DESIGN OF INDIO HIGH SCHOOL AGRICULTURE SHOP

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First, I would like to thank my mother for helping me with my project and providing me the framework and basis for the project.

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ABSTRACT

Indio High School was built in 1958 and has been approved by the board and state to undergo a complete renovation. The estimated project costs will be around $84.1 million. The project will include a complete demolition of the current structures on the campus and a complete rebuild of new state-of-the-art facilities. Phase 1 of 3 was started in September 2011. Phase 2 which includes the Agriculture Shop is planned to begin construction June 2013.

When designing a new building there are many aspects to take into account, such as how big the building is, what is the purpose of the building, what is going to be placed in the building, etc. Other things that need to be considered are what kind of machines and tools are going to be used within the building, where they should be placed, how much room does each machine need to be used properly and safely, safe storage processes and what kind of electrical the machines will need to be operated.

The existing facilities include a 3,829 square foot shop area, (7) 5' by 5' lab tables, (4) 3' by 3' lab tables, (2) storage rooms, a walk-in cooler, a teacher's office and a hand washing station in Shop 1. Shop 2 includes 3,403 square feet of shop area, (2) tool storage rooms, (4) 12' by 12' roll up doors, a teacher's office and a hand washing station.

The proposed new facilities include six designated shop and classroom areas; the agriculture business science classroom, floral shop, agriculture biology classroom, agriculture shop, welding area and tool/material storage.

In the agriculture business science classroom there will be around 2,880 square feet of classroom area, 20 workstations, 7 lab stations, 4 washing stations, a material storage area and a teacher's workstation.

In the floral shop there will be around 1,360 square feet of working space, 20 workstations, 7 lab stations, 3 washing stations, a floral sales counter, a walk-in cooler, material storage area, teacher's office and workstation.

In the agriculture biology classroom there will be around 2,960 square feet of classroom, 20 workstations, 7 lab stations, 4 washing stations, a prep-science area and a teacher's workstation.

The agriculture shop will be around 3,360 square feet, 24 workstations, 9 lab tables, 7 lab stations, 2 hand washing stations, a tool storage board, a roll up door and a teacher's workstation.

In the welding area, there will be around 1,440 square feet of welding shop, with 30 welding stations and a roll up door. In the tool/material storage area there will be around 640 square feet of storage area, a roll up door and a gas storage section.

The proposed exterior of the new facilities will include two shaded areas with tables, two garden areas, a wood shop yard, rabbit and poultry area, processing room, parking and loading area.

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INTRODUCTION

I designed the layout and organization of the new agriculture shop for Indio High School's agriculture department building. Currently the high school is the oldest high school in the district, over 40 years old, and is two different classrooms that house all the classes in the department. The facilities are old and outdated and with the new school, all classrooms will be state-of-the-art and be built to teach in for another 40 years.

My project will give the department a design that will be used for ideas for construction and give the teachers an equipment list made from the design. They will know where each machine should be placed in order to have the most available space in the classrooms and keep the classroom safe for students.

Designing the shop before it is built gives the teacher a great advantage of knowing where machines will be placed and how much walking room will be available for students and faculty to move around so things are not placed too tightly together with no room to work. This design will also be approved by the department head and will give the teachers an idea of what the shop will look like when completed.

LITERATURE REVIEW

The agricultural shop will be one that serves multiple purposes at the high school. It will teach students everything from what to call tools to advanced classes in welding, fabrication and design. A shop provides a place to do anything that involves using machinery to design and build a product used by the student. Technical and vocational skills are becoming more important in hard times because people cannot afford to pay someone to fix everything that breaks. The shop will also provide a central location to store and keep track of tools used throughout classes taken. With the new shop, the high school agriculture department will have the ability to fix and build almost anything they desire.

Shop Setup

Important aspects when planning a shop are space requirements, equipment layout and access to all parts of the shop, storage, electrical, ventilation and other amenities needed. The size of the shop will regulate the number of machines that will be able to be purchased and placed. An outdoor area will also provide for a bigger working area other than just inside the shop. Tools and equipment need to be in a place easy to reach and convenient to make it easier to work in the shop.

The electrical aspect of the shop is going to be very intricate and carefully planned. An electrical service of 200 amps, 240 volts is the minimum recommended electrical for a shop says Hofman and Hellevang. This service will provide for the machines and power tools that will be running. Use separate circuits for motors over ½ horsepower and no more than two motors on a circuit. The welders need a 50 amp or larger 240 volt outlet and since there is many welders there will be many 240 outlets. Ground fault interrupters are needed around anywhere that can get wet or along the outside of the building. These outlets prevent the user from electrocuting themselves. Lighting in the shop will be planned to provide enough lighting throughout the shop so work can be done anytime day or night. Electricians and electrical inspectors will inspect the wiring before anything is finalized. Ventilation of the shop will be planned and the welding area will need its own exhaust hood to provide adequate exhaust of the welding gases and fumes created from welding.

