



STATE OF ILLINOIS

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# Model Programs of Study Guide

# Architecture, Construction, and Energy

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PATHWAYS



**EdSystems**  
EDUCATION SYSTEMS CENTER at  
NORTHERN ILLINOIS UNIVERSITY

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## About ICCB

In 1965, the Illinois General Assembly established the Illinois Community College Board to create a system of public community colleges that would be within easy reach of every resident. Today, the Illinois Community College System covers the entire state with 48 colleges and one multi-community college center in 39 community college districts. Community colleges serve nearly one million Illinois residents each year in credit and noncredit courses and many more through their public service programs.

Illinois' community colleges meet both local and statewide needs for education and workforce development through high-quality, affordable, accessible, and cost-effective programs and services. Learn more at [iccb.org](https://iccb.org).



## About EdSystems

Education Systems Center (EdSystems) is a mission-driven policy development and program implementation center based within Northern Illinois University. We work at the state level to create ecosystem and policy change while simultaneously working at the local level to create organizational change. This bi-directional approach allows us to align local efforts to state policy while elevating local experiences and learnings to state tables. Learn more at [edsystemsniu.org](https://edsystemsniu.org).

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## I. About the Model Programs of Study Guide

The Illinois Community College Board (ICCB) sponsored the development of the State of Illinois Model Programs of Study Guides in crucial industry areas as part of the [Illinois State Plan for Strengthening Career and Technical Education for the 21st Century Act](#) (also known as the Perkins V plan). This guide was developed in consultation and collaboration with the Illinois State Board of Education (ISBE) through a process led and facilitated by Education Systems Center at NIU (EdSystems). As further detailed in this guide, the process involved extensive research into labor market information and credential programs, and dialogue across secondary, postsecondary, and employer stakeholders.

The primary purposes and goals for the Model Programs of Study are to:

1. **Provide guidance and exemplars** for local pathway programs to adopt or customize as they develop programs of study for approval as part of Perkins V or Illinois' College and Career Pathway Endorsements.
2. **Establish a framework** for state agencies to develop and implement program supports.
3. **Identify priority dual credit courses** that are foundational to the industry sector's program of study and well-situated for statewide scaling and articulation.
4. **Define the competencies** that should be sequenced across a program of study course sequence to prepare students for the future of work in that industry area.
5. **Identify entry points** for employers to support coursework and work-based learning experiences.

Model Programs of Study supplement and complement other State of Illinois career and technical education and career pathway resources, including the [ISBE Career Guide](#), [State of Illinois Career Pathways Dictionary](#), [Career Development Experience Toolkit](#), [Recommended Technical and Essential Employability Competencies](#), [State of Illinois Workforce Development Strategic Plan](#), and related state and regional data resources. School districts, community colleges, and their partners are encouraged to use this guide, state resources, and local program and course information to develop materials for student and family outreach.

The Model Programs of Study Guide in Architecture, Construction, and Energy can be used as a reference in local planning processes. The guide presents and describes in detail each component of the sequence, including descriptions of the underlying research, analysis, and Advisory Committee input. In addition to the complete guide, a [pathway map](#) depicting the diagrams of the secondary and postsecondary sequences, as well as a table of the selected occupations, wages, and job growth, is available at the end of this document or at [edsystemsniu.org/guides](https://edsystemsniu.org/guides).

## II. Development of the Model Programs of Study

Programs of study are a coordinated, non-duplicative sequence of academic and technical content at the secondary and postsecondary levels that culminate in a recognized postsecondary credential. The State of Illinois Model Programs of Study Guides are aligned with broader state policy goals to promote college and career readiness, including the state's Perkins V and ESSA plans (in particular, the College and Career Readiness Indicator), the Postsecondary and Workforce Readiness Act, the Dual Credit Quality Act, and the Illinois Career Pathways Dictionary.



### Process for Development

Each Model Programs of Study was developed using a data-driven, backward-mapping approach that extended from the areas of job growth down through to the high school course sequence. The specific steps in this analysis included:

1. **Identifying high-priority occupations** in the industry sector that are high-skill, high-wage, and in-demand based on federal Department of Labor data for Illinois.
2. **Identifying promising postsecondary credentials** (degrees or certificates) that are broadly accessible to and through the Illinois community college system, and lead to high-priority occupations.
3. **Mapping the stackable degrees and certificates** that progress to promising credentials.
4. **Identifying strategic community college courses** that appear broadly among promising credentials, provide a solid foundation of knowledge essential to that industry sector, and are feasible for dual credit delivery.
5. **Mapping a course sequence from secondary through the first year of postsecondary** that incorporates strategic early college credit (including at least six early college credits in the career-focused course sequence) and is applicable to both Illinois secondary and postsecondary Perkins V requirements.
6. **Defining related technical competencies** for the foundational program of study courses that can be utilized to guide course development and postsecondary articulation.

Using data from the Department of Labor, Illinois Department of Employment Security, and MIT's Living Wage Calculator for the State of Illinois as a reference, the project team identified "high-priority occupations" as jobs with a positive growth outlook over the next 10 years, of high relative volume within that industry sector, and with median salaries that could sustain various family sizes within Illinois.<sup>1</sup> Occupations with median salaries higher than the living wage for 1 adult + 1 child (\$39.63/hour) are considered as having a "high" living wage potential. Occupations with median salaries only higher than the living wage of 1 adult, no children (\$22.86/hour) are considered as having a "medium" living wage

<sup>1</sup> U.S. Department of Labor, Employment and Training Administration (n.d.). "Explore Careers." CareerOneStop. Retrieved December 2023, from [careeronestop.org/explorecareers](https://careeronestop.org/explorecareers). Illinois Department of Employment Security, "Long-Term Occupational Projections 2020-2030" and "Wage Information: Occupational Employment and Wage Statistics (OEWS) Statewide." Retrieved December 2023, from [ides.illinois.gov](https://ides.illinois.gov). Amy K. Glasmeier, "Living Wage Calculator," Massachusetts Institute of Technology, 2024. Retrieved December 2023, from [livingwage.mit.edu](https://livingwage.mit.edu).





potential, and occupations with median salaries below the living wage of 1 adult, no children (less than \$22.86/hour) are considered as having a “low” living wage potential.

The team identified as a “promising credential” any degree or certification that immediately prepares an individual for entry into or is a stackable for the identified high-priority occupations, then analyzed community college programs leading to these credentials from a sampling of six to ten colleges from across Illinois, representing a mix of urban, suburban, and rural institutions.<sup>2</sup> EdSystems analyzed and categorized all the career-focused and general education courses across the full sampling of the promising credential programs to determine which of these courses:

- are broadly common across multiple college programs in the sample,
- are likely accessible for dual credit opportunities considering student prerequisites and teacher credentialing requirements, and
- are generally transferable through Illinois Articulation Initiative or various articulation agreements.

This analysis and categorization process led to a recommended set of strategic career-focused and general education courses that provide a critical foundation for the program of study sequence.

Following this internal analysis, EdSystems and ICCB convened a stakeholder Advisory Committee of secondary, postsecondary, and private sector representatives to vet the recommendations and provide expertise and guidance on the development of the Model Programs of Study (see [Appendix B](#)). Over multiple webinars and feedback sessions across four months, the Advisory Committee and smaller working groups provided information about industry trends that may not be reflected in the Department of Labor or IDES data, credentials and degrees that are emerging as most promising in the field, on-the-ground implementation considerations for secondary and postsecondary programs, and future of work implications for the sector. The Advisory Committee further informed important decision-points including adjusting the course map and promising credential endpoints, selecting strategic early college credit courses, and identifying key competencies for target courses lacking broad statewide articulation. The culmination of EdSystems’ analysis and the input of the Advisory Committee is reflected in this guide.

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<sup>2</sup> For the analysis of this guide, EdSystems surveyed City Colleges of Chicago, College of DuPage, Elgin Community College, Illinois Central College, Illinois Eastern Community Colleges, Kankakee Community College, Lake Land College, and Rock Valley College.

