

Design Drafting Program of Study and Complementary Course Standards



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Vision

All Nevada students are equipped and feel empowered to attain their vision of success

Mission

To improve student achievement and educator effectiveness by ensuring opportunities, facilitating learning, and promoting excellence



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Business and Industry Validation

All CTE standards developed through the Nevada Department of Education are validated by business and industry through one or more of the following processes: (1) the standards are developed by a team consisting of business and industry representatives, or (2) a separate review panel is coordinated with industry experts to ensure the standards include the proper content, or (3) nationally recognized standards currently endorsed by business and industry.

The Design Drafting standards were validated through active participation of business and industry representatives on the development team.

Introduction

The standards in this document are designed to clearly state what the student should know and be able to do upon completion of a high school Design Drafting program of study. These standards are designed for a two-credit course sequence that prepares the student for a technical assessment directly aligned to the standards.

These exit-level standards are designed for the student to complete all standards through their completion of a program of study. These standards are intended to guide curriculum objectives for a program of study.

The standards are organized as follows:

- **Content Standards** are general statements that identify major areas of knowledge, understanding, and the skills students are expected to learn in key subject and career areas by the end of the program.
- **Performance Standards** follow each content standard. Performance standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.
- **Performance Indicators** are very specific criteria statements for determining whether a student meets the performance standard. Performance indicators may also be used as learning outcomes, which teachers can identify as they plan their program learning objectives. The indicators are followed by designations that reflect the course sequence (e.g., 12 for the first-year course of a two-year program and 22 for the second-year course, C is to designate the indicators to be taught in the complementary courses) as referenced in the Core Course Sequence table.

The crosswalks and alignments are located in the Program Supplemental Program Resources document. These will show where the performance indicators support the Nevada Academic Content Standards. For individual course descriptions, please reference the Supplemental Program Resource or the Nevada CTE Catalog.

All students are encouraged to participate in the career and technical student organization (CTSO) that relates to the Design Drafting program. CTOS are co-curricular national organizations that directly reinforce learning in the CTE classroom through curriculum resources, competitive events, and leadership development. CTOS provide students the ability to apply academic and technical knowledge, develop communication and teamwork skills, and cultivate leadership skills to ensure college and career readiness.

The Employability Skills for Career Readiness identify the skills needed to be successful in all careers and must be taught as an integrated component of all CTE course sequences. These standards are available in a separate document.

The **Standards Reference Code** is only used to identify or align performance indicators listed in the standards to daily lesson plans, curriculum documents, or national standards. The Standards Reference Code is an abbreviated name for the program, and the content standard, performance standard and performance indicator are referenced in the program standards. This abbreviated code for identifying standards uses each of these items. For example, DD is the Standards Reference Code for Design Drafting. For Content Standard 2, Performance Standard 3 and Performance Indicator 4 the Standards Reference Code would be DD.2.3.4.

Design Drafting

Program Information

Program of Study: Design Drafting
Standards Reference Code: DD
Career Cluster: Architecture and Construction
Career Pathway(s): Design/Pre-Construction
Program Length: 2-year, completed sequentially
CTSO: SkillsUSA

Program Structure Required Program of Study Courses

The core course sequencing is provided in the following table. Complementary Courses are available and provided later in this document. The following courses provide a completed program of study. The Lab is a complementary course available concurrently with the Design Drafting II course.

Core Course Sequence (R) with Lab Course(s) (C)

Required/ Complementary	Course Title	Abbreviated Name
R	Design Drafting I	DES DRAFT I
R	Design Drafting II	DES DRAFT II
C	Design Drafting II LAB	DES DRAFT II L

CONTENT STANDARD 1.0: INTEGRATE CAREER AND TECHNICAL STUDENT ORGANIZATIONS (CTSOs)**Performance Standard 1.1: Explore the History and Organization of CTSOs**