Tool benches and part storage is very important to keep tools organized and easy to access. An easy way of organizing tools is hanging them on a wallboard and outlining the individual tools. This way you can glance at a board and see what is missing very quick. Grouping alike tools will make finding tools easier when looking for a specific tool. Plywood or pegboard can be used to hang the tools on the wall. These will provide

enough thickness to screw screws into or have nails to hang the tools on. Workbenches should be 34 to 38 inches high and adjusted to the principal user's height. The bench depth is normally 24 to 30 inches and should be anchored securely (Hofman, Hellevang). These benches will be covered with steel for durability.

The large, freestanding tools should be placed near the welding area and fabrication part of the shop. They cannot be placed in the corner because it limits the ability to work on large pieces of material. These tools should have stable bases but should not be anchored to the floor to provide flexibility of the machine placement when dealing with an oversized piece of material that does not fit within the space boundaries.

There will be many storage areas around the shop and will be organized by style of material or tool. They will have shelving and drawers to be used for similar parts and materials. These areas will need to be kept clean and organized, so every day the students will need to clean and put everything away where they got it from.

Safety

Shop safety is the number one priority when working in the shop. Especially at a high school level, rules have to be created and followed. The hazards are special and require special safety considerations. The ASABE standards article talk about having a safety color code for educational and training laboratories. It discusses having color coded areas so people know what kind of hazards or dangers are present in that area. It says the different tools and hazards that should be marked and what colors should be used for those areas. These colors will tell the people using the tools exactly what to watch for not to get hurt.

General Shop Safety

Potential Hazards	**Hazard Sources**
Electrical: Overload Fire Shock	Too many cords per outlet Frayed, damaged cords Ungrounded tools, equipment
Fire: Flammable Chemicals	Gasoline, degreasers, paint thinners, etc.

Sparks Static Sparks Uncontrolled Fire	Welders, grinders Ungrounded tools or solvent containers Lack of appropriate fire extinguishers
Chemical: Toxic Liquids Toxic Fumes, Gases, Dusts	Cleaning solvents, degreasers, etc. Welding, motor exhaust, etc.
Physical: Compressed air/gases Flying Debris Noise Pinching, Cutting, Amputation Slipping, Tripping UV Radiation	Oxygen, acetylene, air Grinders, saws, welders Any power tool Vises, power tools, hand tools Wood/metal chips, electrical cords, oil, etc. Welding

http://safety.ag.utk.edu/safetyplan/17Shopweb/17shopsafety.htm

Shop Safety

Follow these guidelines for general shop safety:

1. Know the hazards associated with your work. Be sure you are fully educated on the proper use and operation of any tool before beginning a job.
2. Always wear appropriate safety gear and protective clothing.
3. Wear nitride gloves when cleaning with degreasers or ferric chloride (latex gloves do not provide adequate protection.)
4. Ensure that there is adequate ventilation to prevent exposure from vapors of glues, lacquers, paints, and from dust and fumes.
5. Maintain good housekeeping standards.

    - Keep the work area free from slipping/tripping hazards (oil, cords, debris, etc.)

- Clean all spills immediately
- Remove sawdust, wood chips, and metal chips regularly
- It is recommended that electrical cords pull down from an overhead pulley rather than lying on the floor.

6. Leave tool and equipment guards in place.
7. Know where fire extinguishers are located and how to us them.
8. Make sure all tools and equipment are properly grounded and that cords are in good condition.

    - Double insulated tools or those with three wire cords are essential for safety
    - Use extension cords that are large enough for the load and distance

9. Secure all compressed gas cylinders. Never use compressed gas to clean clothing or skin.
10. Always use flashback arresters on cutting/welding torches.
11. Take precautions against heat stroke and heat exhaustion.
12. Wear infrared safety goggles when appropriate.

Source: http://safety.ag.utk.edu/safetyplan/17Shopweb/17shopsafety.htm

General hand tool safety

1. Wear safety glasses whenever you hammer or cut, especially when working with surfaces that chip or splinter.
2. Do not use a screwdriver as a chisel. The tool can slip and cause a deep puncture wound.
3. Do not use a chisel as a screwdriver. The tip of the chisel may break and cause an injury.
4. Do not use a knife as a screwdriver. The blade can snap and cause an injury.
5. Never carry a screwdriver or chisel in your pocket. If you fall, the tool could cause a serious injury. Instead, use a tool belt.
6. Replace loose, splintered, or cracked handles. Loose hammer, axe, or maul heads can fly off defective handles.
7. Use the proper wrench to tighten or loosen nuts. Pliers can chew the corners off a nut.
8. When using a chisel, always chip or cut away from yourself.
9. Do not use a wrench if the jaws are sprung.

