Maryland CTE Program of Study

**Construction: Trades Professions**

**Secondary CTE Program of Study Proposal Form**

Maryland State Department of Education

Division of Career and College Readiness

200 West Baltimore Street

Baltimore, Maryland 21201-2595

This agreement is between the Division of Career and College Readiness (DCCR), Maryland State Department of Education, and the local school system (LSS) listed below.

**LOCAL SCHOOL SYSTEM INFORMATION**

Complete the information requested below, including the original signature of the CTE Local Director.

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| Local School System (LSS) and Code: |       |
| Name of CTE Local Director: |       | Phone: |       |
| LSS Career Cluster: |       |
| LSS Program Title: | **Construction: Trades Professions** |
| Pathway Options: | **1. Carpentry** | **2. Electrical** | **3. Plumbing** | **4. Masonry** |
| Value Added Options: | [x]  Yes [ ]  No | This program provides students the opportunity to earn early college credit. The academic and technical course sequences for both secondary and postsecondary programs are included herein. |
| [ ]  Yes [ ]  No | Enclosed is a copy of the articulation agreement (Copy required for CTE program approval if the program is articulated with a postsecondary education provider). |
| [x]  Yes [ ]  No | This program provides students with the opportunity to earn an industry-recognized credential. The credential is identified herein. |
| Program Start Date: |       |  |  |
| Signature of CTE Local Director: |  | Date: |       |
| Signature of Local Superintendent: |  | Date: |       |

**TO BE COMPLETED BY MSDE/DCCR**

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| Date Program Proposal received by CTE Systems Branch: |       |
| CTE Control Number: |       | Fiscal Year: |       |
| CIP Number: | Program: **Construction: Trades Professions** | Pathway Option 1:**Carpentry 46.5200**  | Pathway Option 2:**Electrical 46.5300** | Pathway Option 3:**Plumbing 46.5500** | Pathway Option 4: **Masonry 46.5100** |
| MSDE Cluster Title: | **Construction and Development** |

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| **Approval Starts FY:** |  |  |
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| Signature, Assistant State Superintendent, Career and College Readiness |  | Date |

**CTE Secondary Program Proposal Contents**

**STEP 1A: PROGRAM ADVISORY COMMITTEE MEMBERS AND THEIR AFFILIATIONS**

Complete the list of the Program Advisory Committee (PAC) members. Members should include employers, local workforce development representatives, economic development personnel, business, or labor representatives, and the remainder should include secondary and postsecondary, academic and technical educators and other stakeholders. Place a check in the appropriate box to indicate the role each person plays. Include all of the information requested for each entry. Use this form or a locally developed form – either one is acceptable as long as all information is provided.

# Program Advisory Committee List

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| **Membership: First entry should be the industry representative who is leading the PAC.** |
| PAC Leader Name: |       | Representation: |
| Title: |       | [ ]  Industry [ ]  Secondary [ ]  Postsecondary  |
| Affiliation: |       |
| Address1: |       |
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| Area of Expertise: |       |
| Role: | [ ]  Work-based Learning [ ]  Curriculum Development [ ]  Skills Standards Validation [ ]  Staff Development |
| [ ]  Program Development  | [ ]  Other (specify):  |       |

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| [ ]  Program Development  | [ ]  Other (specify):  |       |

STEP 1B: DOCUMENTED LABOR MARKET DEMAND

Check the appropriate box below.

[x]  **Demand exists**

The PAC will review labor market information on a local, regional and/or state basis. Check this box if demand exists for the identified occupations. The labor market information does not need to be provided with the proposal as long as there is a demand for employees according to data provided by the [Department of Labor, Licensing and Regulation](http://www.dllr.state.md.us/lmi/) (DLLR) or documented by employers in letters or other correspondence.

[ ]  **If evidence for labor market demand is not readily available, attach documentation to the proposal.**

Check this box if there is a unique labor market demand for a program and data are not available from the DLLR. If the occupation is new or emerging and no data exist, supporting evidence is submitted with the proposal (i.e., document local, national, or regional trends, local circumstances, or provide letters from employers or local economic/workforce development offices documenting employment demand including the projected number of openings by pathway).

**STEP 2A: PROGRAM OVERVIEW**

After determining the cluster and pathway options, identify the standards used to develop the CTE program of study. Describe the program to be developed in detail based on what students are expected to know and be able to demonstrate as a result of participating in the program.

