



**Cleveland Heights – University Heights
City School District**

Automotive Collision

COURSE OF STUDY

July, 2008

**Deborah S. Delisle
Superintendent of Schools**

STATEMENT OF APPROVAL

THIS COURSE OF STUDY HAS BEEN EXAMINED BY THE CLEVELAND HEIGHTS-UNIVERSITY HEIGHTS BOARD OF EDUCATION.

THE DOCUMENT WAS FORMALLY APPROVED FOR ADOPTION BY THE BOARD OF EDUCATION ON JULY 15, 2008.

RESOLUTION #08-07-092

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Automotive Collision
Career Field Technical Content
Standards Document

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ACKNOWLEDGEMENTS
AUTOMOTIVE COLLISION TECHNOLOGY
CLEVELAND HEIGHTS – UNIVERSITY HEIGHTS
SCHOOL DISTRICT

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I would also like to thank the Automotive Technology's Advisory Committee:

- Karla Henderson, Fine Line Foreign Auto Body, LLC
- Pat McCarthy, McCarthy's Auto Body
- Walter Kimbrough, Former Auto Collision Tech. Student
- Gary Horst, Cleveland Painter's Supply
- Jeff Porter, Cleveland Heights High School Auto Technology Teacher

**RECOMMENDATION BY AUTOMOTIVE TECHNOLOGY
COMMITTEE**

Cleveland Heights-University Heights School District

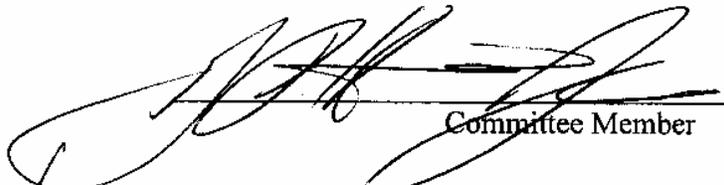
The Career and Technical Advisory Committee of the Auto Collision Technology Program, Cleveland Heights-University Heights School District, has reviewed this course of study and recommends it for use as the foundation for instruction in classroom, laboratory, and cooperative occupational experiences.

The developers of the course of study have considered local labor market needs and the school district's ability to offer specialized programs. The competencies found on the Integrated, Technical & Academic Competencies (ITAC) for this program have been reviewed, modified and accepted as being congruent with our school district's philosophy and student outcome measures. Additional competencies related to the Auto Collision Technology Program have been incorporated into the course of study.

We believe that this course of study adequately and correctly focuses upon the development of technical competencies, attitudes, values and appreciation's critical to success in Auto Collision Technology.

The Auto Collision Technology Advisory Committee recommended this course of study

on 1-16-08
(date)


Committee Member


Committee Member


Committee Member

DISTRICT PHILOSOPHY

PHILOSOPHY OF EDUCATION

The educational organization, administration, development and programs within our school system are to be guided by the following premises:

1. All children are entitled to a public education that will encourage the fullest development of their individual talents.
2. Learning is essential to individual independence and the general welfare of the changing American society.
3. Effective learning develops both intellectual and emotional qualities and is for action; its proper evaluation lies in the quality of resultant activity, not mere response.
4. Organized education, a deployment of human and material resources as means toward learning, implies learning for all -
- students, teachers, administrators -- at different levels of understanding and maturity.
5. Organized education is at its best when graced with experimental attitudes and dedicated to the proposition that all issues between organization and learning shall be resolved in favor of learning.
6. All rewards and penalties adopted in the organization of education become legitimate only insofar as they assist learning.
7. For purposes of learning and growth, internal motivations are more valuable than the external, such as, grades and competition.

The primary people in our school system are first, the students, and next, the teachers. Accordingly, they will be given primary consideration in any action taken by the Board of Education.

Our school system will provide training in the basic skills.

Our school system should provide a framework in which basic problem-solving and personal adjustment methods can be learned in an orderly, phased, and wholly accessible manner.

Our school system should educate toward both responsibility and responsiveness. It should provide greatly enriched conditions for individual growth in self-awareness, in a larger social awareness, and in controlled and meaningful response both to inner and outer influences. It should strive to heighten the developing student's appreciation of the cultural and individual diversity within the human family, and improve his/her skill in working harmoniously and creatively with that diversity, since this is a rich resource for innovative and successful growth.

A major effort of the teaching-learning process should be the early development of positive self-assurance and the continuing development of individual potential to deal with a changing society, to think rationally and creatively, to be independent and productive, and to choose rewarding life activities. Thinking, creativity, independence, productivity, and activity are also characterized by individual differences. Yet they must meet external requirements, and these change with the changing society.

*Ohio Administrative Code 3301-35-02

Approved by Board of Education February 9, 1970

Revised by Board of Education January 31, 1977

Re-adopted by Board of Education January 3, 1978; March 14, 1983;
December 11, 1989

Key to Profile Codes

Importance of Competencies

All of the competencies in this document represent the minimum requirements for a College Tech Prep program. It is the responsibility of the local consortia to further define and/or expand, as needed, the descriptors for each competency. Each competency must be taught at the Proficient level (P) by the completion of the College Tech Prep program, which is an Associate Degree (AD). A minimal number of competencies have been identified as Introduce (I) at the Associate Degree level. These may require further higher education.

This document integrates college prep academics with technical skill. Technical skills are a required component.

- I = Introduce** (Learner will demonstrate knowledge and comprehension of the competency.)
- P = Proficient** (Learner will demonstrate ability to apply knowledge of and/or perform the competency.)
- R = Reinforced** (Competencies marked proficient at the secondary level are to be reinforced at the associate degree level.)

- Grade Level: 10** = by the end of grade 10
- 12** = by the end of grade 12
- AD** = by the end of the Associate Degree

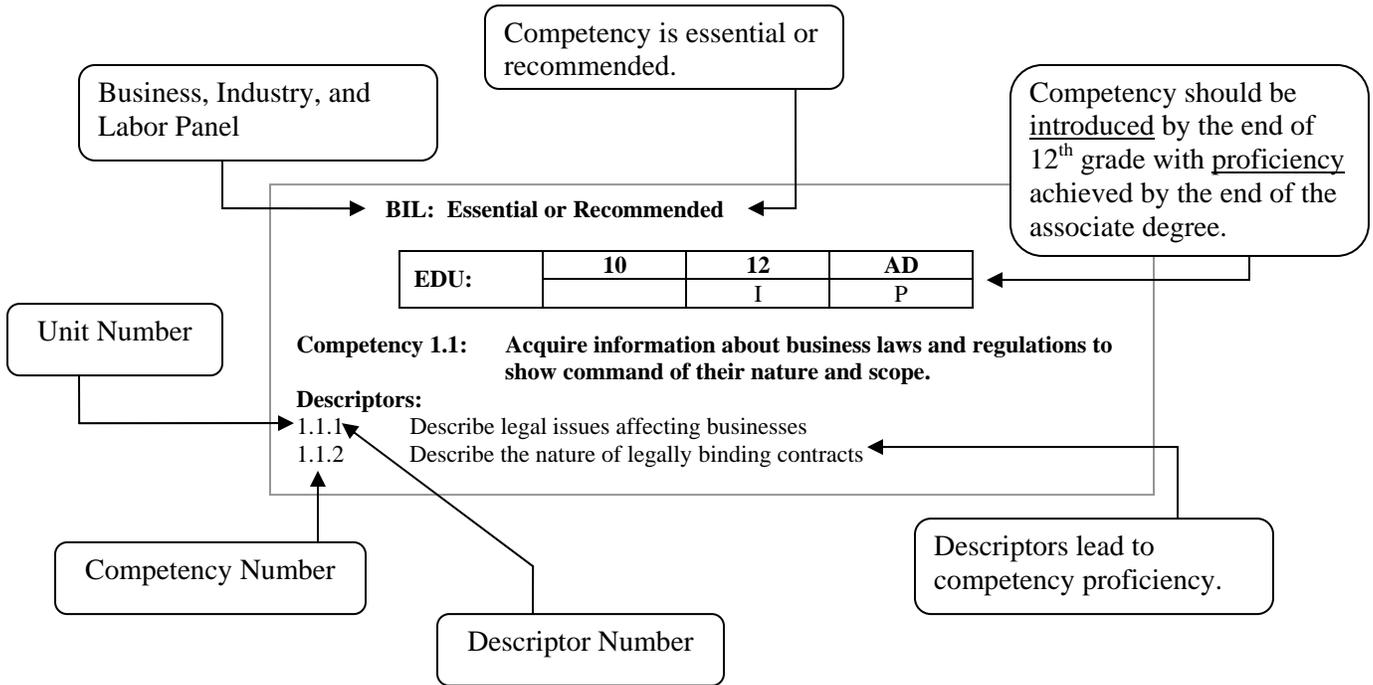
Academic Connection:

As rigorous programs of study, College Tech Prep and Career-Technical programs required academics to be taught at a college preparatory level, and contextually within the technical content. State academic mathematics and language arts benchmarks are embedded within the Career Field Technical Content Standards Document (CFS).

Additional Profile Codes:

TPO: Terminal Performance Objective

Example of Profile Codes



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**TRANSPORTATION
SYSTEMS CORE BODY OF
KNOWLEDGE**

UNITS 1-10

Transportation Systems Core

Unit 1: Career Exploration and Development

BIL: Essential

EDU:	12	AD
	P	R

Competency 1.1: Explore career pathways in transportation systems.

TPO: Given students knowledge about internet usage, explore career pathways in transportation systems, with 90% accuracy.

Descriptors:

- 1.1.1 Identify current and future career options for a person interested in transportation systems.
- 1.1.2 Research the historical evolution of the various careers in transportation systems.
- 1.1.3 Experience specific transportation interests (e.g., shadowing, professional readings, community service, and internship).
- 1.1.4 Analyze the interrelationships between the transportation industry and other industries (e.g., business, agriculture, energy, travel and tourism).
- 1.1.5 Identify the education and licensing requirements needed for a career in transportation systems.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Formulate open-ended research questions suitable for investigation and adjust questions as necessary while research is conducted.* (Research A, 8-10)
- *Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted.* (Research A, 11-12)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)

Correlated Science Academic Content Benchmarks

- *Recognize that scientific literacy is part of being a knowledgeable citizen.* (Scientific Ways of Knowing D, 9-10)
- *Explain how societal issues and considerations affect the progress of science and technology.* (Scientific Ways of Knowing C, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 1.2: Explore professional development and career advancement opportunities for transportation professional.

TPO: Given an article, explore professional development and career advancement opportunities for transportation professional; list 5 key points of the article.

Descriptors:

- 1.2.1 Identify advancement opportunities in transportation systems (e.g., internal and external).
- 1.2.2 Describe the importance of professional organizations, associations, seminars and professional relationships with transportation professionals.
- 1.2.3 Remain current on changes in the transportation systems profession.
- 1.2.4 Demonstrate quality work as measured by performance evaluations.
- 1.2.5 Develop a résumé, list of references and a portfolio.