- 1.1.1 Discuss the requirements of CTSO participation/involvement as described in Carl D. Perkins Law (12, 22, C)
- 1.1.2 Research nationally recognized CTSOs (12, 22, C)
- 1.1.3 Investigate the impact of federal and state government regarding the progression and operation of CTSOs (e.g., Federal Statutes and Regulations, Nevada Administrative Code [NAC], Nevada Revised Statutes [NRS]) (12, 22, C)

Performance Standard 1.2: Develop Leadership Skills

- 1.2.1 Discuss the purpose of parliamentary procedure (12, 22, C)
- 1.2.2 Demonstrate the proper use of parliamentary procedure (12, 22, C)
- 1.2.3 Differentiate between an office and a committee (12, 22, C)
- 1.2.4 Discuss the importance of participation in local, regional, state, and national conferences, events, and competitions (12, 22, C)
- 1.2.5 Participate in local, regional, state, or national conferences, events, or competitions (12, 22, C)
- 1.2.6 Describe the importance of a constitution and bylaws to the operation of a CTSO chapter (12, 22, C)

Performance Standard 1.3: Participate in Community Service

- 1.3.1 Explore opportunities in community service-related work-based learning (WBL) (12, 22, C)
- 1.3.2 Participate in a service learning (program related) and/or community service project or activity (12, 22, C)
- 1.3.3 Engage with business and industry partners for community service (12, 22, C)

Performance Standard 1.4: Develop Professional and Career Skills

- 1.4.1 Demonstrate college and career readiness (e.g., applications, resumes, interview skills, presentation skills) (12, 22, C)
- 1.4.2 Describe the appropriate professional/workplace attire and its importance (12, 22, C)
- 1.4.3 Investigate industry-standard credentials/certifications available within this Career Cluster™ (12, 22, C)
- 1.4.4 Participate in authentic contextualized instructional activities (12, 22, C)
- 1.4.5 Demonstrate technical skills in various student organization activities/events (12, 22, C)

Performance Standard 1.5: Understand the Relevance of Career and Technical Education (CTE)

- 1.5.1 Make a connection between program standards to career pathway(s) (12, 22, C)
- 1.5.2 Explain the importance of participation and completion of a program of study (12, 22, C)
- 1.5.3 Promote community awareness of local student organizations associated with CTE programs (12, 22, C)

CONTENT STANDARD 2.0: APPLY FUNDAMENTAL DRAFTING SKILLS**Performance Standard 2.1: Create Geometric Constructions**

- 2.1.1 Describe general shop safety rules and procedures (i.e., safety test) (12)
- 2.1.2 Utilize safe procedures for handling of tools and equipment (12)
- 2.1.3 Identify and use proper placement of floor jacks and jack stands (12)
- 2.1.4 Identify and use proper procedures for safe vehicle lift operation (12)
- 2.1.5 Utilize proper ventilation procedures for working within the lab/shop area (12)
- 2.1.6 Identify marked safety areas (12)

Performance Standard 2.2: Demonstrate Measuring and Scaling Techniques

- 2.2.1 Explain the purpose for scaling of objects (12)
- 2.2.2 Determine appropriate engineering, architecture, and metric scales (12)
- 2.2.3 Measure using appropriate tools, (e.g., calipers, micrometer, tape measures, scales) and calculate object size, area, and volume (12)
- 2.2.4 Construct drawings utilizing metric and customary (i.e., Society of Automotive Engineers [SAE], Imperial) measurement systems (12)
- 2.2.5 Transcribe drawings accurately using ratios and proportions (12)
- 2.2.6 Determine and apply the equivalence between fractions and decimals (12)
- 2.2.7 Convert between customary (i.e., SAE, Imperial) and metric systems (12)

Performance Standard 2.3: Demonstrate Conventional Drafting Practices

- 2.3.1 Identify and select appropriate drafting media (e.g., paper type and size, digital formats) for various presentations (12)
- 2.3.2 Complete title blocks (12)
- 2.3.3 Utilize appropriate drawing composition and layout (12)
- 2.3.4 Identify and utilize industry standard object properties (i.e., line weight, line type) (12)
- 2.3.5 Produce drawings from sketches (12)
- 2.3.6 Apply symbols to industry standards (i.e., American National Standards Institute [ANSI], American Society of Mechanical Engineers [ASME]) (12)
- 2.3.7 Apply appropriate annotations to drawings (12)
- 2.3.8 Produce lettering and text using industry standards (12)