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| **Indicate the title and source of the skills standards for this program:** * National Center for Construction Education and Research (NCCER) provides standards, curriculum, and assessment for these program areas.
* North America’s Building Trades Unions, through the local Building Trades Councils (BTC), provides standards, curriculum, and assessment for the first Core course, an alternative to the NCCER Core.
 |
| **Program Overview:**The Maryland program of study Construction: Trades follows NCCER curricula, accessed via [this link](http://www.nccer.org/curriculum?mID=86), with an option to follow the BTC’s core course.  Within Construction: Trades, also identified at times as Construction: Professions, are 4 pathway options: Carpentry, Electrical, Plumbing, and Masonry.Each Construction: Trades pathway option starts with a 1 credit core curriculum course that provides a strong foundation for all students entering this career field. NCCER’s core course, *Foundations of Building and Construction,* aligns with the NCCER national standards and related work-based learning opportunities, and is designed to be completed in approximately 100 hours (80 hours of instruction with an additional estimated 20 hours of related hands-on applications/work-based learning opportunities to reinforce and extend learning). BTC’s core course, *Multi-Craft Core Curriculum – MC3*, is 120 hours of apprentice readiness training developed and approved by the Building Trades National Apprenticeship and Training Committee. After successful completion of *Foundations of Building and Construction*, if this is the core course chosen by the LSS, students must pass the National Construction Career Test (NCCT) for the Core in order to be entered into NCCER’s National Registry (required for these program options).  Once registered, students may proceed into a specific pathway option and take Craft Level 1 (1 credit) and the associated NCCER certification exam, and then Craft Level II (2 credits) and the associated NCCER certification exam.  In support of the curriculum package, students in the program spend approximately 25% of their time in integrated hands-on experience working on construction projects at the school and on the work-site. As students successfully complete each level of the curriculum and related NCCT exam, their NCCER National Registry status is updated.  The National Registry provides a nationally recognized certification in the industry.If the LSS chooses to offer the BTC *Multi-Craft Core Curriculum – MC3* core option, students must still be registered with NCCER’s national Registry before proceeding to NCCER Levels I and II. (NOTE: Completion option to the final course is to complete a registered apprenticeship experience.)Additional curriculum modules covering project management and project supervision as it relates to all areas of Construction Trades are offered as supplemental resources and support articulation to postsecondary Construction Management programs.The NCCER Contren™ Learning Series prepares students for entry into their selected career pathway and for further study and training through apprenticeship providers and through articulation agreements with community colleges.  Craft Levels I and II meet the Apprenticeship Training requirements, as specified by the Employer and Labor Services (formerly Bureau of Apprenticeship Training) for classroom-related training.Schools offering the Construction: Trades program must complete the NCCER accreditation process and ensure students have access to certification through the NCCER National Registry.  As part of the accreditation process, NCCER has developed the Instructor Certification Training Program (ICTP).  This program ensures the uniform delivery of training.  All teachers in the program receive training and are certified as an instructor and to administer NCCER assessments. The CTE Pathway Programs are supported by an industry sponsor as required by NCCER. The sponsor provides oversight to the program, specifically providing assurances for instructor certification, assessment administration, and on-going support and evaluation of program quality. The Accredited Training Sponsor, **Insert Sponsor Name**, was declared as an Accredited Training & Education Facility, **Insert Date**. |

**STEP 2B: COURSE DESCRIPTIONS AND END-OF-COURSE ASSESSMENTS**

Insert each CTE completer course title. Describe each course based on what students are expected to know and be able to demonstrate as a result of their participation. Check the assessment instrument(s) that will be used to document student attainment of the knowledge and skills included in each course and specify additional information as appropriate.

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| **CORE OPTION #1:****Course Title: Foundations of Building and Construction Technology (NCCER Core)** – all pathway options (one credit)**Course Description**:The Foundations of Building and Construction course (ed. 2015) is the Core Curriculum of the Construction and Development Cluster. The NCCER Core Curriculum is taught within this course and is the basis for all construction skills. NCCER strongly recommends that students successfully complete the Core Curriculum before advancing to Level One of their chosen field. The course of study descriptions correlate to the modules of the NCCER national standards and related work-based learning opportunities. The following modules are designed to be completed in approximately 80 hours of instruction and allows for an estimated 20 hours of related “hand-on” applications/work-based learning opportunities to reinforce and extend the learning.The course of study includes demonstration of student mastery of the following topics:* Basic Safety (12.5 hrs). Includes personal protective equipment, performance safety, and what to do if an accident occurs.
* Introduction to Construction Math (10 hrs). From basic addition to multiplying fractions, this module prepares students to do the calculations they’ll be performing on the job site.
* Introduction to Hand Tools (10 hrs). Covers basic tools and equipment used in the field. Also covers maintenance instructions and safety tips.
* Introduction to Power Tools (10 hrs). Provides instructions for tools powered by electricity, batteries, and pressurized air, such as drills, saws, grinders and sanders, and other common construction equipment. Also covers maintenance instructions and safety tips.
* Introduction to Construction Drawings (10 hrs). Introduces students to different types of plans and how they represent a finished building. Shows the parts of blueprint in detail, including symbols, title block, and gridlines.
* Introduction to Basic Rigging (7.5 hrs). Covers the slings, hardware, hoists, and hitches used in rigging operations. Also highlights critical safety issues and accepted rigging techniques and practices.
* Basic Communication Skills (7.5 hrs). Covers information and skills needed to communicate effectively and clearly.
* Basic Employability Skills (7.5 hrs). Provides guidance related to finding and securing a position in the construction trades.
* Introduction to Material Handling (5 hrs). Covers safety guidelines for workers handling materials on the job site.
* Hands-On Experiences (20 hrs). Provides hands-on experiences in each of the trades areas, Carpentry, Masonry, Construction Electricity and/or HVAC so that students can gain a working knowledge of the construction industry.

Given the emphasis on providing a broad introduction to the Career Cluster in this course, one module from the Carpentry Level One curriculum will be provided (listed below). Additional modules and/or academic remediation (including communication and employability skills) may be provided given an estimated additional 35 hours of instructional time in the first credit/course. * Orientation to the Trade. Reviews the history of the trade, describes the apprentice program, identifies career opportunities for carpentry and construction workers, and list the responsibilities and characteristics for success.
* Schools may explore the use of SkillsUSA Professional Development Program (PDP) resources to enhance career development and workplace readiness knowledge and skills.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      ☒ Certification or credentialing exam: (specify) (see description below)☒ Nationally recognized examination: (specify)      Students must pass the module assessments for the **Construction Core** to be entered into NCCER’s National Registry. The National Registry provides a nationally recognized certification in the industry. Upon completion of the Core, students move to the Craft Level curriculum and assessments for their chosen option/trade. |
| **CORE OPTION #2:****Course Title: Multi-Craft Core Curriculum – MC3 (BTC Core)** – all pathway options (one credit)**Course Description**:The Building Trades Unions use this Multi-Craft Core Curriculum (MC3) in their apprentice readiness programs. It is a 120-hour comprehensive training program developed and approved by the Building Trades National Apprenticeship and Training Committee, and it is recognized by the US Department of Labor. The MC3 prepares people to enter into apprenticeship programs, and is only offered in cooperation with state and local Building Trades Councils (BTC). To offer this BTC Multi-Craft Core Curriculum – MC3, contact your local BTC.The Multi-Craft Core Curriculum contains 84 hours of required coursework, and 36 hours of electives:* Required:
* Orientation and Industry Awareness- 8 hours
* Construction Trade Awareness- 8 hours
* Tools and Materials Hands on Training- 8 hours
* Basic Math for Construction- 40 hours
* Heritage of the American Worker- 8 hours
* Diversity in the Construction Industry- 12 hours (Diversity Awareness- 4 hours/Sexual Harassment- 8 hours)
* Electives options:
* Construction Health and Safety- 22 hours (CPR and First Aid- 8 hours/Osha-10- 10 hours/Women’s Health and Safety- 4 hours)
* Blueprint Reading- 24 hours
* Green Construction- 4-8 hours
* Financial Responsibility- 4-8 hours