Correlated English Language Arts Academic Content Benchmarks

- *Produce letters (e.g., business, letters to the editor, job applications) that follow the conventional style appropriate to the text, include appropriate details and exclude extraneous details and inconsistencies. (Writing Applications C, 8-10)*
- *Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)*
- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources. (Research C, 11-12)*

BIL: Essential

EDU:	12	AD
	P	R

Competency 1.3: Demonstrate positive work behaviors and personal qualities.

TPO: On all lectures and lab work, demonstrate positive work behaviors and personal qualities for all note-taking, and lab work at 90% accuracy.

Descriptors:

- 1.3.1 Conform to company and departmental policies (e.g., attendance, punctuality, time management).
- 1.3.2 Demonstrate professionalism, self-discipline, self worth, positive attitude and integrity in a work situation.
- 1.3.3 Demonstrate flexibility and willingness to learn.
- 1.3.4 Exhibit a commitment to the organization.
- 1.3.5 Explain how individuals impact performance in the transportation industry.
- 1.3.6 Describe the expectations for individuals in terms of performance.

- 1.3.7 Identify impact areas of individual performance (e.g., quality, profit, customer relations).1.3.8 Discuss the importance of having all employees understand the core business processes of transportation organizations.
- 1.3.9 Demonstrate positive co-worker and employee/employer relationships.
- 1.3.10 Explain the importance of demonstrating appropriate workplace behaviors and the consequences and negative impacts (e.g. personal and company success) of workplace harassment.

BIL: Essential

EDU:	12	AD
	P	R

Competency 1.4: Develop personal career goals and the objectives to meet those career goals.

TPO: Upon completion of the lesson, develop personal career goals and the objectives to meet those career goals at 90% accuracy.

Descriptors:

- 1.4.1 Identify personal goals and objectives in concert with transportation organization goals.
- 1.4.2 Demonstrate the ability to seek and apply for employment.
- 1.4.3 Research employers and companies and the applicability of personal skill sets.
- 1.4.4 Prepare and interview for employment.
- 1.4.5 Demonstrate the ability to evaluate and compare employment opportunities.
- 1.4.6 Identify the motivations and personal rewards of effective career goals.

Correlated English Language Arts Academic Content Benchmarks

- *Produce letters (e.g., business, letters to the editor, job applications) that follow the conventional style appropriate to the text, include appropriate details and exclude extraneous details and inconsistencies.* (Writing Applications C, 8-10)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

Unit 2: Business Foundations

BIL: Essential

EDU:	12	AD
	I	P

Competency 2.1: Analyze the roles and major functions of transportation systems.

TPO: From a workbook assignments, analyze the roles and major functions of transportation

systems at 80% accuracy.

Descriptors:

- 2.1.1 Identify types of transportation organizations and their functions.
- 2.1.2 Describe and explain the mission of transportation organizations.
- 2.1.3 Use organizational charts to analyze workplace operations.
- 2.1.4 Describe and explain the major internal functions and structures of transportation organizations.
- 2.1.5 Define and explain the critical customers, suppliers, and stakeholders for transportation organizations.
- 2.1.6 Explain the major competitive challenges faced by organizations in the transportation industry.

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Patterns, Functions and Algebra C, 8-10)
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatter plots, measures of center and variability.* (Data Analysis and Probability A, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

BIL: Recommended

EDU:	12	AD
	I	P

Competency 2.2: Develop a business process model for a transportation organization.

TPO: Given an assignment, develop a business process model for a transportation organization, with 80% accuracy.

Descriptors:

- 2.2.1 Define business processes.
- 2.2.2 Identify and explain the core business operations in a transportation organization.
- 2.2.3 Prepare a diagram, chart and/or model that illustrate the organization.
- 2.2.4 Prepare a diagram, chart and/or model that illustrate the workflow through a transportation organization.
- 2.2.5 Demonstrate the fundamentals of systems thinking (e.g. integrate supply chain).

Correlated English Language Arts Academic Content Benchmarks

- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.* (Research E, 8-10; Research E, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Patterns, Functions and Algebra C, 8-10)
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatter plots, measures of center and variability.* (Data Analysis and Probability A, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

BIL: Essential

EDU:	12	AD
	I	P

Competency 2.3: Explain the impact of economic, social and technological changes on a transportation organization.

TPO: Using information from a lesson on industry trends, explain the impact of economic, social and technological changes on a transportation organization, meeting program standards.

Descriptors:

- 2.3.1 Explain the impact of economic changes, including economic income growth and decline, consumer confidence, interest rates, labor, and fuel and material costs.
- 2.3.2 Explain the impact of social changes, including consumer attitudes and preferences, demographics, and population shifts.
- 2.3.3 Explain quality assurance systems and how they contribute to effective work organizations.
- 2.3.4 Describe productivity issues related to transportation (e.g., employee productivity, quality).
- 2.3.5 Explain the impact of technological changes, including transportation and information technology.
- 2.3.6 Explain the major competitive challenges faced by transportation businesses.
- 2.3.7 Describe historical influences on transportation (e.g., labor movement, high-performance, quality).

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Patterns, Functions and Algebra C, 8-10)
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.* (Data Analysis and Probability A, 8-10)

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

BIL: **Recommended**

EDU:	12	AD
	I	P

Competency 2.4: **Explain how planning and budgeting are used to accomplish organizational goals and objectives.**

TPO: *Given an article, explain how planning and budgeting are used to accomplish organizational goals and objectives, write a paragraph about the key points of the article.*

Descriptors:

- 2.4.1 Explain how work plans and budgets are used to allocate people and resources.
- 2.4.2 Identify reports used to track performance and resources, and explain how they are used.
- 2.4.3 Explain how plans and budgets are revised to meet goals and objectives.
- 2.4.4 Explain the impact of long term goals and planning on organization performance.
- 2.4.5 Identify and describe the most critical performance problems that transportation businesses typically face.
- 2.4.6 Describe how improvements are identified and modifications are implemented.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.* (Patterns, Functions and Algebra D, 8-10)
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.* (Data Analysis and Probability A, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

BIL: **Recommended**

EDU:	12	AD
	I	P

Competency 2.5: **Explain material control and product inventories necessary to meet customer and business requirements.**

TPO: Given a supply room, explain material control and product inventories necessary to meet customer and business requirements, by performing a complete inventory with 95% accuracy.

Descriptors:

- 2.5.1 Analyze the relationship of quality control to supply of materials.
- 2.5.2 Identify inventory control systems and system reliability used in business (e.g., just-in-time) and its relationship to transportation costs and risks.
- 2.5.3 Analyze the impact of inventory control systems on productivity and profit or loss.

Correlated English Language Arts Academic Content Benchmarks

- *Evaluate the usefulness and credibility of data and sources.* (Research B, 8-10)
- *Organize information from various resources and select appropriate sources to support central ideas, concepts and themes.* (Research C, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.* (Data Analysis and Probability E, 8-10)
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.* (Data Analysis and Probability A, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

BIL: Essential

EDU:	12	AD
	I	P

Competency 2.6: Maintain compliance with organizational policies and government laws and regulations.

TPO: Using information from a lesson on ethics, Maintain compliance with organizational policies and government laws and regulations, meeting industry standards.

Descriptors:

- 2.6.1 Identify and explain relevant organizational policies and regulations for general functions that are driven by government laws and regulations.
- 2.6.2 Identify and explain relevant government laws and regulations for specific functions within transportation organizations.
- 2.6.3 Examine the governmental roles in managing the infrastructure of transportation operations.
- 2.6.4 Explain the governmental roles in health, safety and environment management.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)

BIL: **Essential**

EDU:	12	AD
	I	P

Competency 2.7: **Explain how transportation businesses manage customer relationships.**

TPO: *Given a repair order with customer information and needs, explain how transportation businesses manage customer relationships, with 100% compliance.*

Descriptors:

- 2.7.1 Conduct in-depth investigation to identify internal and external customer needs.
- 2.7.2 Maintain a liaison with customer contacts.
- 2.7.3 Maintain customer satisfaction and address customer problems and complaints efficiently.
- 2.7.4 Communicate with internal and/or external customers to ensure products or services meet customer requirements.

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted.* (Research A, 11-12)
- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communication A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.* (Data Analysis and Probability E, 8-10)
- *Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.* (Data Analysis and Probability C, 11-12)
- *Connect statistical techniques to applications in workplace and consumer situations.* (Data Analysis and Probability D, 11-12)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 2.8: Describe a management plan for business.

TPO: Given a group activity to complete in a given time, describe a management plan for business, with 80% accuracy.

Descriptors:

- 2.8.1 Describe strategies to achieve company goals and objectives.
- 2.8.2 Design an organizational chart with job and activity descriptions.
- 2.8.3 Identify market segments and perspective clients.
- 2.8.4 Describe a business development plan.
- 2.8.5 Define and explain the role of research and development.

Correlated English Language Arts Academic Content Benchmarks

- *Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)*

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis and Probability F, 8-10)*
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data Analysis and Probability A, 11-12)*
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience. (Mathematical Processes I, 11-12)*

BIL: Recommended

EDU:	12	AD
	I	R

Competency 2.9: Identify basic procedures in the accounting cycle.

TPO: Given a repair order with parts and labor prices, identify basic procedures in the accounting cycle, with 100% compliance.

Descriptors:

- 2.9.1 Describe the basic application of internal and external accounting.
- 2.9.2 Describe the essential nature of profitability and value.
- 2.9.3 Describe job costing with direct and indirect costs.
- 2.9.4 Explain basic economic concepts (e.g., supply, demand, price, cost, profit, value, cash flow).
- 2.9.5 Recognize accounting as part of the organizational team.

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Patterns, Functions and Algebra C, 8-10)
- *Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros.* (Patterns, Functions and Algebra E, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 2.10: Define and explain the major measures a transportation organization uses to manage and improve performance.

TPO: Using ones notes, define and explain the major measures a transportation organization uses to manage and improve performance, with 80% accuracy according to industry.

Descriptors:

- 2.10.1 Define and explain the measures for financial performance (e.g. profitability, cost reduction, asset utilization).
- 2.10.2 Define and explain the measures for market performance (e.g., customer and sales and/or service growth).
- 2.10.3 Define and explain the operational measures for service and internal operations performance (e.g., customer satisfaction, service quality, cycle time, on-time delivery, claims-free handling).
- 2.10.4 Define and explain the measures for organizational compliance and health, safety and environmental performance (e.g., audit findings, emissions, lost time accidents).
- 2.10.5 Describe benchmark performances against competitors and the general industry.
- 2.10.6 Describe the continuous improvement process.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 2.11: Explain the role of risk management in reducing risks and improving performance.