Performance Standard 2.4: Create Multi-View Drawings Using Orthographic Projection

- 2.4.1 Determine the principle view of an object (12)
- 2.4.2 Identify, create, and arrange the six standard views (using properties of similarities of right angles) (12)
- 2.4.3 Project from an existing view to create additional views (i.e., sectional views, primary auxiliary views) (12)
- 2.4.4 Apply appropriate measurement (12)

Performance Standard 2.5: Apply Dimensions and Annotations

- 2.5.1 Differentiate appropriate dimension standards (e.g., American Institute of Architects [AIA], ANSI, International Standards Organization [ISO]) (12)
- 2.5.2 Arrange dimensions and annotations using appropriate standards (e.g., AIA, ANSI, ISO) (12)
- 2.5.3 Use various dimensioning styles (i.e., aligned, unidirectional, polar, ordinate, datum) (12)
- 2.5.4 Identify tolerance annotation standards within industry practices (22)

Performance Standard 2.6: Identify Pictorial Drawings

- 2.6.1 Identify oblique drawings (cavalier, cabinet) (12)
- 2.6.2 Identify axonometric drawings (e.g., isometric, dimetric, trimetric) (12)
- 2.6.3 Identify perspective drawings (one point, two point, three point) (12)

Performance Standard 2.7: Demonstrate Sketching Techniques

- 2.7.1 Develop design ideas using freehand sketching (12)
- 2.7.2 Create pictorial and multi-view sketches (12)
- 2.7.3 Create rough sketches (12)
- 2.7.4 Produce drawings from sketches (12)
- 2.7.5 Utilize hand lettering techniques (12)
- 2.7.6 Utilize the alphabet of lines (i.e., styles and weights) (12)
- 2.7.7 Prepare field sketches (e.g., as built, satellite views) (22)

CONTENT STANDARD 3.0: APPLY FUNDAMENTAL COMPUTER-AIDED DESIGN AND DRAFTING (CADD) SKILLS**Performance Standard 3.1: Utilize Basic Computer and IT Skills**

- 3.1.1 Use computer hardware and input/output devices to solve design drafting problems (12)
- 3.1.2 Apply basic commands of an operating system and software (12)
- 3.1.3 Apply file and disk management techniques (12)
- 3.1.4 Access and use a network to transfer files (12)
- 3.1.5 Demonstrate the use of various storage media (12)
- 3.1.6 Identify basic troubleshooting skills related to fundamental hardware and software problems (e.g., power, plugs, updates, help resources) (12)
- 3.1.7 Evaluate resources to acquire information to complete drafting problems (e.g., electronic, internet, books) (12)
- 3.1.8 Demonstrate personal safety (i.e., electrical and mechanical hazards) (12)
- 3.1.9 Interpret and utilize acceptable use policies (i.e., network and lab agreements, restrictions, school/district networking agreements) (12)
- 3.1.10 Import and export data files using various formats (22)

Performance Standard 3.2: Set Up a Drawing Environment

- 3.2.1 Select appropriate existing title blocks (12)
- 3.2.2 Set drafting settings (i.e., grid, snap, and modes) (12)
- 3.2.3 Determine and apply scaling factors (12)
- 3.2.4 Assign line weights, line types, and colors (12)
- 3.2.5 Utilize template files (12)
- 3.2.6 Utilize sheets/layouts for plotting/printing (12)
- 3.2.7 Scale sheets/layout views for plotting/printing (12)

Performance Standard 3.3: Utilize the Cartesian Coordinate System to Create Geometric Shapes and Objects

- 3.3.1 Describe and utilize the Cartesian Coordinate System to create geometric shapes and objects (x, y, z) (12)
- 3.3.2 Calculate input coordinates (22)
- 3.3.3 Manipulate coordinate systems (i.e., absolute, relative, and polar) (22)
- 3.3.4 Utilize appropriate coordinate entry methods (22)