### III. Priority Occupations and Promising Credentials

Occupations in architecture, construction, and energy encompass an ever-growing array of well-paying career opportunities across Illinois. In the Chicago area, the Chicagoland Workforce Funders Alliance estimates there are more than 100,000 construction trades workers in the region, with 11,000 new hires expected annually through 2026.<sup>3</sup> Illinois is a leading state for jobs in the energy industry, with the state ranked 13th in the nation for the total number of solar jobs.<sup>4</sup> As both the State of Illinois and federal government consider infrastructure investments, including projects to mitigate climate change, the continued availability of a qualified workforce will serve as an anchor for Illinois' economic growth.

#### Promising Credential Program Categories

The project team's analysis of occupations and related postsecondary credentials in the architecture, construction, and energy sectors led to an identification of four credential program categories or pathways and additional subcategories:

1. **Trades and technicians** pathways and credentials leading to hands-on, skilled positions relating to the installation and repair of various building and energy system projects. Subcategories include:
  - a. **Construction trades**, involving a variety of occupations in the building trades such as carpenters, construction laborers, plumbers, and electricians.
  - b. **Energy technicians**, involving the installation and repair of renewable energy systems, such as wind and solar energy, and electric vehicle charging systems.
2. **Heating, ventilation, air condition, and refrigeration (HVACR) and maintenance** credentials for skilled labor positions as HVACR technicians or as installers of weatherization and energy efficiency improvements for residential and commercial buildings.
3. **Architecture and drafting** credentials that either prepare individuals for entry-level computer aided drafting and design (CAD), or that prepare students to transfer into bachelor' degree programs in architecture and similar fields.
4. **Construction management** credentials preparing students to actively manage complex construction and energy installation projects.

Although not depicted in the diagram, engineering credentials are also critical for these occupational areas, which prepare students for a range of careers to analyze, design, evaluate, and continuously improve complex manufacturing and industrial systems. Pathways to Engineering credentials are detailed in the [State of Illinois Models Programs of Study Guide in Manufacturing and Engineering](#).

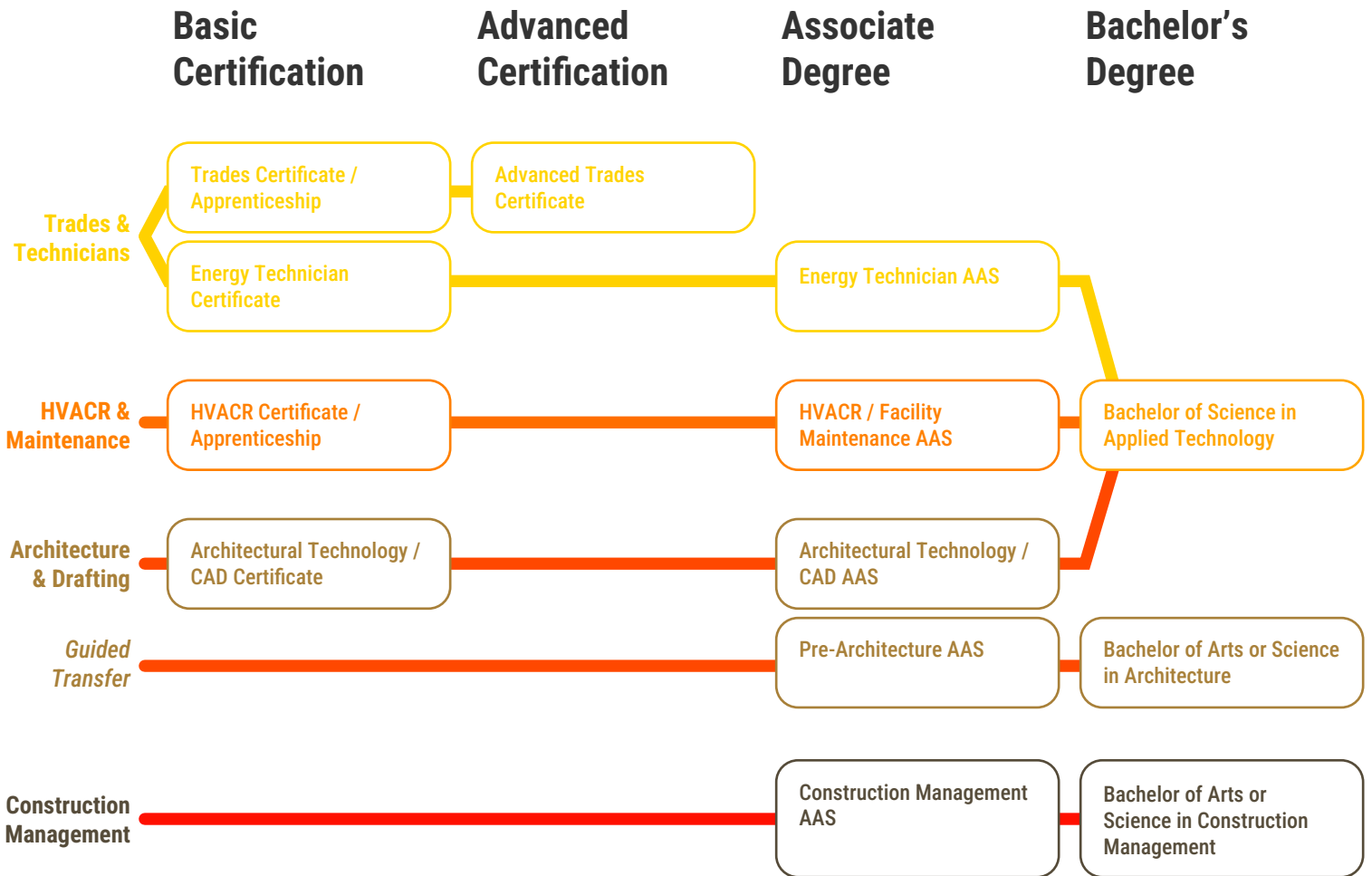
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<sup>3</sup> Origami Works Foundation and Embarc Chicago (2021, January). "Construction Trades Guidebook." Chicagoland CareerPathways. [careerpathways.net/wordpress/wp-content/uploads/2021/01/Construction-Trades-Guidebook.pdf](https://careerpathways.net/wordpress/wp-content/uploads/2021/01/Construction-Trades-Guidebook.pdf)

<sup>4</sup> Interstate Renewable Energy Council (n.d.). "Illinois: Solar and Clean Energy Jobs." Retrieved February 2024, from [irecusa.org/illinois-solar-and-clean-energy-jobs/](https://irecusa.org/illinois-solar-and-clean-energy-jobs/)

Illinois Department of Employment Security, "[Long-Term Occupational Projections 2020-2030](#)" and "[Wage Information: Occupational Employment and Wage Statistics \(OEWS\) Statewide](#)." Retrieved December 2023, from [ides.illinois.gov](https://ides.illinois.gov).

## Diagram: Postsecondary Opportunities





**Table: Selected Occupations, Wages, and Job Growth**

Program	Typical Job(s)	Living Wage Potential*	Median Hourly Wage**	IL Growth: Change over 10 years ***	IL Annual Job Openings***	Typical Educational Requirements
<b>Trades &amp; Technicians</b>	<a href="#">Carpenters</a>	Medium	\$33.17	4.3%	3,091	High School Diploma
	<a href="#">Construction Laborers</a>	Medium	\$30.86	10.4%	4,444	
	<a href="#">Plumbers, Pipefitters, and Steamfitters</a>	High	\$48.86	9.6%	2,038	
	<a href="#">Electricians</a>	High	\$44.14	12.7%	3,006	High School Diploma + Some College
	<a href="#">Electrical Power-Line Installers and Repairers</a>	High	\$51.23	9.4%	432	Postsecondary Certificate + Some College
	<a href="#">Electrical and Electronics Repairers, Commercial and Industrial Equipment</a>	Medium	\$32.40	8.0%	142	
	<a href="#">Electrical and Electronics Repairers, Powerhouse, Substation, and Relay</a>	High	\$51.89	4.3%	39	
<b>HVACR &amp; Maintenance</b>	<a href="#">Heating, Air Conditioning, and Refrigeration Mechanics and Installers</a>	Medium	\$28.93	9.5%	967	Postsecondary Certificate + Some College
	<a href="#">First-Line Supervisors of Mechanics, Installers, and Repairers</a>	Medium	\$37.67	9.6%	1,434	High School Diploma + Some College
<b>Architecture &amp; Drafting</b>	<a href="#">Architects</a>	High	\$40.72	5.4%	524	Bachelor's Degree
	<a href="#">Architectural &amp; Civil Drafters</a>	Medium	\$29.90	0.1%	287	
<b>Construction Management</b>	<a href="#">Construction Managers</a>	High	\$50.91	13.5%	1,471	Bachelor's Degree
	<a href="#">Cost Estimators</a>	Medium	\$38.99	4.2%	481	
	<a href="#">First-Line Supervisors of Construction Trades and Extraction Workers</a>	High	\$46.38	9.5%	1,326	High School Diploma

\* Living wage potential is based on MIT's Living Calculator ([livingwage.mit.edu](http://livingwage.mit.edu)) for Illinois in 2024. Occupations with median salaries higher than the living wage for 1 adult + 1 child (\$39.63/hour) are considered as having a "high" living wage potential. Occupations with median salaries only higher than the living wage of 1 adult, no children (\$22.86/hour) are considered as having a "medium" living wage potential, and occupations with median salaries below the living wage of 1 adult, no children (less than \$22.86/hour) are considered as having a "low" living wage potential.

