North Dakota Automotive Collision Repair Education

Content Standards

Adopted and Approved May 2025

North Dakota Department of Career and Technical Education
Wayde Sick, State Director and Executive Officer
600 E Boulevard Avenue, Dept. 270
Bismarck, North Dakota 58505-0610

North Dakota Technical Education Standards Process

This set of standards was reviewed by the North Dakota state Automotive secondary and post-secondary teachers.

Questions regarding these standards can be directed to:

Michael Netzloff
Standards and Curriculum Specialist
ND Department of Career and Technical Education
600 E. Boulevard Avenue, Department 270
Bismarck, ND 58505-0610
(701) 328-3187
mnetzloff@nd.gov

Adapted from the ASE EDUCATION FOUNDATION AUTOMOTIVE PROGRAM STANDARDS, Collision Repair and Refinish, Effective Date: 2023, pages 43-67.

It is the policy of the North Dakota State Board for Career and Technical Education not to discriminate in its educational programs, activities, or employment policies as required by Final Regulation implementing Title IX of the 1972 Education Amendments, Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973.

The Board policy does not advocate, permit, nor practice discrimination on the basis of sex, race, color, national origin, religion, age, or disability as required by various state and federal laws. Equal education opportunity is a priority of the North Dakota State Board for Career and Technical Education.

North Dakota State Board for Career and Technical Education
Board Members

Chair
Sonia Meehl
Oakes Public Schools
Oakes, ND

Vice Chair
Mike McHugh
ND Aeronautics Commission
Mandan, ND

Levi Bachmeier
West Fargo Public School
West Fargo, ND

Kirsten Baesler
Department of Public Instruction
Bismarck, ND

Patrick Bertagnolli
Job Service North Dakota
Bismarck, ND

Lyndsi Engstrom
Westhope Public Schools
Westhope, ND

Eric Nelson
Creedence Energy Services, LLC
Williston, ND

Jason Rohr
Jamestown School District
Jamestown, ND

Brent Sanford
North Dakota University System
Bismarck, ND

Career and Technical Education Standards Introduction

Mission

The mission of the State Board for Career and Technical Education (CTE) is to work with others to provide all North Dakota citizens with the technical skills, knowledge, and attitudes necessary for successful performance in a globally competitive workplace.

Vision

The State Board for Career and Technical Education (CTE) is committed to providing career awareness, work readiness skills, occupational preparation, and retraining of workers throughout the state. Career and technical education will span all educational levels, providing youth with exploration opportunities and the foundation skills needed to enter the world of work while providing adults with skills needed to enter, re-enter, or advance in the workforce.

Goal

North Dakota Career and Technical Education's goal is to create a competitive and knowledgeable work force. This is accomplished through a variety of educational program areas that are organized to prepare students for careers in their chosen fields, to take leadership roles, and balance their multiple roles in life. CTE programs prepare students with the knowledge and skills to make informed career choices, to integrate and apply academic concepts, to prepare for successful participation in a global society, and to engage in lifelong learning.

Standards Development Process

Standards development is a multi-phase process. Existing and/or industry standards are the basis for the North Dakota Program Standards. A team of expert secondary and postsecondary teachers, business and industry representatives, and the state program supervisor draft the standards document. Once the document is finalized, the State Board for Career and Technical Education approves and adopts the standards.

Course Frameworks are also developed by the writing team. A framework includes a brief overview of the course content, topical units of study, and identifies the standards recommended for inclusion within the course. The frameworks are tailored to prepare young people for the opportunities in North Dakota. School Districts will use the frameworks as a guide for developing curriculum that reflects local needs.

Key Principles of Career and Technical Education

We believe that Career Technical Education:

1. **Draws its curricula, standards, and organizing principles from the workplace.**
   The workplace provides the context, objectives, and organizing constructs for instruction and assessment. The workplace also defines the standards of performance necessary, including those required for academic, technical, and employability skills.

2. **Is a critical and integral component of the total educational system, offering career-oriented benefits for all students.**
   CTE classes offer educational benefits to students pursuing careers requiring specific technical skills as well as providing a strong foundation for those pursuing a traditional four-year (or more) degree.

3. **Is a critical and integral component of the workforce development system, providing the essential foundation for a thriving economy.**
   Preparation of a well-prepared, qualified workforce requires solid academics, good work ethics, and specific technical skills as well as the ability to communicate, work with others, solve problems, and use information. CTE contributes directly to this preparation by providing a curriculum tied to specific workplace requirements.

4. **Maintains high levels of excellence supported through identification of academic and workplace standards, measurement of performance (accountability), and high expectations for participant success.**
   Career Technical Education is committed to continuous improvement, attention to industry certification, and the development of highly qualified teachers.

5. **Is robust and flexible enough to respond to the needs of the multiple educational environments, customers, and levels of specialization.**
   CTE involves a large and complex delivery system that (1) integrates career exploration, (2) provides effective tools for organizing all curricula, (3) facilitates the teaching and use of technology, (4) is integrated into the total learning experience, (5) enhances the learning of academic subjects, (6) teaches broad occupational skills, (7) includes all aspects of the industry, (8) teaches how to balance family and work responsibilities, (9) provides job-specific training, (10) is offered at multiple levels of the educational continuum, and (11) is delivered through a variety of educational environments.

