

# **Curriculum Frameworks**

## **A Reference Guide for the Computer-Aided Design Career Pathway**

**Albuquerque Public Schools  
Career Technical Education  
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## CAREER AND TECHNICAL EDUCATION

Career and Technical Education (CTE), a formal part of American education since the first federal vocational education law was passed in 1917, is proactively responding to an educational reform agenda and to a changing national and global economy. CTE now is increasingly linked to high academic standards as well as particularly responsive to our nation's need for a labor force prepared with the diverse skills required for our knowledge-based economy. CTE provides relevant experiences and enhances opportunities for learning, careers, and further education.

## PURPOSE OF THIS GUIDE

The goal of this guide is to provide an integrated curriculum framework that blends the learning and performance expectations in the Computer-Aided Design Pathway with New Mexico core academic standards and expected workforce skills.

This guide contains:

- **Course descriptions** for each course offered within the CAD Pathway
- **Foundation Standards**, with core academic standards and skills necessary for all courses offered in the CAD Pathway, and
- **Pathway Standards** and **Assessment Illustrations** specific to each course.

## COMPUTER-AIDED DESIGN (CAD) CAREER PATHWAY

This Pathway is designed to provide a foundation in CAD for students in the Albuquerque Public Schools. The pathways emphasize real-world, occupationally relevant experiences of significant scope and depth. The standards are designed to integrate academic and technical preparation with a focus on career awareness, career exploration, and skill preparation. Integral components include classroom, laboratory, contextual learning, and project- and work-based instruction as well as internship, community classroom, cooperative career technical education, and leadership development. The CAD standards prepare students for continued training, postsecondary education, and entry to a career. The courses include:

In **CAD Architecture I**, the student develops drafting techniques to study the basic principles of residential building design and construction with an emphasis on measurement, basic CAD commands, and employability skills. The student produces hand drawn and/or computer generated designs and projects. Career interests are explored.

In **CAD Architecture II**, the student develops a set of house plans using computers in drawing and problem-solving activities. The student incorporates advanced commands into his/her projects and integrates general employability skills with architectural coursework.

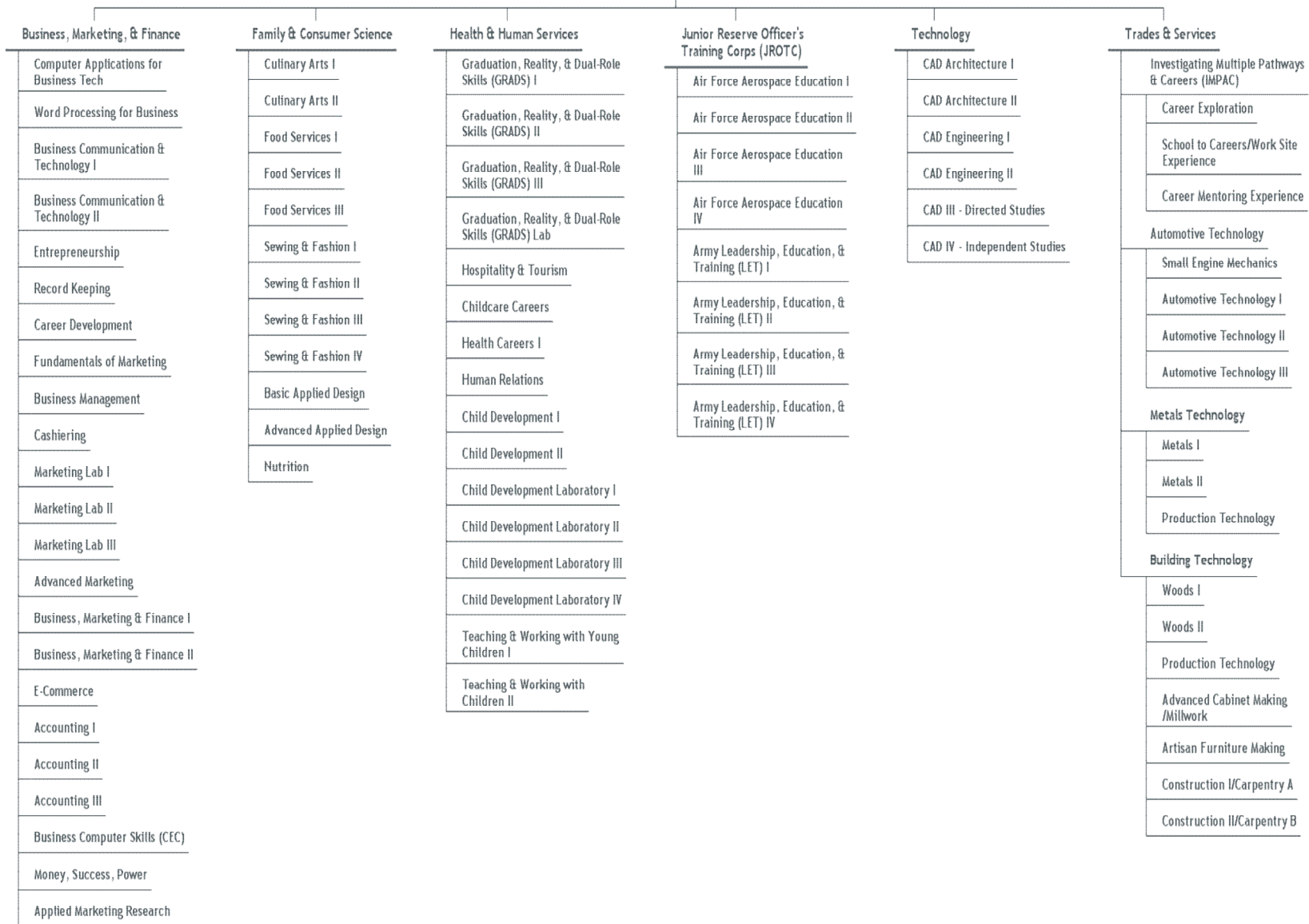
In **CAD Engineering I**, the student studies the process of converting ideas and designs into technical drawings and communicates these ideas through drafting techniques. The student achieves understanding of the design and communication process by understanding traditional drafting techniques and increasing productivity through the use of computers. Career interests are explored.

In **CAD Engineering II**, the student utilizes the computer to learn advanced drafting techniques while applying drafting theories and standards to solve design problems. The student focuses on the integration of general employability skills with the course design problems.

In **CAD III – Directed Studies** advanced individual study is pursued in an area of architecture or engineering graphics. The student assumes responsibility for identifying, pursuing, and culminating an activity that expands knowledge about some phase of industry. The study is pursuant to approval by instructor, parent/guardian, student, and school administrator.

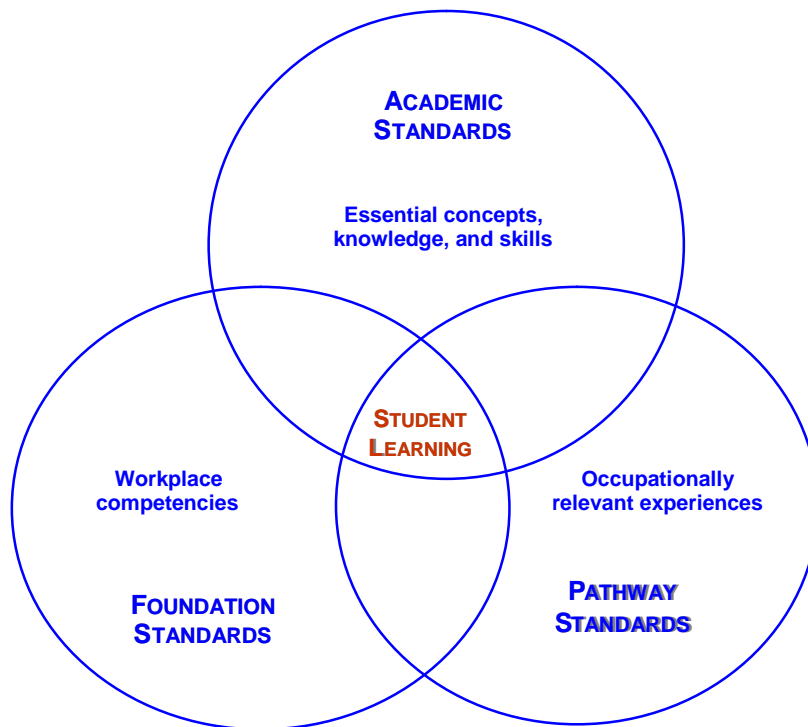
In **CAD IV – Independent Studies**, a student pursues advanced individual study in an area of architecture or engineering graphics. The student assumes responsibility for identifying, pursuing, and culminating an activity that expands knowledge about some phase of industry. The study is pursuant to approval by instructor, parent/guardian, student, and school administrator.

## Career and Technical Education Pathways



# Computer-Aided Design (CAD) Career Pathway Framework

Career and Technical Education (CTE) students need to master certain workplace skills. The Secretary's Commission on Achieving Necessary Skills (SCANS) calls these essentials "foundation skills" because they prepare students to master workplace competencies both within the curriculum and in the workplace. These foundation standards are common to all of the Albuquerque Public Schools' CTE clusters.



The CAD Career Pathway Foundation Standards include the New Mexico Academic Content Standards.

