

UNIVERSITY OF NEBRASKA-LINCOLN

DEPARTMENT OF MECHANICAL & MATERIALS
ENGINEERING

MECH 446H Postmortem Report

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Project 3 Stump Grinder Portable Device

Sponsored By: Gary and Carol Sherman

Made For:

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University of Nebraska-Lincoln

And For

The University Of Nebraska Lincoln Honors Department

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Project Description:

The project that my team had worked on this semester was a portable stump grinder device for Gary and Carol Sherman, two farmers out of Lincoln Nebraska. For this project, my team and I needed to identify and analyze the subsystems of a stump grinder and provide the foundation for future engineers to design and build a stump grinder for Gary and Carol Sherman based on our findings. In addition to this Gary and Carol wanted us to analyze this device and create potential solutions under a very inexpensive budget as most commercial stump grinders are too expensive for them and the farming community and are too large for the machines they have. It is also within our scope to provide multiple iterations of this stump grinder device and analyze which components and materials would work best with each iteration and the reason we do this is to provide options for future teams of engineers to build off of. Additionally, it is within our scope to analyze and design these iterations to be able to attach to the two machines Gary and Carol have which are an Owatonna 770 loader and a New Holland L325 Skid steer and both of these devices are pictured below. Next I am going to describe the deliverables that went along with this project.

New Holland Skid Steer:



Owatonna 770 Loader:



The first of our deliverables for this project are to identify the key subsystems within a stump grinder and identify the requirements that go alongside these subsystems. The next deliverable is to specify the design of each subsystem without designing the subsystem itself. For instance we provide the calculations, dimensions, and material properties of each of the subsystems, but do not design the subsystem in Solid works or CAD as it is within our scope to provide the foundation for future engineers and if we design the subsystem it could create confusion for those engineers and could possibly cause them to have to redo the entire process. The next two deliverables we have are time dependent and they are a 3D printed prototype of the linkage/ hookup system and designing the mounting system. Both of these deliverables would provide us the opportunity to further evaluate the subsystems we have researched and determine what is vital for the overall design of the stump grinder, however they do not give our group an official finalized design as again that is outside of our scope for this project. Next I am going to discuss the budget, bill of materials, and timeline for our project.

The budget we were given was 3,000 dollars and this value was given to us by Gary and Carol Sherman as they wanted a new stump grinder that could fit their machines and be cheaper than the commercial stump grinders on the market. Down below is a Bill of Materials that has some of the potential costs this project has.

Bill of Materials:

Frame:

Item	Cost (\$)
Steel plate (2x)	79.24
Steel L angle (4x)	23.75
Total frame cost	253.48

Dampening:

Item	Cost (\$)
Hydraulic shocks	44.50
Vibration isolation pad	18.99
Spring isolation mounts	14.95

Swivel (Will be assessed after analysis):

Item	Cost (\$)
Hydraulic Cylinder	50-600
or	-
Hydraulic Motor	150-700
Drive Train	50-200

Grinder:

Material	Cost (\$)
62.83 in ³ piece of 80CrV2	\$136.15
144 in ³ piece of 1075Cr1	\$248.42