\*\* Illinois Department of Employment Security (2022). Wage Information: Occupational Employment and Wage Statistics (Statewide). Retrieved April 2, 2024, from [ides.illinois.gov/resources/labor-market-information/oews.html](https://ides.illinois.gov/resources/labor-market-information/oews.html)

\*\*\* Illinois Department of Employment Security. Employment Projections (Long-Term Occupational Projections 2020-2030). Retrieved April 2, 2024, from [ides.illinois.gov/resources/labor-market-information/employment-projections.html](https://ides.illinois.gov/resources/labor-market-information/employment-projections.html)

## High-Priority Occupations

The high-priority occupations associated with each of the promising credential program areas are identified in the table entitled Select Occupations, Wages, and Job Growth. A wide range of occupations in the construction trades, and HVACR and repair meet the job growth and living wage threshold described in this guide. This table also demonstrates the substantial job growth projected for construction management occupations, in contrast to substantially fewer openings in architecture, CAD, and surveying occupations.

While many think of renewable energy jobs as primarily solar photovoltaic installers or wind turbine technicians, those occupations are of relatively low volume in Illinois. This may be the result of labor data lagging behind on-the-ground implementation or too narrowly defined roles in renewable energy. However, there are a large number of occupations supporting the expansion of electric vehicles, solar power, and wind energy that are deeply intertwined with the trade roles to install, build, or repair Illinois' electrical infrastructure, primarily focused on connecting renewable energy to the state's electrical grid or expanding the network for recharging electric vehicles.<sup>5</sup> Thus, the selected occupations table lists various roles in electrical repair and infrastructure that should be considered a part of the renewable energy sector in trades and will experience substantial growth over the next decade.

## Levels of Education Needed

The levels of education needed for the various pathways in this guide vary greatly. More than half of the workforce's carpenters, plumbers pipefitters, and laborers have no postsecondary education, making this pathway highly accessible for students receiving industry credentials and training in high school. Entry-level positions for electricians and energy technicians, HVACR, and maintenance are accessible after high school graduation or upon completion of a short-term postsecondary credential. A key consideration for individuals seeking to enter the construction trades after high school is whether to enter directly into entry-level non-union employment, seek a union apprenticeship, or pursue postsecondary education at a community college. While individuals can enter directly into entry-level, low-wage positions directly after high school, an apprenticeship or further education is generally required for higher-skill and higher-paying occupations. (Additional considerations for advising students on union vs. non-union pathways are detailed later in this guide.) In the construction trades, progression into supervisory roles is typically through on-the-job training and related industry credentials, rather than through attainment of an associate or bachelor's degree.

Careers in architectural technology or CAD typically require at least a long-term certification (e.g., 40 or more credits) or an Associate of Applied Sciences (AAS) degree. As completion of the AAS better positions workers to enroll in a Bachelor of Science degree program at a later stage in their careers, the guide recommends an AAS in the architecture and drafting pathway.

Several Illinois universities offer a Bachelor of Science in Applied Technology, to which AAS degrees articulate.<sup>6</sup> Whenever possible, community colleges should ensure that AAS degrees articulate to bachelor's degree programs at Illinois public universities, recognizing that students may need targeted instructional supports to complete the math sequence requirements typical of bachelor's degrees.

Architects must be licensed by the Illinois Department of Financial and Professional Regulation, which requires completion of a professional architecture degree program approved by the National Architectural Accrediting Board (NAAB). Typically, students must complete a pre-professional bachelor's degree program in architecture, and then a NAAB-accredited Master of Architecture program requiring

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<sup>5</sup> Green Careers. U.S. Bureau of Labor Statistics. Retrieved February 2024, from [bls.gov/green/greencareers.htm](https://bls.gov/green/greencareers.htm)

<sup>6</sup> Examples include Northern Illinois University's Bachelor of Science in Technology, Southern Illinois University's Bachelor of Science in Industrial Management and Applied Engineering, or GSU's Bachelor of Arts in Manufacturing Management.

an additional 2–3 years of study. The Model Programs of Study incorporates a pre-architecture AAS program, which several Illinois community colleges offer to articulate into baccalaureate architecture programs within the Illinois university system. Pre-architecture AAS programs ensure students meet the requirements for junior year studio placement; a key milestone necessary for a student to complete the program in two additional years.

Occupations in construction management typically require a bachelor's degree. The Advisory Committee noted that individuals with an AAS can enter certain roles, but would need extensive on-the-job training and, most likely, additional education for continued advancement into higher-paying roles.

### **Advisory Committee Considerations**

The Advisory Committee emphasized the need for students to leave high school with a fundamental set of both business and construction skills foundational to all pathways. The committee noted the growing role of technology in all areas of construction and design, and that current technologies must be integrated into all stages of the pathway model. Committee members also emphasized the need for students to have a strong understanding of reading schematics (including traditional blueprints and electronic versions), suggesting that this skillset should be embedded across pathways courses, instead of through a single course on blueprint reading. In the construction trades, the committee recommended informing students of the differences between union and non-union pathways, and the requirements and expectations for union apprenticeships. Finally, the Advisory Committee recommended that pathways expose students to occupations in construction and energy management, as areas that provide significant job opportunities but are not often presented to high school students.

## Union vs. Non-Union Pathway Opportunities

School districts and colleges preparing students for the construction trades need to ensure that students leave high school with a strong understanding of both union and non-union pathways.

The following information is adapted from a September 2020 report prepared for the Chicagoland Workforce Funders Alliance, "Pathways in the Chicago-Area Building Trades," along with information provided by the Advisory Committee.<sup>7</sup>

- Estimates of the unionization rate of Illinois construction workers varies significantly by source, ranging from one-third to one-half of construction workers (with the remainder non-union).
- In the construction trades, hourly wages vary significantly for union and non-union positions. Non-union workers typically work for smaller contractors, on smaller projects.
  - The starting hourly wage for non-union positions are typically close to minimum wage, while union trade apprenticeships start at 50% of union journey worker wage (\$17–25/hour in the Chicago area)
- Annual compensation levels will depend on the number of hours worked, and young people must factor in expected hours when determining compensation. Some non-union roles with lower hourly wages may be able to provide consistent work hours if the hiring company has a consistent workflow.
- Union apprenticeships involve from three to five years of near full-time paid work experience combined with extensive schooling during the first two years. While union apprenticeships require years of training, the unions are seeking individuals for their programs that can add value right away.
- The typical apprenticeship program requires apprentices to be age 18; have a high school diploma or GED; have a driver's license and access to a car (for transportation to both training locations and jobsites); pass an aptitude test that typically involves questions on simple algebra, unit conversions, mechanical reasoning, and reading comprehension; pass a drug test; demonstrate physical fitness; and demonstrate motivation and relevant experience through an interview.
- Unions limit the number of applicants and can be highly competitive. Some have as many as 5,000 annual applicants for only a few hundred positions.
- Few trade apprentices begin immediately out of high school, with most beginning after age 21. However, it is unclear whether younger applicants are being filtered out, or whether younger people are not applying. High school pathway program coordinators should seek strong relationships with trade apprenticeship programs to increase opportunities for high school graduates to enter directly into trade apprenticeships after high school graduation. Entry-level positions with a non-union construction company can develop experience for individuals that intend to later apply to an apprenticeship, as can training through community college programs.
- The vast majority of construction trades training outside of union apprenticeships is for electricians, HVACR, and welding. Community college programs in the construction trades and HVACR either provide preparation for an apprenticeship program or non-unionized entry-level employment in the trades or with utilities.