TPO: Given the automotive shop safety standards, explain the role of risk management in reducing risks and improving performance, with 100% accuracy for safety.

Descriptors:

- 2.11.1 Explain the concept of risk management programs.
- 2.11.2 Describe the major types of loss exposures for a transportation organization, including property, liability, personnel and net income.
- 2.11.3 Describe the approaches for managing organizational risks.
- 2.11.4 Describe the employees' role in risk management.

Correlated Mathematics Academic Content Benchmarks

- *Connect statistical techniques to applications in workplace and consumer situations.* (Data Analysis and Probability D, 11-12)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Recommended

EDU:	12	AD
	I	R

Competency 2.12: Examine entrepreneurship.

TPO: Presented with a group activity, examine entrepreneurship, with 90%.

Descriptors:

- 2.12.1 Compare personal interests and skills with those needed by an entrepreneur.
- 2.12.2 Examine the abilities and aptitudes needed to become a successful entrepreneur.
- 2.12.3 Determine motives for becoming an entrepreneur.
- 2.12.4 Examine characteristics of entrepreneurs.
- 2.12.5 Compare business ownership to working for others.
- 2.12.6 Explain the risks and rewards of business ownership.
- 2.12.7 Examine the relationship of small business to the state, national and global economies.
- 2.12.8 Explain how an entrepreneurial mindset can affect a company.

Correlated English Language Arts Academic Content Benchmarks

- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Connect statistical techniques to applications in workplace and consumer situations.* (Data Analysis and Probability D, 11-12)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

BIL: **Recommended**

EDU:	12	AD
	I	R

Competency 2.13: **Explain the role of small business in the economy.**

TPO: Presented with a lecture, explain the role of small business in the economy, with 80% accuracy.

Descriptors:

- 2.13.1 Explain the need for entrepreneurial discovery.
- 2.13.2 Determine opportunities for venture creation.
- 2.13.3 Assess opportunities for venture creation.
- 2.13.4 Describe idea-generation methods.
- 2.13.5 Generate venture ideas.
- 2.13.6 Determine the feasibility of ideas.

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigation and adjust questions as necessary while research is conducted.* (Research A, 8-10)
- *Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted.* (Research A, 11-12)
- *Organize information from various resources and select appropriate sources to support central ideas, concepts and themes.* (Research C, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Connect statistical techniques to applications in workplace and consumer situations.* (Data Analysis and Probability D, 11-12)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematical Processes B, 8-10)

Unit 3: Communications

BIL: **Essential**

EDU:	12	AD
	P	R

Competency 3.1: **Utilize reading strategies to interpret transportation systems data, information and analysis.**

TPO: Presented with a reading activity, utilize reading strategies to interpret transportation systems data, information and analysis, with 80% accuracy.

Descriptors:

- 3.1.1 Skim, read for detail, read for meaning and for critical analysis, to determine the purpose of a text.
- 3.1.2 Describe the content, technical concepts and vocabulary to analyze information and follow directions.
- 3.1.3 Interpret, transcribe and communicate information, data and observations to apply information learned from reading to actual practice.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Apply reading comprehension strategies to understand grade-appropriate text.* (Reading Process A, 8-10; Reading Process A, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 3.2: Locate, organize and reference written transportation systems information from various sources.

TPO: Using a given repair on a vehicle, locate, organize and reference written transportation systems information from various sources, with 80% accuracy.

Descriptors:

- 3.2.1 Locate written information to communicate with co-workers, clients and participants.
- 3.2.2 Organize information to use in written and oral communications.
- 3.2.3 Document the source and proper reference for written information.

Correlated English Language Arts Academic Content Benchmarks

- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources.* (Research C, 11-12)
- *Use style guides to produce oral and written reports that give proper credit for sources (e.g., words, ideas, images and information) and include an acceptable format for source acknowledgement.* (Research D, 8-10; Research D, 11-12)
- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia.* (Research E, 8-10; Research E, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. (Patterns, Functions and Algebra C, 8-10)*
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability. (Data Analysis and Probability A, 8-10)*
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)*
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience. (Mathematical Processes I, 11-12)*

BIL: Essential

EDU:	12	AD
	P	R

Competency 3.3: Write and utilize coherent and focused technical communications that support a defined perspective for transportation systems.

TPO: Provided with forms and a customer, write and utilize coherent and focused technical communications that support a defined perspective for transportation systems, with 80% accuracy in accordance with industry standards.

Descriptors:

- 3.3.1 Use various note-taking techniques to summarize main ideas.
- 3.3.2 Structure ideas and arguments in an organized manner and that are supported by relevant documentation and/or examples.
- 3.3.3 Write messages using language that is appropriate for the intended audience and purpose.
- 3.3.4 Use correct spelling, grammar, capitalization and punctuation.
- 3.3.5 Identify positions from relevant research and resources.
- 3.3.6 Calculate and interpret descriptive statistics to communicate and support predictions and conclusions.
- 3.3.7 Utilize tables, charts and graphs to clarify textual explanations and support arguments.

Correlated English Language Arts Academic Content Benchmarks

- *Formulate writing ideas, and identify a topic appropriate to the purpose and audience. (Writing Process A, 8-10; Writing Process A, 11-12)*
- *Prepare writing for publication that is legible, follows an appropriate format and uses techniques such as electronic resources and graphics. (Writing Process F, 8-10)*
- *Prepare writing for publication that follows an appropriate format and uses a variety of techniques to enhance the final product. (Writing Process F, 11-12)*
- *Edit to improve sentence fluency, grammar and usage. (Writing Process D, 8-10)*
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)*
- *Organize information from various resources and select appropriate sources to support central ideas, concepts and themes. (Research C, 8-10)*

Correlated Mathematics Academic Content Benchmarks

- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.* (Data Analysis and Probability A, 8-10)
- *Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose.* (Data Analysis and Probability B, 8-10)
- *Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data.* (Data Analysis and Probability D, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data Analysis and Probability B, 11-12)
- *Write clearly and coherently about mathematical thinking and ideas.* (Mathematical Processes G, 8-10)

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.* (Scientific Inquiry A, 9-10)
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data.* (Scientific Inquiry A, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 3.4: Deliver formal and informal presentations that demonstrate organization and delivery skill.

TPO: Upon completion of the lesson, deliver formal and informal presentations that demonstrate organization and delivery skill at 90% accuracy.

Descriptors:

- 3.4.1 Demonstrate appropriate usage of grammar, diction and sentence structure.
- 3.4.2 Communicate main ideas and supporting facts to achieve the purpose of communication.
- 3.4.3 Use appropriate technology to enhance the clarity and persuasiveness.
- 3.4.4 Use proper organization and structure to achieve coherence.
- 3.4.5 Use technical terms, references and quoted material properly.
- 3.4.6 Engage an audience using appropriate vocal variety and gestures.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communications: Oral and Visual D, 8-10)

- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)
- *Give presentations using a variety of delivery methods, visual displays and technology.* (Communications: Oral and Visual G, 8-10; Communications: Oral and Visual F, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 3.5: Listen and speak effectively to contribute to group discussions and meetings.

TPO: On all classroom presentations, listen and speak effectively to contribute to group discussions and meetings, and lab work at 90% accuracy.

Descriptors:

- 3.5.1 Conduct meetings in a timely, organized and professional manner.
- 3.5.2 Clarify the purpose and goals of a discussion or meeting.
- 3.5.3 Demonstrate respect for diverse cultures.
- 3.5.4 Give and receive feedback appropriately.
- 3.5.5 Stay on subject and task.
- 3.5.6 Summarize the results of the meeting, including agreements and disagreements.
- 3.5.7 Speak succinctly and clearly to convey information.
- 3.5.8 Correctly utilize transportation terminology.
- 3.5.9 Discuss slang and jargon related to different trades.
- 3.5.10 Communicate with non-English-speaking populations.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)
- *Demonstrate an understanding of effective speaking strategies by selecting appropriate language and adjusting presentation techniques.* (Communications: Oral and Visual D, 8-10)
- *Give informational presentations that present ideas in a logical sequence, include relevant facts and details from multiple sources and use a consistent organizational structure.* (Communications: Oral and Visual E, 8-10)

BIL: Essential

EDU:	12	AD
	P	R

Competency 3.6: Apply active listening skills to obtain and clarify information provided in oral communications.

TPO: On all lectures and lab work, apply active listening skills to obtain and clarify information provided in oral communications, and lab work at 90% accuracy.

Descriptors:

- 3.6.1 Identify and apply active listening techniques one-to-one and in team or group meetings.
- 3.6.2 Interpret verbal cues and behaviors to enhance communication.
- 3.6.3 Interpret nonverbal cues and behaviors to enhance communication.
- 3.6.4 Paraphrase and repeat information to confirm understanding.
- 3.6.5 Record and summarize information in written notes.
- 3.6.6 Ask questions to seek or confirm understanding.

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 3.7: Utilize written documents to direct the transportation systems operations.

TPO: Given industry forms and reports, utilize written documents to direct the transportation systems operations, and lab work at 90% accuracy.

Descriptors:

- 3.7.1 Identify types of reports (e.g. quality assurance, shift turnover, schedules, preventive maintenance).
- 3.7.2 Generate work orders, including change order requests.
- 3.7.3 Calculate job cost and prepare billing documents.
- 3.7.4 Complete reports in accordance with established standards.
- 3.7.5 Apply concepts of tolerances and equivalency to specifications.
- 3.7.6 Identify the components of contract documents.
- 3.7.7 File reports with the appropriate personnel.
- 3.7.8 Disseminate written information from various sources to co-workers and clients.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Apply editing strategies to eliminate slang and improve conventions.* (Writing Process D, 11-12)
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 3.8: Research and respond to customer needs.

TPO: Provided with a customer research and respond to customer needs, and lab work at 90% accuracy.

Descriptors:

- 3.8.1 Recognize the importance of all customers to business.
- 3.8.2 Describe the relationship between meeting customer needs and profitability.
- 3.8.3 Interact with customers and vendors in a professional manner.
- 3.8.4 Demonstrate professional phone etiquette when dealing with customers, vendors and the general public.
- 3.8.5 Follow through on commitments made to customers and vendors in a timely manner.
- 3.8.6 Maintain customer satisfaction and address customer problems and complaints efficiently.

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Connect statistical techniques to applications in workplace and consumer situations.* (Data Analysis and Probability D, 11-12)

Unit 4: Problem Solving and Critical Thinking

BIL: Essential

EDU:	12	AD
	P	R

Competency 4.1: Employ critical thinking and problem solving skills independently and in teams to formulate solutions to problems.

TPO: Given an assignment, employ critical thinking and problem solving skills independently and in teams to formulate solutions to problems, with 80% accuracy.