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.☒ Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment☒ Vendor-developed exam: (specify) Maryland BTI developed MC3 examination[ ]  Licensing exam: (specify)      [ ]  Certification or credentialing exam: (specify) (see description below)[ ]  Nationally recognized examination: (specify)      Students must pass the assessments for the MC3, and be entered into NCCER’s National Registry prior to sitting for NCCER Craft Level I and II examinations for their chosen option/trade. |

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| **The PATHWAY OPTION 1** The **Carpentry** program option provides students with an opportunity to learn about the home building industry. Participants master a variety of construction skills. Students apply their knowledge and skills by participating in school/lab-based and work-based projects. The course of study descriptions correlate to the modules of the NCCER national standards.**Course Title: Carpentry 1 - Level I includes a minimum of 160+ hours NCCER** (ed. 2013, 1 credit)Course Description: The course of study for Carpentry I (Level I) includes demonstration of student mastery of the following topics:* Building Materials, Fasteners, and Adhesives (20 hrs). Provides an overview of the building materials used by carpenters, including lumber, engineered wood products, concrete, and steel framing materials. The module also describes the various fasteners, anchors, and adhesives used in construction.
* Hand and Power Tools (10 hrs). Detailed descriptions and explanation of the use of hand-operated and power tools used by carpenters. Emphasis is on safe and proper operation of tools as well as care and maintenance.
* Introduction to Construction Drawings, Specifications, and Layout (22.5). Describes the information contained in construction drawings, including foundation, floor, and other plan view drawings, as well as how to read them.
* Floor Systems (25 hrs). Covers framing basic as well as the procedures for laying out and constructing a wood floor using common lumber as well as engineered building materials.
* Wall Systems (10 hrs). Describes the procedures for laying out and framing walls, including roughing-in door and window openings, constructing corners and partition Ts, bracing walls, and applying sheathing.
* Ceiling Joist and Roof Framing (47.5 hrs). Provides an overview of ceiling and roof framing, including the components of ceiling and roof framing, the different types of roofs used in residential construction, and the use of trusses in basic roof framing.
* Introduction to Building Envelope Systems (12.5 hrs). Introduces the building envelope system and its components. The module describes the various types of windows, skylights, and exterior doors and provides instructions for installing them.
* Basic Stair Layout (12.5 hrs). Introduces the various types of stairs and the common building code requirements related to stairs.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      X Certification or credentialing exam: (specify) see below[ ]  Nationally recognized examination: (specify)      Students must pass the NCCT for the **Carpentry Level I** through the NCCER’s National Registry for certification before advancing to Level II. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s). Students completing the Residential carpentry I curriculum will require additional modules (57.5 hours covering concrete) prior to completing **Residential Carpentry I**. |
| **Course Title: Carpentry 2 - Level II includes a minimum of 210+ hours NCCER** (2 credits)Course Description: The course of study for Carpentry 2 includes demonstration of student mastery of the following topics:* Commercial Drawings (25 hrs). Describes how to read and interpret a set of commercial drawings and specifications.
* Cold-Formed Steel Framing (15 hrs). Describes the types and grades of steel framing materials, and includes instructions for selecting and installing metal framing for interior and exterior walls, loadbearing and nonbearing walls, partitions, and other applications.
* Exterior Finishing (35 hrs). Covers the various types of exterior finish materials and their installation procedures, including wood, metal, vinyl, and fiber-cement siding.
* Thermal and Moisture Protection (7.5 hrs). Covers the selection and installation of various types of insulating materials in walls, floors, and attics. It also covers the uses and installation practices for vapor barriers and waterproofing materials.
* Roofing Applications (25 hrs). Describes how to properly prepare the roof deck and install roofing for residential and commercial buildings.
* Doors and Door Hardware (20 hrs). Describes the installation of metal doors and related hardware in steel-framed, wood-framed, and masonry walls, along with their related hardware, such as locksets and door closers.
* Drywall Installation (15 hrs). Describes the various types of gypsum drywall, their uses, and the fastening devices and methods used to install them.
* Drywall Finishing (17.5 hrs). Covers the materials, tools, and methods used to finish and patch gypsum drywall.
* Suspended Ceilings (15 hrs). Describes the materials, layout, and installation procedures for many types of suspended ceilings used in commercial construction, as well as ceiling tiles, drywall suspension systems, and pan-type ceilings.
* Window, Door, Floor, and Ceiling Trim (25 hrs). Provides instruction on the different types of trim used in finish work and focuses on the proper methods for selecting, cutting, and fastening trim to provide a professional finished appearance.
* Cabinet Installation (10 hrs). Detailed instructions for the selection and installation of base and wall cabinets and countertops.