The following three tabs contain these academic standards, and are labeled:

- **Mathematics Content Standards,**
- **Science Content Standards, and**
- **Language Arts Content Standards.**

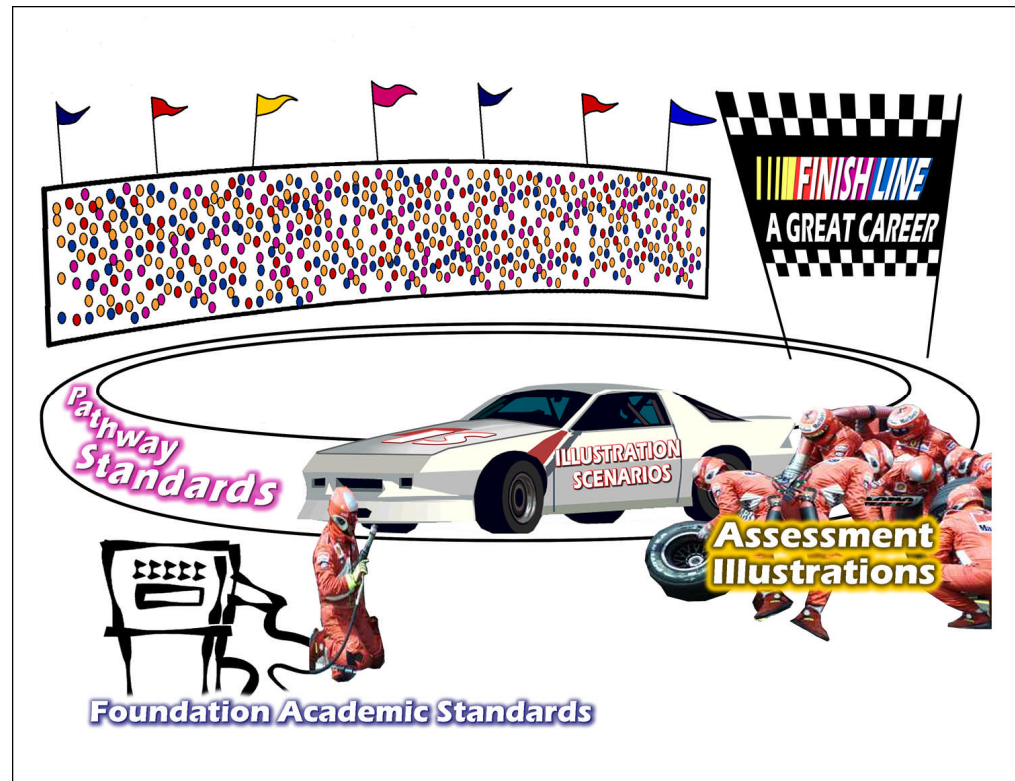
The remaining nationally recognized Foundation Standards are found under the Workforce Skills tab.

The Foundation Standards include workplace competencies. The Core Academic Standards articulate essential concepts, knowledge, and skills. The Pathway Standards contain occupationally relevant materials. When integrated, these three components intersect, creating relevant and successful student learning.

# The Relationship Between Foundation Standards, Pathway Standards Assessment Illustrations, and Integration Scenarios

In understanding how these components relate to each other, consider this:

- The **pathway standards** are the track, or super-highway, providing the most direct route between where a student currently is (in school) and their ultimate destination (an engaging and productive career).
- The **illustration scenarios** (or lessons) are the vehicle that moves the student along the track, or highway, and gives students hands on experience in their chosen program of study.
- The **assessment illustrations** are the diagnostics, and instructors use the assessments provided, augmented by their own understanding and any assessment tools they create, to determine where a student is on the track and how ably and quickly they are moving toward the finish line.



- Most importantly, the **foundation standards** are the fuel. The foundation standards, which include the core academic standards, enable students to be successful in their chosen program of study.

# Mathematics Academic Content Standards

## 1.0 Academics

*Students understand the academic content required for entry into postsecondary education and employment within the Technology pathway.*

The **critical mathematics standards** that build a foundation under the CAD Career Pathway are:

- CMS 1: **Interpret and draw two-dimensional objects and find the area and perimeter of basic figures (e.g., rectangles, circles, triangles, other polygons [e.g. rhombi, parallelograms, trapezoids]).**  
(Reference: Mathematics Grade 9-12 Strand: Geometry and Trigonometry, Benchmark, Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, Performance Standard 1).
- CMS 2: **Find the area and perimeter of a geometric figure composed of a combination of two or more rectangles, triangles, and or semicircles with just edges in common.**  
(Reference: Mathematics Grade 9-12 Strand: Geometry and Trigonometry, Benchmark, Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, Performance Standard 2).
- CMS 3: **Interpret and draw three-dimensional objects and find the surface area and volume of basic figures (e.g., spheres, rectangular solids, prisms, polygonal cones) and calculate the surface areas and volumes of these figures as well as figures constructed from unions of rectangular solids and prisms with faces in common, given the formulas for these figures.**  
(Reference: Mathematics Grade 9-12 Strand: Geometry and Trigonometry, Benchmark, Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, Performance Standard 4).
- CMS 4: **Demonstrate understanding of the construction of the coordinate plane, know the names of the origin, coordinate axes and four quadrants, draw and label them correctly, find the coordinates of an indicated point, and plot a point with given coordinates.**  
(Reference: Mathematics Grade 9-12 Strand: Geometry and Trigonometry, Benchmark, Specify locations and describe spatial relationships using coordinate geometry and other representational systems, Performance Standard 1).
- CMS 5: **Deduce properties of figures using transformations that include translations, rotations, reflections, and dilations in a coordinate system.**  
(Reference: Mathematics Grade 9-12 Strand: Geometry and Trigonometry, Benchmark, Apply transformations and use symmetry to analyze mathematical situations, Performance Standard 2).
- CMS 6: **Solve problems involving the perimeter, circumference, area, volume, and surface area of common geometric figures.**  
(Reference: Mathematics Grade 9-12 Strand: Geometry and Trigonometry, Benchmark, Use visualization, spatial reasoning, and geometric modeling to solve problems, Performance Standard 3).

- CMS 7: **Use basic geometric ideas (e.g. Pythagorean theorem) to calculate perimeters of geometric shapes.**  
(Reference: Mathematics Grade 9-12 Strand Geometry and Trigonometry, Benchmark Specify locations and describe spatial relationships using coordinate geometry and other representational systems, Performance Standard 9).
- CMS 8: **Perform conversions with multiple terms between metric and U.S. standard measurement systems.**  
(Reference: Mathematics Grade 8, Strand Measurement, Benchmark Apply appropriate techniques, tools, and formulas to determine measurements, Performance Standard 5).
- CMS 9: **Develop an appropriate strategy using a variety of data from surveys, samplings, estimations, and inferences to address a specific problem.**  
(Reference: Mathematics Grade 8, Strand Measurement, Benchmark, Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, Performance Standard 6).
- CMS 10: **Demonstrate understanding of the relationships between ratios, proportions, and percents and solve for a missing term in a proportion.**  
(Reference: Mathematics Grade 8, Strand Algebra, Benchmark Represent and analyze mathematical situations and structures using algebraic symbols, Performance Standard 4).
- CMS 11: **Generate different representations to model a specific numerical relationship given one representation of data.**  
(Reference: Mathematics Grade 8, Strand Algebra, Benchmark Use mathematical models to represent and understand quantitative relationships, Performance Standard 1).
- CMS 12: **Use a variety of computational methods (e.g. mental arithmetic, paper and pencil, technological tools).**  
(Reference: Mathematics Grade 9-12 Strand Algebra, Functions, Graphs Benchmark Use mathematical models to represent and understand quantitative relationships, Performance Standard, 12).
- CMS 13: **Understand the differences between the various methods of data collection.**  
(Reference: Mathematics Grade 9-12 Strand Data Analysis and Probability, Benchmark Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, Performance Standard 1).
- CMS 14: **Understand the meaning of measurement data and categorical data, and of the term “variable”.**  
(Reference: Mathematics Grade 9-12 Strand Data Analysis and Probability, Benchmark Select and use appropriate statistical methods to analyze data, Performance Standard, 1).



# Science Academic Content Standards

## 1.0 Academics

**Students understand the academic content required for entry into postsecondary education and employment within the Technology (CAD) sector.**

The **critical science standards** that build a foundation under the CAD Career Pathway are:

- CSS 1: **Create multiple displays of data to analyze and explain the relationships in scientific investigations.**  
(Reference: Science Grade 9-12 Strand: Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 1).
- CSS 2: **Use mathematical models to describe, explain, and predict natural phenomena.** (  
Reference: Science Grade 9-12 Strand: Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 2).
- CSS 3: **Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling.**  
(Reference: Science Grade 9-12 Strand: Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 3).
- CSS 4: **Identify and apply measurement techniques and consider possible effects of measurement errors.**  
(Reference: Science Grade 9-12 Strand: Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 4).
- CSS 5: **Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis.**  
(Reference: Science Grade 9-12 Strand: Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 5).