Table of Contents

Standard 1	***STRUCTURAL ANALYSIS AND DAMAGE REPAIR***	
Topic 1.1	**Frame Inspection and Repair**	
	Student Competencies	
	1.1.1	Measure and diagnose structural damage using a metric tape measure and a tram gauge.
	1.1.2	Properly clamp/anchor vehicle to a frame bench/rack.
	1.1.3	Analyze, straighten, and align mash (collapse) damage.
	1.1.4	Analyze, straighten, and align sag damage.
	1.1.5	Analyze, straighten, and align side sway damage.
	1.1.6	Analyze, straighten, and align twist damage.
	1.1.7	Analyze, straighten, and align diamond frame damage.
	1.1.8	Remove and replace damaged structural components.
	1.1.9	Remove and replace protective coatings; restore corrosion protection to repaired or replaced frame areas and anchoring locations.
	1.1.10	Analyze and identify misaligned or damaged steering, suspension, and powertrain mounting points and components.
	1.1.11	Align or replace misaligned or damaged steering, suspension, and powertrain mounting points.
	1.1.12	Identify heat limitations and monitoring procedures for structural components.
	1.1.13	Demonstrate an understanding of structural foam applications.
	1.1.14	Measure and diagnose structural damage using a three-dimensional measuring system (mechanical, electronic, laser), etc.
	1.1.15	Determine the extent of the direct and indirect damage and the direction of impact; document the methods and sequence of repair.
	1.1.16	Analyze and identify crush/collapse zones.
	1.1.17	Follow manufacturers guidelines when applying heat to structural components during repair.
Topic 1.2	**Unibody and Unitized Structure Inspection, Measurement, and Repair**	
	Student Competencies	
	1.2.1	Analyze and identify misaligned or damaged steering, suspension, and powertrain mounting points that can cause vibration, steering, and chassis alignment problems.
	1.2.2	Align or replace misaligned or damaged steering, suspension, and powertrain mounting points that can cause vibration, steering and chassis alignment problems.
	1.2.3	Measure and diagnose unibody damage using a metric tape measure and tram gauge.
	1.2.4	Measure and diagnose unibody vehicles using a dedicated/universal (fixture) measuring system.
	1.2.5	Diagnose and measure unibody vehicles using a three-dimensional measuring system (mechanical, electronic, laser, etc.).

	1.2.6	Determine the extent of the direct and indirect damage and the direction of impact; plan and document the methods and sequence of repair.
	1.2.7	Attach anchoring devices to vehicle; remove or reposition components as necessary.
	1.2.8	Straighten and align roof rails/headers and roof panels.
	1.2.9	Straighten and align rocker panels and pillars.
	1.2.10	Straighten and align vehicle openings and floor pans.
	1.2.11	Straighten and align quarter panels, wheelhouse assemblies, and rear body sections (including rails and suspension/powertrain mounting points).
	1.2.12	Straighten and align front-end sections (aprons, strut towers, upper and lower rails, steering, and suspension/power train mounting points, etc.).
	1.2.13	Determine structural repair component or replacement recommendations.
	1.2.14	Identify proper cold stress relief methods.
	1.2.15	Determine sectioning procedures of a steel body structure.
	1.2.16	Remove and replace damaged structural components.
	1.2.17	Determine the extent of damage to aluminum structural components; repair, weld, or replace.
	1.2.18	Analyze and identify crush/collapse zones.
	1.2.19	Remove and replace protective coatings on anchoring locations/pinch welds.
	1.2.20	Follow manufacturers guidelines when applying heat to structural components during repair.
Topic 1.3	**Stationary Glass**	
	Student Competencies	
	1.3.1	Identify considerations for removal, handling, and installation of advanced glass systems (comfort and safety features).
	1.3.2	Remove and reinstall or replace modular glass using recommended materials, procedures, and curing time.
	1.3.3	Check for water leaks, dust leaks, and wind noise.
	1.3.4	Identify considerations for pre-scan, post-scan, and recalibration procedures.