10. Do not use impact tools, such as chisels, wedges, or drift punches if their heads are mushroom shaped. The heads may shatter upon impact.
11. Direct saw blades, knives, and other tools away from aisle areas and other employees.
12. Keep knives and scissors sharp. Dull tools are more dangerous than sharp tools.
13. Iron and steel hand tools may cause sparks, which are hazardous around flammable substances. Use spark-resistant tools made from brass, plastic, aluminum, or wood when working around flammable hazards.

Tool Storage

Improper tool storage is responsible for many shop accidents. Follow these guidelines to ensure proper tool storage:

1. Have a specific place for each tool.
2. Do not place unguarded cutting tools in a drawer. Many hand injuries are caused by rummaging through drawers that contain a jumbled assortment of sharp-edged tools.
3. Store knives or chisels in their scabbards.
4. Hang saws with the blades away from someone's reach.
5. Provide sturdy hooks to hang tools on.
6. Store heavy tools, such as axes and sledges, with the heavy end down.

Power Tool Safety

1. Use the correct tool for the job. Do not use a tool or an attachment for something it was not designed to do.
2. Select the correct bit, blade, cutter, or grinder wheel for the material at hand. This precaution will reduce the chance for an accident and improve the quality of your work.
3. Keep all guards in place. Cover exposed belts, pulleys, gears, and shafts that could cause injury.
4. Always operate tools at the correct speed for the job at hand. Working too slowly can cause an accident just as easily as working too fast.
5. Watch your work when operating power tools. Stop working if something distracts you.
6. Do not rely on strength to perform an operation. The correct tool, blade, and method should not require excessive force. If undue force is necessary, you may be using the wrong tool or have a dull blade.

7. Before clearing jams or blockages on power tools, disconnect from power source. Do not use your hand to clear jams or blockages, use an appropriate tool.
8. Never reach over equipment while it is running.
9. Never disable or tamper with safety releases or other automatic switches.
10. When the chance for operator injury is great, use a push stick to move material through a machine.
11. Disconnect power tools before performing maintenance or changing components.
12. Keep a firm grip on portable power tools. These tools tend to "get away" from operators and can be difficult to control.
13. Never leave chuck key in chuck.
14. Keep bystanders away from moving machinery.
15. Do not operate power tools when you are sick, fatigued, or taking strong medication.
16. When possible, secure work pieces with a clamp or vise to free the hands and minimize the chance of injury. Use a jig for pieces that are unstable or do not lie flat.

Source: http://safety.ag.utk.edu/safetyplan/17Shopweb/17shopsafety.htm

Welding and Cutting

Welding and cutting are two forms of hot metal work that require special safety considerations. Unless they are done in a designated shop area, welding and cutting are strictly prohibited without proper authorization.

Before conducting welding or cutting operations, inspect your equipment for the following:

1. Welding leads must be completely insulated and in good condition.
2. Cutting tools must be leak-free and equipped with proper fittings, gauges, regulators, and flashback devices.
3. Oxygen and acetylene tanks must be secured in a safe place.

In addition, follow these guidelines for most welding and cutting procedures:

1. Conduct welding and cutting operations in a designated area free from flammable materials. When welding or cutting is necessary in an undesignated or hazardous area, have someone nearby act as a fire attendant.
2. Periodically check welding and cutting areas for combustible atmospheres.
3. Take care to prevent sparks from starting a fire.
4. Remove unused gas cylinders from the welding and cutting area.

5. Keep hoses out of doorways and away from other people. A flattened hose can cause a flashback.
6. Mark hot metal with a sign or other warning when welding or cutting operations are complete.

Source: http://safety.ag.utk.edu/safetyplan/17Shopweb/17shopsafety.htm

PROCEDURES AND METHODS

Procedures to design the shop start with knowing the important factors that will influence the design. Such as square footage of the building, square footage of areas which will be used for storage, working areas, learning areas, office areas, cleanup areas, and all other areas which will be built.

The next step is to find out what the department wants in the building. What type of facilities are needed, what type of facilities are wanted and what other tools are needed to be included in the design. Having the current building acting as a building block/basis for the new building, all facilities in the current building need to be included as a minimum for the new building.

As you can see in Figure 1, on the next page, the current facilities include a 3,829 square foot shop area, (7) 5’ by 5’ lab tables, (4) 3’ by 3’ lab tables, (2) storage rooms, a walk-in cooler, a teacher’s office and a hand washing station in Shop 1. Shop 2 includes 3,403 square feet of shop area, (2) tool storage rooms, (4) 12’ by 12’ roll up doors, a teacher’s office and a hand washing station. Once all pertinent information is known about the building the designing can begin.