<sup>7</sup> Lewis, J., & Paral, R. (2015, June 24). Pathways in the Chicago-Area Building Trades. Chicagoland Workforce Funder Alliance. [chicagoworkforcefunders.org/wp-content/uploads/2021/01/Construction-Report-Jan-2021.pdf](http://chicagoworkforcefunders.org/wp-content/uploads/2021/01/Construction-Report-Jan-2021.pdf)

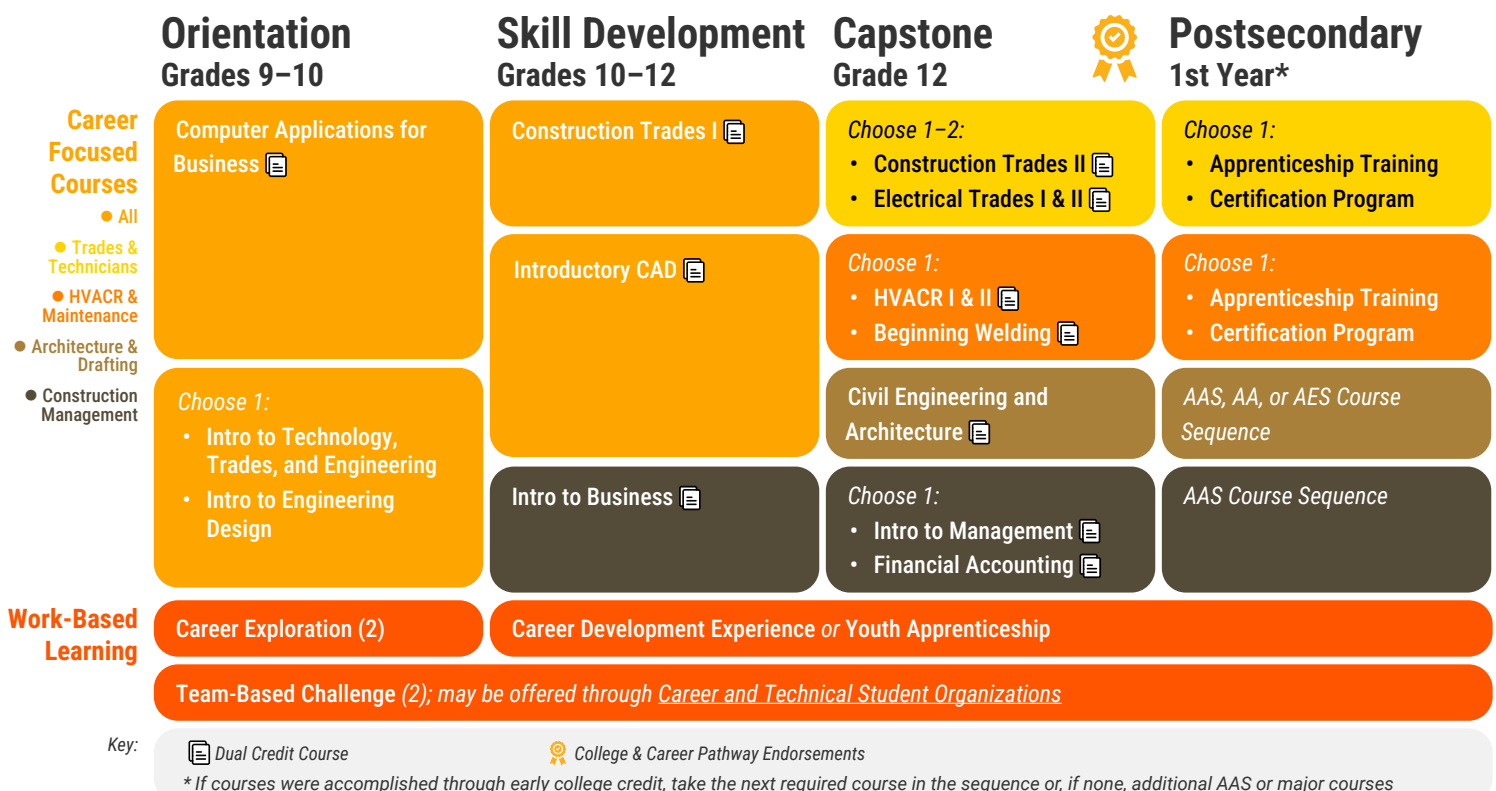
## IV. Programs of Study Sequence Description

Students should start a career-focused instructional sequence with an orientation course in 9th or 10th grade, with students engaging in career awareness and exploration in the middle school grades if possible. With this early start, students have more openings in their schedule to complete skill development and capstone options, obtain significant early college credits, earn valuable industry credentials, and potentially acquire a [College and Career Pathway Endorsement](#) before high school graduation.

As school districts and their community college partners develop a program of study sequence, they should ensure that the high school coursework enables all students in the pathways to attain Illinois' [Recommended Essential Employability and Technical Competencies](#) and the top relevant technical competencies (see [Appendix A](#)).

The Model Programs of Study in Architecture, Construction, and Energy begin in high school by addressing foundational skills and knowledge across all pathways, and then, at the skill development and capstone levels, branch into four separate pathways: trades and technicians, HVACR and maintenance, architecture and drafting, or construction management. Within postsecondary programs, students are prepared to pursue promising credentials in all of these areas, with trades apprenticeships serving as an option for the trades and HVACR pathways. Students can typically continue the course sequence through stackable credentials and associate degrees to a Bachelor of Science degree program.

Diagram: **Career-Focused Instructional Sequence**



## High School Career-Focused Instructional Sequence and Work-Based Learning

The career-focused instructional sequence in this program of study builds from a set of courses providing an orientation to careers across the sectors and emphasizing key foundations skills, towards a set of capstone courses tailored to each of the separate pathways. Ideally, students would begin career awareness and exploration in the middle school grades then start the career-focused instructional sequence with an orientation course in 9th grade. With an early start, students will have more openings in their schedule to complete skill development and capstone options, to obtain significant early college credits, and to earn valuable industry credentials before high school graduation.

The proposed courses at the orientation and skill development levels provide students with information on an array of careers in the architecture, construction, and energy sectors, includes courses that can typically be offered using high school facilities and instructors, and builds a general skillset needed for different careers across these sectors. The more advanced coursework at the capstone level enables students to deeply explore a pathway of interest and develop skills needed for entry-level employment or further postsecondary education.

### Orientation Coursework

The Model Programs of Study in Architecture, Construction, and Energy commences with two suggested courses: a course focused on foundational computer applications and technology, and an introductory course providing a broad orientation to the field.

The first course, focused on computer applications and technology, is the Illinois Articulation Initiative (IAI)-affiliated Computer Applications for Business. This course is designed for prospective business majors but applicable to all, aiming to train students in general software applications including word processing, spreadsheets, and internet access methods.

The second course provides a broad introduction to all architecture, construction, and energy pathways. Two options are provided: Introduction to Technology, Trades, and Engineering or Introduction to Engineering Design. While Introduction to Engineering Design is affiliated with an IAI course, it may be difficult for high schools to offer due to the teacher qualification and course content requirements; however, the course is aligned to the [ISBE Career and Technical Education \(CTE\) course](#) Introduction to Technology and Engineering. The Introduction to Engineering Design course combines pathways orientation with an introduction to the design development process.

To begin preparing for the College and Career Pathway Endorsements, students should also participate in multiple virtual and in-person visits to employer sites to better understand authentic industry environments and engage with professionals in the field. Students should hear from a variety of guest speakers in an array of architecture, construction, and energy careers to better understand opportunities in the field. Through the orientation course, students should be prepared to document their own personalized career pathway that leads to a promising credential.

### Skill Development Coursework

The skill development course recommendations include (i) Construction Trades I for all students, across all pathways; (ii) Introductory CAD, for students in all pathways other than construction management; and (iii) Introduction to Business, for students in the construction management pathway.