Standard 2	*NON-STRUCTURAL ANALYSIS AND DAMAGE REPAIR (BODY COMPONENTS)*	
Topic 2.1	**Preparation**	
	Student Competencies	
	2.1.1	Perform a pre-scan; identify and document illuminated dash malfunction indicator lamp(s) (MIL) and stored diagnostic codes.
	2.1.2	Review damage report and analyze damage to determine appropriate methods for overall repair; develop, and document a repair plan.
	2.1.3	Inspect, remove, protect, label, store, inventory, and reinstall exterior trim and moldings.
	2.1.4	Inspect, remove, label, store, inventory, and reinstall interior trim and components.
	2.1.5	Inspect, remove, label, store, inventory, and reinstall body panels and components that may interfere with or be damaged during repair.
	2.1.6	Inspect, remove, label, store, inventory, and reinstall vehicle mechanical and electrical components that may interfere with or be damaged during repair.
	2.1.7	Protect panels, glass, interior parts, and other vehicles adjacent to the repair area.
	2.1.8	Soap and water wash entire vehicle; complete pre-repair inspection checklist.
	2.1.9	Prepare damaged area using water-based and solvent-based cleaners.
	2.1.10	Remove corrosion protection, undercoating, sealers, and other protective coatings as necessary to perform repairs.
	2.1.11	Inspect, remove, and reinstall repairable plastics and other components for off-vehicle repair.
Topic 2.2	**Outer Body Panel Repairs, Replacements, and Adjustments**	
	Student Competencies	
	2.2.1	Inspect/locate direct, indirect, or hidden damage and direction of impact.
	2.2.2	Inspect, remove and replace welded steel panel or panel assemblies.
	2.2.3	Determine the extent of damage to aluminum body panels; repair or replace.
	2.2.4	Inspect, remove, replace, and align hood, hood hinges, and hood latch
	2.2.5	Inspect, remove, replace, and align deck lid, lid hinges, and lid latch.
	2.2.6	Inspect, remove, replace, and align doors, latches, hinges, and related hardware.
	2.2.7	Inspect, remove, replace and align tailgates, hatches, and liftgates.
	2.2.8	Inspect, remove, replace, and align sliding doors.
	2.2.9	Inspect, remove, replace, overhaul, and align bumpers, covers, reinforcements, guards, impact absorbers, and mounting hardware.
	2.2.10	Inspect, remove, replace and align fenders, and related panels.
	2.2.11	Restore corrosion protection during and after the repair.
	2.2.12	Replace seam sealer to match OEM appearance.
	2.2.13	Replace door skins.

	2.2.14	Restore sound deadeners and foam materials.
	2.2.15	Perform panel bonding and weld bonding.
	2.2.16	Diagnose and repair water leaks, dust leaks, and wind noise.
	2.2.17	Identify one-time use fasteners.
	2.2.18	Weld damaged or torn steel body panels; repair broken welds.
	2.2.19	Inspect and identify labels/decals and replace as necessary.
	2.2.20	Follow manufacturers guidelines when applying heat to non-structural components during repair.
Topic 2.3	**Metal Finishing and Body Filling**	
	Student Competencies	
	2.3.1	Prepare a panel for body filler by abrading or removing the coatings; featheredge, refine scratches, and clean the surface before the application of body filler.
	2.3.2	Locate and repair surface irregularities and straighten contours on a damaged body panel using power tools, hand tools, and weld-on pulling attachments.
	2.3.3	Demonstrate hammer and dolly techniques.
	2.3.4	Heat shrink stretched panel areas to proper contour.
	2.3.5	Cold shrink stretched panel areas to proper contour.
	2.3.6	Identify body filler defects; correct the cause and condition. (Pinholing, ghosting, staining, over catalyzing, etc.)
	2.3.7	Identify different types of body fillers.
	2.3.8	Shape body filler to contour; finish sand.
	2.3.9	Perform proper metal straightening techniques for aluminum.
	2.3.10	Perform proper application of body filler to aluminum.
	2.3.11	Locate and repair surface irregularities and straighten contours on a damaged panel using Glue-Pulling Dent Repair (GPDR).
	2.3.12	Mix and apply body filler.
Topic 2.4	**Moveable Glass and Hardware**	
	Student Competencies	
	2.4.1	Inspect, adjust, overhaul repair or replace window regulators, run channels, glass, power mechanisms, and related controls.
	2.4.2	Inspect, adjust, repair, remove, reinstall or replace weather-stripping.
	2.4.3	Inspect, remove, repair or replace, and adjust removable power operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs.
	2.4.4	Inspect, remove, reinstall, and align convertible top and related mechanisms.
	2.4.5	Identify or recalibrate electrical components that may need to be initialized.
Topic 2.5	**Plastics, Adhesives, and Welding**	
	Student Competencies	
	2.5.1	Identify the types of plastics; determine repairability.

	2.5.2	Identify location of damage relative to safety systems (ADAS); determine repairability according to manufacturer repair procedures.
	2.5.3	Clean and prepare the surface of plastic parts; identify the types of plastic repair procedures.
	2.5.4	Repair rigid, semi-rigid, or flexible plastic panels.
	2.5.5	Remove, replace, or repair damaged areas of rigid exterior composite panels.
	2.5.6	Replace bonded rigid exterior composite body panels; straighten or align panel supports.
	2.5.7	Repair plastic parts by welding (nitrogen or, airless).
	2.5.8	Perform a single-sided adhesively bonded cosmetic repair.
	2.5.9	Perform a double-sided adhesively bonded repair.
	2.5.10	Perform an adhesively bonded or welded tab repair.
	2.5.11	Shape and reform damaged plastic.