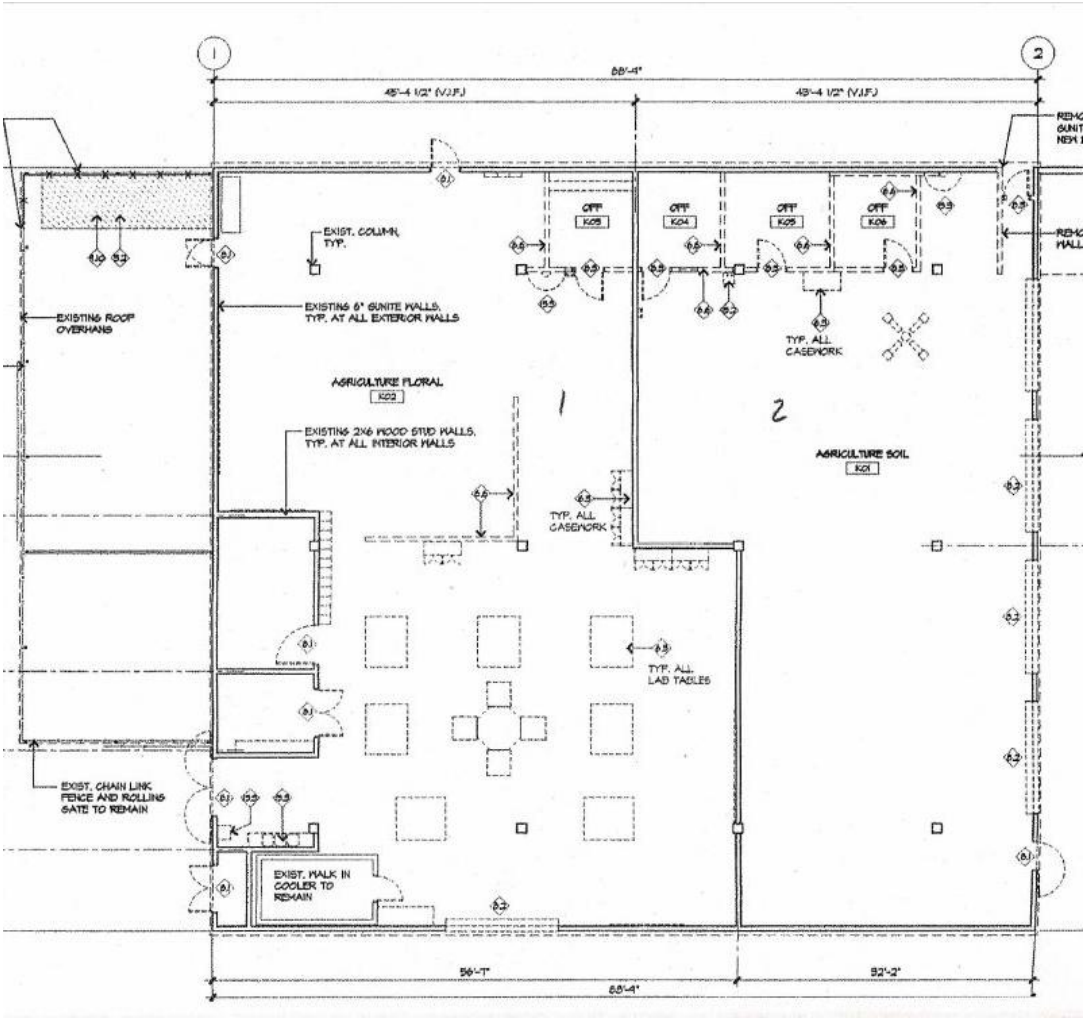

Figure 1. Existing shop layout

The proposed new facilities include six designated shop and classroom areas; the agriculture business science classroom, floral shop, agriculture biology classroom, agriculture shop, welding area and tool/material storage.

In the agriculture business science classroom there will be around 2,880 square feet of classroom area, 20 workstations, 7 lab stations, 4 washing stations, a material storage area and a teacher's workstation.