The Construction Trades I course (or two-semester course sequence) provides students a strong foundation in safety, the design and construction process, measuring and scaling, and other foundational concepts for promising credentials in the field. A strong foundation in construction practices, processes, and principles is critical for students planning for a career in any of the proposed pathways, even if the student ultimately pursues a role in the business- or design-oriented pathways. Schools should



integrate this course with Geometry in Construction, a model where geometry curriculum is taught in the construction context, co-taught by a math and career and technical education teacher. Even if not taught as an integrated Geometry in Construction course, math competencies should be incorporated with reference to the Transition to Technical Math course competencies outlined in the [Statewide Transitional Math Competencies and Policies](#).

The recommended Construction Trades I course competencies, detailed later in this guide, scaffold on to the orientation-level courses to further emphasize awareness and understanding of career pathways in the field. It emphasizes application of safety, construction processes, and other basic concepts under close teacher direction, and should utilize authentic projects addressing realistic customer needs. Essential employability competencies should be reinforced, with a priority emphasis on communication, problem-solving, initiative and self-drive, reliability and accountability, and adaptability and flexibility. Classroom instruction should include a team-based challenge that provides hands-on experience with, at minimum, fundamental construction techniques for framing, drywalling, and finishing. These trade areas are more feasible for incorporation into a high school classroom, as opposed to areas such as masonry or machinery operation.

In addition, students should attain the Occupational Safety and Health Administration (OSHA) ten-hour course completion card, which can be earned online through the [CareerSafe](#) program. Some Illinois community colleges offer prior learning to students who enroll with this credential.

At the skill development level, students should enroll in either Introductory CAD or, for students in the construction management pathway, Introduction to Business. Introductory CAD provides an introduction to computer aided drafting and design and its role in various technical occupations. The course's recommended competencies, detailed later in the guide, include a progression from fundamental principles of hand drawing to the basics of 2D CAD operations, with a preliminary introduction to 3-D CAD (with students learning more advanced 3D CAD operations in a subsequent course). This course should also provide students with an understanding of how different drawings are used for different trades, with a basic overview of the construction drawing process.

For students in the construction management pathway, Introduction to Business is a recommended course that provides students with a foundational understanding of business and management principles applicable across multiple business-related postsecondary programs. While Intro to Business is recommended, students in the construction management pathway with sufficient schedule flexibility should also consider Introductory CAD as an additional elective.

To be on track to earn the College and Career Pathway Endorsements, regional high school and community college partners should ensure students have earned three to six early college credit hours through the skill development courses. Additionally, students should continue progressing through the [work-based learning continuum](#). Classroom instruction should be coupled with continued employer site visits, an opportunity for students to participate in a job shadow experience at an employer site, and clubs or challenges related to their program area. Team-based challenges should be completed either as activities embedded within course curriculum or through a student/extracurricular organization. Students should be encouraged to engage in student or professional architecture, construction, or energy organizations, including Career and Technical Student Organizations such as SkillsUSA Illinois or Technology Student Association of Illinois, to continue to build familiarity with the profession and pathways towards various career options.

### Capstone Coursework

At the capstone level, students engage in advanced topics relating to their individualized postsecondary pathway direction. The recommendations for students with a trades and technician focus are to either complete Construction Trades II, or, for students interested in pursuing an electrician career, Electrical Trades I/II.

The Construction Trades II course (or two-semester course sequence) develops students' advanced construction skills, either for entry-level employment, to continue into an apprenticeship or postsecondary program, or as a foundation for other related programs such as energy technicians or HVACR. As detailed in the recommended course competencies later in this guide, students in this course should be supported to make an informed decision as to whether to pursue postsecondary training and employment in the trades and be prepared for local apprenticeship application processes and requirements. The course's other competencies scaffold upon those introduced in Construction Trades I to prepare students for either entry-level employment or further postsecondary education and training. The course competencies intentionally emphasize knowledge needed for energy technician roles, including an understanding of work at height expectations typical for solar and wind energy jobs, and introduce students to the relationship between building envelopes and systems to energy utilization and efficiency.<sup>8</sup>

At the capstone level, all students should complete a career development experience (CDE) of at least 60 hours in length. As their schedules permit, students can participate in a for-credit cooperative class to obtain work experience in addition to the recommended career-focused courses.

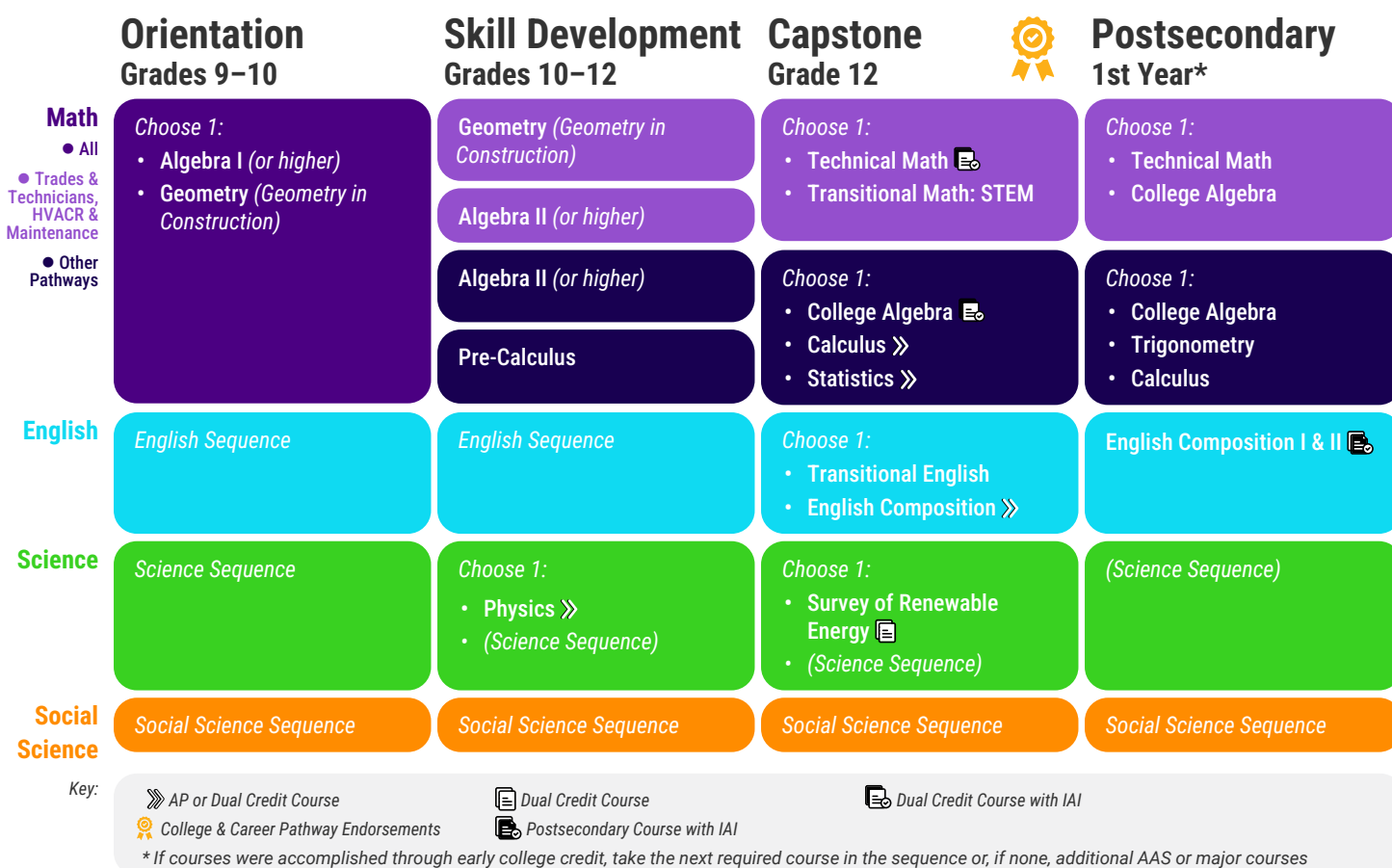
For pathways other than trades and technicians, the recommended capstone courses enable students to engage in advanced topics specific to the pathway, with coursework aligned to community college program sequences. In the construction management pathway, students should be offered Intro to Management because that course is broadly applicable to construction management and business sequences.