Descriptors:

- 4.1.1 Define problem-solving methods accepted in the transportation industry.
- 4.1.2 State the problem completely and precisely.
- 4.1.3 Assemble and examine pertinent information.
- 4.1.4 Brainstorm potential solutions.
- 4.1.5 Identify constraints and parameters to solutions as they relate to budgets, scope and schedules.
- 4.1.6 Compare and contrast consequences, and discuss underlying assumptions.
- 4.1.7 Identify the best solution based on risks, costs, ethics, laws, benefits, conflicting concerns and points of view.
- 4.1.8 Apply the best solution to the problem.
- 4.1.9 Evaluate the solution.
- 4.1.10 Evaluate resources and timelines.

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigation and adjust questions as necessary while research is conducted. (Research A, 8-10)*
- *Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted. (Research A, 11-12)*
- *Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)*
- *Organize information from various resources and select appropriate sources to support central ideas, concepts and themes. (Research C, 8-10)*
- *Evaluate the usefulness and credibility of data and sources, and synthesize information from multiple sources. (Research C, 11-12)*
- *Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 8-10; Research E, 11-12)*

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Patterns, Functions and Algebra D, 8-10)*
- *Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis and Probability F, 8-10)*
- *Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution. (Mathematical Processes A, 8-10)*
- *Use precise mathematical language and notations to represent problem situations and mathematical ideas. (Mathematical Processes F, 8-10)*
- *Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences. (Mathematical Processes F, 11-12)*

- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Mathematical Processes J, 11-12)*

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society. (Science and Technology A, 9-10)*

BIL: Essential

EDU:	12	AD
	I	P

Competency 4.2: Apply problem solving and critical thinking techniques to the conflict between available resources, requirements of the project, and timelines.

TPO: Given a group activity to complete in a given time, apply problem solving and critical thinking techniques to the conflict between available resources, requirements of the project, and timelines, with 80% accuracy.

Descriptors:

- 4.2.1 Identify alternative solutions for a specific resources and/or materials problem.
- 4.2.2 Calculate the potential waste of resources and materials.
- 4.2.3 Examine the feasibility of each alternative suggestion.
- 4.2.4 Implement the appropriate alternative.
- 4.2.5 Use available resources and materials efficiently to complete the project.
- 4.2.6 Discuss strategies to avoid the problem in the future.

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number, Number Sense and Operations G, 8-10)*
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. (Measurement F, 8-10)*
- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Patterns, Functions and Algebra D, 8-10)*
- *Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis and Probability F, 8-10)*
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)*
- *Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences. (Mathematical Processes F, 11-12)*
- *Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation. (Mathematical Processes J, 11-12)*

Correlated Science Academic Content Benchmarks

- Explain the ways in which the processes of technological design respond to the needs of society. (Science and Technology A, 9-10)

BIL: **Essential**

EDU:	12	AD
	P	R

Competency 4.3: Combine critical thinking and team-building skills to solve problems.

TPO: Presented with a group activity, combine critical thinking and team-building skills to solve problems, with 90%.

Descriptors:

- 4.3.1 Work with others to define problems.
- 4.3.2 Share ideas, facts, information and/or data with others.
- 4.3.3 State personal positions clearly, and respect conflicting positions.
- 4.3.4 Accept and support group decisions even when different from a personal solution, within the bounds of ethical, safety, legal or similar concerns.

Correlated English Language Arts Academic Content Benchmarks

- Communicate findings, reporting on the substance and processes orally, visually and in writing or through multimedia. (Research E, 8-10; Research E, 11-12)
- Use a variety of strategies to enhance listening comprehension. (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- Select and use effective speaking strategies for a variety of audiences, situations and purposes. (Communications: Oral and Visual C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis and Probability F, 8-10)
- Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)
- Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience. (Mathematical Processes I, 11-12)

BIL:
Essential

EDU:	12	AD
	I	P

Competency 4.4: Evaluate and adjust plans and schedules to respond to unexpected events and conditions.

TPO: Given a situation, evaluate and adjust plans and schedules to respond to unexpected events and conditions, with 80% accuracy in accordance with safety.

Descriptors:

- 4.4.1 Identify potential events and conditions that disrupt the completion of a job.
- 4.4.2 Incorporate potential job disruptions into planning timelines.
- 4.4.3 Solve situational problems involved with unexpected events and conditions.
- 4.4.4 Identify and assess critical situations, and implement an appropriate response.
- 4.4.5 Adjust plans and schedules to reflect an unexpected change.
- 4.4.6 Provide a project update to track change.

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigation and adjust questions as necessary while research is conducted.* (Research A, 8-10)
- *Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted.* (Research A, 11-12)
- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources.* (Research C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)
- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.* (Patterns, Functions and Algebra D, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 4.5: Apply mathematical principles and formulas to transportation systems problems.*TPO: Using a given repair order a vehicle; apply mathematical principles and formulas to transportation systems problems, with 90% accuracy.***Descriptors:**

- 4.5.1 Utilize statistical probability to address problems.
- 4.5.2 Apply statistical process control to operational problems.

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)

- Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. (Measurement F, 8-10)
- Use counting techniques, such as permutations and combinations, to determine the total number of options and possible outcomes. (Data Analysis and Probability H, 8-10)
- Design an experiment to test a theoretical probability, and record and explain results. (Data Analysis and Probability I, 8-10)
- Compute probabilities of compound events, independent events, and simple dependent events. (Data Analysis and Probability J, 8-10)
- Make predictions based on theoretical probabilities and experimental results. (Data Analysis and Probability K, 8-10)
- Connect statistical techniques to applications in workplace and consumer situations. (Data Analysis and Probability D, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 4.6: Apply scientific theory and applications to transportation systems problems.

TPO: Using a given repair on a vehicle, apply scientific theory and applications to transportation systems problems, with 90% accuracy.

Descriptors:

- 4.6.1 Identify situations that require scientific theory and application.
- 4.6.2 Utilize physical sciences and applications to address problems.

Correlated Science Academic Content Benchmarks

- Explain that scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world. (Scientific Ways of Knowing A, 9-10)
- Explain the ways in which the processes of technological design respond to the needs of society. (Science and Technology A, 9-10)
- Explain the movement of objects by applying Newton’s three laws of motion. (Physical Sciences D, 9-10)
- Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems. (Physical Sciences D, 11-12)

Unit 5: Leadership and Teamwork

BIL: Essential

EDU:	12	AD
	P	R

Competency 5.1: Summarize the interpersonal skills that contribute to positive leadership and teamwork.

TPO: Given a lecture on work ethics, summarize the interpersonal skills that contribute to positive leadership and teamwork, working in a group developing a list of concerns and resolutions.

Descriptors:

- 5.1.1 Identify and explain basic interpersonal skills most closely associated with a positive work environment (e.g., empathy, listening, respect, unconditional positive regard).
- 5.1.2 Discuss the importance of relating to the culture and climate of an organization.
- 5.1.3 Identify the variety of cultural diversity in the workplace (e.g., race, religion, nationality, gender).
- 5.1.4 Discuss cultural diversity issues related to business.

BIL: Essential

EDU:	12	AD
	P	R

Competency 5.2: Demonstrate the ability to work on a team and recognize the importance of teamwork and its impact on business in a transportation environment.

TPO: Given a lab with assigned positions that relate to automotive, demonstrate the ability to work on a team and recognize the importance of teamwork and its impact on business in a transportation environment, with 90% based on industry standards.

Descriptors:

- 5.2.1 Define teamwork and team goals and objectives.
- 5.2.2 Identify types of teams (e.g. cross-functional, cross-trained).
- 5.2.3 Describe the role of effective teams in high-performance workplaces.
- 5.2.4 Examine unique issues associated with working on teams.
- 5.2.5 Apply team problem-solving and conflict-resolution practices.
- 5.2.6 Explain the roles and responsibilities of the individual as part of the team.
- 5.2.7 Identify attitudes and behaviors that promote positive interaction between members of the work team (e.g., punctuality, attendance, preparedness).

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 5.3: Perform responsibly as a team member.

TPO: Given a lab with assigned positions that relate to automotive, perform responsibly as a team member, with 90% based on industry standards.

Descriptors:

- 5.3.1 Organize and schedule dependent team assignments.
- 5.3.2 Demonstrate an organized team approach to accomplishing tasks.
- 5.3.3 Assist other members of the work team.
- 5.3.4 Discuss typical safety situations encountered where teamwork is essential.
- 5.3.5 Describe the importance of accountability for roles and responsibilities.
- 5.3.6 Identify the basic psychological needs that motivate behavior (e.g., belonging, power, freedom).
- 5.3.7 Discuss the role that different values play in generating conflict.
- 5.3.8 Identify how the effects of substance abuse, mental health and disabilities impact conflict.

BIL: Essential

EDU:	12	AD
	I	P

Competency 5.4: Use motivational techniques to enhance performance in others.

TPO: Upon completion of the lesson, Use motivational techniques to enhance performance in others, at 90% accuracy.

Descriptors:

- 5.4.1 Describe the induction process new employees experience when they enter a new work group.
- 5.4.2 Discuss communication barriers new employees may encounter.
- 5.4.3 Use reward and incentive systems.
- 5.4.4 Coach associates to expand their role within the transportation organization.
- 5.4.5 Use coaching skills to inspire others to achieve.
- 5.4.6 Explain the importance of progressive disciplinary action to improve performance.

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 5.5: Examine the different responses to conflict as they relate to results.

TPO: Provided with an automotive shop and given situations, examine the different responses to conflict as they relate to results, with 100% accuracy to safety standards.

Descriptors:

- 5.5.1 Describe the soft response approach (e.g. avoidance, compromise and accommodation) and the typical reasons for using that approach.
- 5.5.2 Describe the hard response approach (e.g. force, threats, aggression and anger) and the typical reasons for using that approach.

5.5.3 Describe the principled response approach (e.g. good communication skills, problem solving skills, and the ability to see the problem from more than one perspective) and the typical reasons for using that approach.

BIL: Essential

EDU:	12	AD
	I	P

Competency 5.6: Resolve conflicts to maintain a smooth workflow.

TPO: Given a company policy, resolve conflicts to maintain a smooth workflow, list procedures in correct order.

Descriptors:

- 5.6.1 Use conflict resolution skills.
- 5.6.2 Work collaboratively and cooperatively.
- 5.6.3 Give and receive criticism in a diplomatic and constructive manner.
- 5.6.4 Use diplomatic and constructive statements and responses.
- 5.6.5 Manage stress and control emotions.
- 5.6.6 Convey honesty and integrity when providing feedback to associates.

Correlated English Language Arts Academic Content Benchmarks

- *Use a variety of strategies to enhance listening comprehension.* (Communications: Oral and Visual A, 8-10; Communications: Oral and Visual A, 11-12)
- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

Unit 6: Legal and Ethical Aspects

BIL: Essential

EDU:	12	AD
	I	P

Competency 6.1: Differentiate between legal and ethical issues.

