

California State Standards

An argument for Computer Numeric Controlled equipment in your shop

The Tool: The use and integration of machinery is one of the fundamental practices of our woodshop classes. In most of our shops it is the task that takes the overwhelming amount of time and energy and yet there is no state standard for a Table Saw or a Sliding Compound Miter Saw or Worm Drive Circular Saw. In all practicality, type of saw it is and the name of the saw is simply a secondary thing. The Standard says that students should know how to work safely with any tool they are asked to work with in the industry. A glaring deficiency both in the standards and in the classroom is modern day CNC equipment and the role it plays in the modern woodworking field. While it is not mentioned in the current standards, today's students will be at a huge disadvantage if they go into a woodworking field without a basic knowledge of how to safely operate CNC equipment.

The Project: In like fashion there are no specific projects ordained by the standards. They talk about 3 broad areas that students should have competency: home construction, furniture construction, and cabinet construction. This really leaves the decision about how these competencies are reached to the teacher. A glaring deficiency in the standards is modern day CNC equipment and the role it plays in creating furniture, cabinets and homes. Very little of today's furniture, cabinetry, and construction materials are fabricated without the use of CNC machines. Again, today's students will be at a huge disadvantage if they go into a woodworking field without a basic knowledge of how to create parts and mill lumber for a project using CNC equipment.

The Student: Kevin was a student in a high school woodshop class for 4 years. He started as a freshman and took whatever woodshop classes he could fit into his schedule. He even repeated classes whenever he could just to spend another period in woodshop. He made many really great wood projects that gave him a good background in woodworking. A new machine that had just been purchased for the shop was a CNC Router. Kevin used it several times to make some basic projects. Soon after Kevin graduated he stopped back by the woodshop to say that he'd gotten a job at a local cabinet shop as their CNC Router operator. He explained that when they asked him if he knew anything about CNC and he explained that he had operated one in high school...he was immediately hired!

How CNC Technology Is Changing Architecture Today

Taken from: <https://caddetailsblog.com/post/how-cnc-technology-is-changing-architecture-today>

BIM/CAD/SKETCHUP/REVIT

With the ability to provide higher precision, safer assembly, faster manufacturing times, and greater variety, it is no wonder that CNC technology is gradually superseding traditional fabrication delivery systems and attracting the attention of architects and manufacturers. With CNC machines, architecture can explore various potentials and CNC technology is already being used for many architectural purposes today....

CNC Technology Is Ideal for Interior and Exterior Design Elements

Taken from: <https://caddetailsblog.com/post/how-cnc-technology-is-changing-architecture-today>

CNC technology is being used to create entire buildings, but it is also being widely utilized to create interior design elements. Instead of having to manually create molds, converting them into harder forms, and then recreating an injection mold from a chosen material, as would be the traditional method, manufacturers can now simply jump straight to the prototype molding using CNC technology; making for a much more efficient and inexpensive process. Whether architects and manufacturers want to make interior ornaments or exterior features like a weathervane or column, CNC machining makes the process much easier with more flexibility.

Examples of CNC-created Architecture

Taken from: <https://caddetailsblog.com/post/how-cnc-technology-is-changing-architecture-today>

Now you have a good idea of how CNC technology is used in the architecture world, it is time to look at some of the structures that have actually been built via the use of CNC machinery. [New Zealand architects](#) have been utilizing CNC tech perhaps more than in any other country. One of its success stories includes the creation of a minimal habitat called Click-Raft. Situated in Wellington, the structure was created by Chris Moller and Jaap Dankert to show off the benefits of CNC technology. The plywood lattice structure comprises post-tensioned, straight-click beams and curved panels. By clicking and weaving, rafts form that morph into floors, rooves, and panels with a multitude of possible configurations; all of which would have been impossible without the use of CNC technology. The Click-Raft's pieces are manufactured with a CNC cutter, flat-packed, and then sent to the site to be assembled. Unlike other timber-framed construction techniques, Click-Raft does not involve any intricate joining, detailing, or protection. Instead, it fits together in the same manner as a flat-packed piece of furniture.

Another CNC architectural project that has been successful in New Zealand is Eco Digital FABrication, known as EDFAB for short, which was created by researchers at the University of Auckland. The project showcases how easy it now is for a layman to build a structure using CNC technology. The EDFAB system consists of stackable plywood pieces that are structurally braced with butterfly plugs as joints. Software was used to divide the prototype into numerous labeled modular parts that were then fed into a CNC router for fabrication. The EDFAB prototype shows that construction is becoming less exclusive via the use of CNC technology.

Do not underestimate how much of a game-changer CNC-produced items like the EDFAB prototype are. With the implementation of CNC technology, the construction industry will be able to reduce labor costs, and unskilled people will be able to much more easily create bespoke structures and buildings. As architects around the world continue to embrace CNC technology, and as the tech continues to grow, you can expect to see the world of architecture and construction become transformed over the coming years.

State Standards that can be met with CNC equipment

As mentioned above there is no set project that must be built to meet a particular standard. On the other hand, to meet modern day cabinet making standards it makes sense to create a project that uses a CNC router since that is how many of them are made.

Building and Construction Trades Knowledge and Performance Anchor Standards

2.0 Communications

2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format

2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies

3.0 Career Planning and Management

3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.

4.0 Technology

4.5 Research past, present, and projected technological advances as they impact a particular pathway

5.0 Problem solving and critical thinking

5.1 Identify and ask significant questions that clarify various points of view to solve problems

5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.

6.0 health and safety

6.2 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies

6.3 Set up work area, or shop, to avoid potential health concerns and safety hazards, including but not limited to electrical(shock), wires(tripping) fumes (lung health), noise (hearing loss), fire (burns), and so forth, incorporating ergonomics.