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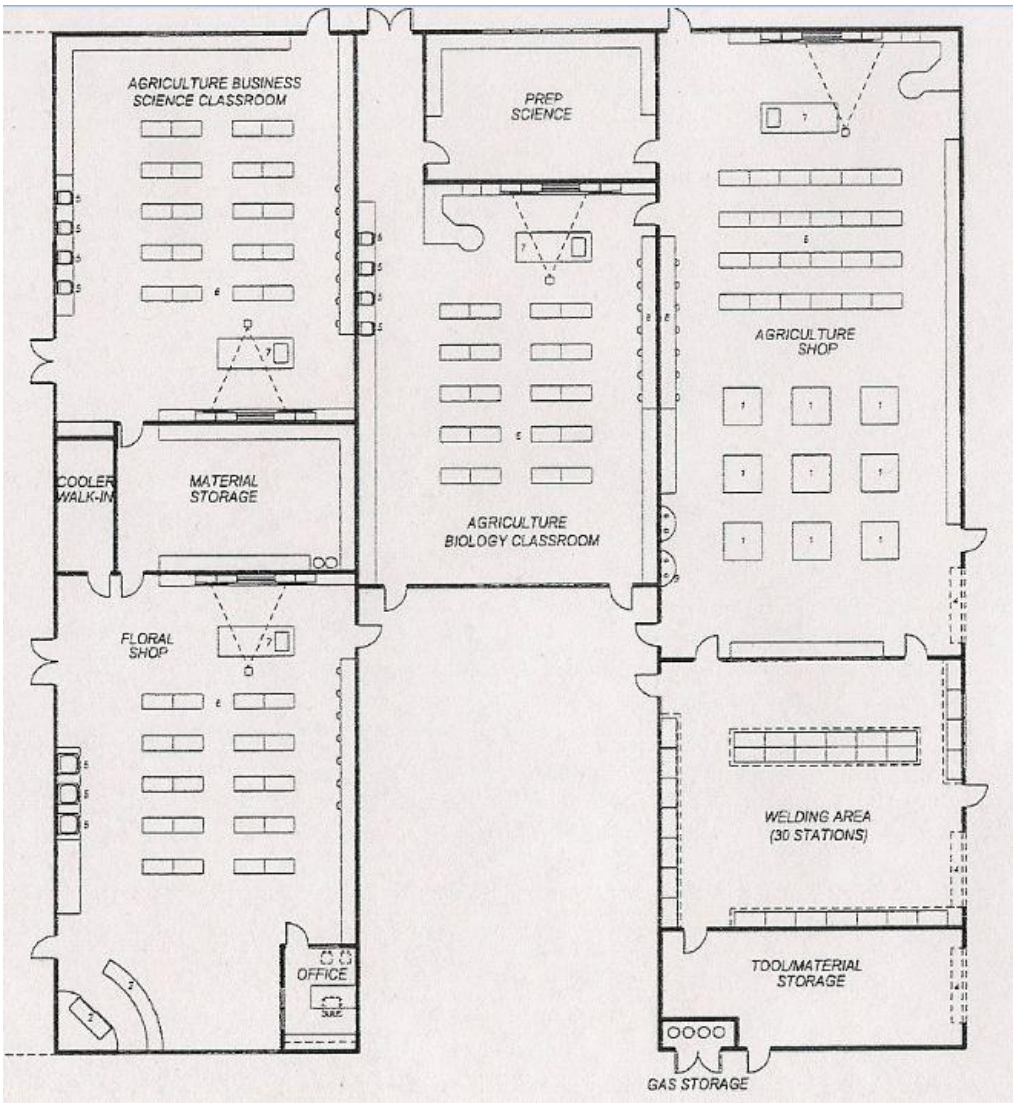

Figure 2. Proposed design of shop area

Once the inside is designed with the needed materials the exterior may be looked at. The proposed exterior of the new facilities will include two shaded areas with tables, two garden areas, a wood shop yard, rabbit and poultry area, processing room, parking and loading area. This layout is very different than the current building. the current building does not have any areas for animals, no shaded areas, except for what is provided by the

over-grown trees. The new building and area layout will provide for a much better use of space available for all kinds of different uses. You can see in Figure 2 below, the proposed exterior layout.