# Language Arts Academic Content Standards

## 2.0 Communication

**Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contents.**

The critical language arts standards that build a foundation under the Technology (CAD) Career Pathway are:

- CLAS 1: **Respond to informational texts by using a variety of strategies for preparation, engagement, and reflection; paraphrasing main ideas and supporting details.**  
*(Reference: Language Arts Grade 11, Strand: Reading and Listening for Comprehension, Benchmark, Listen to, read, react to, and analyze information, Performance Standard 3).*
- CLAS 2: **Use multiple resources to gather information to evaluate problems, examine cause and effect relationships, and answer research questions to inform an audience.**  
*(Reference: Language Arts Grade 10, Strand: Reading and Listening for Comprehension, Benchmark, Synthesize and evaluate information to solve problems across the curriculum, Performance Standard 3).*
- CLAS 3: **Synthesize a variety of types of visual information including pictures and symbols.**  
*(Reference: Language Arts Grade 9, Strand: Reading and Listening for Comprehension, Benchmark, Synthesize and evaluate information to solve problems across the curriculum, Performance Standard 2).*
- CLAS 4: **Read critically and independently to draw conclusions from research.**  
*(Reference: Language Arts Grade 10, Strand: Reading and Listening for Comprehension, Benchmark, Demonstrate critical thinking skills to evaluate information and solve problems, Performance Standard 5).*
- CLAS 5: **Demonstrate proficiency in accessing and sending information electronically.**  
*(Reference: Language Arts Grade 11, Strand: Reading and Listening for Comprehension, Benchmark, Synthesize and evaluate information to solve problems across the curriculum, Performance Standard 4).*
- CLAS 6: **Accurately interpret information from and detect inconsistencies in a variety of informational, literary, and technical texts.**  
*(Reference: Language arts Grade 9, Strand: Reading and Listening for Comprehension, Benchmark, Apply knowledge of reading process to evaluate print, non-print, and technology-based information, Performance Standard 3).*
- CLAS 7: **Accurately interpret information presented in a technical format (e.g., charts, diagrams, tables).**  
*(Reference: Language Arts Grade 11, Strand: Reading and Listening for Comprehension, Benchmark, Apply knowledge of reading process to evaluate print, non-print, and technology-based information, Performance Standard 5).*

- CLAS 8: **Synthesize and organize information from a variety of sources in order to inform and persuade an audience.**  
*(Reference: Language Arts Grade 11, Strand: Speaking and Writing for Expression, Benchmark Demonstrate competence in the skills and strategies of the writing process, Performance Standard 2).*
- CLAS 9: **Demonstrate control of grammar, paragraph and sentence structure, diction, and syntax.**  
*(Reference: Language Arts Grade 9, Strand: Writing and Speaking for Expression, Benchmark Apply grammatical and language conventions to communicate, Performance Standard 3).*
- CLAS 10: **Use a variety of technology tools to present information appropriate for the purpose and audience.**  
*(Reference: Language Arts Grade 11, Strand: Speaking and Writing for Expression, Benchmark, Apply grammatical and language conventions to communicate, Performance Standard 2).*
- CLAS 11: **Make well-informed and well-organized formal presentations with a clear main point, adjusting the message, wording, and delivery to the particular audience and context.**  
*(Reference: Language Arts Grade 10, Strand: Writing and Speaking for Expression, Benchmark, Communicate information in a coherent and persuasive manner using verbal and non-verbal language, Performance Standard 2).*

# Workforce Skills Foundation Standards

The critical workforce skills that build a foundation for the CAD Career Pathway are:

## 3.0 Career Planning and Management

***Students understand how to make effective decisions, use career information, and manage personal career plans, and:***

- 3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.
- 3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.
- 3.3 Develop a career plan that is designed to reflect career interests, pathways, and postsecondary education.
- 3.4 Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.
- 3.5 Understand the past, present, and future trends that affect careers, such as technological developments and societal trends, and the resulting need for life-long learning.
- 3.6 Know key strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and portfolio preparation.

## 4.0 Technology

***Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments, and:***

- 4.1 Understand the influence of current and emerging technologies as they relate to the industry.
- 4.2 Understand the use of technological resources to access, manipulate, and produce information, products, and services.
- 4.3 Understand the influence of current and emerging technologies on selected segments of the economy.
- 4.4 Understand the role and function of state-of-the art tools, equipment, and machines in use in the industry.
- 4.5 Know key aspects of the current economy and labor market, including the type of good and services produced, the type of skills workers need, the effects of rapid technological change, and the impact of international competition.

## 5.0 Problem Solving and Critical Thinking

***Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques, and:***

- 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
- 5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
- 5.3 Use critical thinking skills to make information decisions and solve problems.
- 5.4 Apply troubleshooting strategies, including failure analysis procedures, to issues as they arise.
- 5.5 Understand and demonstrate the ability to plan and solve problems in a systematic manner and apply the learned skill to real-world problems.

## 6.0 Health and Safety

***Students understand health and safety policies, procedures, regulations, and practices, including equipment and hazardous material handling, and:***

- 6.1 Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
- 6.2 Understand critical elements for health and safety practices related to storing cleaning, and maintaining tools, equipment, and supplies.

- 6.3 Use tools, equipment, and machinery safely and appropriately.
- 6.4 Know local, state, and federal laws, and the requirements of regulatory agencies, that affect the small engine and automotive industry.

## **7.0 Responsibility and Flexibility**

***Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings, and:***

- 7.1 Understand the qualities and behaviors that constitute a positive and professional work demeanor.
- 7.2 Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to varied roles and responsibilities.
- 7.4 Understand that individual actions can affect the larger community.

## **8.0 Ethics and Legal Responsibilities**

***Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms, and:***

- 8.1 Know major local, district, state, and federal regulatory agencies and entities that affect industry and how they enforce laws and regulations.
- 8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards.
- 8.3 Understand the role of personal integrity and ethical behavior in the workplace.

## **9.0 Leadership and Teamwork**

***Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution, and:***

- 9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.2 Understand the ways in which pre-professional associations and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.
- 9.3 Understand how to organize and structure work individually and in teams for effective performance and attainment of goals.
- 9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
- 9.5 Understand how to interact with others in ways that demonstrate respect for a variety of situations in the workplace.
- 9.6 Participate as a member of a team and contribute to a group effort.

## **10.0 Technical Knowledge and Skills**

***Students understand the essential knowledge and skills common to all pathways in the Trades and Services sector, and:***

- 10.1 Know how to use a variety of business- and industry-standard software and hardware, including major proprietary and open standards.
- 10.2 Understand the economic effects of technology on a business in the global marketplace.
- 10.3 Use technology and electronic media to manage the work flow and to provide feedback.
- 10.4 Understand the interrelationships between hardware components and supportive software.
- 10.5 Analyze the functions, features, and limitations of different operating systems, environments, applications, and utilities.

## **11.0 Demonstration and Application**

***Students demonstrate and apply the concepts contained in the foundation and pathway standards.***

# **CAD Architecture I:**

## **Pathway Standards, Benchmarks, and Performance Standards**

In **CAD Architecture I**, the student develops drafting techniques to study the basic principles of residential building design and construction with an emphasis on measurement, basic CAD commands, and employability skills. The student produces hand drawn and/or computer generated designs and projects. Career interests are explored.

References in parentheses following some of the descriptors refer to critical NM mathematics (CMS), science (CSS), and language arts (CLAS) academic content standards, the NM Career Readiness Standards (CR), and Professional Development Plan (PDP).

### **STRAND I: MEASUREMENT**

**CONTENT STANDARD:** *The student demonstrates appropriate applications of various measurement systems.*

- A. The student exhibits an understanding of various measurement systems used in the architectural field, applies mathematics, and interprets various scales.
  - 1. Performs conversions with multiple terms between metric and U.S. standard measurement systems (CMS 8).
  - 2. Understands the relationship between ratios, proportions, and percents, and solves for a missing term in a proportions (CMS 10).
  - 3. Differentiates among types of units (CMS 8).
  - 4. Reads scales (CMS 10).
  - 5. Measures accurately using English and metric systems (CMS 8, 10).
  - 6. Draws a 1-to-1 scale object (CMS 10).

### **STRAND II: GRAPHIC PRESENTATION**

**CONTENT STANDARD:** *The student demonstrates acceptable sketching techniques and knowledge of drafting tools.*

- B. The student produces a variety of sketches of architectural devices using appropriate hand drafting tools.
  - 1. Creates and interprets a variety of 2-dimensional and 3-dimensional drawings (CMS 1, 3); finds the area and perimeter of a geometric shape composed of two or more rectangles, triangles, and or semicircles with just edges in common (CMS 2); demonstrates understanding of the construction of the coordinate plane (CMS 4); deduces properties of figures using transformations (CMS 5); solves problems involving perimeter, circumference, area, volume, surface area of common geometric shapes (CMS 6); and uses basic geometric ideas (e.g., Pythagorean theorem) to calculate perimeters of geometric shapes (CMS 7).
  - 2. Understands the types and uses of various drafting tools
  - 3. Utilizes appropriate drafting techniques (e.g., isometrics, perspective)
  - 4. Recognizes the different types of media used in the field
  - 5. Understands the importance of lettering techniques

### **STRAND III: BASIC CAD COMMANDS**

**CONTENT STANDARD:** *The student comprehends and utilizes basic CAD commands.*

- C. The student uses basic commands, including drawing, editing and modifying, and drawing tools.

1. Knows file maintenance and drawing setup
2. Demonstrates basic drawing commands.
3. Utilizes modifying and editing commands.
4. Incorporates drawing aids and controls (e.g., object snap, pan, zoom).
5. Chooses appropriate dimensioning commands (e.g., linear, angular, diameter (CMS1, 2, 3, 4, 5, 6)).
6. Produces a drawing through printing and plotting commands to generate different representations that model a specific numerical relationship (CMS 11).

#### **STRAND IV: ARCHITECTURAL DRAWING AND DESIGN**

**CONTENT STANDARD:** *The student produces and recreates architectural drawings and projects.*

- D. The student designs and creates residential plans.
  1. Identifies the three areas of a residential structure (i.e., sleeping, living, and service).
  2. Demonstrates an understanding of area, perimeter (CMS 1, 2, 6), various geometric concepts (CMS 4, 5), measurement systems (CMS 8), mathematical computations involving ratios, proportions, and percents (CMS 10), and the ability to generate different representations to model specific numerical relationships (CMS 11) through drawings of room layouts (e.g., kitchen, living, dining, bedroom)
  3. Designs and constructs a set of residential plans, (e.g., floor plan, foundation, elevation) (CMS 1, 2, 4, 5, 6, 8, 10, 11).
  4. Understands differences between various methods of data collection (CMS 13), measurement data and categorical data (CMS 14), and practices accepted standards, symbols, and conventions.