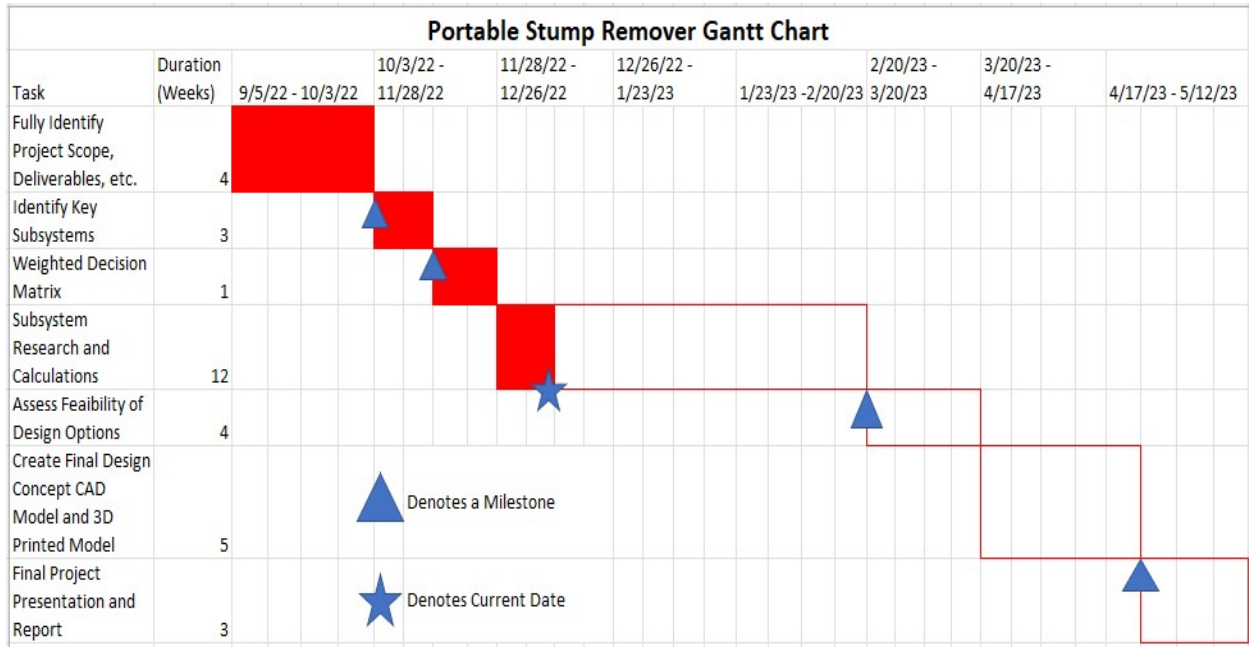
Hydraulics:

Material	Cost (\$)
Hydraulic Hose	\$70x2= \$140
Hydraulic Solenoid Valve	\$350

According to our bill of materials we have a maximum cost of 2,809.48 dollars and this puts us underneath our budget which is what we want. I will mention though that this bill of materials is not finalized, and parts may either get more or less expensive as more research is conducted, but

as it stands we are underneath our budget. Moving on down below is a picture of our timeline for this semester.

Timeline:



As can be seen above we are on schedule for our project. In the beginning of the semester, we were a little behind due to confusion on what we were supposed to accomplish for the project, but now that we understand the project we have corrected our issues and are back on schedule. Looking forward on this timeline we plan to do more calculations and research over winter break and going into the next semester which puts my team right on schedule to finish the project on time.

Project Improvement:

Now knowing that our project is on schedule and under our budget it does not mean that it is perfect and has some room for improvement. The first area of improvement is the specification of the device. With our project having the overall goal of laying the foundation for future engineers specificity becomes a large problem with analysis. The reason this is a problem is the more specific we make our subsystem analysis and the more narrowed down we are with research the less options there are for future engineers to utilize and with being specific it could create the potential problem of our subsystem design not working and creating problems for those future teams. To alleviate this, I could implement an executive order to my team members to create more options by the deadlines we have in place and conduct thorough research on those potential designs to guarantee success and increase overall effectiveness of the end goal of our project. There is an additional area that could be improved to increase the effectiveness of the project and that area is design cohesiveness and overall harmony with each of the subsystems.

The reason that this area could use improvement is that each of my team members did their own unique research on one subsystem that each of them was assigned. The problem was that none of them shared their research or findings with each other to verify if what they had

found and analyzed would work with each other's subsystems. To alleviate this issue, I plan on issuing an executive order and plan that the entire team will work on the analysis and calculations of one to two subsystems at a time that way the entire team can understand what is required of the subsystem and analyze and research other subsystems to meet the requirements of the already researched and analyzed subsystems. By doing this we can alleviate all confusion and potential problems that arise with individual research.