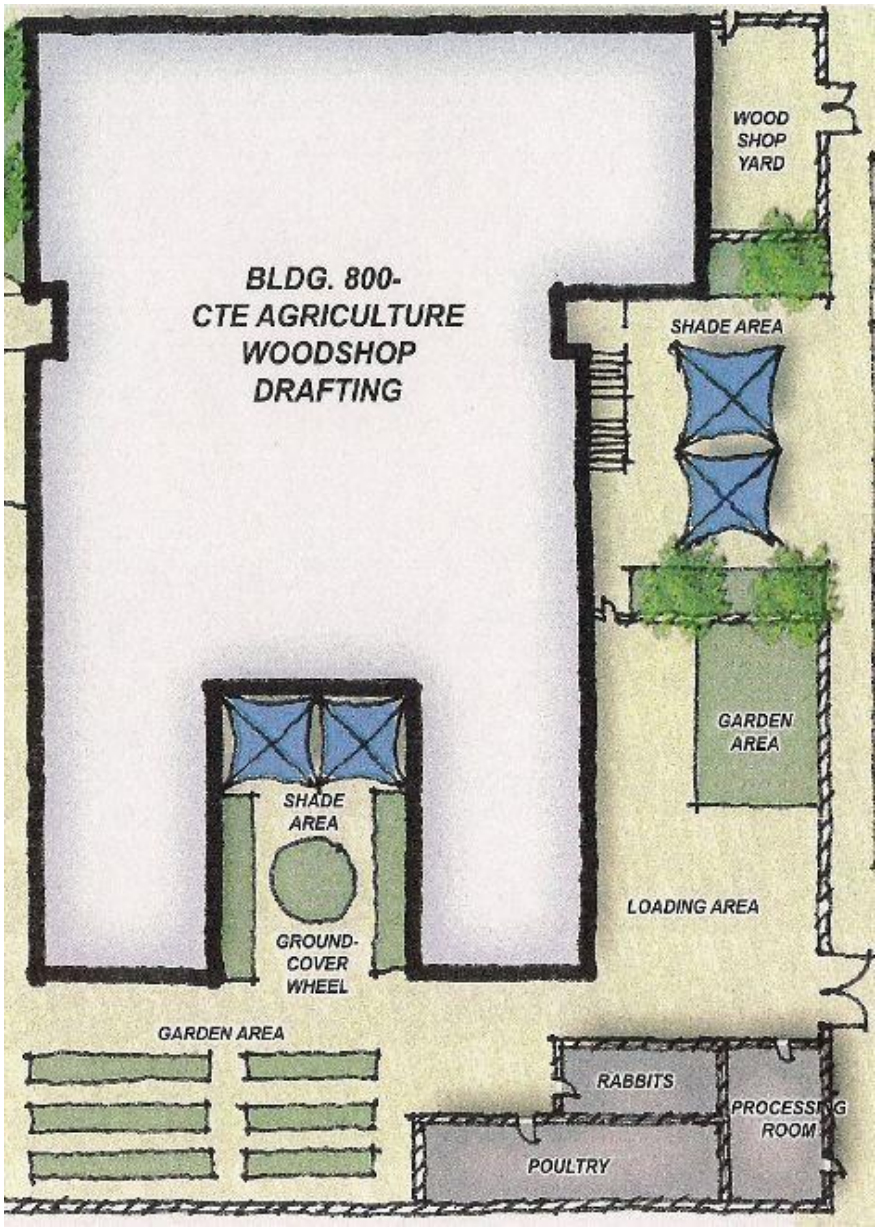

Figure 3. Proposed exterior layout

After the design was reviewed and approved by the department head, figuring out what types of machines are going to be used is the next step. In the welding and fabrication area there will be 20 welders along with other fabrication machines. Along the back wall

I planned for a grinder stand, plasma cutter, pipe notcher and grinder and band saw. All these machines need at least five feet of space around them with no other machines interfering. This will allow adequate space to maneuver materials and people. The plasma cutter will be placed in the back corner with extra room around it for access with a forklift to move material on and off the plasma bench.

For the electrical outlets, each machine will need its own circuit to run, giving the shop added control and access to turning on and off machines when the teacher feel it is necessary. In addition, if two machines are running at once, if they were on the same circuit it could trip the circuit causing both machines to stop. With each machine being on one circuit it will allow the circuit to remain on even with multiple machines running at once.

The tables and chairs will be purchased and provided by the district through their suppliers of classroom equipment, along with other materials such as whiteboards, shelving, cabinets, classroom materials, workbenches and any other materials that will be purchased from district suppliers.

There are two storage areas in the building. The material storage, which is located by the classroom, is for classroom materials and learning materials used in the classroom. No tools, welding tools, or any other tools will be stored in this storage area. In the tool storage area behind the welding area, all tools and other materials needed for the shop part will be stored there. This is where the walls should be tool boards and the shelving should be labeled for what tools go where and organized so the students will know exactly where everything will go.

The gas storage area will be where the welding gases will be stored. In the area, the tanks will be strapped to the wall for security and to pass code enforcement. With all the earthquakes in Southern California the gas tanks have to be secured properly to stay safe.

Other areas will be designated for electrical equipment, computer equipment and all other equipment that cannot be out in the classroom or shop areas.

The final design of the shop will be done by the architects hired by the district for the job and will be designed to details given to them by the school and district. This design was done with the proposed drawings and concepts given to the school by the architects and planners along with some changes and suggestions given to the department head of the agriculture department at Indio High School.

RESULTS

The new facilities will include six designated shop and classroom areas; the agriculture business science classroom, floral shop, agriculture biology classroom, agriculture shop, welding area and tool/material storage.

In the agriculture business science classroom there will be around 2,880 square feet of classroom area, 20 workstations, 7 lab stations, 4 washing stations, a material storage area and a teacher's workstation.

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DISCUSSION

The new agriculture shop for Indio High School will be a brand new state of the art facility for use by incoming and current students for the next 40 to 50 years given the age of the current building. It will provide the students with the machinery needed to learn how to weld and fabricate with metal. The classrooms will provide a space for education and learning of agriculture related fields and studies. With a floral shop built into the building the students will be able to learn about flowers and creating arrangements to sell to the rest of the school.

This building will start students off with a basic understanding and knowledge of many different aspects of agriculture. With the knowledge they learn, the students will be able to improve their abilities and experience with real life trades in today's world. Not all students go to college these days. Vocational training has been on the decline due to lack of funding and test scores being low, causing schools to reevaluate the education they are providing. Schools have had to focus more on academics to try and get test scores to increase. Due to this, funding has been concentrated to other parts of high schools and away from vocational training.

With these facility and the proper teachers teaching, students will be able to learn new trades and experience new things they would not have been able to experience before this facility. I believe with this facility lives will be changed and the future of vocational training at Indio High School will increase and students will enjoy classes again.