#### **STRAND V: CAREER PATHS**

**CONTENT STANDARD:** *The student explores various careers that are related to CAD.*

- E. The student participates in activities to discover career interests and abilities and identifies educational requirements for technical careers.
  1. Distinguishes among various technical fields that utilize CAD (CR: 3B, 3C, 3D).
  2. Recognizes levels of education needed for career positions (CR: 3C).
  3. Uses a variety of resources to expand knowledge/gather information on various technical careers (CR: 3C, 3D, 5A).

#### **STRAND VI: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student identifies positive employability skills and good work characteristics.*

- F. The student demonstrates team work, exhibits timeliness, follows directions, completes tasks, and shows respect.
  1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 1.3; CR: 2B, 5A, 5C, 5D, 5E).
  2. Demonstrates respect for equipment, software etiquette, and observes all ethical guidelines for telecommunications (PDP Level 1.8; CR: 3A, 3B, 3C, 3D).
  3. Demonstrates respect for one another and self (PDP Level 1.3; CR: 4A, 4B, 4C, 4E).
  4. Conforms to established rules and regulations (PDP Level 1.3; CR: 4C, 4D).
  5. Maintains appropriate appearance and punctuality (PDP Level 1.1; CR: 4A).
  6. Completes assigned tasks in a timely manner (PDP Level 1.3; CR: 4B, 4C).
  7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 1.1; CR: 4A, 4B, 4C, 4D, 4E).

- 4A).
8. Communicates effectively in both oral and written forms (PDP Level 1.3).
  9. Follows directions (PDP Level 1.1, 1.3).



# CAD Architecture I: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

## STRAND I: MEASUREMENT

**CONTENT STANDARD:** *The student demonstrates appropriate applications of various measurement systems.*

- 1,2,4. Using a tape measure marked in inches and feet, the student measures parts of the human body (e.g., hand, foot). Data is collected, discussed, and averages for the class are found. The student then a) converts the results to metric or b) remeasures using a tape measure marked in centimeters and meters.
- 3,5. The student measures objects in the classroom (e.g., desk, chair), develops a scale of  $1/4" = 1$  foot, and draws a room layout plan. The student does this first using pencil and paper and then follows with a computer drawing.
  - ✓ accuracy

## STRAND II: GRAPHIC REPRESENTATION

**CONTENT STANDARD:** *The student demonstrates acceptable sketching techniques and knowledge of drafting tools.*

- 1,2,3. Given a variety of figures/drawings with specified scales and step-by-step directions, the student recreates the figures/drawings using hand drafting tools (e.g., ruler, compass, pencil, triangles).
  - ✓ correct scales
  - ✓ accurate measurements
  - ✓ neatness and accuracy
  - ✓ appropriate use of tools
  - ✓ meeting deadlines
  - ✓ following directions
4. The student selects a variety of drawings to reproduce on the computer using a software program (e.g., Auto CAD).
  - ✓ use of technology
  - ✓ print out
  - ✓ correct scales
  - ✓ accurate measurements
  - ✓ appropriate symbols
- 3,5. Following a teacher demonstration on correct tool use, the student practices drawing lines, line weights, arcs, symbols, and lettering.
  - ✓ ability to follow directions
  - ✓ technique applications
  - ✓ accuracy
  - ✓ comprehension

Extension: The student makes 3-D models of geometric shapes (e.g., boxes, pyramids, dream house.)

### **STRAND III: BASIC CAD COMMANDS**

**CONTENT STANDARD:** *The student comprehends and utilizes basic CAD commands.*

1. The student logs onto computers, establishes a file hierarchy, and saves documents to proper folders.
- 2,3,5. The student produces orthographic drawings of various assigned objects using acceptable commands and dimensioning conventions.
  - ✓ accuracy
  - ✓ appropriate commands
  - ✓ required elements
4. After demonstrating menu commands relating to object snaps, the student completes lab activities illustrating evidence of command knowledge.
  - ✓ comprehension
  - ✓ accuracy
6. The student submits all assigned drawings properly formatted and plotted (printed).
  - ✓ use of appropriate commands
  - ✓ quality of drawings

### **STRAND IV: ARCHITECTURAL DRAWING AND DESIGN**

**CONTENT STANDARD:** *The student produces and recreates architectural drawing and projects.*

1. Using colored pencils, felt tip markers, or adhesive - backed overlays, the student shades each of the three basic areas of the house using three colors. The student includes the legend.
  - ✓ identification of structures
  - ✓ legend
2. Using a pre-drawn layout of a large kitchen, the student designs and develops a complete kitchen layout including the following: base and upper cabinets, refrigerator, range, dishwasher, planning desk, sink, breakfast bar with cabinets above and stools below. The student shows ceramic tile floor as 12" square grid, labeled appliances, and the work triangle.
  - ✓ correct identification and labeling of parts
- 3,4. The student designs and develops a floor plan of a residential structure of his/her choice. Included features are: Exterior and interior walls — size and location, size and location of windows and doors, built-in cabinets and appliances, permanent fixtures, stairs and fireplaces (optional), beams and arches (optional). Room names, sizes and notes, material symbols, location and size dimensions, and scale of drawing.
  - ✓ all required components
  - ✓ accuracy
  - ✓ clarity
  - ✓ understanding of symbols and standards

## **STRAND V: CAREER PATHS**

### **CONTENT STANDARD: *The student explores various careers that are related to CAD.***

- 1-3. Using library references or Internet resources (e.g., the Occupational Outlook Handbook), the student selects a career related to architecture and creates a presentation that includes such topics as job opportunities, educational requirements, job responsibilities and predicted factors for success.
- ✓ effective writing elements
  - ✓ accuracy
  - ✓ inclusion of required components
- 1,2. The student prepares a bulletin board display that depicts the many jobs involved in architecture. The student makes use of pictures, magazine clippings, industrial literature, and actual drawings to illustrate the ways in which the architect influences the construction of a residential structure.
- ✓ effectiveness
  - ✓ relevance
  - ✓ multiple resources

## **OR**

- 1-3. As a group, the students visit a local architect's office or a firm to ask questions and observe its operation. Each student then prepares an illustration of the various responsibilities and skills required by those involved with residential architecture and construction and makes note of the use of any new techniques or equipment in architectural designing.
- ✓ thoroughness
  - ✓ differentiation of various fields
  - ✓ creativity
  - ✓ association with technology trends

## **STRAND VI: EMPLOYABILITY SKILLS**

### **CONTENT STANDARD: *The student identifies positive employability skills and good work characteristics.***

- 1,3,4,6,8,9. The student selects another student from the class to interview and prepares a 1-3 minute introduction to be made to the class. The introduction includes background information, hobbies, extra-curricular activities, as well as likes and dislikes (e.g., music, movies, foods).
- ✓ elements of effective speaking
  - ✓ adherence to time limits
  - ✓ organization
  - ✓ criteria
- 2,3,7,8. The student participates in a class discussion to create a set of classroom rules that are written and posted. Rules include safety, proper equipment use, good character traits, and general classroom etiquette.
- ✓ language conventions
  - ✓ individual participation

- ✓ clarity
- ✓ appropriateness
- ✓ safety factors
- ✓ ethical use of telecommunications

5,8,9. The student completes a personal interest inventory, scores his/her responses, and matches the total score with an inventory score description. The student writes a personal reflection of the results.

- ✓ self-assessment
- ✓ completeness of task

# **CAD Architecture II:**

## **Pathway Standards, Benchmarks, and Performance Standards**

In **CAD Architecture II**, the student develops a set of house plans using computers in drawing and problem-solving activities. The student incorporates advanced commands into his/her projects and integrates general employability skills with architectural coursework.

References in parentheses following some of the descriptors refer to critical NM mathematics (CMS), science (CSS), and language arts (CLAS) academic content standards, NM Career Readiness Standards (CR), and Professional Development Plan (PDP).

### **STRAND I: ADVANCED CAD COMMANDS**

**CONTENT STANDARD:** *The student comprehends and utilizes advanced CAD commands.*

- A. The student uses advanced commands, including dimensioning, 3-D drawing and modeling, and working with blocks.
  - 1. Knows advanced dimensioning commands (e.g., dimensioning style and aligned dimensions) (CMS 1, 2, 3, 4, 5, 6)).
  - 2. Understands and applies user coordinate systems, surface modeling, and solid modeling
  - 3. Analyzes characteristics and properties of two- and three-dimensional geometrical shapes (CMS 3) and models specific numerical relationships (CMS 11) by creating and inserting various blocks (library of technical symbols).

### **STRAND II: ADVANCED ARCHITECTURAL PLANS AND PROJECTS**

**CONTENT STANDARD:** *The student produces and creates architectural plans and projects.*

- B. The student completes assigned advanced architectural plans and constructs a 3-D model.
  - 1. Designs and constructs a complex set of residential plans (e.g., floor plans, foundations, elevations) (CMS 1, 2, 4, 6)
  - 2. Applies transformations and uses symmetry to analyze solutions for architectural designs through 3-D modeling (CMS 3, 5)(CR: 5E).
  - 3. Examines products and materials used in residential design (CR: 2A).
  - 4. Applies accepted standards, symbols, and conventions.

