class	Qty Order	Qty B/O	Bin Loc	Wt	Unit Price	Extend Price
10	LB		Line# 10 Material# LINED032589 Stor. Loc. F001 LINCOLN E7018 STICK ELECTRODE 1/8 EXCALIBUR 7018MR 10LB EASY OPEN CAN	10	0	S11000	10 LB	3.21	32.10
1	EA		Line# 20 Material# MIL217043 Stor. Loc. F001 BATTERY NON-RECHARGEABLE CR2450	1	0	S18B	0.02 LB	4.39	4.39
1	EA		Line# 30 Material# RAD64000956 Stor. Loc. F001 DISC FLAP 4.5X5/8-11 TRIM ZA 80 GRIT T27 BY NORTON Hazmat Flat Rate	1	0			5.98	5.98
								Subtotal	46.87
								State Tax	3.05
								County Tax	0.47
								District Tax	0.23
								Total Sales	50.62

EMERGENCY CONTACT: 1-866-734-3438
PURCHASER AGREES TO OBTAIN MATERIAL SAFETY DATA SHEETS (MSDS) FROM ONE OF THE FOLLOWING SOURCES: POINT OF PURCHASE, AIRGAS WEB SITE AT WWW.AIRGAS.COM OR BY CALLING THE ABOVE LISTED EMERGENCY CONTACT PHONE NUMBER AND SELECTING OPTION #3
THIS IS TO CERTIFY THAT THE ABOVE NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION

PLACARDS OFFERED
☐ ACCEPT ☐ REJECT
CUSTOMER MUST INITIAL CHOICE

THIS AGREEMENT IS SUBJECT TO AIRGAS' STANDARD TERMS AND CONDITIONS SEE REVERSE SIDE FOR IMPORTANT SAFETY INFORMATION.
ACCEPTED FOR THE ABOVE CUSTOMER **X**
NAME PLEASE PRINT Morgan Perry

AIRGAS PERSONNEL _____ **DATE** _____ **T.O.D.** _____

INTERNAL USE ONLY

Filled By	Staging Area	Total PKGS	Tracking / Pro Number	Freight Charges

Delivery # 8028813636

Reference List

- Barclay, E. 2001. A Review of the Literature on Agricultural Crime. New South Wales, Australia: University of New England.
- Barclay, E. and J.F. Donnermeyer. 2002. "Property Crime and Crime Prevention on Farms in Australia." *Crime Prevention and Community Safety: An International Journal* 4:47–61.
- Barclay, E., J.F. Donnermeyer, B.P. Doyle, and D. Talary. 2001. Property Crime Victimization and Crime Prevention on Farms. New South Wales, Australia: University of New England.
- Beneke, J. (2005). *The fence bible: How to plan, install, and build fences and gates*. (1st ed.). Storey Publishing, LLC.
- Broussard, K. (1988). Comparative costs for fence construction. *Rangelands*, 10(5), 224.
- Butterworth, B. (1979). Spare a thought for gate design. *Top Livestock Farming*, 17(9), 18.
- California Fire Code (CFC). 2009. Standards for Fire Department Vehicle Access. UN-096.
- California Irrigation Management Information Station (CIMIS). 2011. Daily Report.
<http://www.cimis.water.ca.gov/cimis/dailyReport.do> 5 June 2011.
- Donnermeyer, J.F. 1987. Crime Against Farm Operations. Columbus: Ohio State University.
- Donnermeyer, J.F. and E. Barclay. 2005. "The Policing of Farm Crime." *Police Practice and Research* 6:3–17.
- East, D. (1993). *Fences & gates: design & construction*.
- Economic Research Service. 2004. Rural America at a Glance, 2004. Washington, D.C.: U.S. Department of Agriculture.

- Economic Research Service. 2005. Profiles of America: Demographic Data and Graphic Builder. Washington, D.C.: U.S. Department of Agriculture.
- Gate Crafters. 2012. <http://gatecrafters.com/single-swing-gate-openers> 29 November 2013.
- Kubik, R. (2007). *How to build & repair fences & gates*. (1st ed.). Voyageur Press.
- Lobao, L. and K. Meyer. 2001. "The Great Agricultural Transition: Crisis, Change, and Social Consequences of Twentieth Century U.S. Farming." *Annual Review of Sociology* 27:103–24.
- Lobao, L. and K. Meyer. 2004. "Farm Power without Farmers." *Contexts* 3:12–21.
- Mears, D., Scott, M., & Bhati, A. (2007). Opportunity theory and agricultural crime victimization. *Rural Sociology*, 72(2), 151-184.
- Malone, J. 2005. "Farm Thefts Are on the Rise." *The Courier-Journal*. April 12, p. A1.
- National Electric Code. 2011. Article 690 – Solar Photovoltaic (PV) systems.
- Quigley, T., & Sanderson, R. (1989). Analysis of fence construction costs. *Rangelands*, 11(4), 183.
- Reeves, S. (1988). Power fence construction and design. *Georgia Cattleman*, 16(9), 22.
- Saltiel, J., J. Gilchrist, and R. Harvie. 1992. "Concern About Crime Among Montana Farmers and Ranchers." *Rural Sociology* 57:535–45.
- Sugden, G. 1998. "In Defense of Farms: An Agrarian Crime Prevention Audit in Rutland." Pp. 83–94 in *Crime at Work, Vol. 2, Increasing the Risk for Offenders*, edited by M. Gill. Leicester, UK: Perpetuity.

- Sugden, G. 1999. "Farm Crime: Out of Sight, Out of Mind: A Study of Crime on Farms in the County of Rutland, England." *Crime Prevention and Community Safety: An International Journal* 1:29–36.
- Swanson, C.R., N.C. Chamelin, and L. Territo. 2002. *Criminal Investigation*. Boston, MA: McGraw.
- Swanton Pacific Ranch. 2012. California Polytechnic State University.
<http://spranch.calpoly.edu/index.ldml>.
- U.S. Census Bureau. 2005a. Census 2000 Summary File 1. Washington, D.C.: U.S. Census Bureau.
- U.S. Census Bureau. 2005b. Census 2000 Summary File 1, Matrix P1. Washington, D.C.: U.S. Census Bureau.
- U.S. Department of Agriculture. 2004. 2002 Census of Agriculture. Vol. 1. Washington, D.C.: U.S. Department of Agriculture, National Agricultural Statistics Service.
- Weisheit, R.A. and J.F. Donnermeyer. 2000. "Change and Continuity in Crime in Rural America." Pp. 309–57 in *The Nature of Crime: Continuity and Change*, edited by G. LaFree. Washington, D.C: National Institute of Justice.
- Weisheit, R.A. and L.E. Wells. 1996. "Rural Crime and Justice: Implications for Theory and Research." *Crime and Delinquency* 42:379–97.
- Weisheit, R.A., L.E. Wells, and D.N. Falcone. 1995. *Crime and Policing in Rural and Small-Town America: An Overview of the Issues*. Washington, D.C.: National Institute of Justice.