RECOMMENDATIONS

I recommend that the new agriculture shop be built to the final design agreed upon by the principle of the school, department head of the agriculture department, teachers and some chosen students which will be using the facilities. There have been many plans and suggestions throughout the planning and design. The best design will come out in the end and will be the best possible use of the building. As long as safety remains the number one concern of everyone involved in the planning and building of this building, I believe it will be a place for students to learn and build things they would have never been able to without this building.

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APENDIX A

HOW PROJECT MEETS REQUIREMENTS FOR THE ASM MAJOR

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ASM Project Requirements

The ASM senior project must include a problem solving experience that incorporates the application of technology and the organizational skills of business and management, and quantitative, analytical problem solving.

Application of Agricultural Technology

The project involves planning of what machines will be needed, where the workstations should be placed, what kind of storage is needed and where they will be placed in order to create a safe agriculture shop for high school students.

Application of Business and/or Management Skills

The project involves business/management in the areas of machinery managmenet and time managmenet to complete the project.

Quantitative, Analytical Problem Solving

Quantitative problem solving includes the analysis of the machinery and other equipment needed for the classroom and figuring out the safe working area for all machines in the shop.

Capstone Project Experience

The ASM senior project must incorporate knowledge and skills acquired in earlier coursework (Major, Support and/or GE courses).

- BRAE 129 Lab Skills/Safety
- BRAE 151 AutoCAD
- BRAE 142 Machinery Management
- BRAE 321 Agriculture Safety
- BRAE 418/419 Ag Systems Management
- ENGL 148 Technical Writing

ASM Approach

Agricultural Systems Managmeent involves the development of solutions to technological, business or management problems associated with agricultural or realted industries. A systems approach, interdisciplinary experience and agricultural training in

specialized areas are common features of this type of problem solving. This project addresses these issues as follows.

Systems Approach

The project includes planning and designing a shop with multiple systems of machines that will need to work together and be safe.

Interdisciplinary Features

The project includes aspects of mechanical systems, agricultural safety and time management.

Specialized Agricultural Knowledge

The project applies knowledge about machinery and how the different tools need to be placed for a safe environment.