TPO: Using information from a lesson on ethics, differentiate between legal and ethical issues, meeting program and legal ethical business standards.

Descriptors:

- 6.1.1 Define “legal” and “ethical” issues.
- 6.1.2 Translate legal and ethical issues to the transportation industry.
- 6.1.3 Define and distinguish between company and departmental policies.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 6.2: Complete work-related duties within an ethical framework.

TPO: Using information from a lesson on ethics, complete work-related duties within an ethical framework, meeting program standards.

Descriptors:

- 6.2.1 Identify codes of ethics within the professions.
- 6.2.2 Develop an individual ethical framework.
- 6.2.3 Demonstrate ethical behavior when interacting with colleagues both internal and external to the profession.
- 6.2.4 Describe the ethical impact of positive cultural sensitivity in a transportation organization.

BIL: Essential

EDU:	12	AD
	I	P

Competency 6.3: Assess the implications of ethical and unethical behavior.

TPO: Using information from a case study on ethics, assess the implications of ethical and unethical behavior, meeting program and legal ethical business standards.

Descriptors:

- 6.3.1 Compare and contrast personal, professional and organizational ethics.
- 6.3.2 Demonstrate respect for the property of customers, other professions and coworkers.
- 6.3.3 Resolve issues relating to any potential conflicts of interest between personal and organizational ethics.
- 6.3.4 Identify strategies for responding to the unethical actions of individuals and organizations.
- 6.3.5 Identify the ramifications of unethical actions.

BIL: Essential

EDU:	12	AD
	I	P

Competency 6.4: Perform duties according to laws, regulations, contract provisions and policies.

TPO: Given repair order with customer information, perform duties according to laws, regulations, contract provisions and policies, with 100% compliance.

Descriptors:

- 6.4.1 Describe the legal responsibilities, limitations and implications of actions.
- 6.4.2 Comply with the legal responsibilities specified by state practice act(s) and other pertinent legislation.
- 6.4.3 Compare and contrast the roles of various regulatory agencies (e.g. content of laws and regulation of jurisdictions).
- 6.4.4 Identify the types of contracts and describe their roles in the transportation industry.
- 6.4.5 Illustrate how work activities relate to health and safety issues.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)

BIL: Essential

EDU:	12	AD
	I	P

Competency 6.5: Comply with applicable governmental regulations and codes.

TPO: Provided with books computers and internet access, comply with applicable governmental regulations and codes, with 100% accuracy in compliance.

Descriptors:

- 6.5.1 Identify governmental regulations and codes.
- 6.5.2 Describe mandated standards for workplace safety, harassment, labor and employment laws.
- 6.5.3 Identify personal and organizational ramifications for failure to comply with government laws and regulations.
- 6.5.4 Describe the interrelationships between local and national codes.
- 6.5.5 Identify legal responsibilities specified by state practice act(s) and other pertinent legislation (e.g., substance abuse, harassment, discrimination).
- 6.5.6 Identify legal responsibilities specified by state practice act(s), other pertinent legislation and regulatory agencies as it relates to union and/or non-union practices.
- 6.5.7 Apply regulations and codes according to guidelines.
- 6.5.8 Complete job inspections and adhere to all regulations and codes.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)

- Apply reading comprehension strategies to understand grade-appropriate texts. (Reading Process A, 8-10; Reading Process A, 11-12)
- Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number, Number Sense and Operations G, 8-10)
- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data Analysis and Probability A, 11-12)
- Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (Data Analysis and Probability B, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 6.6: Explain employee and employer liability (e.g., monetary and personal).

TPO: Upon completion of the lesson, explain employee and employer liability (e.g., monetary and personal) to show understanding at 100% accuracy.

Descriptors:

- 6.6.1 Define liability and negligence.
- 6.6.2 Discuss protections against liability.
- 6.6.3 Explain the role of the Bureau of Workers’ Compensation in workplace injuries.
- 6.6.4 Discuss the concept of transferring risk.
- 6.6.5 Describe the “multi-employer” responsibility under Department of Transportation (DOT), Federal Motor Carrier Safety Administration (FMCSA) and OSHA.

Correlated English Language Arts Academic Content Benchmarks

- Use context clues and text structures to determine the meaning of new vocabulary. (Acquisition of Vocabulary A, 8-10)
- Use multiple resources to enhance comprehension of vocabulary. (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)

Unit 7: Information Technology Applications

BIL: Essential

EDU:	12	AD
	P	R

Competency 7.1: Use computer-based technology.

TPO: Provided with books computers and internet access, use computer-based technology, with

100% accuracy in compliance.

Descriptors:

- 7.1.1 Access a Web site using the Internet.
- 7.1.2 Use e-mail to send and receive messages.
- 7.1.3 Collect data from the environment, people or instruments.
- 7.1.4 Use electronic sources to determine the quality, relevance or usefulness of a product.
- 7.1.5 Use electronic sources to generate and access client or customer information for evaluation.
- 7.1.6 Use a database to summarize, compare and contrast information.
- 7.1.7 Represent existing client, product, service or topical information in a different form.
- 7.1.8 Interpret client or product information to determine appropriate action.

Correlated English Language Arts Academic Content Benchmarks

- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources.* (Research C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.* (Patterns, Functions and Algebra C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data Analysis and Probability B, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 7.2: Employ information technology applications.

TPO: Provided with books computers and internet access, employ information technology applications, with 90% accuracy in compliance.

Descriptors:

- 7.2.1 Identify organizational policies and ethics regarding the use of communications tools.
- 7.2.2 Use personal information management (PIM) productivity applications (e.g., schedules, contacts, memos).
- 7.2.3 Communicate using electronic equipment (e.g. e-mail, fax, phone).
- 7.2.4 Utilize Internet applications.
- 7.2.5 Utilize writing and publishing applications.
- 7.2.6 Prepare reports and other business communications integrating graphics and other non-text elements.
- 7.2.7 Demonstrate presentation applications.
- 7.2.8 Utilize spreadsheets and database applications.

- 7.2.9 Employ collaborative and groupware applications.
- 7.2.10 Examine computer-driven equipment and machines, and access support as needed.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)
- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly.* (Writing Applications C, 11-12)
- *Give presentations using a variety of delivery methods, visual displays and technology.* (Communications: Oral and Visual G, 8-10; Communications: Oral and Visual F, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data Analysis and Probability B, 11-12)
- *Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.* (Data Analysis and Probability C, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 7.3: Use geographic information systems.

TPO: Provided with books computers and internet access, use geographic information systems, with 95% accuracy in compliance.

Descriptors:

- 7.3.1 Represent data on maps using Global Positioning System and Geographic Information Systems (GPS and GIS) software.
- 7.3.2 Locate physical addresses on maps using GPS and GIS software.
- 7.3.3 Estimate distances and travel times between two or more locations.
- 7.3.4 Utilize GPS and GIS software to produce and print maps.

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)

Unit 8: Safety, Health and Environmental Aspects

BIL: Essential

EDU:	12	AD
	P	R

Competency 8.1: Maintain general safety in accordance with government regulations, health standards, company policy, procedure and practices.

TPO: Given a lab setting, maintain general safety in accordance with government regulations, health standards, company policy, procedure and practices by walking around the shop to identify and differentiate between safe and unsafe conditions.

Descriptors:

- 8.1.1 Wear personal protective equipment (PPE) as appropriate (e.g., dust mask, hearing protection, respirators, eye protection).
- 8.1.2 Check and correct potential hazards (e.g., hair, jewelry, clothing).
- 8.1.3 Maintain personal protective equipment (e.g., inspect, clean, replace).
- 8.1.4 Follow established procedures for the use of safety apparatus and equipment, including fall protection.
- 8.1.5 Conduct routine building safety inspections.
- 8.1.6 Check power sources for potential hazards, and confirm proper grounding.
- 8.1.7 Shut down power equipment in dangerous situations using disconnect switches and established lock-out/tag-out (LO/TO) procedures.
- 8.1.8 Identify the location of emergency flush showers, eye wash fountains, fire alarms and exits.
- 8.1.9 Maintain work areas in accordance with standards for cleanliness and safety.
- 8.1.10 Describe how to operate fire extinguishers, and identify classes of fires.
- 8.1.11 Inspect air and exhaust systems, including intake filters, fans and other mechanical components.
- 8.1.12 Explain the value of an emergency response plan.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability.* (Data Analysis and Probability A, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (Scientific Inquiry A, 9-10)*
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data. (Scientific Inquiry A, 11-12)*

BIL: Essential

EDU:	12	AD
	P	R

Competency 8.2: Evaluate the human and ergonomic factors associated with the transportation industry.

TPO: Upon completion of lesson, evaluate the human and ergonomic factors associated with the transportation industry, with 90% accuracy.

Descriptors:

- 8.2.1 Wear personal protective equipment (PPE) in accordance with the ergonomic process.
- 8.2.2 Define ergonomics.
- 8.2.3 Describe ergonomic factors of the workplace.
- 8.2.4 Identify work associated with repetitive motion, as well as lifting or moving heavy objects.
- 8.2.5 Demonstrate appropriate body mechanics in lifting and moving heavy objects.
- 8.2.6 Describe the ergonomic importance of properly operating various types of tools and equipment.

Correlated English Language Arts Academic Content Benchmarks

- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Acquisition of Vocabulary D, 11-12)*

Correlated Mathematics Academic Content Benchmarks

- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)*
- *Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population. (Data Analysis and Probability G, 8-10)*

BIL: Essential

EDU:	12	AD
	I	P

Competency 8.3: Identify state, federal, and local worker safety, health and environmental regulations.

TPO: Upon completion of lesson, identify state, federal, and local worker safety, health and environmental regulations, with 90% accuracy.

Descriptors:

- 8.3.1 Examine the Occupational Safety and Health Administration (OSHA) and Federal Aviation Administration (FAA) regulations.
- 8.3.2 Examine the state Bureau of Workers' Compensation (BWC).
- 8.3.3 Explain workers' compensation cost as it relates to transportation.
- 8.3.4 Describe the purpose of the National Institute for Occupational Safety and Health (NIOSH).
- 8.3.5 Identify safety documentation.
- 8.3.6 Discuss applicable international regulations that impact transportation operations.
- 8.3.7 Discuss the Ohio and Federal Environmental Protection Agency (EPA) regulations.
- 8.3.8 Describe the industry-specific governmental regulatory agencies (e.g., Department of Transportation [DOT]).
- 8.3.9 Interpret personal safety rights according to employee's right-to-know plans and hazardous communications.
- 8.3.10 Interpret material safety data sheets (MSDS), and use materials accordingly.