Standard 3	*MECHANICAL AND ELECTRICAL COMPONENTS*	
Topic 3.1	**Suspension and Steering**	
	Student Competencies	
	3.1.1	Perform visual inspection and measuring checks to identify steering and suspension collision damage.
	3.1.2	Identify one–time use fasteners.
	3.1.3	Clean, inspect, and prepare reusable fasteners.
	3.1.4	Remove, replace, inspect or adjust power steering pump, pulleys, belts, hoses, fittings, and pump mounts.
	3.1.5	Remove and replace power steering gear (non-rack and pinion type).
	3.1.6	Inspect, remove, and replace power rack and pinion steering gear and related components.
	3.1.7	Inspect and replace parallelogram steering linkage components.
	3.1.8	Inspect, remove, and replace upper and lower control arms and related components.
	3.1.9	Inspect, remove, and replace steering knuckle/spindle/hub assemblies (including bearings, races, seals, etc.).
	3.1.10	Inspect, remove, and replace front suspension system coil springs and spring insulators (silencers).
	3.1.11	Inspect, remove, replace, and adjust suspension system torsion bars, and mounts.
	3.1.12	Inspect, remove, and replace stabilizer bar bushings, brackets, and links.
	3.1.13	Inspect, remove, and replace MacPherson strut or assembly, upper bearing, and mount.
	3.1.14	Inspect, remove, and replace rear suspension system transverse links, control arms, stabilizer bars, bushings, and mounts.
	3.1.15	Inspect, remove, and replace suspension system leaf spring(s) and related components.
	3.1.16	Inspect axle assembly for damage and misalignment.
	3.1.17	Inspect, remove, and replace shock absorbers.
	3.1.18	Diagnose, inspect, adjust, repair, or replace active suspension systems and associated lines and fittings.
	3.1.19	Measure vehicle ride height and wheelbase according to manufacturer specifications.
	3.1.20	Inspect, remove, replace, and align front and rear frame (cradles/subframe).
	3.1.21	Diagnose and inspect steering wheel, steering column, and components.
	3.1.22	Verify proper operation of steering systems including electronically controlled, hydraulic and electronically assisted steering systems.
	3.1.23	Diagnose front and rear suspension system noises and body sway problems; determine necessary action.
	3.1.24	Diagnose vehicle wandering, pulling, hard steering, bump steer, memory steering, torque steering, and steering return problems; determine necessary action.
	3.1.25	Demonstrate an understanding of wheel, suspension, and steering alignments (caster, camber, toe, SAI etc.).
	3.1.26	Inspect tires; identify tire wear patterns, direction of rotation and location; check tire size, identify nitrogen or air, check tire pressure monitoring system (TPMS) and adjust air pressure.
	3.1.27	Diagnose wheel/tire vibration, shimmy, tire pull (lead), wheel hop problems; determine needed repairs.

	3.1.28	Measure wheel, tire, axle, and hub runout; determine needed repairs.
	3.1.29	Reinstall wheels and tighten lug nuts to manufacturers spec using a torque wrench.
	3.1.30	Perform initialization or calibration procedures for steering angle sensor (SAS) following suspension and/or steering system repairs.
	3.1.31	Perform a tire pressure monitoring system (TPMS) recalibration.
	3.1.32	Lift the vehicle for inspection, service, and repair by properly raising and supporting the vehicle.
Topic 3.2	**Electrical -----*Note: all tasks in this section refer to low voltage systems and components only***	
	Student Competencies	
	3.2.1	Demonstrate an understanding of Ohm's Law.
	3.2.2	Check for available voltage, voltage drop and current, and resistance in electrical wiring circuits and components with a DMM (digital multimeter).
	3.2.3	Repair wiring and connectors.
	3.2.4	Inspect, test, and replace fusible links, circuit breakers, and fuses.
	3.2.5	Perform battery state-of-charge test and slow/fast battery charge.
	3.2.6	Inspect and clean or replace battery, battery cables, connectors, and clamps.
	3.2.7	Dispose/recycle batteries according to local, state, and federal requirements.
	3.2.8	Identify programmable electrical/electronic components and check for malfunction indicator lamp (MIL) and fault codes; record data (pre-scan) for reprogramming before disconnecting battery; perform post-scan after repairs are completed.
	3.2.9	Inspect alignment, adjust, remove and replace alternator (generator), drive belts, pulleys, and fans.
	3.2.10	Check operation and aim headlamp assemblies and fog/driving lamps; determine needed repairs.
	3.2.11	Inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and ground wires of interior and exterior light circuits.
	3.2.12	Remove and replace horn(s); check operation.
	3.2.13	Check operation of wiper/washer systems; determine needed repairs.
	3.2.14	Check operation of power windows; determine needed repairs.
	3.2.15	Check operation of motorized sliding doors, lift gates tailgates, running boards, etc.; determine needed repairs.
	3.2.16	Inspect, remove, and replace power seat, motors, linkages, cables, etc.
	3.2.17	Inspect, remove, and replace components of electric door and hatch/trunk lock.
	3.2.18	Inspect, remove, and replace components of keyless lock/unlock devices and alarm systems.
	3.2.19	Inspect, remove, and replace components of electrical sunroof and convertible/retractable hard top.
	3.2.20	Check operation of electrically heated mirrors, windshields, back lights, panels, etc.; determine needed repairs.
	3.2.21	Demonstrate self-grounding procedures (anti-static) for handling electronic components.
	3.2.22	Check for module communication errors using a scan tool.
	3.2.23	Use wiring diagrams, component location, and diagnostic flow charts during diagnosis of electrical circuit problems.
	3.3.24	Check operation of motorized sliding doors, lift gates tailgates, running boards, etc.; determine needed repairs.