To be eligible for the College and Career Pathway Endorsements, all students should complete a career development experience of at least 60 hours in length and earn at least six or more early college credit hours, through a mix of both career-focused and general education coursework. Additionally, students should continue participation in clubs, professional organizations, or challenges related to their pathway.

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<sup>8</sup> One curricular resource for energy efficiency concepts is the energy code curriculum provided by the Smart Energy Design Assistance Center, available at [smartenergy.illinois.edu/community-college-energy-code/](https://smartenergy.illinois.edu/community-college-energy-code/).

## Diagram: General Education Instructional Sequence



### High School General Education Courses

There are several critical considerations for general education coursework before graduating high school. The courses mentioned here are frequent requirements for many postsecondary promising credentials in architecture, construction, and energy and enhance students' opportunities for postsecondary success in addition to the career-focused courses already delineated.

- In **science**, students should complete physics, if possible, as either Advanced Placement or dual credit. At the senior year, Survey of Renewable Energy was identified by the Advisory Committee as an emerging dual credit or dual enrollment course opportunity and is included. This course involves the exploration of environmental, social, and basic technological issues relating to renewable energy technologies.
- In **math**, students should complete the highest math course possible in a calculus-based course sequence to be prepared for the full range of career options in Architecture, Construction, and Energy. Districts should consider math courses that contextualize math application in career fields, such as Geometry in Construction for all students in 9th or 10th grade, and technical math courses emphasizing application for students planning to pursue a career in the trades or as technicians. Students that do not demonstrate readiness for an early college math course during their senior year of high school should enroll in a STEM transitional math course that guarantees placement into

college algebra at the postsecondary level. Students pursuing postsecondary credentials relating to the trades and technicians pathways may instead consider Technical Math, a transitional math course, to guarantee placement into the required math for that credential at the partner community college.

- In **English**, students prepared for college-level coursework in their senior year should enroll in a dual credit English Composition course (if available) or Advanced Placement English Language and Composition. If students are not prepared for college-level coursework, students should enroll in a transitional English course that, upon successful completion, guarantees placement into the partner community college's English Composition course.

### **First-Year Postsecondary Courses**

The recommended first-year postsecondary courses build upon the knowledge and skills recommended at the capstone level. As described in the Union vs. Non-Union Pathway Opportunities section of this guide, students pursuing careers in the construction trades should carefully consider whether to apply to a trades apprenticeship or enroll in a postsecondary certificate program.

As is recommended at the high school level, community colleges should pursue opportunities to integrate and align career-focused coursework and work-based learning opportunities.

In the general education course areas, students will take the required 100-level courses. If the 100-level courses have been accomplished through early college credit, students will take the next required course in the subject or, if none, additional courses in their major.

## V. Strategic Dual Credit Courses: Competency Descriptions

EdSystems and ICCB convened a stakeholder Advisory Committee of secondary, postsecondary, and private sector representatives to vet the Model Program of Study recommendations. A smaller working group further convened to identify key competencies for the targeted early college courses currently lacking current statewide articulation. In architecture, construction, and energy, these courses are Construction Trades I & II, and Introduction to Computer Aided Drafting (CAD).

<b>CONSTRUCTION TRADES I</b> Key Competencies	
<b>Career Awareness</b>	<p>Students can demonstrate awareness of the career pathways in architecture, construction, and energy in order to plan a personalized pathway leading to a promising credential.</p> <p>Students have engaged in career exploration activities that include guest speakers and virtual and in-person site visits with architecture and construction firms, renewable energy companies, and utilities.</p>
<b>Safety Mindset</b>	<p>Students can use their awareness of safety practices and PPE in order to demonstrate a safety mindset when navigating a construction environment.</p> <p>Students are prepared to attain an OSHA 10-hour course completion card.</p>
<b>Introduction to Tools</b>	<p>Students can use their understanding of simple hand and power tools in order to identify, correctly set-up, and operate them.</p>
<b>Material Handling</b>	<p>Students can use their knowledge of material types, standard sizes, and safe handling practices to identify and utilize materials needed for basic project types.</p>
<b>Measuring and Scaling</b>	<p>Students can use their understanding of measurement systems and scaling concepts to demonstrate proper use of measuring tools, as well as conversion between decimal and fraction units.</p>
<b>Design and Construction Process</b>	<p>Students can use their awareness of basic concepts in design and construction in order to describe the steps in a residential construction project, with an introduction to, at minimum, blueprints, floor plans, foundations, carpentry, plumbing, electrical, HVAC, and masonry systems.</p>
<b>Layout and Schematic Reading</b>	<p>Students can use their understanding of basic project layout and schematic concepts to differentiate among schematics needed for different trade areas (e.g., carpentry, electrical, plumbing) and apply their understanding in authentic situations.</p>
<b>Cost Estimation</b>	<p>Students can apply of basic cost estimation principles to estimate labor and material costs in an authentic situation.</p>

## CONSTRUCTION TRADES II

### Key Competencies

<b>Career Decision Making</b>	<p>Students can use their understanding of the physical demands, education requirements, transportation needs, and earning potential of various construction career pathways in order to make an informed decision as to whether to pursue postsecondary training and employment in a particular pathway.</p> <p>Students are aware of and prepared for local apprenticeship application, interview, testing, and fitness demonstration processes and requirements.</p>
<b>Safety Compliance</b>	<p>Students can use their knowledge of safety principles and regulations in order to maintain a secure work environment, safely engage in construction processes, and comply with local, federal, and jobsite health and safety demands.</p> <p>Students are prepared to attain or renew CPR and First Aid certifications from an accrediting body.</p>
<b>Work at Height</b>	<p>Students can use their understanding of ladders, scaffolding, safety harnesses, and rigging to engage in safe work at height construction practices; students understand work at height expectations in various trade areas.</p>
<b>Cost Estimation</b>	<p>Students can use their knowledge of material and labor costs and technical math principles to accurately estimate both the material and labor costs of an authentic project.</p>
<b>Energy Utilization and Efficiency</b>	<p>Students can apply their understanding of building envelopes and mechanical, electrical, and plumbing (MEP) systems in an authentic assessment of impacts on a building's energy utilization and efficiency.</p>
<b>Construction Application</b>	<p>Students can use their knowledge of schematic reading and apply fundamental construction skills and techniques to, with minimal supervision, interpret the requirements of schematics and safely construct or install an authentic project.</p> <p>Ideally, students are allowed to choose an area of specialization such as carpentry, plumbing, electrical, or masonry.</p>



## INTRODUCTION TO COMPUTER AIDED DRAFTING (CAD)

### Key Competencies

Students can use their understanding of the construction drawing process and various trades to read and interpret authentic architectural and engineering drawings, including drawings from various trades areas.

<b>CAD Hardware</b>	Students can use their knowledge of a CAD workstation to identify and use its hardware configurations.
<b>Basic Drawing Functions</b>	Students can use their knowledge of CAD software to construct and revise 2-D Drawings, including basic draw, editing, and layering.
<b>View Selections:</b>	Students can utilize their understanding of appropriate CAD drawing views to choose among orthographic, section, auxiliary, and pictorial where appropriate.
<b>Notation</b>	Students can produce appropriate drawing notes, symbols, and schedules.
<b>Dimensioning and Tolerancing</b>	Students can apply their understanding of basic dimensioning and tolerancing concepts in authentic scenarios.
<b>2D and 3D Comparison</b>	Students can demonstrate an understanding of how 2D and 3D CAD operations and software are each used in authentic scenarios and processes.
<b>Reading and Interpretation</b>	Students can use their understanding of the construction drawing process and various trades to read and interpret authentic architectural and engineering drawings, including drawings from various trades areas.

# Appendices

## A: Cross-Sector Essential Employability and Entrepreneurial Competencies

The following cross-sector competencies are from “[Recommended Technical and Essential Employability Competencies for College and Career Pathway Endorsements](#),” a document developed through an iterative process involving public-private steering committees established pursuant to the Postsecondary and Workforce Readiness Act in order to implement College and Career Pathway Endorsements.