Design Improvement:

According to our scope it is outside of our definition of said scope to create a design for this project as future engineers are going to be handed this project and design and build the stump grinder. That being said there are two subsystems that we have designed to get an idea of what this stump grinder should look like. The two subsystems mentioned are the grinding mechanism and the guard for the grinding mechanism. To improve the design of the grinder I recommend that my team make multiple iterations of the grinder instead of just the one that way more options are available for further research and just in case the one design proves faulty or inefficient for the overall stump grinder design. The reason my team should do this is because it is part of the goal of this project to analyze multiple iterations of the stump grinder subsystems and with this goal in mind it is completely feasible and doable to analyze multiple iterations as we have the time to do so and doing this would improve the overall efficiency of the project. There is one other recommendation that I would make for the design of this stump grinder and that being the analysis of varied materials for components and subsystems.

The reason I recommend this is because as it stands we have one metal in mind when it comes to building the stump grinder which again does not follow the overall goal of our project. In addition to this, analyzing multiple metals would give future teams more options to work with and would allow us to analyze multiple metals just in case the metal we have chosen is not efficient or strong enough to support the overall stump grinder. These are a few design recommendations that I could make given that it is outside of our scope to make a design.

Project Team Interaction:

As efficient as my team has been this semester there were many problems with communication amongst my team members. The first aspect for improvement was the fact that we possibly were not meeting for enough time throughout the week which decreased the efficiency and moving speed of the project as we possibly did not spend enough time on the project due to schedule conflicts. What I plan to do is launch an executive order that my team meet more frequently throughout the week so that more time can be spent completing the project. To implement this, I will address everyone's schedule and organize meetings around scheduling alignments and if it appears that one or two members cannot attend some of the meetings then they will be excused from said meetings. Once I have created the meeting schedules I will alert those who can attend to attend so that work on the project can be accomplished. The second area of improvement was member-to-member communication. What I plan to do to solve this issue is stress the importance of communication to my team members and encourage them to communicate as it will improve the efficiency of the project and may even lighten the workload

for some of my members. To implement this I will have everyone together for one meeting highlighting the importance of member to member communication and throughout the semester I will monitor communication through the use of a group chat and monitoring of emails through the use of google docs and if I notice that communication has not improved amongst some of my team members I will pull them aside privately and again reinforce the importance of communication and encourage them to communicate and if they do not do this still then I will ask that they meet with specific team members on their own time to accomplish work together.

Action Plan:

For Mech 447 an action plan is necessary to accomplish the goals and requirements of this project and in this section that action plan will be explained in depth. To start out next semester I am going to hold a meeting discussing the importance of communicating amongst members, doing combined research and analysis for subsystems, and the importance of analyzing iterations of the subsystems we analyze. The goal of doing this is to increase the amount of work completion for the project and allow us to finish on time and to increase team member collaboration. Once this has been implemented on the first meeting of the semester I plan to assess everyone's schedule and create a meeting schedule for each member and share it with them individually. The goal of this is to again increase the efficiency of the project and allow us to complete the project on time. The ultimate measure of success with these parts of the action plan is are we accomplishing more work for the project, are we completing the project correctly, and are we communicating more and working together and if the answer is yes to all of these questions then these parts of the plan have succeeded at doing their job. To finish this plan during the first two weeks after the meeting I will ask team members what variations in design they have produced and if nothing new has been created I will encourage them to produce creative ideas so that the project will have variation. The measure of success for this part of the plan is if there are multiple variations for each subsystem and if my team members are working together to make these variations and comparing them to their own respective subsystems throughout the semester then this part of the plan would be considered on overall success.

Conclusion:

This is the project that me and my team have been working on all semester. Throughout the course of this semester, we have had some issues, but in this report all those issues have been addressed and a plan has been made for next semester so that this project can be completed efficiently and successfully. Hopefully, upon completion of the project Gary and Carol will continue to work with the University of Nebraska Lincoln and hand off our ideas to future engineers to design and build the stump grinder we spent a year analyzing and hopefully they will have a device that will last for years of use.