Individual programs may place greater emphasis on the requirements of **Carpentry Level I and II** with modules including concrete handling and forms, or the program may emphasize **Residential Carpentry I and II** curriculum. Additional modules from Carpentry III or Residential Carpentry will provide preparation for either NCCT Exams/Certification.* Site Layout One—Distance Measurement and Leveling. Covers principles, equipment, and methods used to perform the site layout tasks of distance measurement and differential leveling. Also information about layout responsibilities of surveyors, field engineers, carpenters and using site drawings and on-site communications.
* Introduction to Concrete and Reinforcing Materials. Describes the properties, characteristics, and uses of various types of cement, aggregates, and other materials. Procedures for concrete volume estimates and testing of mixed concrete, methods and materials for curing concrete and reinforcement materials used in concrete, such as reinforcement bars, bar supports, and welded-wire fabrics are covered.
* Foundations and Flatwork. Covers construction of forms for continuous, stepped and grade beam concrete footings. Also covers edge forms used for on-grade concrete slabs.
* Concrete Forms. Covers the application and construction methods for various types of forms, including wall, column, slab and beam, and stair.
* Reinforcing Concrete. Explains the selection and used of different types of reinforcing materials. Describes general requirements for cutting, bending, splicing, and tying reinforcing steel.
* Handling and Placing Concrete. Covers the tools, equipment and procedures for handling, placing, and finishing concrete at the job site. Safety procedures are emphasized.
* Manufactured Forms. Covers the types of forma and hardware systems used in the construction of walls, columns, deck and roof slabs, beams and girders, culverts, and highways. Includes coverage of flying forms, slipforms, shoring and architectural finishes.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      X Certification or credentialing exam: (specify) see below[ ]  Nationally recognized examination: (specify)      Students must pass the NCCT **Carpentry** through the NCCER’s National Registry. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s).  |

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| **The PATHWAY OPTION 2** The **Electrical** program option provides students with an opportunity to learn about the residential and commercial building industry and to master a variety of electrical skills. All students complete the Construction Core (1 credit) before advancing to the Electrical pathway. The course of study descriptions correlate to the modules of the NCCER national standards leading to industry certification.**Course Title: Electrical 1 - Level I includes a minimum of 107.5+ hours NCCER** (ed. 2014, 1 credit)Course Description: The course of study for Electrical 1 includes demonstration of student mastery of the following topics:* Electrical Safety (10 hrs). Covers safety rules and regulations for electricians. Students learn the necessary precautions to take for various electrical hazards found on the job. Also teaches the OSHA-mandated lockout/tagout procedure.
* Introduction to Electrical Circuits (7.5 hrs). Offers a general introduction to electrical concepts used in Ohm’s law. It includes atomic theory, electromagnetic force, resistance, and electric power equations. It also covers series, parallel, and series-parallel circuits.
* Electrical Theory (7.5 hrs). Introduces students to circuit calculations involving the application of Ohm’s and Kirchoff’s laws.
* Introduction to the National Electrical Code (7.5 hrs). Provides a navigational road map for using the NEC. Students are introduced to the layout of the NEC and the types of information found within the code book. Students are able to practice finding information using an easy-to-follow procedure.
* Device Boxes (10 hrs). Explains how to select and size outlet boxes, pull boxes, and junction boxes pursuant to *NEC*® requirements.
* Hand Bending (10 hrs). Provides an introduction to conduit bending and installation. Covers the techniques for using hand-operated and step conduit benders, as well as cutting, reaming, and threading conduit.
* Raceways and Fittings (20 hrs). Introduces the types and application of raceways, wireways, and ducts. The appropriate NEC requirements are stressed.
* Conductors and Cables (10 hrs). Focuses on the types and applications of conductors and covers proper wiring techniques. It also stresses the appropriate *NEC*® requirements.
* Basic Electrical Construction Drawings (7.5 hrs). Describes the types and uses of construction drawings. It provides information about the format and content of basic electrical construction drawings and their use in conveying specific construction requirements. It describes the standard format for specifications.
* Residential Electrical Services (15 hrs). Introduces students to the various types of devices and installation procedures used in residential wiring. It also covers service-entrance and branch circuit calculations and *National Electrical Code*® requirements.
* Electrical Test Equipment (2.5 hrs). Introduces the student to electrical test equipment. It explains the purpose and use of voltmeters, ohmmeters, clamp-on ammeters, multimeters, megohmmeters, and motor and phase rotation testers. It also covers basic safety and explains category ratings.

**End of Courses Assessment**Check the assessment instruments that will be used to document student attainment of the program knowledge and skills.[ ]  Teacher-designed end-of-program assessment[ ]  School system-designed end-of-program assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      [x]  Certification or credentialing exam: (specify)[x]  Nationally recognized examination: (specify) See AboveStudents must pass the NCCT for the **Electrical** through the NCCER’s National Registry for certification before advancing to Level II. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s). |
| **Course Title: Electrical 2 - Level II includes a minimum 145+ hours NCCER** (2 credits)The course of study for Electrical 2 includes demonstration of student mastery of the following topics:* Alternating Current (17.5 hrs). Focuses on forces that are characteristic of alternating-current systems and the application of Ohm’s law to AC circuits.
* Motors: Theory and Application (20 hrs). Covers AD and DC motors including the main parts, circuits, and connections.
* Electric Lighting (15 hrs). Introduces the methods and procedures used in the handling and installation of different types of lamps and lighting fixtures.
* Conduit Bending (15 hrs). Covers all types of bends in sizes of conduit up to 6 inches. Focus is placed on mechanical, hydraulic, and electrical benders.
* Pull and Junction Boxes (12.5 hrs). Introduces the students to the methods and procedures used in the selection and installation of pull and junction boxes.
* Conductor Installations (10 hrs). Covers the transportation, storage, and setup of cable reels; methods of rigging; and procedures for complete cable pulls in raceways and cable trays.
* Cable Tray (7.5 hrs). Focuses on NEMA and NEC installation requirements for cable tray, including modifications and cable installations.
* Conductor Termination and Splices (7.5 hrs). Describes method of terminating and splicing conductors of all types and sizes, including the preparation and taping of conductors.
* Grounding and Bonding (15 hrs). Introduces the *NEC*® requirements and procedures for proper grounding and bonding.
* Circuit Breakers and Fuses (12.5 hrs). Introduces the methods and procedures used in the selection and installation of circuit breakers and fuses.
* Control Systems and Fundamental Concepts (12.5 hrs). Introduces the *NEC*® requirements and procedures used in the selection and installation of contactors and relays.