ESSENTIAL EMPLOYABILITY COMPETENCIES	
<b>Teamwork &amp; Conflict Resolution</b>	Students can use their understanding of working cooperatively with others to complete work assignments and achieve mutual goals.
<b>Communication</b>	<p><b>Verbal:</b> Students can use their understanding of English grammar and public speaking, listening, and responding, convey an idea, express information, and be understood by others.</p> <p><b>Written:</b> Students can use their understanding of standard business English to ensure that written work is clear, direct, courteous, and grammatically correct.</p> <p><b>Digital:</b> Students can use their understanding of email, keyboarding, word processing, and digital media to convey work that is clear, direct, courteous, and grammatically correct.</p>
<b>Problem Solving</b>	Students can use their critical thinking skills to generate and evaluate solutions as they relate to the needs of the team, customer, and company.
<b>Decision Making</b>	Students can use their understanding of problem solving to implement and communicate solutions.
<b>Critical Thinking</b>	Students can use their understanding of logic and reasoning to analyze and address problems.
<b>Adaptability &amp; Flexibility</b>	Students can use their understanding of workplace change and variety to be open to new ideas and handle ambiguity.
<b>Initiative &amp; Self-Drive</b>	Students can use their understanding of goal setting and personal impact to achieve professional goals and understand personal impact.
<b>Reliability &amp; Accountability</b>	Students can use their understanding of commitment, time management, and follow through to ensure that a professional team functions properly and meets collective goals.
<b>Cultural Competence</b>	Students can use their understanding of diversity and inclusion to communicate and work effectively across a multitude of abilities, cultures, and backgrounds.
<b>Planning &amp; Organizing</b>	Students can use their understanding of time management to plan effectively and accomplish assigned tasks.

## ENTREPRENEURIAL COMPETENCIES

<b>Principles of Entrepreneurship</b>	Students can apply their understanding of the process and characteristics of business development and promotion in order to apply strategies of innovation to personal and professional business pursuits.
<b>Innovation &amp; Invention</b>	Students can use their understanding of idea generation, design thinking, product and business development in order to introduce and process new and effective ideas.
<b>Growth Mindset</b>	Students can use their understanding of learning from challenges, set-backs, and failure in order to adapt strategies and continue efforts to achieve personal goals.

## B: 2021 Advisory Committee Membership

### **Craig Anz**

Associate Professor  
Southern Illinois University

### **Jeff Bott**

CTE Division Head  
Buffalo Grove High School

### **John Cabage**

Associate Professor & Construction Management  
Coordinator  
Eastern Illinois University

### **Kristie Conklin**

Workforce Development Contractor  
ComEd

### **Kimberly Erskine**

Workforce Development Manager  
Ameren

### **Bridget French**

Executive Director of College & Career Readiness  
Rockford Public Schools

### **Angela Gerberding**

Associate Director for Integrated Career Programs  
ICCB

### **Chris Gordon, PhD**

Associate Dean, School of Engineering  
Southern Illinois University Edwardsville

### **Michael Hartge**

Senior Manager, Policy  
Hire 360 Chicago

### **Sam Herr**

CEO  
Renewal by Andersen - Central IL

### **Eric Hill**

Executive Director  
SkillsUSA of Illinois

### **Randy Hines**

Assistant Professor, CAD & Drafting  
Waubensee Community College

### **Board Member**

Illinois Design Educators Association

### **Sana Jafi**

Executive Director  
Chicago Learning Exchange

### **Nicole Joerger**

Associate Director for CTE  
ICCB

### **Luke Karner**

Pathways Program Manager  
Chicago Learning Exchange

### **Patrick Klette**

Electrical Technology Program Coordinator  
Kankakee Community College

### **Eric Lasky**

Vice Principal  
Ridgewood High School

### **Steven Lenz**

Chair, Heating & Air Conditioning Engineering  
Technology  
College of Lake County

### **Scott Loberg**

VP Education Safety  
Associated Builders & Contractors, Inc.

### **Dave Loomis**

Director, Center for Renewable Energy  
Illinois State University

### **Lucretzia Jamison**

Dean, Dawson Technical Institute  
City Colleges of Chicago Kennedy-King

### **Alicia Martin**

President & CEO  
Associated Builders & Contractors, Inc.

**Chris Merrill**

*Executive Director  
Illinois TSA*

**Uzma Noormohamed**

*Program Director  
Illinois Science and Energy Innovation Foundation*

**David Osborne**

*Principal Consultant  
Illinois State Board of Education*

**Kevin Rodgers**

*Director, Energy Management and Retail  
Brookfield Properties*

**Margi Schiemann**

*Director, Infrastructure Programs & Support  
Nicor*

**Clint Taylor**

*District Council Business Manager  
Illinois Laborers' & Contractors Joint Apprenticeship  
& Training Program*

**Whitney Thompson**

*Senior Director for CTE  
Illinois Community College Board*

**Lead EdSystems Staff**

**Jon Furr**

*Executive Director*

**Juan Jose Gonzalez**

*Pathways Director*

**Sarah Clark**

*Development and Communications Director*



## C: College and Career Pathway Endorsements Framework

The College and Career Pathway Endorsements system is a voluntary system for school districts to award endorsements on high school diplomas to graduates who have demonstrated readiness for college and careers. The following framework for the endorsement system is available as a [PDF download](#).



### College and Career Pathway Endorsements Framework



#### INDIVIDUAL PLAN

Each student completing an endorsement must have an individualized plan, which includes college planning linked to early understanding of career goals, financial aid, resume, and personal statement.

#### PROFESSIONAL LEARNING

Awareness, exploration, and preparation activities that provide opportunities for students to interact with adults in their workplace and gain essential employability and technical competencies.

9th	10th	11th	12th
At least 2 career exploration activities or 1 intensive experience		60 cumulative hours of paid or for credit, supervised career development experience(s) with a professional skills assessment r	
At least 2 team-based challenges with adult mentoring			

#### CAREER-FOCUSED INSTRUCTIONAL SEQUENCE

2 years of secondary coursework or equivalent that include essential employability and technical competencies, at least 6 hours of early college credit, and articulation to a postsecondary credential with labor market value.

9th	10th	11th	12th
Orientation / Introduction Courses			
	Skill Development Courses		
			Capstone / Advanced Courses

#### ACADEMIC READINESS

Ready for non-remedial coursework in reading and math by high school graduation through criteria defined by the school district and local community college.

## D: Illinois' Work-Based Learning Continuum

Illinois has a defined continuum of work-based learning opportunities, which spans from secondary to postsecondary. Components, defined in statute and the [Illinois Career Pathways Dictionary](#), include career awareness, career exploration, team-based challenges, career development experiences, youth or pre-apprenticeships, and apprenticeships.

*Work-Based Learning & Host Engagement Continuums*



Illinois' continuum represents the many forms of work-based learning that grow in intensity depending on the model. However, this continuum is not intended to convey a fixed or ideal progression. As individuals learn through their work-based learning experiences, they may return to less intensive models to develop different skills or explore additional interests. Individuals should be supported to engage in these activities iteratively as they explore the multiple entry and exit points of career pathways.

Providing high-quality work-based learning requires strong partnerships between educators and regional employers. As the intensity of students' experiences progress, so too does the role of employer partners serving as host sites.