APENDIX B

DESIGN DRAWINGS

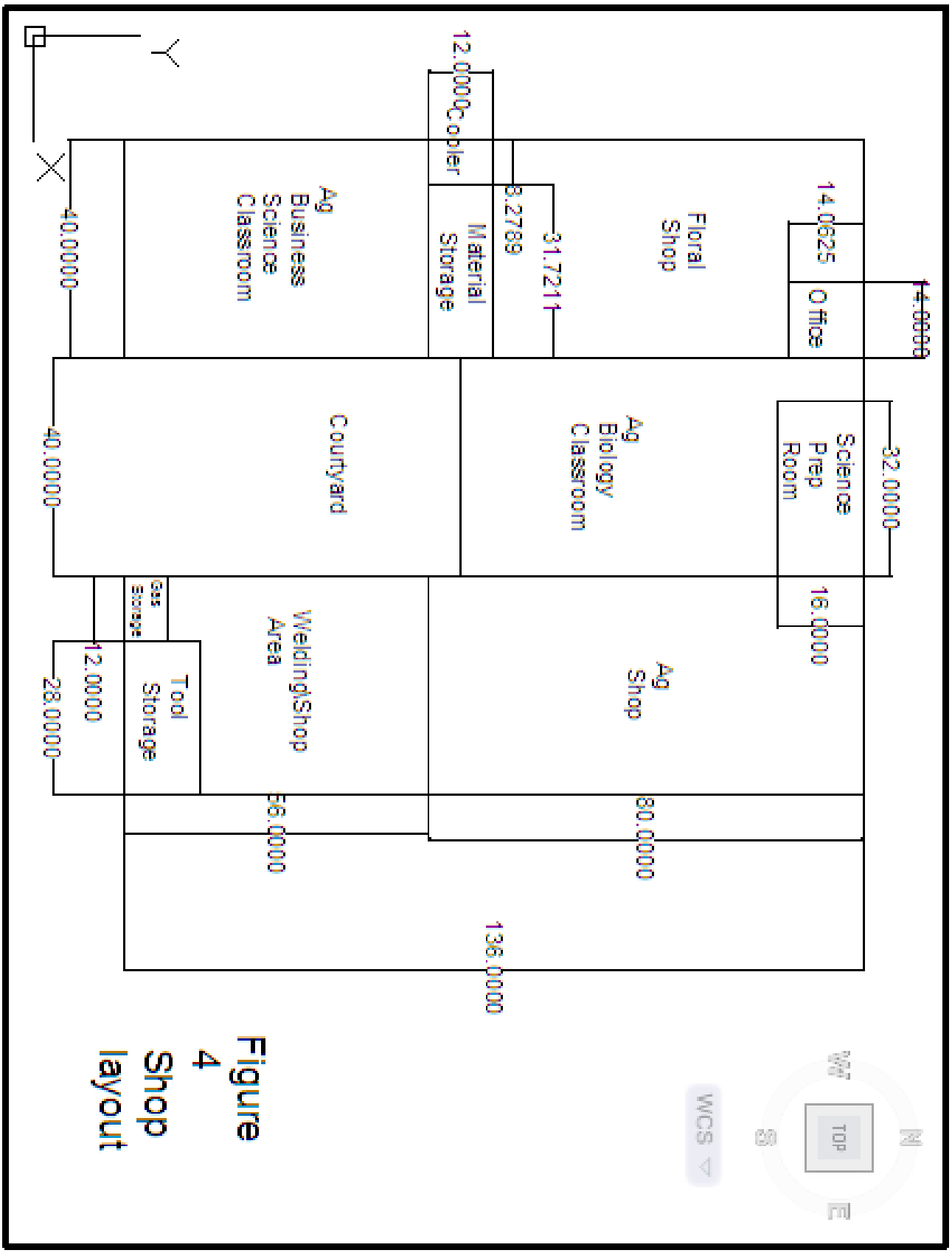

Figure 4 Shop layout

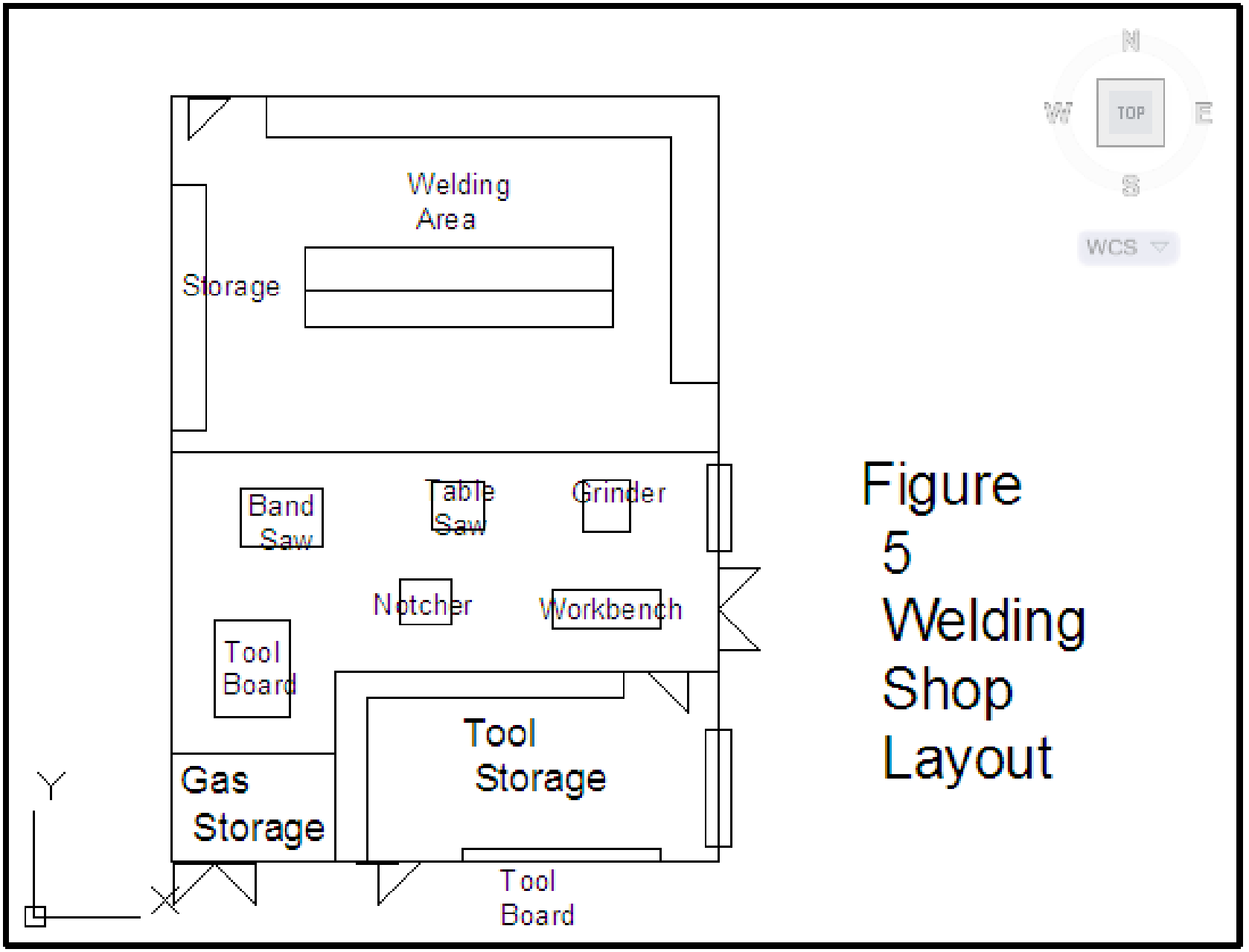

Figure 5 Welding Shop Layout