Topic 3.3	**Brakes**	
	Student Competencies	
	3.3.1	Inspect brake lines, hoses, and fittings for damage or wear; tighten fittings and supports; replace brake lines (double flare and ISO types).
	3.3.2	Identify, handle, store, and fill with appropriate brake fluids.
	3.3.3	Bleed (manual, pressure, or vacuum) hydraulic brake system.
	3.3.4	Pressure test brake hydraulic system; determine necessary action.
	3.3.5	Adjust brake shoes; remove and reinstall brake drums or drum/hub assemblies.
	3.3.6	Remove, clean, and inspect caliper and rotor assembly and mountings for wear and damage; reinstall.
	3.3.7	Inspect parking brake system operation; repair or adjust as necessary; verify operation.
	3.3.8	Identify the proper procedures for handling brake dust.
	3.3.9	Check for bent or damaged brake system components.
	3.3.10	Demonstrate an understanding of various types of advanced braking systems (ABS, electronic parking brake, hydraulic, electronic, traction and stability control).
	3.3.11	Place vehicle in service mode as needed before servicing brake system.
Topic 3.4	**Air Conditioning**	
	Student Competencies	
	3.4.1	Identify and comply with environmental regulations relating to refrigerants and coolants.
	3.4.2	Maintain and verify correct operation of certified refrigerant recovery and recharging equipment.
	3.4.3	Locate and identify A/C system service ports.
	3.4.4	Review procedures for recovering, labeling, and recycling refrigerant from an A/C system in accordance with EPA section 609 guidelines.
	3.4.5	Select refrigerant, evacuate, and recharge A/C system.
	3.4.6	Select oil type and install correct amount in A/C system.
	3.4.7	Inspect, adjust, and replace A/C compressor drive belts; check pulley alignment.
	3.4.8	Remove and replace A/C compressor; inspect, repair or replace A/C compressor mount.
	3.4.9	Inspect, repair, or replace A/C system mufflers, hoses, lines, fittings, orifice tube, expansion valve, and seals.
	3.4.10	Inspect, test, and replace A/C system condenser and mounts.
	3.4.11	Inspect and replace receiver/drier or accumulator/drier.
	3.4.12	Inspect and repair A/C component wiring.
	3.4.13	Inspect and protect open A/C system components from contaminants during repairs.
	3.4.14	Verify and document air temperature at dash vents following repair.
Topic 3.5	**Cooling Systems**	
	Student Competencies	
	3.5.1	Check engine cooling and heater system hoses and belts; determine needed repairs.
	3.5.2	Inspect, test, remove, and replace radiator, pressure cap, coolant recovery system, and water pump.

	3.5.3	Recover, refill, and bleed system with proper coolant and check level of protection; leak test system and dispose of materials in accordance with EPA regulations.
	3.5.4	Remove, inspect, and replace fan (both electrical and mechanical), fan sensors, fan pulley, fan clutch, and fan shroud; check operation.
	3.5.5	Inspect, remove, and replace auxiliary oil/fluid coolers; check oil levels.
	3.5.6	Verify and document air temperature at floor vents following repair.
Topic 3.6	**Drive Train**	
	Student Competencies	
	3.6.1	Remove, replace, and adjust shift or clutch linkage as required.
	3.6.2	Remove and replace electronic sensors, wires, and connectors.
	3.6.3	Remove and reinstall powertrain assembly; inspect, replace, and align powertrain mounts.
	3.6.4	Remove and replace drive axle assembly.
	3.6.5	Inspect, remove, and replace half shafts and axle constant velocity (CV) joints.
	3.6.6	Inspect, remove, and replace drive shafts and universal joints.
Topic 3.7	**Fuel, Intake, and Exhaust Systems**	
	Student Competencies	
	3.7.1	Inspect, remove, and replace exhaust pipes, mufflers, converters, resonators, tail pipes, and heat shields.
	3.7.2	Inspect, remove, and replace fuel tank, tank filter, cap, filler hose, pump/sending unit and inertia switch; inspect, depressurize, and replace fuel lines and hoses.
	3.7.3	Inspect, remove, and replace air intake systems.
	3.7.4	Inspect, remove, and replace canister, filter, vent, and purge lines of fuel vapor (EVAP) control systems.
Topic 3.8	**Restraint Systems**	
	Student Competencies	
	3.8.1	Inspect, remove, and replace seatbelt and shoulder harness assembly and components.
	3.8.2	Inspect restraint system mounting areas for damage; repair as needed.
	3.8.3	Inspect the operation of seatbelt system.
	3.8.4	Disable and enable Supplemental Restraint System (SRS).
	3.8.5	Inspect, protect, remove, and replace Supplemental Restraint Systems (SRS) sensors and wiring; ensure sensor orientation.
	3.8.6	Verify that Supplemental Restraint System (SRS) is operational.
	3.8.7	Inspect, remove, replace, and dispose of deployed and non-deployed airbag(s) and pretensioners following federal, state, and local regulations.
	3.8.8	Use Diagnostic Trouble Codes (DTC) to diagnose and repair the Supplemental Restraint System (SRS).
	3.8.9	Demonstrate an understanding of advanced restraint systems and occupant classification systems (OCS).
	3.8.10	Identify components of Supplemental Restraint Systems (SRS)