# Model Programs of Study in Architecture, Construction, and Energy

## Recommended Courses

### Orientation Grades 9–10

### Skill Development Grades 10–12

### Capstone Grade 12



### Postsecondary 1st Year\*

#### Career Focused Courses

- All
- Trades & Technicians
- HVACR & Maintenance
- Architecture & Drafting
- Construction Management

Computer Applications for Business

Construction Trades I

Choose 1–2:

- Construction Trades II
- Electrical Trades I & II

Choose 1:

- Apprenticeship Training
- Certification Program

Choose 1:

- Intro to Technology, Trades, and Engineering
- Intro to Engineering Design

Introductory CAD

Choose 1:

- HVACR I & II
- Beginning Welding

Choose 1:

- Apprenticeship Training
- Certification Program

Intro to Business

Civil Engineering and Architecture

AAS, AA, or AES Course Sequence

Choose 1:

- Intro to Management
- Financial Accounting

AAS Course Sequence

#### Work-Based Learning

Career Exploration (2)

Career Development Experience or Youth Apprenticeship

Team-Based Challenge (2); may be offered through Career and Technical Student Organizations

#### Math

- All
- Trades & Technicians, HVACR & Maintenance
- Other Pathways

Choose 1:

- Algebra I (or higher)
- Geometry (Geometry in Construction)

Geometry (Geometry in Construction)

Choose 1:

- Technical Math
- Transitional Math: STEM

Choose 1:

- Technical Math
- College Algebra

Algebra II (or higher)

Algebra II (or higher)

Choose 1:

- College Algebra
- Calculus >>
- Statistics >>

Choose 1:

- College Algebra
- Trigonometry
- Calculus

Pre-Calculus

#### English

English Sequence

English Sequence

Choose 1:

- Transitional English
- English Composition >>

English Composition I & II

#### Science

Science Sequence

Choose 1:

- Physics >>
- (Science Sequence)

Choose 1:

- Survey of Renewable Energy
- (Science Sequence)

(Science Sequence)

#### Social Science

Social Science Sequence

Social Science Sequence

Social Science Sequence

Social Science Sequence

Key:

AP or Dual Credit Course

Dual Credit Course

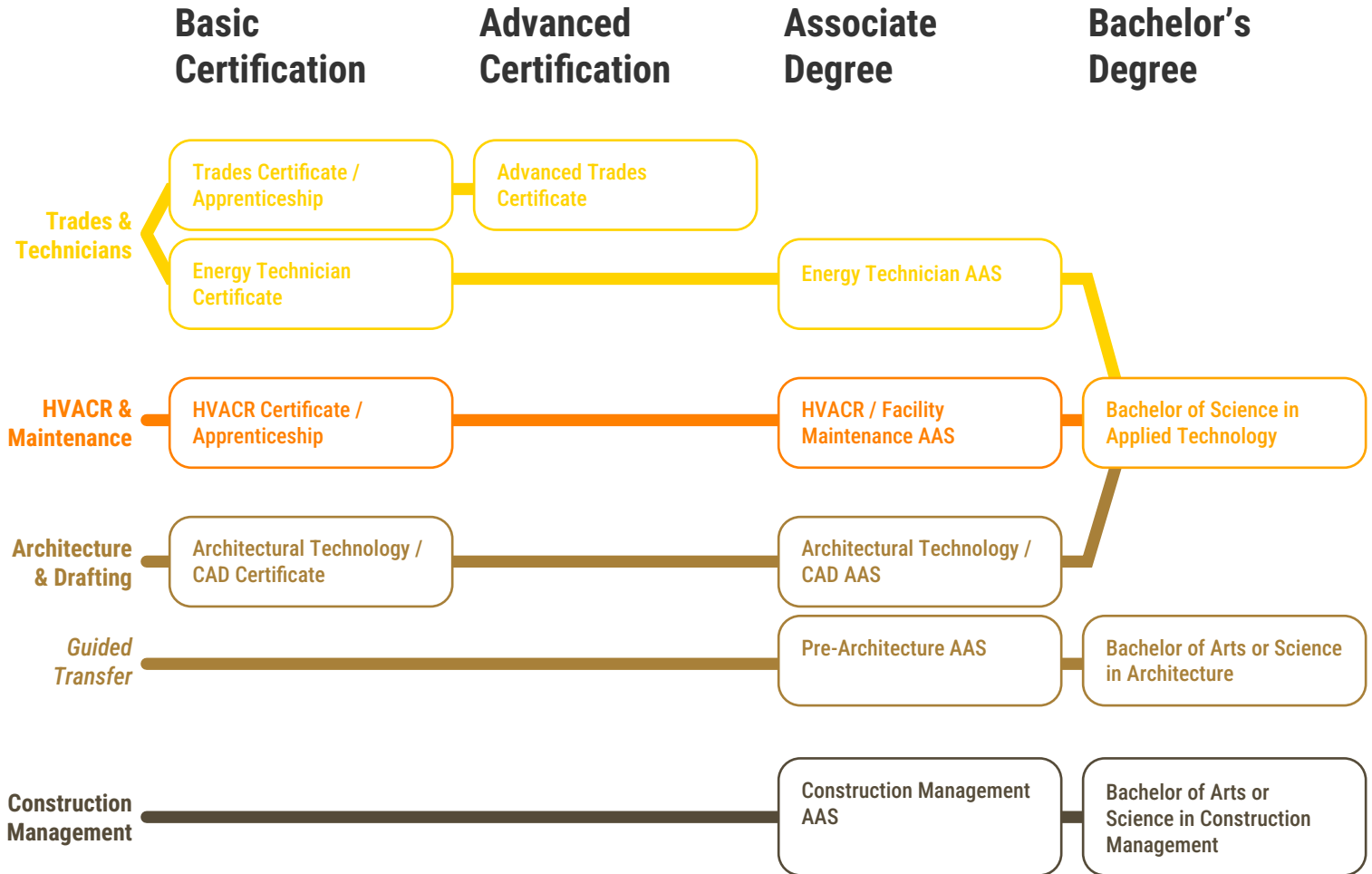
Dual Credit Course with IAI

College & Career Pathway Endorsements

Postsecondary Course with IAI

\* If courses were accomplished through early college credit, take the next required course in the sequence or, if none, additional AAS or major courses

## Postsecondary Opportunities



## Selected Occupations, Wages, and Job Growth

Program	Typical Job(s)	Living Wage Potential*	Median Hourly Wage**	IL Growth: Change over 10 years ***	IL Annual Job Openings***	Typical Educational Requirements
Trades & Technicians	<a href="#">Carpenters</a>	Medium	\$33.17	4.3%	3,091	High School Diploma
	<a href="#">Construction Laborers</a>	Medium	\$30.86	10.4%	4,444	
	<a href="#">Plumbers, Pipefitters, and Steamfitters</a>	High	\$48.86	9.6%	2,038	
	<a href="#">Electricians</a>	High	\$44.14	12.7%	3,006	High School Diploma + Some College
	<a href="#">Electrical Power-Line Installers and Repairers</a>	High	\$51.23	9.4%	432	Postsecondary Certificate + Some College
	<a href="#">Electrical and Electronics Repairers, Commercial and Industrial Equipment</a>	Medium	\$32.40	8.0%	142	
	<a href="#">Electrical and Electronics Repairers, Powerhouse, Substation, and Relay</a>	High	\$51.89	4.3%	39	
HVACR & Maintenance	<a href="#">Heating, Air Conditioning, and Refrigeration Mechanics and Installers</a>	Medium	\$28.93	9.5%	967	Postsecondary Certificate + Some College
	<a href="#">First-Line Supervisors of Mechanics, Installers, and Repairers</a>	Medium	\$37.67	9.6%	1,434	High School Diploma + Some College
Architecture & Drafting	<a href="#">Architects</a>	High	\$40.72	5.4%	524	Bachelor's Degree
	<a href="#">Architectural &amp; Civil Drafters</a>	Medium	\$29.90	0.1%	287	
Construction Management	<a href="#">Construction Managers</a>	High	\$50.91	13.5%	1,471	Bachelor's Degree
	<a href="#">Cost Estimators</a>	Medium	\$38.99	4.2%	481	
	<a href="#">First-Line Supervisors of Construction Trades and Extraction Workers</a>	High	\$46.38	9.5%	1,326	High School Diploma

\* Living wage potential is based on MIT's Living Calculator ([livingwage.mit.edu](https://livingwage.mit.edu)) for Illinois in 2024. Occupations with median salaries higher than the living wage for 1 adult + 1 child (\$39.63/hour) are considered as having a "high" living wage potential. Occupations with median salaries only higher than the living wage of 1 adult, no children (\$22.86/hour) are considered as having a "medium" living wage potential, and occupations with median salaries below the living wage of 1 adult, no children (less than \$22.86/hour) are considered as having a "low" living wage potential.

\*\* Illinois Department of Employment Security (2022). Wage Information: Occupational Employment and Wage Statistics (Statewide). Retrieved April 2, 2024, from [ides.illinois.gov/resources/labor-market-information/oews.html](https://ides.illinois.gov/resources/labor-market-information/oews.html)

\*\*\* Illinois Department of Employment Security. Employment Projections (Long-Term Occupational Projections 2020-2030). Retrieved April 2, 2024, from [ides.illinois.gov/resources/labor-market-information/employment-projections.html](https://ides.illinois.gov/resources/labor-market-information/employment-projections.html)