6.6 Maintain a safe and healthful working environment.

6.10 Maintain proper use of safety apparel at all times, including but not limited to, eye protection, hearing protection, skin protection, head protection, footwear and protection from airborne particulate matter.

6.12 Demonstrate the proper care and safe use of hand, portable and stationary power tools.

7.0 Responsibility and flexibility

7.4 Practice time management and efficiency to fulfill responsibilities

7.5 Apply high quality techniques to product or presentation design and development

10.0 Technical Knowledge and Skill

10.1 Interpret and explain terminology and practices specific to the building and construction trades sector.

10.4 Collaborate with industry experts for specific technical Knowledge and Skills

10.5 Demonstrate the basic care, proper maintenance, and use of hand, portable and, and stationary tools related to the building and construction trades.

11.0 Demonstration and application

11.1 Utilize work-based / workplace learning experiences to demonstrate and expand upon knowledge and skill gain during classroom instruction and laboratory practices specific to the building and construction trades sector program of study

11.2 Demonstrate Proficiency in a Career Technical pathway that leads to certification licensure and/or continued learning at the post-secondary level.

11.3 Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures.

Building and Construction Trades Pathway Standards

A1.0 Demonstrates competence in planning, design, layout and Technical drawing interpretation for practical use in cabinet making and millworking

A 1.1 Identify common sizes in relation to furniture and cabinets

A 1.2 Describe the relationship between the function and form of a cabinet

A 1.3 Calculate board, square, and linear feet

A 1.4 Estimate material cost

A 1.5 Apply design elements shapes, textures, lines, and colors to create functional and attractive cabinets, furniture, and Millwork.

A1.6 Apply principles of design, harmony, repetition comedy balance, and proportion to create functional and attractive cabinets, furniture, and Millwork

A1.7 Read and interpret technical drawings

A1.8 Sketch a project using manual drawing techniques

A2.0 Differentiate between the various furniture and cabinet styles used in the cabinet and Furniture industry

A2.3 Explain the progress of cabinetry and furniture styles from the seventeenth century to today

A 4.0 Demonstrate proper selection and use of woodworking tools a 4.1 demonstrate the accurate use of common measuring and layout tools

A 4.2 Select the proper layout tools for a specific task

A 4.3 Select the proper cutting tools for specific operations (ie straight cuts, curves, drilling holes)

A 4.4 Select the most appropriate blade for a given operation

A4.5 Select the proper boring tool for specific operations

A 4.6 Select the proper hand-shaping tools for specific operations

A 4.7 Select the proper clamping tools for specific operations

A 5.0 Identify wood products and materials used in the furniture and cabinet making industry and describe their characteristics and uses

A 5.1 identify and be able to differentiate panel products and their uses in the cabinet making industry

A 5.6 Describe the cutting and handling techniques used for sheet goods

A 5.10 Identify the proper adhesive required for applying laminate.

A 5.11 Identify standard sizes and grades of various veneers.

A 5.12 Identify the proper adhesive required for applying veneers

A 5.13 Identify the different types of pattern matching in veneers

CNC Router project and California State Standards



Project: CNC Wall Hanging(Sign)

Standards met by this project: An Explanation

Building and Construction Trades Knowledge and Performance Anchor Standards

- 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format **(student design must be accurately spelled)**
- 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies **(all online searching must be done responsibly)**
- 3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure. **(project write-up includes CNC career research)**
- 4.5 Research past, present, and projected technological advances as they impact a particular pathway **(project write-up includes CNC technology advancement research)**
- 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate. (getting everything to work properly and be designed to fit requires problem solving)
- 6.3 Set up work area, or shop, to avoid potential health concerns and safety hazards, including but not limited to electrical(shock), wires(tripping) fumes (lung health), noise (hearing loss), fire (burns), and so forth, incorporating ergonomics. **(working with CNC equipment requires safe setup and PPG use)**
- 6.6 Maintain a safe and healthful working environment. **(working with CNC equipment requires safe setup and Personal Protective Gear use)**
- 6.10 Maintain proper use of safety apparel at all times, including but not limited to, eye protection, hearing protection, skin protection, head protection, footwear and protection from airborne particulate matter. **(working with CNC equipment requires safe setup and PPG use)**
- 6.12 Demonstrate the proper care and safe use of hand, portable and stationary power tools. **(working with CNC equipment requires knowledge of how to safely and correctly run the machine)**

Building and Construction Trades Pathway Standards

- A 1.3 Calculate board, square, and linear feet **(Project write up has students calculate Bd Ft of the project)**
- A 1.4 Estimate material cost **(Project write up has students calculate cost of the project)**
- A 1.5 Apply design elements shapes, textures, lines, and colors to create functional and attractive cabinets, furniture, and Millwork. **(The designing of the project requires the use of the “elements of design”)**
- A1.6 Apply principles of design, harmony, repetition comedy balance, and proportion to create functional and attractive cabinets, furniture, and Millwork **(The designing of the project requires the use of the “elements of design”)**
- A1.7 Read and interpret technical drawings **(Students can follow their own design or follow a Plan Of Procedure(POP) provided by the teacher)**
- A1.8 Sketch a project using manual drawing techniques **(this can be done as a class assignment guided by the teacher)**
- A 4.2 Select the proper layout tools for a specific task **(this is guided by the POP. Substrate block is layed out and cut)**
- A 4.3 Select the proper cutting tools for specific operations (ie straight cuts, curves, drilling holes) **(this is guided by the POP)**
- A 4.4 Select the most appropriate blade for a given operation **(this is guided by the POP. Substrate block is laid out and cut)**
- A4.5 Select the proper boring tool for specific operations **(this is guided by the POP. A hole is put into the block with a keyhole bit so it can be hung on the wall)**

This list can be continued using all the Building and Construction Standards...