Topic 3.9	Advanced Driver Assistance Systems (ADAS)	
	Student Competencies	
	3.9.1	Identify types of ADAS systems (such as speed control, collision avoidance, lane departure warning and assist, and camera systems) on the vehicle being repaired.
	3.9.2	Research operation of ADAS systems, sensors, and actuators, and static and/or dynamic recalibration procedures on the vehicle being repaired.
	3.9.3	Prepare vehicle and ensure service area is appropriate for static ADAS system recalibration.
	3.9.4	Perform static/dynamic ADAS recalibration procedures.
	3.9.5	Diagnose failed ADAS recalibrations, identify needed repairs.
Topic 3.10	**Hybrid/Electric Vehicle Service**	
	Student Competencies	
	3.10.1	Locate procedures for safe disabling and re-enabling of high voltage systems on hybrid/electric vehicles.
	3.10.2	Identify potential safety and materials handling concerns associated with high voltage hybrid/electric vehicle battery systems.
	3.10.3	Demonstrate knowledge of special multimeters, insulated tools, and other test equipment required for use in high voltage/electric vehicle circuits.
	3.10.4	Demonstrate knowledge of personal protective equipment (PPE) required for use in high voltage/electric vehicle circuits.
	3.10.5	Demonstrate knowledge of the use of a live-dead-live/zero potential test to verify isolation of the high voltage traction battery.
	3.10.6	Demonstrate knowledge of the testing and verification of ground circuit isolation between vehicle chassis ground and the high voltage circuits and components.
	3.10.7	Demonstrate an understanding of safe handling procedures associated with high voltage A/C compressors and wiring.
	3.10.8	Demonstrate an understanding of hybrid/electric cooling systems.
	3.10.9	Demonstrate an understanding of safe handling procedures associated with high voltage powertrain components.
	3.10.10	Demonstrate knowledge of recommendations/requirements for the storage of high voltage batteries removed from vehicles and replacement high voltage batteries.

Standard 4		***COLLISION REPAIR AND REFINISH FUNDAMENTALS***
Topic 4.1	**Damage Analysis and Estimating: Damage Analysis**	
	Student Competencies	
	4.1.1	Identify components to be removed to gain access to damaged areas.
	4.1.2	Analyze damage to determine appropriate repair methods in accordance with manufacturer's recommendations and guidelines.
	4.1.3	Determine the direction, point(s) of impact, and extent of direct, indirect, and inertia damage.
	4.1.4	Perform visual inspection of non-structural components.
	4.1.5	Determine parts, components, material type(s) and procedures necessary for a proper repair.
	4.1.6	Identify suspension, electrical, and mechanical component physical damage.
	4.1.7	Identify single (one time) use components.
Topic 4.2	**Damage Analysis and Estimating: Estimating**	
	Student Competencies	
	4.2.1	Determine and record customer/vehicle owner information.
	4.2.2	Identify and record vehicle identification number (VIN) information, including nation of origin, make, model, restraint system, body type, production date, engine type, build data, and assembly plant.
	4.2.3	Identify and record vehicle mileage and options, including trim level, paint code, transmission, accessories, and modifications.
	4.2.4	Identify safety systems; determine precautions, inspections, and replacement items as required.
	4.2.5	Apply appropriate estimating and parts nomenclature (terminology).
Topic 4.3	**Damage Analysis and Estimating: Vehicle Construction and Parts Identification**	
	Student Competencies	
	4.3.1	Identify type of vehicle construction (unibody, body-over-frame).
	4.3.2	Recognize the different collision damage between unibody and body-over-frame vehicles.
	4.3.3	Identify impact energy absorbing components.
	4.3.4	Identify different types and strengths of substrates (steel types, aluminum, magnesium, plastic, composites, etc.)
	4.3.5	Identify vehicle glass components and repair/replacement procedures.
	4.3.6	Identify add-on accessories.
	4.3.7	Recognize different vehicle joining/attaching methods (e.g., welding, adhesives, rivets, etc.)