Correlated English Language Arts Academic Content Benchmarks

- *Use context clues and text structures to determine the meaning of new vocabulary.* (Acquisition of Vocabulary A, 8-10)
- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)
- *Evaluate how features and characteristics make information accessible and usable and how structures help authors achieve their purposes.* (Reading: Informational, Technical and Persuasive Text A, 8-10)

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.* (Patterns, Functions and Algebra D, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.* (Scientific Inquiry A, 9-10)
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data.* (Scientific Inquiry A, 11-12)

BIL: **Essential**

EDU:	12	AD
	I	P

Competency 8.4: Demonstrate practices that contribute to a safe workplace environment.

TPO: Provided with a automotive shop and given situations, demonstrate practices that contribute to a safe workplace environment, with 100% accuracy to safety standards.

Descriptors:

- 8.4.1 Identify unsafe operations of a process.
- 8.4.2 Establish safety training meetings with relevant topics.
- 8.4.3 Explain the concept of “engineering out” as a personal protection strategy.
- 8.4.4 Conduct and participate in accident and other incident investigations.
- 8.4.5 Perform a job safety analysis (JSA).
- 8.4.6 Inform and correct unsafe activities committed by coworkers.
- 8.4.7 Examine access and egress procedures.
- 8.4.8 Employ ergonomic concepts in daily work activities.

Correlated English Language Arts Academic Content Benchmarks

- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.* (Scientific Inquiry A, 9-10)
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data.* (Scientific Inquiry A, 11-12)

BIL: **Recommended**

EDU:	12	AD
	I	R

Competency 8.5: Complete the requirements for first aid and CPR certification.

TPO: Given a company policy, complete the requirements for first aid and CPR certification, in accordance with the local certifying agency.

Descriptors:

- 8.5.1 Complete first aid training and certification.
- 8.5.2 Complete cardiopulmonary resuscitation (CPR) training and certification.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 8.6: Complete and apply operations and safety training on pertinent equipment.

TPO: Given a lab setting and individual equipment, complete and apply operations and safety training on pertinent equipment to satisfy a 100% score on each assessment.

Descriptors:

- 8.6.1 Complete orientation to pertinent equipment before operating.
- 8.6.2 Review all important information regarding equipment safety.
- 8.6.3 Utilize the correct tools to do the job during training.
- 8.6.4 Conduct a post-training evaluation to assure the equipment is operated safely.
- 8.6.5 Document the quality and effectiveness of the training.
- 8.6.6 Fulfill safety and health requirements for maintenance.
- 8.6.7 Monitor and operate equipment in compliance with both company and national regulations.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

Competency 8.7: Identify practices that contribute to a healthy environment.

TPO: Upon completion of lesson, identify practices that contribute to a healthy environment, with 100% accuracy.

Descriptors:

- 8.7.1 Discuss symptoms of exposure to health-threatening environments (e.g., temperature; chemicals; noise, vibrations, harshness [NVH]; biological hazards).

- 8.7.2 Describe the effects of hazardous activities (e.g., welding).
- 8.7.3 Describe precautions required when using toxic or flammable materials.
- 8.7.4 Discuss the inspection of air and exhaust systems, including intake filters, fans and other mechanical components.
- 8.7.5 Describe the interactions of incompatible substances.
- 8.7.6 Describe basic health and hygiene principles.

BIL: Essential

EDU:	12	AD
	P	R

Competency 8.8: Handle hazardous materials in accordance with government regulations and health standards.

TPO: Upon completion of lesson and demonstration, handle hazardous materials in accordance with government regulations and health standards, with 100% accuracy.

Descriptors:

- 8.8.1 Identify types of hazardous materials (e.g., chemical, biological).
- 8.8.2 Interpret container label precautions.
- 8.8.3 Identify hazardous storage procedures in compliance with government regulations.
- 8.8.4 Dispose of hazardous materials in accordance with government regulations.
- 8.8.5 Examine a hazardous materials safety plan.

Correlated English Language Arts Academic Content Benchmarks

- *Apply reading comprehension strategies to understand grade-appropriate texts.* (Reading Process A, 8-10; Reading Process A, 11-12)

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.* (Scientific Inquiry A, 9-10)
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data.* (Scientific Inquiry A, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 8.9: Analyze regulations for transporting hazardous materials.

TPO: Upon completion of lesson and demonstration, analyze regulations for transporting hazardous materials, with 100% accuracy.

Descriptors:

- 8.9.1 Describe the United Nations (UN) and North American (NA) shipping documents.
- 8.9.2 Explain the function of placards and labeling.
- 8.9.3 Describe the manifest and explain its function.
- 8.9.4 Discuss handling and loading procedures.
- 8.9.5 Describe the procedures for emergency response and cleanup.
- 8.9.6 Identify and explain the security regulations and precautions.
- 8.9.7 Identify potential transportation threats and the appropriate reporting authorities.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Evaluate how features and characteristics make information accessible and usable and how structures help authors achieve their purposes.* (Reading: Informational, Technical and Persuasive Text A, 8-10)

Unit 9: Transportation Fuels

BIL: Recommended

EDU:	12	AD
	I	P

Competency 9.1 Discuss the historical and economic impact of the petroleum industry.

TPO: Upon completion of the lesson, discuss the historical and economic impact of the petroleum industry with an 85% understanding and accuracy.

Descriptors:

- 9.1.1 Discuss historical and current events related to the petroleum industry.
- 9.1.2 Discuss the impact of the petroleum industry on environmental factors.
- 9.1.3 Discuss the economic impact of the petroleum industry.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

Correlated Science Academic Content Benchmarks

- *Describe the finite nature of Earth’s resources and those human activities that can conserve or deplete Earth’s resources.* (Earth and Space Sciences D, 9-10)

- Explain that humans are an integral part of the Earth’s system and the choices humans make today impact natural systems in the future. (Earth and Space Sciences C, 11-12)
- Describe how human activities can impact the status of natural systems. (Life Sciences G, 9-10)
- Explain how human choices today will affect the quality and quantity of life on earth. (Life Sciences F, 11-12)
- Describe how atoms and molecules can gain or lose energy only in discrete amounts. (Physical Sciences C, 11-12)
- Explain that science and technology are interdependent; each drives the other. (Science and Technology B, 9-10)
- Predict how human choices today will determine the quality and quantity of life on Earth. (Science and Technology A, 11-12)

BIL: Recommended

EDU:	12	AD
	I	P

Competency 9.2: Discuss the alternative vehicular fuel industry.

TPO: Upon completion of the lesson, discuss the alternative vehicular fuel industry with an 85% understanding and accuracy.

Descriptors:

- 9.2.1 Discuss the history of the alternative fuel industry.
- 9.2.2 Identify driving forces in the move to alternative fuel solutions.
- 9.2.3 Discuss local, state and national legislation related to alternative vehicular fuels.

Correlated English Language Arts Academic Content Benchmarks

- Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)
- Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data Analysis and Probability A, 11-12)
- Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience. (Mathematical Processes I, 11-12)

Correlated Science Academic Content Benchmarks

- Predict how human choices today will determine the quality and quantity of life on Earth. (Science and Technology A, 11-12)
- Explain how societal issues and considerations affect the progress of science and technology. (Scientific Ways of Knowing C, 11-12)

BIL: Recommended

EDU:	12	AD
	I	P

Competency 9.3 Compare and contrast viable fuels.

TPO: Using information gathered through lecture and internet research, compare and contrast viable fuels, by creating a chart listing at least five advantages and five disadvantages.

Descriptors:

- 9.3.1 Discuss the concept of well-to-wheel.
- 9.3.2 Identify various viable fuels.
- 9.3.3 Discuss the environmental impact of each fuel source.
- 9.3.4 Discuss emission characteristics of each fuel source.
- 9.3.5 Compare the economic viability of each fuel source depending on the application life cycle.
- 9.3.6 Calculate costs and benefits of various alternative fuels.

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Patterns, Functions and Algebra D, 8-10)*
- *Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis and Probability F, 8-10)*
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators. (Data Analysis and Probability A, 11-12)*
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability. (Data Analysis and Probability B, 11-12)*
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)*
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience. (Mathematical Processes I, 11-12)*

Correlated Science Academic Content Benchmarks

- *Predict how human choices today will determine the quality and quantity of life on Earth. (Science and Technology A, 11-12)*

BIL: Recommended

EDU:	12	AD
	I	P

Competency 9.4 Discuss engine modification related to the use of alternative fuels.

TPO: Given an article, discuss engine modification related to the use of alternative fuels, list 5 key points of the article.

Descriptors:

- 9.4.1 Identify the modifications to current vehicles that are required for burning alternative fuels.
- 9.4.2 Discuss idle reduction technology.
- 9.4.3 Discuss safety issues related to various vehicular fuels.

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Recommended

EDU:	12	AD
	I	P

Competency 9.5 Discuss future vehicular fuel sources.

TPO: Given an article, discuss future vehicular fuel sources, list 3 fuel sources from the article.

Descriptor:

- 9.5.1 Discuss current research in future vehicular fuel sources.
- 9.5.2 Identify costs, benefits and the environmental impact of future vehicular fuel sources.

Correlated English Language Arts Academic Content Benchmarks

- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.* (Patterns, Functions and Algebra D, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.* (Data Analysis and Probability B, 11-12)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)

- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience. (Mathematical Processes I, 11-12)*

Correlated Science Academic Content Benchmarks

- *Explain that science and technology are interdependent; each drives the other. (Science and Technology B, 9-10)*
- *Predict how human choices today will determine the quality and quantity of life on Earth. (Science and Technology A, 11-12)*

Unit 10: Transportation Systems Technical Skills Sets

BIL: Essential

EDU:	12	AD
	I	P

Competency 10.1: Explore the performance skills of an automotive technician.

TPO: After textbook and internet research of NATEF skill listings, explore the performance skills of an automotive technician, by choosing at least two skills involving career choices.

Descriptors:

- 10.1.1 Identify the role and function of an automotive technician.
- 10.1.2 Identify the areas of specialization and related occupations.
- 10.1.3 Explore the types of work techniques, processes and procedures a typical automotive technician might be called upon to perform.
- 10.1.4 Describe the education, training and certification required to work as an automotive technician.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)*

BIL: Essential

EDU:	12	AD
	I	P

Competency 10.2: Explore the performance skills of a medium and heavy transportation technician.

TPO: After internet research of the ASE web site, explore the performance skills of a medium and heavy transportation technician, by listing at least six skills involving medium and heavy transportation technician.

Descriptors:

- 10.2.1 Identify the role and function of a medium and heavy transportation technician.

- 10.2.2 Identify the areas of specialization and related occupations.
- 10.2.3 Explore the types of work techniques, processes and procedures a typical medium and heavy transportation technician might be called upon to perform.
- 10.2.4 Describe the education, training and certification required to work as a medium and heavy transportation technician.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 10.3: Explore the performance skills of a collision repair technician.