Additional modules and/or work-based learning opportunities may be provided given an estimated additional 100 hours of instructional time over the last two credits. The modules listed below are recommended from the Electrical Level III curriculum and represent an additional 82.5 hours of instruction. * Load Calculations-Branch Circuits. Introduces the industry standards for electrical work, including the topics of branch circuits, rating and derating, and various types of residential and commercial electrical loads.
* Conductor Selection and Calculations. Covers the types of conductors used in wiring systems, including insulation, current-carrying capacity, and temperature ratings.
* Wiring Devices. Covers popular receptacles and switches, and takes an in-depth look at safety switches and other wiring devices.
* Distribution System Transformers. Discusses transformer types, construction, connections, protection, and grounding along with capacitors and rectifiers.
* Motor Calculations. Covers single and multi-motor calculations to enable the student to size conductors, overcurrent protection, and overload protection for motor applications.
* Motor Controls. Provides information on selecting, sizing, and installing motor controllers. Also covers control circuit pilot devices and basic relay logic.

**End of Courses Assessment**Check the assessment instruments that will be used to document student attainment of the program knowledge and skills.[ ]  Teacher-designed end-of-program assessment[ ]  School system-designed end-of-program assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      [x]  Certification or credentialing exam: (specify)[x]  Nationally recognized examination: (specify) See BelowStudents must pass the NCCT for **Electrical** through the NCCER’s National Registry. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s). |

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| **The PATHWAY OPTION 3** The **Plumbing** program option provides students with an opportunity to learn about the industry as it relates to residential and commercial building. Participants master a variety of plumbing skills. Students apply their knowledge and skills by participating in the “student-built” house project. The course of study descriptions correlate to the modules of the NCCER national standards. **Course Title: Plumbing 1 - Level I includes a minimum of 145+ hours NCCER** (ed. 2012, 1 credit)Course Description: The course of study for Plumbing I includes demonstration of student mastery of the following topics:* Introduction to the Plumbing Profession (5 hrs). Covers the history of plumbing from ancient times to current plumbing training programs. Also covers professional practices, career opportunities, and some basic safety information.
* Plumbing Safety (22.5 hrs). Reviews the common causes of plumbing-related accidents and injuries. Students will learn how to identify hazardous situations and unsafe conditions as well as how to handle and respond to these situations and conditions.
* Tools of the Plumbing Trade (10 hrs). Covers the tools that plumbers used in their daily work, including measuring tools, leveling tools, wrenches, pliers, hammers, screwdrivers, vises, saws, pipe cutters, drills threaders, and soldering equipment.
* Introduction to Plumbing Math (12.5 hrs). Reviews basic math principles and then moves on to plumbing-specific math problems, including calculating pipe lengths, runs, and offsets for 45-degree angles.
* Introduction to Plumbing Drawings (17.5 hrs). Reviews the blueprints that are included in a building’s plans and then moves on to specific plumbing drawings, such as isometric and oblique pictorial drawings, orthographic drawings, and schematic drawings. Also covers drawings of fixtures, assembly drawings, and cutaway drawings.
* Plastic Pipe and Fittings (12.5 hrs). Describes the various types of plastic piping and fittings; what each is used for; and the measuring, cutting, and joining techniques for each type. Also covers the hangers and supports used with plastic pipe.
* Copper Tube and Fittings (12.5 hrs). Discusses the materials, schedules, and properties of copper tube, fittings, and valves. Students will learn how to measure, ream, cut, join, and groove copper tube, as well as how to hang and support copper tube.
* Cast-Iron Pipe and Fittings (12.5 hrs). Describes the two types of cast-iron pipe (hub and no-hub); fittings used with each; and how each is measured, cut, joined, and assembled. Also covers the hangers and supports used with cast-iron pipe.
* Steel Pipe and Fittings (12.5 hrs). Describes carbon steel pipe; fittings used with it; and how it is measured, cut, threaded, joined, and assembled. Also covers the hangers and supports used with carbon steel pipe.
* Introduction to Plumbing Fixtures (7.5 hrs). Discusses the materials commonly used to make fixtures, the most common types of fixtures, and the types of faucets available.
* Introduction to Drain, Waste, and Vent (DWV) Systems (10 hrs). Provides an overview of the drawing, waste, an vent (DWV) system from inside the building, where the liquid drains into pipes, to the sewer and waste treatment facilities. Covers the basics of traps, drawings, vents, DWV fittings, and cleanouts.
* Introduction to Water Distribution Systems (10 hrs). Discusses the processes in which water is distributed. Students will learn to identify the components and functions of a water distribution system, as well as explain the relationships among the components.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      X Certification or credentialing exam: (specify) see below[ ]  Nationally recognized examination: (specify)      Students must pass the NCCT for the **Plumbing** through the NCCER’s National Registry for certification before advancing to Level II. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s). |
| **Course Title: Plumbing 2 - Level II includes a minimum of 175+ hours NCCER** (2 credits)The course of study for Plumbing 2 includes demonstration of student mastery of the following topics:* Plumbing Math Two (15 hrs). Explains the Pythagorean Theorem, reviews methods for laying out square corners, and discusses the techniques used to calculate simple and rolling offsets, as well as offsets on parallel runs of pipe.
* Reading Commercial Drawings (25 hrs). Teaches how to interpret and use civil, architectural, structural, mechanical, plumbing, and electrical drawings when installing plumbing systems.
* Structural Penetrations, Insulation, and Fire-Stopping (15 hrs). Covers how to cut, bore, and sleeve structural members using the appropriate tools including proper locations, restrictions, and reinforcement techniques; how to install fiberglass and flexible foam insulation on pipe; and how to install fire-stopping on walls, floors, and ceiling according to code.
* Installing and Testing DWV Piping (30 hrs). Explains how to locate, install, connect, and test a complete drain, waste, and vent (DWV) system.
* Installing Roof, Floor and Area Drains (5 hrs). Covers techniques for locating, installing, and connecting roof, floor and area drains according to code.
* Installing and Testing Water Supply Piping (20 hrs). Teaches the student how to locate, install, connect, and test water supply piping while observing safety guidelines.
* Types of Valves (5 hrs). Provides students with an overview of the many types of valves, their components, and valve applications, and explains how to service common valves.
* Installing Fixtures and Valves (20 hrs). Provides instruction on how to install basic plumbing fixtures, including bathtubs, shower stalls, lavatories, sinks, water closets, and urinals; reviews the installation of associated valves, faucets, and components; and discusses how to connect appliances such as dishwashers, food-waste disposers, refrigerators and ice makers, and washing machines.
* Installing Water Heaters (10 hrs). Teaches students about gas-fired, electric, solar, and indirect water heaters and reviews the proper installation and testing techniques.
* Basic Electricity (10 hrs). Provides an introduction to electrical safety and the principles of electricity, including voltage, current, resistance, and power. Students will learn about important electrical formulas, circuitry, and common plumbing-related electrical applications.
* Fuel Gas and Fuel Oil Systems (20 hrs). An introduction to the techniques required for the safe handling of natural gas, liquefied petroleum gas, and fuel oil, and also reviews fuel gas and fuel oil safety precautions and potential hazards, applications, systems installation, and testing.