### **STRAND III: CAREER PATHS**

**CONTENT STANDARD:** *The student develops and advanced knowledge of various technical fields that are related to CAD.*

- C. The student participates in activities to investigate career fields and researches educational requirements for technical careers.
  - 1. Investigates through the use of technologies the skill requirements for architectural related careers (CR: 2B, 3A, 3B, 3C, 3D).
  - 2. Compares educational requirements needed for different levels of employment in architectural careers (CR: 1B, 3C).
  - 3. Recognizes career choices through the course applications (CR: 1A, 3D).

### **STRAND IV: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student models good employability skills and good work characteristics.*

- D. The student demonstrates team work, exhibits timeliness, follows directions, completes tasks, and shows respect.
  - 1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 12.5; CR: 2B, 5A, 5C, 5D, 5E).

2. Demonstrates respect for equipment, software etiquette, and observes all ethical guidelines for telecommunications (PDP Level 2.14; CR: 3A, 3B, 3C, 3D).
3. Demonstrates respect for one another and self (PDP Level 2.5; CR: 4A, 4B, 4C, 4E).
4. Conforms to established rules and regulations (PDP Level 2.5, 3.7, 3.9; CR: 4C, 4D).
5. Maintains appropriate appearance and punctuality (PDP Level 3.7, 3.9; CR: 4A).
6. Completes assigned tasks in a timely manner PDP Level 2.12, 2.5; CR: 4B, 4C).
7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 2.12, 2.5; CR: 4A).
8. Communicates effectively in both oral and written forms (PDP Level 1.14, 2.12, 3.7, 3.9).
9. Follows directions (PDP Level 2.12, 2.14, 2.5, 3.7, 3.9).

## CAD Architecture II: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

### STRAND I: ADVANCED CAD COMMANDS

**CONTENT STANDARD: The student comprehends and utilizes advanced CAD commands.**

1-3. The student produces a complete set of house/building plans to include elevations, pictorials, site plans, and basic construction drawings (e.g., foundation plan, electrical plan, plumbing plan).

- ✓ completeness
- ✓ comprehension of commands, coordinate surfaces, and solid modelings
- ✓ creativity
- ✓ block applications

### STRAND II: ADVANCED ARCHITECTURAL PLANS AND PROJECTS

**CONTENT STANDARD: The student produces and creates architectural plans and projects.**

1,3,4. The student completes the following design problem:

Introduction: As a new architect, your first job is to design a residential structure for Mr. and Mrs. Jones. The couple has two children; Jeremy who is eight years old, and Jennifer who is four years of age. Mr. and Mrs. Jones have decided their new house must meet the following requirements:

- Open plan design
- Maximum of 2300 sq. ft.
- Two car garage
- Hot tub outdoors which must be shaded from the sun
- 1 study

#### Activities:

Sketch several designs which meet the requirements stated above and present them to the design team (class) for evaluation

Complete a data research form for each item that goes into this structure and compile them into a notebook with a table of contents. An example of a data research form:

Name:	Problem Assignment:
Date:	Page:
Problem statement:	
Given Data:	

Find:

**Solutions with proper documentation:** Organize in outline form. Use sketches and underline items to be used for specification notes on future drawings. Furthermore, list references, page numbers, and/or tables used.

**Develop the following drawings:** Floor plan, foundation, elevations, site plan, construction details, and other drawings if time available (e.g., electrical).

2. The student develops several 3-D drawings of his/her design for the above residential design using Autocad 2000 or greater.

- ✓ use of technology
- ✓ required components
- ✓ all required components
- ✓ clarity
- ✓ accuracy
- ✓ acceptable standards and symbols

### **STRAND III: CAREER PATHWAYS**

**CONTENT STANDARD:** *The student develops and advanced knowledge of various technical fields that are related to CAD.*

1. The student prepares a chart showing the current wage rate per hour in the area for specific trades people (e.g., carpenters, plumbers, electricians, masons, drywallers, roofers) who work in the housing industry. Sources (e.g., the local associations of homebuilders, Associated General Contractors, local unions) are cited.

1-3. The student obtains catalogs from community colleges, technical schools, and universities and writes down the names of courses available to become better acquainted with education offerings in architecture. The teacher discusses with the class the many directions a person may take in making architecture a career and prerequisites.

- ✓ evidence of technology use
- ✓ personal assessment

**OR**

The student interviews a builder or tradesperson to determine factors they believe are important in progressing on the job and reports his/her findings to the class.

- ✓ comprehension
- ✓ clarity
- ✓ effectiveness of presentation

**OR**

The student selects one of the positions described in instructional materials and collects as much information as he/she can, including responsibilities and skills required, type of work done, and opportunities for advancement and presents the information to the class.

- ✓ completion of required components
- ✓ thoroughness
- ✓ effective presentation

**OR**

The student listens to a guest speaker (e.g., entrepreneur) discuss the pros and cons of owning your own business. The student takes notes and writes a critique of the speaker's information.

- ✓ relevant commentary
- ✓ comprehension
- ✓ effective writing elements



#### **STRAND IV: EMPLOYABILITY SKILLS**

##### **CONTENT STANDARD: The student models good employability skills and good work characteristics.**

- 1,3,6,7,9. The student applies team skills to a group project by using brainstorming techniques to identify possible class projects for a community service project (e.g., hospital work, adopt a highway, serve in a nursing home).
- ✓ individual participation
  - ✓ cooperation and collaboration
  - ✓ completion of task
  - ✓ adherence to timelines
  - ✓ appropriate behavior
- 4, 6-9. The student properly fills out a job application for a position for which he/she would like to work.
- ✓ follows directions
  - ✓ organization
  - ✓ language conventions
  - ✓ effective communication
- 2,8,9. The student assembles his/her employment portfolio.
- ✓ ethical considerations
  - ✓ required components
  - ✓ organization
  - ✓ quality of portfolio
  - ✓ effective communication
- 4,5,8,9. The student sets up an interview with an employer in his/her chosen field. The interview is conducted in an organized, timely fashion. Written questions are formulated before the interview. The interview is taped (with permission) and notes taken.
- ✓ effective oral and written communication
  - ✓ adherence to rules and regulations
  - ✓ appropriate attire
  - ✓ conducts interview in a timely manner

## CAD ENGINEERING I: PATHWAY STANDARDS

In **CAD Engineering I**, the student studies the process of converting ideas and designs into technical drawings and communicates these ideas through drafting techniques. The student achieves understanding of the design and communication process by understanding traditional drafting techniques and increasing productivity through the use of computers. Career interests are explored.

References in parentheses following some of the descriptors refer to critical NM mathematics (CMS), science (CSS), and language arts (CLAS) academic content standards, NM Career Readiness Standards (CR), and Professional Development Plan (PDP).

### STRAND I: MEASUREMENT

**CONTENT STANDARD:** *The student demonstrates appropriate applications of various measurement systems.*

- A. The student exhibits an understanding of various measurement systems used in the engineering field, applied mathematics, and interprets various scales.
  - 1. Applies mathematical conversions with multiple terms between metric and U.S. standard measurement systems (e.g., fractions to decimals, U.S. standard to metric) (CMS 8) and understands the relationships between ratios, proportions, and percents (CMS 10).
  - 2. Differentiates among types of units (CMS 8).
  - 3. Reads scales (CMS 10).
  - 4. Measures accurately using U.S. standard and metric systems (CMS 8,10).
  - 5. Draws a 1-to-1 scale object (CMS 10).

### STRAND II: GRAPHIC REPRESENTATION

**CONTENT STANDARD:** *The student demonstrates acceptable sketching techniques and knowledge of drafting tools.*

- B. The student produces a variety of sketches of mechanical devices using appropriate hand drafting tools.
  - 1. Creates a variety of two- and three-dimensional drawings (CMS 1); finds the area and perimeter of geometric figures (CMS 2); interprets three-dimensional objects and finds the surface area and volume of basic figures (CMS 3); demonstrates understanding of the coordinate plane (CMS 4); deduces properties of figures using transformations (CMS 5); solves problems involving perimeter, circumference, area, volume, and surface area of common geometric figures (CMS 6); and uses basic geometry (e.g., Pythagorean Theorem) to calculate perimeters of geometric shapes (CMS 7).
  - 2. Understands the types and uses of various drafting tools.
  - 3. Utilizes appropriate drafting techniques (e.g., isometrics, perspective).
  - 4. Recognizes the different types of media used in the field..
  - 5. Understands the importance of lettering techniques.

### STRAND III: BASIC CAD COMMANDS

**CONTENT STANDARD:** *The student comprehends and utilizes basic CAD commands.*

- C. The student uses basic commands, including drawing, editing and modifying, and drawing tools.
  - 1. Knows file maintenance and drawing setup.
  - 2. Demonstrates basic drawing commands (e.g., lines, circles, text).

3. Utilizes modifying and editing commands (e.g., erase, copy, rotate).
4. Incorporates drawing aids and controls (e.g., object snap, pan, zoom) (CMS 1,2,3,4,5,6).
5. Chooses appropriate dimensioning commands (e.g., linear, angular, diameter).
6. Produces a drawing through printing and plotting commands (CMS 11).

#### **STRAND IV: ENGINEERING DRAWINGS AND PROJECTS**

**CONTENT STANDARD:** *The student produces and recreates engineering drawings and projects.*

- D. The student completes assigned engineering drawing, constructs projects, and designs corresponding working drawings.
  1. Applies understanding of the characteristics and properties of geometric shapes (CMS 1, 2), demonstrates understanding of the relationship between ratios, proportions, and percents (CMS 10) to detail objects (CMS 3) accurately through the principles of shape and size description (CMS 5, 6).
  2. Demonstrates the relationship between points, lines, and planes (CMS 4) through multi-view drawing principles (CMS 1,3,5,8,10).
  3. Represents objects through various pictorial development techniques (e.g., isometrics) (CMS .
  4. Practices accepted standards, symbols, and conventions (NCSADD: 1.1.7).
  5. Formulates solutions for mechanical design problems through hands-on projects (NCSADD: M4).