TPO: After textbook and internet research of I-CAR skill listings, explore the performance skills of a collision repair technician, by choosing at least four skills involving career choices.

Descriptors:

- 10.3.1 Identify the role and function of a collision repair technician.
- 10.3.2 Identify the areas of specialization and related occupations.
- 10.3.3 Explore the types of work techniques, processes and procedures a typical collision repair technician might be called upon to perform.
- 10.3.4 Describe the education, training and certification required to work as a collision repair technician.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 10.4: Explore the performance skills of an aviation maintenance technician.

TPO: After internet research of the FAA web site, explore the performance skills of an aviation maintenance technician and list requirements needed for technician licensure.

Descriptors:

- 10.4.1 Identify the role and function of an aviation maintenance technician.
- 10.4.2 Identify the areas of specialization and related occupations.
- 10.4.3 Explore the types of work techniques, processes and procedures a typical aviation maintenance technician might be called upon to perform.

10.4.4 Describe the education, training and certification required to work as an aviation maintenance technician.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 10.5: Explore the performance skills of an aviation technology employee.

TPO: Given students knowledge about internet usage, explore the performance skills of an aviation technology employee, with 80% accuracy.

Descriptors:

- 10.5.1 Identify the role and function of an aviation technology employee.
- 10.5.2 Identify the areas of specialization and related occupations.
- 10.5.4 Describe the education, training and certification required to work as an aviation technology employee.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

Competency 10.7: Explore the performance skills of a power equipment technician.

TPO: Given students knowledge about internet usage, explore the performance skills of a power equipment technician, with 80% accuracy.

Descriptors:

- 10.7.1 Identify the role and function of a power equipment technician.
- 10.7.2 Identify the areas of specialization and related occupations.
- 10.7.3 Explore the types of work techniques, processes and procedures a typical power equipment technician might be called upon to perform.
- 10.7.4 Describe the education, training and certification required to work as a power equipment technician.

Correlated English Language Arts Academic Content Benchmarks

Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

COLLISION REPAIR TECHNICIAN

UNITS 22-28

Collision Repair Technician

High Priority Individual = HP-I

High Priority Group = HP-G

Unit 22: Orientation to the Collision Repair Industry

BIL: Essential

EDU:	12	AD
	P	R

TPO: Given students knowledge of internet usage, analyze and explain the scope, trends and issues in the collision repair industry, with 80% accuracy to industry standards.

Competency 22.1: Analyze and explain the scope, trends and issues in the collision repair industry.

Descriptors:

- 22.1.1 Present an overview of the collision repair industry.
Identify trends and issues that affect the collision repair industry.
- 22.1.2 Identify the professional or trade associations related to the collision repair industry.
- 22.1.3 Identify areas of specialization and related occupations within the collision repair industry.
- 22.1.4 Identify employment opportunities in the collision repair industry.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.* (Patterns, Functions and Algebra D, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

-

BIL: Essential

EDU:	12	AD
	P	R

TPO: After reading article about collision repair, determine the skills needed to work in the collision repair industry, with 90% of the article content facts.

Competency 22.2: Determine the skills needed to work in the collision repair industry.

Descriptors:

- 22.2.1 Match collision repair occupational job titles with qualifications and responsibilities.
- 22.2.2 Identify the education, training and certification required to work in the various collision repair fields.
- 22.2.3 Describe the kinds of work techniques, processes and procedures a typical collision repair technician might be called upon to perform.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing).* (Reading Process B, 8-10; Reading Process B, 11-12)
- *Compile, organize and evaluate information, take notes and summarize findings.* (Research B, 11-12)
- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources.* (Research C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

Unit 23: Tools and Equipment

BIL: Essential

EDU:	12	AD
	P	R

TPO: After studying various tools and equipment, identify basic tools and equipment appropriate to the collision repair industry, in a lab setting to a 90% accuracy.

Competency 23.1: Identify basic tools and equipment appropriate to the collision repair industry.

Descriptors:

- 23.1.1 Identify the various types of tools and equipment applicable to the collision repair application.
- 23.1.2 Describe the primary functions of various types of hand and power tools.
- 23.1.3 Discuss ergonomic issues in the design and use of tools and equipment.

Correlated English Language Arts Academic Content Benchmarks

- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary.* (Acquisition of Vocabulary D, 11-12)
- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

TPO: Given instruction, demonstrate the appropriate use of basic hand tools to complete work functions on a lab vehicle to a 90% accuracy in accordance to NATEF standards.

Competency 23.2: Demonstrate the appropriate use of basic hand tools to complete work functions.

Descriptors:

- 23.2.1 Identify potential hazards and limitations related to the use of tools.
- 23.2.2 Demonstrate basic measuring tools.

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)

- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)

BIL: Essential

EDU:	12	AD
	P	R

TPO: After demonstration and hands-on application, operate power tools and stationary equipment within 90% operational standards and 100% of safety standards.

Competency 23.3: Operate power tools and stationary equipment.

Descriptors:

- 23.3.1 Identify types of power tools and stationary equipment and their functions in transportation.
- 23.3.2 Match the appropriate power tools and stationary equipment for a given task.
- 23.3.3 Operate power tools and stationary equipment in accordance with established procedures and safety standards.

BIL: Essential

EDU:	12	AD
	P	R

TPO: Given student instruction, maintain hand and power tools appropriate to the collision repair industry, with 90% accuracy in accordance with NATEF.

Competency 23.4: Maintain hand and power tools appropriate to the collision repair industry.

Descriptors:

- 23.4.1 Conduct routine inspections of hand tools and power equipment.
- 23.4.2 Troubleshoot maintenance problems in accordance with established procedures.
- 23.4.3 Perform preventive maintenance in accordance with guidelines specified by the manufacturer and/or outside authorities with jurisdiction (e.g., OSHA).
- 23.4.4 Describe the certifications for operating specific tools.

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)
- *Evaluate how features and characteristics make information accessible and usable and how structures help authors achieve their purposes.* (Reading: Informational, Technical and Persuasive Text A, 8-10)

BIL: **Essential**

EDU:	12	AD
	P	R

TPO: Provided with a automotive shop and given situations, Use appropriate personal protective equipment (PPE), with 100% accuracy to safety standards.

Competency 23.5: Use appropriate personal protective equipment (PPE).

Descriptors:

- 23.5.1 Identify the appropriate personal protective equipment (PPE) to wear with specific transportation tasks, and identify the consequences of non-compliance.
- 23.5.2 Discuss various conditions that workers encounter, and match the appropriate PPE to each situation.
- 23.5.3 Demonstrate and practice proper fit, use of each type and care of PPE.

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (Scientific Inquiry A, 9-10)*
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data. (Scientific Inquiry A, 11-12).*

Unit 24: Collision Repair Basics

Note: Throughout Unit 24, students are expected to learn and use vocabulary specific to the collision repair technician career field. Correlations to the English Language Arts **Acquisition of Vocabulary** standards include the following benchmarks:

- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Acquisition of Vocabulary D, 11-12); and*
- *Use multiple resources to enhance comprehension of vocabulary. (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12).*

BIL: **Essential**

EDU:	12	AD
	I	P

TPO: Provided with a vehicle and reference material, access needed information using available references and resources, with 80% accuracy in accordance with to NATEF guidelines.

Competency 24.1: Access needed information using available references and resources.

Descriptors:

- 24.1.1 Identify available resources (e.g., manufacturers’ specifications, videos, online information systems, service manuals, parts manuals, company procedure manuals and collision estimating guides).
- 24.1.2 Utilize the reference materials and resources appropriate for a given task.
- 24.1.3 Interpret reference materials and resources.
- 24.1.4 Interpret charts, graphs, schematics, illustrations, scan displays, printouts and tables.

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)*
- *Analyze whether graphics supplement textual information and promote the author’s purpose. (Reading: Informational, Technical and Persuasive Text C, 8-10)*
- *Compile, organize and evaluate information, take notes and summarize findings. (Research B, 11-12)*
- *Evaluate the usefulness and credibility of data and sources and synthesize information from multiple sources. (Research C, 11-12)*

Correlated Mathematics Academic Content Benchmarks

- *Apply various measurement scales to describe phenomena and solve problems. (Measurement B, 11-12)*
 - *Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis and Probability F, 8-10)*
 - *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)*

BIL: Essential

EDU:	12	AD
	I	P

TPO: Following directions of a given task, perform basic collision-related mechanical skills, with 80% accuracy.

Competency 24.2: Perform basic collision-related mechanical skills.

Descriptors:

- 24.2.1 Drill holes.
- 24.2.2 Demonstrate tap and die techniques, including the repair of damaged threads.
- 24.2.3 Sharpen drill bits and chisels.
- 24.2.4 Extract broken screws.
- 24.2.5 Demonstrate flaring techniques (single and double).
- 24.2.6 Assemble hydraulic and pneumatic hose and tubing.
- 24.2.7 Perform wire connection techniques, including soldering, crimping and insulating.
- 24.2.8 Utilize appropriate fasteners and fastening tools (e.g., wrenches, pliers).

BIL: Essential

EDU:	12	AD
	I	P

TPO: Using a vehicle with body damage, Prepare and explain estimates, with 80% accuracy.

Competency 24.3: Prepare and explain estimates.

Descriptors:

- 24.3.1 Ensure the accuracy of estimates.
- 24.3.2 Calculate labor, material, miscellaneous repair costs and taxes.
- 24.3.3 Communicate technical information to a customer.
- 24.3.4 Interpret vehicle identification number (VIN) codes.
- 24.3.5 Interpret code tags for accessories.
- 24.3.6 Establish the value of the vehicle.
- 24.3.7 Organize damage reports.
- 24.3.8 Prepare computerized estimates.
- 24.3.9 Differentiate between repair and replace using conjunctive repair principals and considering paintless dent repair (PDR).
- 24.3.10 Determine when to use original equipment from manufacturer (OEM), aftermarket or recycled parts.
- 24.3.11 Locate hidden damage.
- 24.3.12 Assess sublet repairs.
- 24.3.13 Document unrelated prior damage.
- 24.3.14 Identify the paint type used on a given vehicle.
- 24.3.15 Maintain awareness of prevailing rates.
- 24.3.16 Summarize the final estimate for the customer.
- 24.3.17 Write repair work orders.
- 24.3.18 Comply with notification laws regarding replacement parts.