Individual programs will include additional requirements of **Plumbing Level III** to provide advanced preparation based on the specific recommendations of the PAC. The recommended modules listed below represent an additional 60 hours of instruction.* Applied Math. Introduces students to math concepts they will use on the job, including weights and measures, area and volume, temperature, pressure, and force. Also reviews the six simple machines: inclined planes, levers, pulleys, wedges, screws, and wheels and axles.
* Codes. Discusses the different types of codes used by plumbers across the country and explains how those codes are written, adopted, modified, and implemented.
* Types of Venting. Reviews the different types of vents that can be installed in a DWV system and how they work. Also teaches design and installation techniques.
* Sizing Water Supply Piping. Teaches techniques for sizing water supply systems, including calculating system requirements and demand, developed lengths, and pressure drops. Also reviews the factors that can reduce efficiency of water supply piping.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      X Certification or credentialing exam: (specify) see below[ ]  Nationally recognized examination: (specify)      Students must pass the NCCT for the **Plumbing** through the NCCER’s National Registry for certification. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s).  |

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| **The Pathway Option 4** The **Masonry** program option provides students with an opportunity to learn about the industry as it relates to residential and commercial building. Participants master a variety of masonry skills. Students apply their knowledge and skills by participating in the “student-built” house project. The course of study descriptions correlate to the modules of the NCCER national standards.**Course Title: Masonry 1 - Level I includes a minimum of 122.5+ hours NCCER** (ed. 2013, 1 credit)The course of study for includes demonstration of student mastery of the following topics:* Introduction to Masonry (12.5 hrs). Covers the historic and current methods and procedures used in the masonry trade. Brick and block manufacturing is explained along with the types of brick and block that are currently used in various types of masonry construction. Knowledge, skill, and ability requirements of a mason are also described.
* Masonry Safety (15 hrs). Describes how to identify the common causes of accidents and the hazards associated with masonry tools, equipment, mortar, and concrete. This module also provides information about how to prevent
* accidents and hazards on the job site by using personal protective equipment, working safely from elevated surfaces, properly using masonry tools and equipment, and handling masonry materials safely.
* Masonry Tools and Equipment (15 hrs). Presents and describes the tools and equipment used in the production of mortar, cutting of masonry units, and placing of masonry units. Also explains safe operation and maintenance requirements and provides demonstration of larger pieces of power equipment. Offers students the opportunity to operate each hand tool.
* Measurements, Drawings, and Specifications (10 hrs). Provides a review of the calculation of distances and areas common in masonry work, describes the information found on residential construction drawings, and reviews the role of specifications, standards, and codes.
* Mortar (10 hrs). Explains the properties of mortar and the components that make up the mixture; describes the chemical and physical properties of cement, sand, and various types of admixtures; and discusses procedures for storing materials and mixing mortar.
* Masonry Units and Installation Techniques (60 hrs). Introduces the methods and procedures used in masonry unit installation. Topics include basic techniques for laying brick and block, using mortar to bond masonry units, and patterns.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      X Certification or credentialing exam: (specify) see below[ ]  Nationally recognized examination: (specify)      Students must pass the NCCT for the **Masonry** through the NCCER’s National Registry for certification before advancing to Level II. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s). |
| **Course Title: Masonry 2 - Level II includes a minimum of 155+ hours of NCCER** (2 credits)The course of study for Masonry II includes demonstration of student mastery of the following topics:* Residential Plans and Drawings Interpretation 12.5 hrs). Covers information the mason will need to work with residential plans and construction drawings and be able to convert that information into action on the job. This includes understanding the organization and format of plans; dimensioning and scaling; and estimating materials quantities from information on the plans.
* Residential Masonry (25 hrs). Covers the construction techniques for residential and small structure foundations, steps, patios, decks, chimneys, and fireplaces. Work activities that the mason must perform as well as those that tie into the masonry work are described.
* Reinforced Masonry (15 hrs). Describes the use of grout and other types of reinforcement, such as reinforcing steel, to strengthen and support masonry structures. The module also describes the locations where grout can be used and the techniques for placement.
* Masonry Openings and Metal Work (15 hrs). Instruction on the methods and materials used to install masonry openings and to tie wythes together and to structural elements.
* Advanced Laying Techniques (50 hrs). Contains detailed information that direct the mason in accomplishing the actual construction of walls, arches, and other useful structures.
* Effects of Climate on Masonry (15 hrs). Describes techniques used to construct openings in masonry walls, the application of insulation, and the effects of climate as they relate to the mason’s trade. The module also explains properties and uses of materials used in moisture and temperature control, and describes various methods of insulating structures.
* Construction Inspection and Quality Control (22.5 hrs). Introduces the quality control requirements for masonry construction. Procedures for inspection and testing of masonry materials and finished masonry construction are presented.