Topic 4.4	Refinishing: Safety Precautions and Regulations	
	Student Competencies	
	4.4.1	Select and use the proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application, paint defects, and detailing (gloves, suits, hoods, eye and ear protection, etc.); take necessary precautions with hazardous operations and materials according to federal, state, and local regulations.
	4.4.2	Identify safety and personal health hazards according to OSHA guidelines, the "Right to Know Law", and SDS information.
	4.4.3	Inspect spray environment and equipment to ensure compliance with federal, state and local regulations, and for safety and cleanliness hazards.
	4.4.4	Select and use a NIOSH approved respiratory protection system (supplied air/fresh air make up recommended). Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulations.
	4.4.5	Perform equipment and work area clean-up as per applicable federal, state, and local regulations.
	4.4.6	Demonstrate knowledge of the process for tracking of expelled VOCs.
	4.4.7	Follow federal, state, and local regulations regarding the handling and disposal of refinishing waste products.
Topic 4.5	**Refinishing: Surface Preparation**	
	Student Competencies	
	4.5.1	Inspect, remove, store, protect, and replace exterior trim and components necessary for proper surface preparation.
	4.5.2	Soap and water wash entire vehicle; use appropriate cleaner to remove contaminants.
	4.5.3	Remove paint finish as needed.
	4.5.4	Properly sand areas to be refinished.
	4.5.5	Identify and select appropriate sandpaper to featheredge areas to be refinished.
	4.5.6	Apply suitable metal treatment or primer in accordance with total product systems.
	4.5.7	Mask and protect other areas that will not be refinished.
	4.5.8	Demonstrate different masking techniques (recess/back masking, foam door type, etc.).
	4.5.9	Mix primer, primer-surfacer following paint manufacturers technical data sheet instructions.
	4.5.10	Apply primer onto surface of repaired area, demonstrating control of primer application by keeping the areas as small as possible.
	4.5.11	Force curing and drying of primer coating following paint manufacturers technical data sheet.
	4.5.12	Apply two-component finishing filler to minor surface imperfections.
	4.5.13	Apply guide coat and block sand area with correct grade/grit sandpaper to which primer-surfacer has been applied.
	4.5.14	Dry sand area to which two-component finishing filler has been applied.
	4.5.15	Remove dust from area to be refinished, including cracks or moldings of adjacent areas.
	4.5.16	Clean area to be refinished using a recommended final cleaning solution.
	4.5.17	Prepare adjacent panels for blending using paint manufacturers procedures.

	4.5.18	Identify the types of rigid, semi-rigid or flexible plastic parts to be refinished; determine the materials needed, preparation, and refinishing procedures.
	4.5.19	Identify metal parts to be refinished; determine the materials needed, preparation, and refinishing procedures.
	4.5.20	Identify refinishing guidelines for stationary glass flange areas to be refinished.
Topic 4.6	**Refinishing: Spray Gun and Related Equipment Operation**	
	Student Competencies	
	4.6.1	Inspect, clean, and determine condition of spray guns and related equipment (air hoses, regulators, air lines, air source, spray environment, and filters).
	4.6.2	Select spray gun setup (fluid needle, nozzle, and cap) for product being applied.
	4.6.3	Test and adjust spray gun using fluid, air, and pattern control valves.

Standard 5	*WELDING, CUTTING, AND JOINING*	
Topic 5.1	**Metal Welding, Cutting, and Joining**	
	Student Competencies	
	5.1.1	Identify the considerations for cutting, removing, and welding various types of steel, aluminum, and other metals.
	5.1.2	Determine the correct GMAW welder type, electrode/wire type, diameter, and gas to be used in a specific welding situation.
	5.1.3	Set up, attach work clamp (ground), and adjust the GMAW welder to "tune" for proper electrode stickout, voltage, polarity, flow rate, and wire-feed speed required for the substrate being welded.
	5.1.4	Store, handle, and install high-pressure gas cylinders; test for leaks.
	5.1.5	Determine the proper angle of the gun to the joint and direction of gun travel for the type of weld being made.
	5.1.6	Protect adjacent panels, glass, vehicle interior, etc. to prevent damage from welding and cutting operations.
	5.1.7	Identify hazards, foam coatings, and flammable materials prior to welding/cutting procedures.
	5.1.8	Protect computers and other electronics/wires prior to welding procedures.
	5.1.9	Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary, and clamp or tack as required.
	5.1.10	Determine the joint type (butt weld with backing, lap, etc.) for weld being made.
	5.1.11	Determine the type of weld (continuous, stitch weld, plug, etc.) for each specific welding operation.
	5.1.12	Perform the following welds: plug, butt weld with and without backing, and fillet etc., in the flat, horizontal, vertical, and overhead positions.
	5.1.13	Perform visual evaluation and destructive test on each weld type.
	5.1.14	Identify the causes of various welding defects; make necessary adjustments.
	5.1.15	Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments.
	5.1.16	Identify cutting process for different substrates and locations; perform cutting operation.
	5.1.17	Identify different methods of attaching structural components (squeeze type resistance spot welding (STRSW), structural adhesive, MIG bronze, weld bonding, etc.).
	5.1.18	Perform rivet bonding procedures.
	5.1.19	Dress/grind weld as needed.

Career Ready Practices

1. Lead as a Contributing & Professional Employee

Career-ready individuals understand the role and responsibilities of their position and demonstrate this understanding by regularly contributing to the success of their organization. They are reliable and lead by example through work ethic and professionalism, as defined by the standards set by their workplace. This Career Ready Practice includes understanding and exhibiting the core values of their organization and modeling strong morals, motivation, excellence, and consistency.