Performance Standard 3.4: Create and Modify Objects Utilizing CADD Commands

- 3.4.1 Utilize multiple entry methods to invoke CADD commands (i.e., hot keys, icons, and menus) (12)
- 3.4.2 Utilize geometric relationships to ensure accuracy (i.e., endpoint, midpoint, and center) (12)
- 3.4.3 Create and modify objects using CADD commands (12)
- 3.4.4 Assign property styles to objects (22)
- 3.4.5 Access and integrate help resources to solve problems (22)

Performance Standard 3.5: Create and Modify Annotations

- 3.5.1 Define, create, and modify industry standards text styles (12)
- 3.5.2 Arrange text based on industry standards (12)
- 3.5.3 Create and modify dimension styles (22)
- 3.5.4 Arrange dimensions based on industry standards (may include dual dimensioning) (22)
- 3.5.5 Use industry standard symbols to annotate drawings (22)

Performance Standard 3.6: Utilize Basic Output Methods

- 3.6.1 Recognize plot/print areas for assigned plotter/printer (12)
- 3.6.2 Utilize plot preview function (12)
- 3.6.3 Plot drawings to proper scale (22)
- 3.6.4 Plot drawings to various output media (i.e., paper or electronic) (22)

CONTENT STANDARD 4.0: DEMONSTRATE ADVANCED CADD SKILLS AND TECHNIQUES**Performance Standard 4.1: Utilize Templates, Symbols, and Libraries**

- 4.1.1 Describe the use of symbols (22)
- 4.1.2 Create, edit, save, and use symbols (22)
- 4.1.3 Assign symbol properties (i.e., attributes, parameters, constraints) (22)
- 4.1.4 Create and utilize symbol libraries (22)
- 4.1.5 Create template files (22)

Performance Standard 4.2: Develop and Display Three-Dimensional Models

- 4.2.1 Interpret and define the x, y, and z-axes (22)
- 4.2.2 Develop three-dimensional models (i.e., wireframe, surface, solid, or parametric) (22)
- 4.2.3 Manipulate the x-y plane in three-dimensional space (22)
- 4.2.4 Display three-dimensional objects from various viewpoints (22)
- 4.2.5 Edit the shape and configuration of three-dimensional models (22)
- 4.2.6 Display objects as shaded or hidden lines removed (22)
- 4.2.7 Create working drawings from three-dimensional models (22)

Complementary Courses

State Complementary Skill Standards

The state complementary skill standards are designed to clearly state what the student should know and be able to do upon completion of a complementary course related to their career and technical education (CTE) program of study. The standards are designed for the student to complete all standards through their completion of the **one-year** complementary course(s). **Completion of the qualifying Program of Study is required prior to enrollment in a complementary course.**

Employability Skills for Career Readiness Standards

Students have completed all program content standards and will pursue advanced study through investigation and in-depth research.

Complementary Course Standards Contributing Members

Course Contribution(s)	Name	Occupation/Title	Stakeholder Affiliation	School/Organization
Architectural Design	Richard Knoepfel	Instructor	Secondary Educator	Advanced Technologies Academy, Clark County School District
Architectural Design	Kreg Mebust	Interim Dean	Postsecondary Educator	Truckee Meadows Community College, Reno, NV

Business and Industry Validation

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The Architecture Design complementary standards for Design Drafting program of study were validated through active participation of business and industry representatives on the development team.

Complementary Course Information for Architectural Design

Program Information

Qualifying Program of Study: Architectural Design

Career Cluster: Architecture and Construction

Career Pathway(s): Design/Pre-Construction

CTSO: SkillsUSA

Grade Level: 11-12

Program Structure for Complementary Courses

The complementary courses are provided in the following table. **The qualifying program of study must be completed prior to enrolling in the complementary courses** (except labs that are done concurrently with the second-year course). A program does not have to utilize the complementary courses for students to complete their program of study.