#### **STRAND V: CAREER PATHS**

**CONTENT STANDARD:** *The student explores various technical fields that are related to CAD.*

- E. The student participates in activities to discover career interests and abilities and identifies educational requirements for technical careers.
  1. Distinguishes among various technical fields that utilize CAD (CR: 3B, 3C, 3D).
  2. Recognizes levels of education needed for career positions (CR: 3C).
  3. Uses a variety of resources to expand knowledge/gather information on various technical careers (CR: 3C, 3D, 5A; NSCADD: C9).

#### **STRAND VI: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student identifies positive employability skills and good work characteristics.*

- F. The student demonstrates team work, exhibits timeliness, follows directions, completes tasks, and shows respect.
  1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 1.3, CR: 2B, 5A, 5C, 5D, 5E).
  2. Demonstrates respect for equipment, software etiquette, and observes all ethical guidelines for telecommunications (PDP Level 1.8; NSCADD: 2.1.1; CR: 3A, 3B, 3C, 3D).
  3. Demonstrates respect for one another and self (PDP Level 1.3; CR: 4A, 4B, 4C, 4E).
  4. Conforms to established rules and regulations (PDP Level 1.3; CR: 4C, 4D).
  5. Maintains appropriate appearance and punctuality (PDP Level 1.1; CR: 4A).
  6. Completes assigned tasks in a timely manner (PDP Level 1.3; CR: 4B, 4C).
  7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 1.1; CR: 4A).
  8. Communicates effectively in both oral and written forms (PDP Level 1.3; NSCADD: C1, C2, C6, C22).
  9. Follows directions (PDP Level 1.1, 1.3).

## CAD Engineering I: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

### STRAND I: MEASUREMENT

**CONTENT STANDARD:** *The student demonstrates appropriate applications of various measurement systems.*

- 1,2,4. Using a tape measure marked in inches and feet, the student measures parts of the body (e.g., hand, foot). Data is collected, discussed, and averages for the class are found. The student then a) converts the results to metric or b) remeasures using a tape measure marked in:
- ✓ centimeters and meters.
  - ✓ correct measurements
- 3,5. The student measures objects in the classroom (e.g., desk, chair), develops a scale of  $1/4" = 1$  foot, and draws a room layout plan. The student does this first using pencil and paper and then follows with a computer drawing.
- ✓ accuracy
  - ✓ use of technology
  - ✓ comprehension

### STRAND II: GRAPHIC PRESENTATION

**CONTENT STANDARD:** *The student demonstrates acceptable sketching techniques and knowledge of drafting tools.*

- 1,2,3. Given a variety of figures/drawings with specified scales and step-by-step directions, the student recreates the figures/drawings using hand drafting tools (e.g., ruler, compass, pencil, triangles).
- ✓ correct scales
  - ✓ accurate measurements
  - ✓ neatness and accuracy
  - ✓ appropriate use of tools
  - ✓ meeting deadlines
  - ✓ following directions
4. The student selects a variety of drawings to reproduce on the computer using a software program (e.g., Auto CAD).
- ✓ use of technology
  - ✓ print out
  - ✓ correct scales
  - ✓ accurate measurements
  - ✓ appropriate symbols

3,5. Following a teacher demonstration on correct tool use, the student practices drawing lines, line weights, arcs, symbols, and lettering.

- ✓ ability to follow directions
- ✓ technique applications
- ✓ Accuracy
- ✓ comprehension

Extension: The student makes 3-D models of geometric shapes (e.g., boxes, pyramids, dream house).

### **STRAND III: BASIC COMMANDS**

**CONTENT STANDARD:** *The student comprehends and utilizes basic CAD commands.*

1. The student logs onto computers, establishes a file hierarchy, and saves documents to proper folders.
- 2, 3, 5. The student produces orthographic drawings of various assigned objects using acceptable commands and dimensioning conventions.
  - ✓ accuracy
  - ✓ required elements
  - ✓ appropriate commands
4. After demonstrating menu commands relating to object snaps, the student completes lab activities illustrating evidence of command knowledge.
  - ✓ comprehension
  - ✓ accuracy
5. The student submits all assigned drawings properly formatted and plotted (printed).
  - ✓ use of appropriate commands
  - ✓ quality of drawings

### **STRAND IV: ENGINEERING DRAWINGS AND PROJECTS**

**CONTENT STANDARD:** *The student produces and recreates engineering drawings and projects.*

- 1,4. The student applies measurements, notes, and symbols to orthographic views on a technical drawing.
  - ✓ accuracy
- 2,4. After the student is given a pictorial drawing of a mechanical part, s/he sketches and draws the necessary views (e.g., front, top, right side).
  - ✓ correct use of symbols
  - ✓ comprehension
3. The student constructs an isometric drawing from a multi-view drawing the teacher provides.
  - ✓ technique
  - ✓ accurate representation
5. Using the “Design Process”, the student working in teams of two or three solves the following problem:  
**Problem:** Design a bucket type transport vehicle that can be suspended from an inclined, overhead line and carry a payload (golf ball) be-

tween two points. The design must include a method to deposit the payload into a box. (The box is 18" away from the 2nd point).

**Parameters:**

1. Each team may use any materials found in the class or outside of class. However, the total cost may not exceed \$3.00.
2. Human hands can only touch the system before the vehicle departure and after the golf ball has left the vehicle.
3. The unloading device must be part of the vehicle.

**Design/Development Activities:**

1. Brainstorm as many ideas as possible. Make sketches of all ideas. Consider all ideas, no matter how "unusual".
2. Choose the best idea and make a freehand sketch. Include a list of materials.
3. Each group member needs to develop a multiview drawing of his/her vehicle. Include a materials list.
4. Each individual builds a prototype of the design from working drawings.
5. Test the prototype.
  - ✓ adherence to guidelines
  - ✓ team work
  - ✓ problem solving
  - ✓ quality of design

**Evaluation:**

1. To what extent did the team list all possible ideas? 5 pts
2. To what extent did team members develop a sketch using good sketching techniques discussed in class? 5 pts
3. To what extent did each team member develop a multi-view drawing? 15 pts
4. To what extent did the group follow set parameters as indicated on the problem sheet? 10 pts
5. Did the group develop a prototype? 10 pts

**STRAND V: CAREER PATHS**

**CONTENT STANDARD: The student explores various technical fields that are related to CAD.**

1. The teacher prepares cards that describe various careers of interest, as well as some that have no obvious relationship to a design engineering team. The student selects a card and explains to the class whether this career relates to design engineering, and why.

✓ reasonable explanations OR

The student creates a matching exercise that contrasts careers with their job descriptions.

✓ accuracy

**OR**

With prepared descriptions of several needs in an engineering design team, the student provides a name for the job that each one might entail.

- 1-3. The student checks employment advertisements in local newspapers for listings of positions related to the fields of engineering and drafting. The student prepares a chart showing job titles, experience and educational background required, and starting salaries.

✓ use of multiple resources  
✓ accurate job specifications

## **STRAND VI: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student identifies positive employability skills and good work characteristics.*

- 1,3,4,6,8,9. The student selects another student from the class to interview and prepares a 1-3 minute introduction to be made to the class. The introduction includes background information, hobbies, extra-curricular activities, as well as likes and dislikes (e.g., music, movies, foods). Roles are then reversed.
- ✓ elements of effective speaking
  - ✓ adherence to time limits
  - ✓ organization
  - ✓ criteria
- 2,3,7,8. The student participates in a class discussion to create a set of classroom rules that are written and posted. Rules include safety, proper equipment use, good character traits, and general classroom etiquette.
- ✓ language conventions
  - ✓ individual participation
  - ✓ clarity
  - ✓ appropriateness
  - ✓ safety factors
  - ✓ ethical use of telecommunications
- 5,8,9. The student completes a personal interest inventory, scores his/her responses, and matches the total score with an inventory score description. The student writes a personal reflection of the results.
- ✓ self-assessment
  - ✓ completeness of task

# CAD Engineering II: Pathway Standards

In **CAD Engineering II**, the student utilizes the computer to learn advanced drafting techniques while applying drafting theories and standards to solve design problems. The student focuses on the integration of general employability skills with the course design problems.

References in parentheses following some of the descriptors refer to performance standards found in National Standards for Computer Aided Drafting and Design (NSCADD), in the New Mexico State Content Standards, Career Readiness (CR), and PDP.

## **STRAND I: ADVANCED CAD COMMANDS**

**CONTENT STANDARD:** *The student comprehends and utilizes advanced CAD commands.*

- A. The student uses advanced commands, including dimensioning, 3-D drawing and modeling, and working with blocks.
  - 1. Knows advanced dimensioning commands (e.g., dimensioning style and aligned dimensions) (NSCADD: 1.4).
  - 2. Understands and applies user coordinate systems, surface modeling, and solid modeling (NSCADD: 1.4.9, 4.1.2).
  - 3. Creates and inserts various blocks (library of technical symbols) (NSCADD: 3.3.5).