Individual programs may include additional requirements of **Masonry Level III** to provide advanced preparation based on the specific recommendations of the PAC. The recommended modules listed below represent an additional 50 hours of instruction.* Estimating. Covers the basic procedures for doing take offs and estimating quantities of masonry material. Several different methods are described.
* Project Planning and Supervision. Covers basic project planning and scheduling techniques as well as coordination and communication of work assignments. Also describes project setup and materials purchasing requirements.

**End of Course Assessment**Check the assessment instruments that will be used to document student attainment of the course knowledge and skills.[ ]  Teacher-designed end-of-course assessment[ ]  School system-designed end-of-course assessment[ ]  Vendor-developed exam: (specify)      [ ]  Licensing exam: (specify)      X Certification or credentialing exam: (specify) see below[ ]  Nationally recognized examination: (specify)      Students must pass the NCCT for the **Masonry** through the NCCER’s National Registry for certification and to advance to Level II. Upon completion of the Craft Level curriculum and assessments, students meet classroom instruction requirements of the related apprenticeship program(s). |

**STEP 2C: END-OF-PROGRAM ASSESSMENT**

Check the assessment instruments that will be used to document student attainment of the program knowledge and skills. Include and identify assessments leading to industry recognized credentials if available and appropriate.

[x]  Teacher-designed end-of-program assessment

[ ]  School system-designed end-of-program assessment

[ ]  Partner-developed exam: (specify)

[ ]  Licensing exam: (specify)

[x]  Certification or credentialing exam: (specify) NCCER National Registry: Construction Core, Levels I and II.

[ ]  Nationally recognized examination: (specify)

Regardless of area of specialization, all students will complete module assessments and the NCCT for their area of specialization (trade) through the NCCER’s National Registry: **Construction Core**, **Level I** and **Level II**.

**STEP 2D: Program Sequence Matrix**

(Include the program sequences for High School, Associate’s Degree, and Bachelor’s Degree programs.) Identify the pathway options. Complete the matrix for the 9-12 CTE program of study, plus, for Tech Prep programs include the matrix for the two- or four-year college program of study. Indicate which courses receive CTE credit by placing the number of credits in parentheses after each CTE course title. Place an asterisk (\*) next to the course identified as the concentrator course indicating that the student has completed 50% of the program.

The CTE program matrix defines a planned, sequential program of study that consists of a minimum of four credits in CTE coursework in high school including work-based learning and/or industry-mentored projects. Work-based learning (WBL) experiences or industry-mentored projects must be included in the program to obtain approval. The program matrix includes the recommended academic and CTE courses identified for the pathway and postsecondary linkages (i.e., dual enrollment, Tech Prep, transcripted and articulated credit).

CTE programs typically begin after ninth grade and do not include career exploration courses. Courses such as computer applications and keyboarding are not included in the completer sequence because they provide prerequisite skills for both academic courses and CTE programs. Academic courses are counted only if they are tailored to serve mainly CTE students and have been revised to reflect industry skill standards. Technology Education or Advanced Technology Education courses are not acceptable for credit in the career and technology education program sequence.

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| **The LSS program title should be the same one that appears on the cover page. If more than one pathway option is offered in the program, complete a matrix for each program option (MSDE will insert the CIP number). Example: An Academy of Information Technology program may include options in web design & programming.** |
| **Pathway/Program:** | **Construction Trades Professions** **Four Options: 1-Carpentry; 2-Electrical;**  **3-Plumbing; 4-Masonry** | **CIP Numbers: (For MSDE Use)** | **Carpenter****Electrical****Plumbing****Masonry** | **46.5200****46.5300****46.5500****46.5100** |
| **Graduation Requirements** | **Grade 9** | **Grade 10** | **Grade 11** | **Grade 12** |
| English - 4 |  |  |  |  |
| Social Studies - 3 |  |  |  |  |
| Mathematics - 3  | **Algebra I** | **Geometry** | **Algebra II** | Trig./Pre-Calc. |
| Science - 3 | Earth Science (or) Biology | Biology (or)**Chemistry** | Chemistry (or)**Physics** | Physics |
| Physical Educ.-.5Health Educ.- .5 |  |  |  |  |
| Fine Arts - 1 |  |  |  |  |
| Technology Education – 1 |  |  |  |  |
| CTE Completer Program – 4  |  | **Construction Core** **(1 credit)** All pathways start with this 1 credit foundation course | **Carpentry I** (1 credit) or**Electrical I** (1 credit) or**Plumbing I** (1 credit)or**Masonry I** (1 credit)  | **Carpentry II\*** (2 credits)or**Electrical II\*** (2 credits) or**Plumbing II\*** (2 credits) or**Masonry II\*** (2 credits)  |
|  |  |  |  | \*concentrator courseNOTE: Completion option to the final course is to complete a registered apprenticeship experience. |
| Foreign Language - 2 and/or Adv.Tech Ed - 2 |  |  |  |  |
| **Provide a list of examples of careers students are preparing to enter and postsecondary options:** All program options provide documentation through the NCCER national registry for articulation of program requirements for registered apprenticeship programs. All programs identify an industry sponsor and apprenticeship options as part of the NCCER Certification process. Additional A.A.S. programs are available at several Maryland Community Colleges.* **Carpentry** - Carpenter, Building Management, Construction Management
* **Electrical** - Electrician, Industrial Maintenance Technician, Building Management, Construction Management
* **Plumbing** - Plumber, Industrial Maintenance Technician, Building Management, Construction Management
* **Masonry** - Mason, concrete construction (roads and bridges)
 |