Complementary Courses

Required/ Complementary	Course Title	Abbreviated Name
C	Architectural Design	ARCH DESG
C	Design Drafting Advanced Studies	DES DRAFT AS
C	Industry-Recognized Credential – Design Drafting	IRC DES DRAFT
C	CTE Work Experience – Architecture and Construction	WORK EXPER CONST

Complementary Course Standards Architecture Design

CONTENT STANDARD 1.0: APPLY FUNDAMENTAL ARCHITECTURAL SKILLS

Performance Standard 1.1: Demonstrate Print Reading Practices

- 1.1.1 Interpret basic elements of an architectural drawing (e.g., title block information, dimensions, annotations, line types, and schedules)
- 1.1.2 Identify industry standard architectural symbols
- 1.1.3 Describe various types of drawing views (i.e., plan, elevation, section, and detail)
- 1.1.4 Identify drawing sheet classifications (e.g., architectural, civil, electrical, landscape, and mechanical)

Performance Standard 1.2: Utilize Mathematical Operations and Measuring

- 1.2.1 Determine appropriate architectural and engineering scales
- 1.2.2 Determine and apply the equivalence between fractions and decimals
- 1.2.3 Measure and calculate distance, object size, area, and volume

Performance Standard 1.3: Demonstrate Sketching Techniques

- 1.3.1 Prepare sketches using appropriate scale and proportions
- 1.3.2 Create sketches using appropriate architectural symbols
- 1.3.3 Utilize the alphabet of lines (i.e., styles and weights)
- 1.3.4 Annotate sketches legibly using an appropriate architectural lettering style

Performance Standard 1.4: Demonstrate Spatial Reasoning

- 1.4.1 Define spatial reasoning
- 1.4.2 Identify spatial reasoning techniques (e.g., mapping, rotating, matching, patterning, and counting)
- 1.4.3 Relate spatial analysis techniques to architecture (e.g., circulation and space planning)
- 1.4.4 Utilize spatial reasoning techniques to solve design problems

CONTENT STANDARD 2.0: ANALYZE ARCHITECTURAL PROFESSIONAL PRACTICES

Performance Standard 2.1: Research the History of Architecture

- 2.1.1 Research and compare various architectural styles and designs used throughout history
- 2.1.2 Explain how historical innovations have impacted today's society
- 2.1.3 Describe the significance of major architects and their historical influence on the built environment

Performance Standard 2.2: Analyze Professional Ethical Practices

- 2.2.1 Analyze current professional code of ethics
- 2.2.2 Analyze ethical architectural issues
- 2.2.3 Describe how ethics influence the architectural design process
- 2.2.4 Differentiate between the relationships of all stakeholders involved in a construction project

CONTENT STANDARD 3.0: APPLY DESIGN CONCEPTS**Performance Standard 3.1: Utilize Elements of Design**

- 3.1.1 Identify the elements of design (e.g., line, shape, space, form, texture, value, and color)
- 3.1.2 Demonstrate the elements of design through various drawing techniques

Performance Standard 3.2: Utilize Principles of Design

- 3.2.1 Identify the principles of design (e.g., balance, contrast, rhythm, repetition, movement, harmony, emphasis, unity, proportion, and variety)
- 3.2.2 Demonstrate the principles of design through various drawing techniques

Performance Standard 3.3: Apply the Design Process

- 3.3.1 Define the design process
- 3.3.2 Identify the different types of design processes
- 3.3.3 Describe the activities that occur during each phase of the design process
- 3.3.4 Apply the steps of the architectural design process to solve a variety of design problems

CONTENT STANDARD 4.0: UTILIZE DIGITAL DRAFTING TECHNIQUES**Performance Standard 4.1: Create and Modify Drawings and Models**

- 4.1.1 Utilize templates
- 4.1.2 Set drafting and modeling settings (e.g., grid, snap, and modes)
- 4.1.3 Utilize multiple entry methods to invoke CADD/BIM commands (e.g., hot keys, icons, and menus)
- 4.1.4 Utilize geometric relationships to ensure accuracy (e.g., endpoint, midpoint, and center)
- 4.1.5 Create and modify objects using CADD/BIM commands
- 4.1.6 Assign properties to objects (e.g., line weight, line types, scale factors, and colors)
- 4.1.7 Produce drawings from sketches