## **STRAND II: ADVANCED ENGINEERING DRAWING AND PROJECTS**

**CONTENT STANDARD:** *The student produces and recreates advanced engineering drawings and projects.*

- B. The student completes assigned advanced engineering drawings, constructs projects and designs corresponding working drawings.
  - 1. Creates advanced working drawings (e.g., mating surfaces, threads, tolerances) (NSCADD: 1.4.10, 4.1.2, 4.1.4).
  - 2. Understands and applies thread concepts (NSCADD: under Thinking Skills).
  - 3. Demonstrates geometric tolerancing principles (NSCADD: 1.4.10).
  - 4. Analyzes solutions for mechanical design problems through hands-on projects (NSCADD: M4, 5E).
  - 5. Incorporates advanced techniques in pictorial representations (NSCADD: Section 4).
  - 6. Applies accepted standards, symbols, and conventions (NSCADD: 1.1.7).

## **STRAND III: CAREER PATHS**

**CONTENT STANDARD:** *The develops an advanced knowledge of various technical fields that are related to CAD.*

- C. The student participates in activities to investigate career fields and researches educational requirements for technical careers.
  - 1. Investigate through the use if technologies the skill requirements for engineering related careers (CR: 2B, 3A, 3B, 3C, 3D).
  - 2. Compare educational requirements needed for different levels of employment in engineering careers (CR: 1B, 3C).
  - 3. Recognizes career choices through the course applications (CR: 1A, 3D).

## **STRAND IV: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student models positive employability skills and good work characteristics.*

- D. The student demonstrates team work, exhibits timeliness, follows directions, completes tasks, and shows respect.
  - 1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 12.5; CR: 2B, 5A, 5C, 5D, 5E).
  - 2. Demonstrates respect for equipment, software etiquette, and observes all ethical guidelines for telecommunications (PDP Level 2.14; NSCADD: 2.1.1; CR: 3A, 3B, 3C, 3D).



3. Demonstrates respect for one another and self (PDP Level 2.5; CR: 4A, 4B, 4C, 4E).
4. Conforms to established rules and regulations (PDP Level 2.5, 3.7, 3.9; CR: 4C, 4D).
5. Maintains appropriate appearance and punctuality (PDP Level 3.7, 3.9; CR: 4A).
6. Completes assigned tasks in a timely manner (PDP Level 2.12, 2.5; CR: 4B, 4C).
7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 2.12, 2.5; CR: 4A).
8. Communicates effectively in both oral and written forms (PDP Level 1.14, 2.12, 3.7, 3.9; NSCADD: C1, C2, C6, C22).
9. Follows directions (PDP Level 2.12, 2.14, 2.5, 3.7, 3.9).

# CAD Engineering II: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

## STRAND I: ADVANCED COMMANDS

**CONTENT STANDARD:** *The student comprehends and utilizes advanced CAD commands.*

- 1 – 2. The student produces a complete set of assembly drawings that include 3-D models, orthographic projections, auxiliary views, and isometric drawings as needed.
  - ✓ all required components
  - ✓ understanding of dimensioning commands
  - ✓ applications
3. The student creates as part of assembly drawings any necessary blocks and uses, as needed, to complete drawings.
  - ✓ variety of blocks

## STRAND II: ADVANCED ENGINEERING DRAWINGS AND PROJECTS

**CONTENT STANDARD:** *The student produces and recreates advanced engineering drawings and projects.*

- 1,2,5,6. The student develops a set of working drawings for a machine vise. The set includes the following drawings:
  - working drawings of each part
  - pictorial drawing (e.g., isometric 3-D modeling)
  - parts list
    - ✓ applications of thread concepts
    - ✓ acceptable standards, symbols, and conventions
    - ✓ use of advanced techniques
- 3,5,6. The student develops a set of working drawings for each part of a “housing device.” The set includes the following drawings:
  - working drawings of each part
  - geometric dimensioning and tolerance symbols
  - pictorial drawing (e.g., 3-D modeling, isometric)
  - parts list
    - ✓ completion of required components
    - ✓ acceptable tolerances
    - ✓ critical analysis
    - ✓ advanced techniques
    - ✓ applied standards

4. Using the “Design Process,” the student working in engineering teams of two or three solves the following problem:

**Problem:** Design a machine that is able to pick up ping pong balls and deposit them in a bucket.

**Parameters:**

1. The machine must be electrically operated.
2. The maximum size of the machine is 12” x 12” x 12”.
3. The machine must be able to pick up at least ten balls per run (3 mins. per run).

**Design/Development Activities:**

1. Create a timeline.
2. Brainstorm as many ideas as possible. Make sketches of all ideas. Consider all ideas, no matter how “unusual.”
3. Choose the best idea and make a freehand sketch. Include a list of materials.
4. Each group member needs to develop a set of working drawings to adequately describe each part of the machine. These drawings must include the information required to produce the machine.
5. Each individual builds a prototype of the design from working drawings.
6. Test the prototype.
  - ✓ adherence to guidelines
  - ✓ team work
  - ✓ problem solving
  - ✓ quality of design

**Evaluation:**

1. To what extent did the team list all possible ideas? 5 pts.
2. To what extent did team members develop a sketch using good sketching techniques discussed in class? 5 pts.
3. To what extent did each team member develop a design package that includes the following items:
  - Cover sheet w/pictorial in 3-D? 10 pts.
  - Timeline? 10 pts.
  - Possible solutions? 5 pts.
  - Materials list? 5 pts.
  - Working drawings? 40 pts.
  - Prototype? 25 pts.
4. To what extent did the group follow set parameters as indicated on this problem sheet? 10 pts.

### **STRAND III: CAREER PATHS**

**CONTENT STANDARD:** *The student develops advanced knowledge of various technical fields that are related to CAD.*

1. The student writes the Institute of Electrical and Electronics Engineers (IEEE) or Electronics Industries Association (EIA) and requests information about careers in electrical engineering.

- ✓ appropriateness
- ✓ clarity
- ✓ language conventions

**OR**

The student visits the American Institute of Aeronautics and Astronautics at [www.aiaa.com](http://www.aiaa.com) and checks the AIAA and Space Channel for an in-depth review of current aerospace topics and presents findings to the class.

**OR**

The student visits the National Aeronautics and Space Administration at [www.nasa.gov](http://www.nasa.gov) and checks the daily newsletter containing the latest information about NASA science and technology, collects information, and presents findings to the class.

- ✓ evidence of technology use
- ✓ pertinent information
- ✓ presentation of various career interests

- 2-3. The student invites his/her geography or science teacher to visit the class to “show and tell” and describe career opportunities for specialists (e.g., cartography).

**OR**

The student invites a civil engineer to visit the class to explain about the field of civil engineering and the kinds of maps used by workers in this field.

### **STRAND IV: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student models positive employability skills and good work habits.*

- 1,3,6,7,9. The student applies team skills to a group project by using brainstorming techniques to identify possible class projects for a community service project (e.g., hospital work, adopt a highway, serve in a nursing home).

- ✓ individual participation
- ✓ cooperation and collaboration
- ✓ completion of task
- ✓ adherence to timelines
- ✓ appropriate behavior

- 4, 6-9. The student properly fills out a job application for a position for which he/she would like to work. follows directions

- ✓ organization
- ✓ language conventions
- ✓ effective communication

2,8,9. The student assembles his/her employment portfolio.

- ✓ ethical considerations
- ✓ required components
- ✓ organization
- ✓ language conventions
- ✓ effective communication

4,5,8,9. The student sets up an interview with an employer in his/her chosen field. The interview is conducted in an organized, timely fashion.

Written questions are formulated before the interview. The interview is taped (with permission) and notes taken.

- ✓ effective oral and written communication
- ✓ adherence to rules and regulations
- ✓ appropriate attire
- ✓ conducts interview in a timely manner

# CAD III Directed Studies: Pathway Standards

In **CAD III – Directed Studies** advanced individual study is pursued in an area of architecture or engineering graphics. The student assumes responsibility for identifying, pursuing, and culminating an activity that expands knowledge about some phase of industry. The study is pursuant to approval by instructor, parent/guardian, student, and school administrator.

References in parentheses following some of the descriptors refer to performance standards found in National Standards for Computer Aided Drafting and Design (NSCADD), in the New Mexico State Content Standards, Career Readiness (CR), and PDP.

## STRAND I: DIRECTED DESIGN PROJECTS

**CONTENT STANDARD:** *The pursues advanced individual study in an area of CAD.*

- A. The student identifies, organizes, and completes a course of study in an area of specialized interest.
  - 1. Identifies and defines a technological problem related to a career interest (CR: 5E).
  - 2. Seeks new knowledge, synthesizes this information, and utilizes it in solving the defined problem (NSCADD: Thinking Skills).
  - 3. Develops a timeline and schedule (CR: 2A).
  - 4. Completes the managed activities necessary (CR: 2A, 5A).
  - 5. Evaluates the solutions that have been completed (CR: 5E, 5F).
  - 6. Demonstrates the ability to transfer technical and academic skills from the classroom to careers (CR: 1E).

## STRAND II: CAREER PATHS

**CONTENT STANDARD:** *The student develops an advanced knowledge of various technical fields that are related to CAD.*

- B. The student participates in activities to investigate career fields and researches educational requirements for technical careers.
  - 1. Investigates through the use of technologies the skill requirements for architectural or engineering related careers (CR: 2B, 3A, 3B, 3C, 3D).
  - 2. Compares educational requirements needed for different levels of employment in architectural or engineering careers (CR: 1B, 3C).
  - 3. Examines career choices through the course applications (CR: 1A, 3D).