**Program Sequence Matrix**

Two Year College Program Sequence – Program Overview

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| **Many local school systems provide postsecondary matrices in their program of study guides to inform students, parents, and counselors of the opportunities available to those enrolled in the program. Section 2E must be completed before an articulated CTE program of study can be approved. A copy of the Articulation Agreement is required to be submitted with the proposal prior to program approval.****Describe the program to be developed in detail based on what students are expected to know and be able to demonstrate as a result of participating in the program.**Building Trades Technology (A.A.S.): This program provides the student with a comprehensive mixture of academic and practical training in the areas involved in residential building trades technology. The student elects a major in carpentry; electrical; heating, ventilation, and air conditioning/refrigeration (HVAC/R); or plumbing. Completion of all requirements will lead to the A.A.S. in building trades technology. |
| **Program Title:**      **Description of College/Institution and Program:**       |
| **Recommended Sequence**Complete the program matrix for the postsecondary sequence for the articulated CTE program of study. Indicate which courses receive articulated or transcripted credit by PLACING THE NUMBER OF CREDITS IN PARENTHESES after each course title.  |
| **Semester 1** | **Semester 2** |
| Course Title (# Articulated/Transcripted Credits)Course Description | Course Title (# Articulated/Transcripted Credits)Course Description |
| **Semester 3** | **Semester 4** |
| Course Title (# Articulated/Transcripted Credits)Course Description | Course Title (# Articulated/Transcripted Credits)Course Description |
| **Provide a list of career options for students who complete the program:**       |

**Program Sequence Matrix**

Four Year College Program Sequence – Program Overview

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| *Complete this matrix if the program includes a four year degree option***Many local school systems provide postsecondary matrices in their program of study guides to inform students, parents, and counselors of the opportunities available to those enrolled in the program. Section 2E must be completed before an articulated CTE program of study can be approved. A copy of the Articulation Agreement is also required to be submitted with the proposal prior to program approval.****Describe the program to be developed in detail based on what students are expected to know and be able to demonstrate as a result of participating in the program.** |
| **Program Title:**      **Description of College/Institution and Program:**       |
| **Recommended Sequence**Complete the program matrix for the postsecondary sequence for the articulated CTE program of study. Indicate which courses receive articulated or transcripted credit by PLACING THE NUMBER OF CREDITS IN PARENTHESES after each course title.  |
| **Semester 5** | **Semester 6** |
| Course Title (# Articulated/Transcripted Credits)Course Description | Course Title (# Articulated/Transcripted Credits)Course Description |
| **Semester 7** | **Semester 8** |
| Course Title (# Articulated/Transcripted Credits)Course Description | Course Title (# Articulated/Transcripted Credits)Course Description |
| **Provide a list of career options for students who complete the program:**       |

STEP 2E: VALUE-ADDED OPTIONS

Fill in the name of the partnering college or agency. Specify the credential that students will earn. Under value-added, indicate the number of credits or hours granted. This information is required before a program can be designated as a CTE articulated program of study.

|  |  |  |  |
| --- | --- | --- | --- |
| **Option** | **Partner** | **Credential** | **Value added for CTE completers** |
| Dual Enrollment |       |       |       |
| Transcripted Credit |       |       |       |
| Articulated Credit | Programs currently offered at Anne Arundel, Baltimore, and Montgomery Community Colleges | Associate of Applied Science (A.A.S) in Construction Technology-Montgomery CC | See example below |
| Credit by Exam |       |       |       |
| Advanced Placement |       |       |       |
| Apprenticeship Approved by MATC\* | Related classroom instruction provided in partnership with several community colleges.  | Leads to requirements for Journeyman and Master status | NCCT completion meets requirements for first year apprenticeship |
| Certification(s) | NCCER Certification  | National Registry (NCCER) | Credit awarded through apprenticeship programs |
| License |       |       |       |
| Degree |       |       |       |
| Other (specify) |       |       |       |

\*MD Apprenticeship and Training Council

**STEP 2F: INDUSTRY-MENTORED PROJECT OR WORK-BASED LEARNING (WBL) OPPORTUNITIES**Check each box that applies.

PAC members and other industry partners provide supervised WBL experiences and/or industry-mentored projects for all students who demonstrate performance of the competencies necessary to enter into this phase of the program. Supervised work-based learning experiences are required for all students demonstrating readiness to participate. For the few who do not participate, alternative capstone experiences should be provided (i.e., in school work experiences, a culminating project, or another experience comparable in rigor). Each type of work-based learning is defined in the glossary. Job shadowing is **not** acceptable for credit in a CTE program.

1. [x]  Integrated WBL 2. [ ]  Capstone WBL 3. [x]  Registered Apprenticeship
4. [ ]  Internship 5. [x]  Industry-Mentored Project 6. [ ]  In-school clinic or school-based enterprise

**STEP 2G: STUDENT ORGANIZATIONS PROVIDED TO STUDENTS IN THE PROGRAM**

Check each box that applies, or specify if “Other” is selected.

Students will develop and apply technical and academic skills, as well as Skills for Success, through participation in:

[ ]  DECA [ ]  FFA [x]  SkillsUSA [ ]  FBLA [ ]  OTHER (specify)

STEP 3: COMPLETE THE INSTRUCTIONAL PROGRAM DATA SHEET

|  |  |
| --- | --- |
| Local School System (LSS) and Code: |       |
| Name of CTE Local Director: |       | Phone: |       |
| LSS Program Title: |       | CIP Code: |       |

*STEP 3.1 - DATA SHEET: Pathway Options*

|  |  |
| --- | --- |
| 1. | Carpentry |
| 2. | Electrical |
| 3. | Plumbing |
| 4. | Masonry |

STEP 3.2 - DATA SHEET: *Instructional Program Credit by Grade(s)*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *Credits per year per pathway option as reflected by Course Sequences* | **9** | **10** | **11** | **12** | **TOTAL** |
| 1. Carpentry
 |  | 1 | 1 | 2 | 4 |
| 1. Electrical
 |  | 1 | 1 | 2 | 4 |
| 1. Plumbing
 |  | 1 | 1 | 2 | 4 |
| 1. Masonry
 |  | 1 | 1 | 2 | 4 |

Total number of credits for program completion: **4**

STEP 3.3 - DATA SHEET: Career and Technology Education Program Sites

|  |  |  |
| --- | --- | --- |
| **Pathway Options** | **School Name(s) Sites** | **School Number** |
|       |       |       |
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