2. Communicate Clearly, Effectively, & with Reason

Career-ready individuals are able to communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. This Career Ready Practice includes actively listening to peers and colleagues regardless of level and ensuring that diverse perspectives are heard, considered, and fostered. Regardless of communication method, individuals understand the needs of a specific audience and are able to tailor their message or style to meet these needs. Proficiency in communication helps build strong relationships, facilitates collaboration, and ensures that information is accurately exchanged.

3. Think Critically to Make Sense of Problems & Persevere in Solving Them

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and effectively plan to solve the problem in an efficient way. Individuals can analyze information and evaluate various courses of action for future success. This Career Ready Practice prepares individuals to tackle complex challenges, innovate solutions, and contribute to strategic planning and operational efficiency. Individuals should also use lessons learned from previous projects to improve future projects, systems, or processes through continuous improvement.

4. Collaborate Productively while Using Cultural & Global Competencies

Career-ready individuals are able to work effectively in diverse teams to successfully accomplish a goal in both in-person and virtual environments. This Career Ready Practice includes understanding team dynamics, respecting diverse perspectives, demonstrating empathy, and contributing positively to team outcomes. Effective collaboration leverages the strengths of team members, enhances problem-solving, and leads to innovative solutions by recognizing that each team member has something unique to contribute. Preparing to work in diverse teams ensures readiness for the collaborative nature of modern workplaces and requires recognizing biases and advocating for inclusive practices. Cultivating an inclusive environment not only enhances team dynamics but also drives innovation and reflects positively on organizational culture.

5. Use digital Skills & Technologies to Enhance Productivity & Make Data-informed Decisions

Career-ready individuals are digitally literate—proficient with the digital skills and technology that are regularly used in their evolving workplace. This Career Ready Practice involves using digital tools to enhance productivity, understanding the impact of technology on one's work, and staying updated with technological advancements that may have future impacts for a given industry area. Individuals can use technology and digital tools to analyze and report data, helping to make decisions that are data informed and data driven. Digitally literate individuals are also able to understand digital security and privacy and are able to use social media professionally and responsibly.

6. Remain Resilient in a Changing Workplace & World of Work

Career-ready individuals have the ability to adjust to change and remain resilient in the face of challenges, both within a workplace and throughout their careers. This Career Ready Practice involves maintaining a positive attitude despite challenges and being open to new ideas and feedback. Individuals seek to act in ways that contribute to the betterment of themselves and their teams, families, community, and workplace. Developing adaptability, flexibility, and resilience helps individuals navigate career transitions, embrace new opportunities, and maintain productivity and well-being under pressure. This Career Ready Practice also includes attending to one's own mental well-being and developing an appropriate work-life balance to sustain productivity, reduce stress, and enhance overall quality of life, which directly affects professional performance and satisfaction.

7. Manage Time & Space Effectively

Career-ready individuals are able to effectively manage their time and use organizational skills to prioritize tasks and meet deadlines. This Career Ready Practice includes planning, delegating tasks effectively, and maintaining a well-organized workspace in both physical and virtual environments. Developing these skills leads to increased efficiency, better project outcomes, and a balanced workload.

8. Demonstrate a Creative & Innovative Mindset

Career-ready individuals are able to use innovation and creativity to think outside the box and develop new ideas and solutions. This Career Ready Practice encourages a mindset of continuous improvement and adaptability and fosters a spirit of curiosity, experimentation, and calculated risk-taking. It prepares individuals to improve systems, drive change, create value, and stay competitive in a rapidly evolving workplace.

9. Act as a Good Steward of Organizational & Personal Finances & Resources

Career-ready individuals are financially literate and can demonstrate their ability to make cost effective decisions on behalf of themselves and their workplace. This Career Ready Practice includes managing personal finances, understanding financial documents, and making informed financial decisions. Financial literacy empowers individuals to make sound investments, budget effectively, and contribute to the financial health of their organization.

10. Navigate an Education & Career Path Aligned to Strengths, Work Style, Interests, & Goals

Career-ready individuals are self-aware about their strengths and working style and can understand how to leverage these traits effectively to maximize their careers. They are also aware of their areas for improvement, seeking opportunities for growth and acting on feedback to continuously improve. This Career Ready Practice is essential for setting realistic career goals, pursuing professional development opportunities, reskilling and upskilling to keep skills and knowledge relevant, and achieving personal and professional fulfillment.

11. Consider the Environmental & Social Impacts of Decisions

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively affect and/or mitigate negative impact on other people, their communities, and the environment. They make decisions with integrity by considering the moral and ethical consequences of their decisions and actively planning for the long-term success of projects, systems, and processes. Developing sustainability and environmental literacy skills prepares individuals to also contribute to a greener future and address global challenges.

12. Apply appropriate academic & technical skills

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be effective and productive employees. They have the technical proficiency to use the language, tools, technologies, and methodologies that are relevant to their specific industry sector. They make connections between abstract concepts and real-world applications, and they make correct determinations about when applying an academic skill is appropriate in a workplace situation. This Career Ready Practice includes staying updated about industry advancements and continuously improving technical skills aligned with the changing needs of their sector.