## STRAND III: EMPLOYABILITY SKILLS

**CONTENT STANDARD:** *The student models positive employability skills and good work habits.*

- C. The student develops leadership skills within the work setting at school.
  - 1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 4.8, 4.11; CR: 2B, 5A, 5C, 5D, 5E).
  - 2. Demonstrates respect for equipment, software etiquette, and observes all ethical guidelines for telecommunications (PDP Level 4.8, 5.6; NSCADD: 2.1.1; CR: 3A, 3B, 3C, 3D).
  - 3. Demonstrates respect for one another and self (PDP Level 4.8, 4.11; CR: 4A, 4B, 4C, 4E).
  - 4. Conforms to established rules and regulations (PDP Level 4.8, 4.11; CR: 4C, 4D).
  - 5. Maintains appropriate appearance and punctuality (PDP Level 4.11; CR: 4A).
  - 6. Completes assigned tasks in a timely manner (PDP Level 4.8, 4.11, 5.6; CR: 4B, 4C).

7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 4.8, 4.11; CR: 4A).
8. Communicates effectively in both oral and written forms (PDP Level 4.8, 4.11, 5.6; NSCADD: C1, C2, C6, C22).
9. Follows directions (PDP Level 4.8, 4.11, 5.6).

## CAD III—Directed Studies: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

### STRAND I: DIRECTED DESIGN PROJECTS

**CONTENT STANDARD:** *The student pursues advanced individual study in an area of CAD.*

1-6. The student chooses a facility (e.g., sports) to design and explores commercial designing. The student researches other designs, begins architectural drawings and maintains a notebook of researched materials and supplies needed for such a facility. With an agreed upon timeline, the student works individually and maintains contact with the instructor to develop a complete design.

- ✓ adherence to timelines
- ✓ completion of required activities
- ✓ scrutinization of materials and supplies
- ✓ comprehension
- ✓ application of skills and knowledge
- ✓ problem solving

**OR**

The student expands his/her knowledge in the drawing and designing of a mechanical device (e.g., a bypass for a filter and pump system used for cleaning pools). The student completes working drawings as well as a 3-D model of the new design. The student researches various materials and sizes of parts used in the device and keeps them in a notebook.

- ✓ technical understanding
- ✓ appropriateness of materials and parts
- ✓ completion of required components
- ✓ accuracy of drawings
- ✓ variety of sources

### STRAND II: CAREER PATHS

**CONTENT STANDARD:** *The student develops an advanced knowledge of various technical fields that are related to CAD.*

1-3. The student gathers information about careers by visiting both the school and local libraries, checking reference materials [e.g., Occupational Outlook Handbook (OOH), Occupational Information Network software (O\*NET), magazines, pamphlets]. The student needs to re-search types of careers available, tasks involved in particular jobs, education, special skills, and/or training required, salary and benefits.

- ✓ use of technology
- ✓ completion of task
- ✓ relevancy

**OR**

The student makes contact with a variety of people (e.g., people employed in the field of interest, other teachers and counselors at the school, professional associations) and interviews them to find out training, educational requirements, and opportunities available in the field.

- ✓ use of technology
- ✓ completion of task



- ✓ relevancy

Extension: The student may want to explore getting a part-time job in the field or doing volunteer work in the field.

- ✓ supervisor's evaluation

### **STRAND III: EMPLOYABILITY SKILLS**

**CONTENT STANDARD:** *The student models positive employability skills and good work characteristics.*

1-4, 6-9. The student investigates on-line entrepreneurship opportunities as a team member and reports findings to the team.

- ✓ collaboration and cooperation
- ✓ ethical considerations
- ✓ use of technology
- ✓ appropriate behavior
- ✓ completion of all task components
- ✓ effective communication
- ✓ adherence to criteria and guidelines

1, 3-9. The student manages a project and evaluates others.

- ✓ leadership skills
- ✓ problem solving and critical thinking
- ✓ assessments
- ✓ cooperation and collaboration
- ✓ respect for others
- ✓ effective communication

# CAD IV-Independent Studies: Pathway Standards

In **CAD IV – Independent Studies**, a student pursues advanced individual study in an area of architecture or engineering graphics. The student assumes responsibility for identifying, pursuing, and culminating an activity that expands knowledge about some phase of industry. The study is pursuant to approval by instructor, parent/guardian, student, and school administrator.

References in parentheses following some of the descriptors refer to performance standards found in National Standards for Computer Aided Drafting and Design (NSCADD), in the New Mexico Career Readiness (CR) Content Standards, and PDP.

## STRAND I: INDEPENDENT DESIGN PROJECTS

**CONTENT STANDARD:** *The student continues advanced individual study in an area of CAD.*

- A. The student identifies, organizes, and completes an additional course of study in an area of specialized interest.
  - 1. Identifies and defines a technological problem related to a career interest (CR: 5E).
  - 2. Seeks new knowledge, synthesizes this information, and utilizes it in solving the defined problem (NSCADD: Thinking Skills).
  - 3. Develops a timeline and schedule (CR: 2A).
  - 4. Completes the managed activities necessary (CR: 2A, 5A).
  - 5. Evaluates the solutions that have been completed (CR: 5E, 5F).
  - 6. Demonstrates the ability to transfer technical and academic skills from the classroom to careers (CR: 1E).

## STRAND II: CAREER PATHS

**CONTENT STANDARD:** *The student develops an advanced knowledge of various technical fields that are related to CAD.*

- B. The student engages in activities that expand knowledge in training requirements for technical careers and evaluates choices.
  - 1. Investigates through the use of technologies the skill requirements for architectural or engineering related careers (CR: 2B, 3A, 3B, 3C, 3D).
  - 2. Compares educational requirements needed for different levels of employment in architectural or engineering careers (CR: 1B, 3C).
  - 3. Examines career choices through the course applications (CR: 1A, 3D).

## STRAND III: EMPLOYABILITY SKILLS

**CONTENT STANDARD:** *The student models positive employability skills and good work habits.*

- C. The student develops leadership skills within the work setting at school.
  - 1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 4.8, 4.11; CR: 2B, 5A, 5C, 5D, 5E).
  - 2. Demonstrates respect for equipment, software etiquette, and observes all ethical guidelines for telecommunications (PDP Level 4.8, 5.6; NSCADD: 2.1.1; CR: 3A, 3B, 3C, 3D).
  - 3. Demonstrates respect for one another and self (PDP Level 4.8, 4.11; CR: 4A, 4B, 4C, 4E).
  - 4. Conforms to established rules and regulations (PDP Level 4.8, 4.11; CR: 4C, 4D).
  - 5. Maintains appropriate appearance and punctuality (PDP Level 4.11; CR: 4A).
  - 6. Completes assigned tasks in a timely manner (PDP Level 4.8, 4.11, 5.6; CR: 4B, 4C).

7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 4.8, 4.11; CR: 4A).
8. Communicates effectively in both oral and written forms (PDP Level 4.8, 4.11, 5.6; NSCADD: C1, C2, C6, C22).
9. Follows directions (PDP Level 4.8, 4.11, 5.6).

# CAD IV-Independent Studies: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

## STRAND I: DIRECTED DESIGN PROJECT

**CONTENT STANDARD:** *The student continues advanced individual study in an area of CAD.*

1-6. The student and teacher contact a local engineering firm and develop a schedule for the student to job shadow someone in the firm. The student keeps a journal of activities he/she performs at the firm, as well as reflections on the career chosen. The teacher maintains contact with the firm to follow up on the student's progress and helps make adjustments as needed.

- ✓ adherence to timelines
- ✓ job performance and progress made
- ✓ reflective journal entries
- ✓ self-assessment
- ✓ acquisition of knowledge and skills gained
- ✓ problem solving

**OR**

The student participates in the New Mexico Solar Association competition for a passive solar house design. The student completes required drawings and calculations needed to submit an entry into the competition. The student develops a timeline for completion and maintains contact with the instructor for changes on the drawings.

- ✓ adherence to timelines
- ✓ completion of required components
- ✓ accurate calculations
- ✓ submission of competition application
- ✓ communication
- ✓ problem solving
- ✓ application of technical knowledge and skills

## STRAND II: CAREER PATHS

**CONTENT STANDARD:** *The student develops an advanced knowledge of various technical fields that are related to CAD.*

1-3. The student interviews someone who offers freelance CAD services and finds out what kind of work is available, how much a freelancer charges, and how a freelancer deals with times when work is scarce.

- ✓ use of technology
- ✓ analysis
- ✓ comparisons and contrasts

**OR**

The student researches a firm that recently built a sports facility or other major project. The student checks on what other projects the firm has done, what kind of experience is necessary to obtain a job with the firm, and how the student gets the appropriate experience.

**OR**

The student visits the SkillsUSA-VICA website at [www.skillsusa.org](http://www.skillsusa.org) and writes a report on how SkillsUSA-VICA is helpful if the student were to become a vocational education teacher.

Extensions: The student may want to participate in SkillsUSA VICA competitions and become a member of the club to obtain further information on the careers in CAD.

### **STRAND III: EMPLOYABILITY SKILLS**

**CONTENT STANDARD: *The student models positive employability skills and good work characteristics.***

1,3,6,7,9. The student identifies and applies conflict resolution skills in a group situation.

- ✓ problem solving and critical thinking
- ✓ respect for others
- ✓ listening skills
- ✓ appropriate assessments
- ✓ appropriate behavior
- ✓ effective communication
- ✓ team work
- ✓ leadership
- ✓ completion of tasks

2,4,6-9. The student refines a resume using a computer program.

- ✓ effective writing elements
- ✓ use of technology
- ✓ organization
- ✓ clarity and conciseness
- ✓ guidelines followed

2,8,9. The student completes his/her employment portfolio.

- ✓ ethical considerations
- ✓ organization
- ✓ quality portfolio
- ✓ effective communication and presentation

3,5,8,9. The student develops customer service skills by simulating a complaint department where products might be faulty.

- ✓ effective communication
- ✓ courtesy and respect
- ✓ conflict resolution
- ✓ appropriate attire and behavior