Performance Standard 4.2: Utilize Symbols and Libraries

- 4.2.1 Describe the use of symbols
- 4.2.2 Utilize and edit symbols
- 4.2.3 Create and save symbols
- 4.2.4 Assign symbol properties (e.g., attributes, parameters, and constraints)
- 4.2.5 Create and utilize symbol libraries

Performance Standard 4.3: Apply Dimensions and Annotations

- 4.3.1 Differentiate between appropriate dimension standards (i.e., ANSI and ISO)
- 4.3.2 Define, create, and modify industry standard text styles
- 4.3.3 Define, create, and modify industry standard dimension styles
- 4.3.4 Place dimensions and annotations using appropriate standards (i.e., ANSI and ISO)
- 4.3.5 Use various dimensioning styles (e.g., aligned, unidirectional, baseline, and datum)

Performance Standard 4.4: Create Architectural Visualization

- 4.4.1 Create oblique drawings
- 4.4.2 Create isometric drawings
- 4.4.3 Create perspective drawings

Performance Standard 4.5: Prepare Architectural Construction Drawings

- 4.5.1 Draw a floor plan from an existing plan
- 4.5.2 Draw a site plan from an existing plan using geographic data (e.g., GIS, maps, and aerials)
- 4.5.3 Draw an exterior elevation utilizing an existing plan
- 4.5.4 Draw a roof plan utilizing an existing plan
- 4.5.5 Draw interior elevations utilizing an existing plan
- 4.5.6 Draw building sections and details utilizing an existing plan
- 4.5.7 Draw an electrical plan utilizing an existing plan
- 4.5.8 Prepare and draft schedules (e.g., window, door, and room)
- 4.5.9 Draw reflected ceiling plans

Performance Standard 4.6: Prepare Architectural Construction Drawings

- 4.6.1 Scale sheets/layout views for plotting/printing
- 4.6.2 Select and utilize appropriate title blocks
- 4.6.3 Recognize plot/print areas for assigned plotter/printer
- 4.6.4 Utilize plot preview function
- 4.6.5 Plot drawings to proper scale
- 4.6.6 Reference external files
- 4.6.7 Transmit files electronically

CONTENT STANDARD 5.0: APPLY ARCHITECTURAL DESIGN SKILLS**Performance Standard 5.1: Utilize Building Design Concepts**

- 5.1.1 Compare and contrast residential and commercial building practices
- 5.1.2 Describe the different design considerations (e.g., orientation, solar, climate, and view)
- 5.1.3 Utilize the design process (e.g., problems, constraints, and solutions)
- 5.1.4 Research the importance of construction specifications
- 5.1.5 Create a set of plans per local building permit requirements
- 5.1.6 Create appropriate documents for provided criteria

Performance Standard 5.2: Develop Models and Graphics

- 5.2.1 Develop architectural models (e.g., physical and digital)
- 5.2.2 Display architectural models from various viewpoints
- 5.2.3 Apply surface textures and materials to models
- 5.2.4 Create shaded and rendered presentation drawings
- 5.2.5 Prepare models and graphics to validate a design solution

Performance Standard 5.3: Identify Building Materials

- 5.3.1 Differentiate between the various types of material properties and their applications
- 5.3.2 Discuss the environmental impact of material usage
- 5.3.3 Explain how construction is affected by the availability, quality, and quantity of resources

Performance Standard 5.4: Utilize Building Code and Regulations

- 5.4.1 Identify various building codes and regulations (e.g., ICC, IBC, IRC, ADA, and NEC)
- 5.4.2 Research types of codes and regulations required for building construction
- 5.4.3 Explain the purpose of building codes and regulations
- 5.4.4 Describe how building codes and regulations affect the design process
- 5.4.5 Apply building codes and regulations in a design problem