Correlated English Language Arts Academic Content Benchmarks

- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers' problems or misunderstandings and that include formatting techniques that are user friendly. (Writing Applications C, 11-12)*

- *Select and use effective speaking strategies for a variety of audiences, situations and purposes.* (Communications: Oral and Visual C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.* (Measurement F, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.* (Data Analysis and Probability A, 11-12)
- *Connect statistical techniques to applications in workplace and consumer situations.* (Data Analysis and Probability D, 11-12)
- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.* (Mathematical Processes H, 8-10)
- *Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.* (Mathematical Processes I, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a vehicle and a list of parts, Identify and acquire parts, with 90% accuracy in accordance with NATEF guidelines.

Competency 24.4: Identify and acquire parts.

Descriptors:

- 24.4.1 Collect necessary information (e.g., make, model, year, option codes, vehicle identification number [VIN]).
- 24.4.2 Identify additional damage after disassembly.
- 24.4.3 Convey information to parts person.
- 24.4.4 Confirm that the parts received are correct.
- 24.4.5 Verify part price and availability.
- 24.4.6 Determine all available resource options for parts.

Correlated English Language Arts Academic Content Benchmarks

- *Produce functional documents that report, organize and convey information and ideas accurately, foresee readers’ problems or misunderstandings and that include formatting techniques that are user friendly.* (Writing Applications C, 11-12)

- Evaluate the usefulness and credibility of data and sources. (Research B, 8-10)

Unit 25: Structural Analysis and Damage Repair

Note: Throughout Unit 25, students are expected to learn and use vocabulary specific to the collision repair technician career field. Correlations to the English Language Arts **Acquisition of Vocabulary** standards include the following benchmarks:

- Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Acquisition of Vocabulary D, 11-12); and
- Use multiple resources to enhance comprehension of vocabulary. (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12).

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a vehicle, Inspect, diagnose and repair full frame vehicles, with 90% accuracy in accordance with NATEF.

Competency 25.1: Inspect, diagnose and repair full frame vehicles.

Descriptors:

- 25.1.1 Diagnose and measure structural damage using tram and self-centering gauges [HP-I].
- 25.1.2 Attach vehicle to anchoring devices [HP-I].
- 25.1.3 Analyze, straighten and align mash (collapse) damage [HP-G].
- 25.1.4 Analyze, straighten and align sag damage [HP-G].
- 25.1.5 Analyze, straighten and align sidesway damage [HP-G].
- 25.1.6 Analyze, straighten and align twist damage [HP-G].
- 25.1.7 Analyze, straighten and align diamond frame damage [HP-G].
- 25.1.8 Remove and replace damaged structural components [HP-I].
- 25.1.9 Restore corrosion protection to repaired or replaced frame areas [HP-I].
- 25.1.10 Analyze and identify misaligned or damaged steering, suspension and powertrain components that can cause vibration, steering and wheel alignment problems [HP-I].
- 25.1.11 Align or replace misaligned or damaged steering, suspension and powertrain components that can cause vibration, steering and wheel alignment problems [HP-G].
- 25.1.12 Identify heat limitations in structural components [HP-I].
- 25.1.13 Restore structural form [HP-G].
- 25.1.14 Diagnose and measure structural damage using a universal measuring system (mechanical, electrical, laser) [HP-G].
- 25.1.15 Diagnose and measure structural damage to vehicles using a dedicated (fixture) measuring system [HP-G].

- 25.1.16 Determine the extent of the direct and indirect damage and the direction of impact; document the methods and sequence of repair [HP-I].
- 25.1.17 Analyze and identify crush/collapse zones [HP-I].

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a vehicle, Inspect, inspect, diagnose, measure and repair unibody vehicles, with 90% accuracy in accordance with NATEF.

Competency 25.2: Inspect, diagnose, measure and repair unibody vehicles.

Descriptors:

- 25.2.1 Analyze and identify misaligned or damaged steering, suspension and powertrain components that can cause vibration, steering and chassis alignment problems [HP-I].
- 25.2.2 Realign or replace misaligned or damaged steering, suspension and powertrain components that can cause vibration, steering and chassis alignment problems [HP-G].
- 25.2.3 Diagnose and measure unibody damage using a tram and self-centering gauges [HP-I].
- 25.2.4 Determine and inspect the locations of all suspension, steering and power train component attaching points on the vehicle [HP-G].
- 25.2.5 Diagnose and measure unibody vehicles using a dedicated (fixture) measuring system [HP-G].

- 25.2.6 Diagnose and measure unibody vehicles using a universal measuring system (e.g., mechanical, electronic, laser) [HP-G].
- 25.2.7 Determine the extent of the direct and indirect damage and the direction of impact; plan and document the methods and sequence of repair [HP-I].
- 25.2.8 Attach anchoring devices to vehicle; remove or reposition components as necessary [HP-I].
- 25.2.9 Straighten and align cowl assembly [HP-G].
- 25.2.10 Straighten and align roof rails/headers and roof panels [HP-G].
- 25.2.11 Straighten and align hinge and lock pillars [HP-G].
- 25.2.12 Straighten and align vehicle openings, floor pans and rocker panels [HP-G].
- 25.2.13 Straighten and align quarter panels, wheelhouse assemblies and rear body sections (including rails and suspension/power train mounting points [HP-G].
- 25.2.14 Straighten and align front-end sections (aprons, strut towers, upper and lower rails, steering and suspension/power train mounting points, etc.) [HP-G].
- 25.2.15 Identify heat limitations in unibody vehicles [HP-I].
- 25.2.16 Identify proper cold stress relief methods [HP-I].
- 25.2.17 Repair damage using power tools and hand tools to restore proper contours and dimensions [HP-I].
- 25.2.18 Remove and replace damaged sections of structural steel body panels [HP-G].
- 25.2.19 Restore corrosion protection to repaired or replaced unibody structural areas [HP-I].
- 25.2.20 Determine the extent of damage to aluminum structural components; repair, weld or replace [HP-G].
- 25.2.21 Analyze and identify crush/collapse zones [HP-I].

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a lab display, Perform fixed glass repair, with 100% accuracy in accordance with automotive glass industry standards.

Competency 25.3: Perform fixed glass repair.

Descriptors:

- 25.3.1 Remove and reinstall or replace fixed glass (heated and non-heated) using recommended materials [HP-G].
- 25.3.2 Remove and reinstall or replace modular glass using recommended materials [HP-G].

Correlated Mathematics Academic Content Benchmarks

- *Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner. (Mathematical Processes H, 8-10)*

BIL: Essential

EDU:	12	AD
	P	R

TPO: Provided with a lab setting, weld and cut materials for collision repair, with 90% accuracy in accordance with NATEF standards.

Competency 25.4: Weld and cut materials for collision repair.

Descriptors:

- 25.4.1 Identify weldable and non-weldable materials used in collision repair [HP-I].
- 25.4.2 Weld and cut high-strength steel and other steels [HP-I].
- 25.4.3 Weld and cut aluminum [HP-G].
- 25.4.4 Determine the correct GMAW (MIG) welder type, electrode, wire type, diameter and gas to be used in a specific welding situation [HP-I].
- 25.4.5 Set up and adjust the GMAW (MIG) welder to “tune” for proper electrode stick-out, voltage, polarity, flow rate and wire-feed speed required for the material being welded [HP-I].
- 25.4.6 Store, handle and install high-pressure gas cylinders [HP-I].
- 25.4.7 Determine work clamp (ground) location and attach [HP-I].
- 25.4.8 Use the proper angle of the gun to the joint and direction of gun travel for the type of weld being made in the flat, horizontal, vertical and overhead positions [HP-I].

- 25.4.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations [HP-I].
- 25.4.10 Protect computers and other electronic control modules during welding procedures [HP-I].
- 25.4.11 Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary and clamp as required [HP-I].
- 25.4.12 Determine joint type (e.g., butt weld with backing, lap) for weld being made [HP-I].
- 25.4.13 Determine the type of weld (e.g., continuous, butt weld with backing, plug) for each specific welding operation [HP-I].
- 25.4.14 Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing and fillet weld [HP-I].
- 25.4.15 Perform visual and destructive tests on each weld type [HP-I].
- 25.4.16 Identify the causes of various welding defects; make necessary adjustments [HP-I].
- 25.4.17 Identify the cause of contact tip burn-back and failure of wire to feed; make necessary adjustments [HP-I].
- 25.4.18 Identify cutting processes for different materials and locations; perform cutting operations [HP-I].
- 25.4.19 Identify different methods of attaching structural components (e.g., squeeze type resistance spot welding [STRSW], riveting, structural adhesive, silicon, bronze) [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these*

properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)

Unit 26: Non-Structural Analysis and Damage Repair

Note: Throughout Unit 26, students are expected to learn and use vocabulary specific to the collision repair technician career field. Correlations to the English Language Arts **Acquisition of Vocabulary** standards include the following benchmarks:

- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary.* (Acquisition of Vocabulary D, 11-12); and
- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12).

BIL: Essential

EDU:	12	AD
	P	R

TPO: Provided with an automotive shop and given situations, Organize repair preparation, with 90% accuracy to industry standards.

Competency 26.1: Organize repair preparation.

Descriptors:

- 26.1.1 Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan [HP-I].
- 26.1.2 Inspect, remove, store and replace exterior trim and moldings [HP-I].
- 26.1.3 Inspect, remove, store and replace interior trim and components [HP-I].
- 26.1.4 Inspect, remove, store and replace non-structural body panels and components that may interfere with or be damaged during repair [HP-I].
- 26.1.5 Inspect, remove, store and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair [HP-G].
- 26.1.6 Protect panels, glass and parts adjacent to the repair area [HP-I].
- 26.1.7 Soap and water wash entire vehicle; use appropriate cleaner to remove contaminants from those areas to be repaired [HP-I].
- 26.1.8 Remove corrosion protection, under-coatings, sealers and other protective coatings necessary to perform repairs [HP-I].
- 26.1.9 Inspect, remove and replace repairable plastics and other components that are recommended for off-vehicle repair [HP-I].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

-

BIL: Essential

EDU:	12	AD
	I	P

TPO: Using a given repair on a vehicle, perform outer body panel repairs, replacements and adjustments, with 90% accuracy.

Competency 26.2: Perform outer body panel repairs, replacements and adjustments.

Descriptors:

- 26.2.1 Determine the extent of direct and indirect damage and the direction of impact; develop and document a repair plan [HP-I].
- 26.2.2 Inspect, remove and replace bolted, bonded and welded steel panel or panel assemblies [HP-I].
- 26.2.3 Determine the extent of damage to aluminum body panels; repair or replace [HP-G].
- 26.2.4 Inspect, remove, replace and align hood, hood hinges and hood latch [HP-I].
- 26.2.5 Inspect, remove, replace and align deck lid, lid hinges and lid latch [HP-I].
- 26.2.6 Inspect, remove, replace and align doors, tailgates, hatches, lift gates, latches, hinges and related hardware [HP-I].
- 26.2.7 Inspect, remove, replace and align bumper bars, covers, reinforcement, guards, isolators and mounting hardware [HP-I].
- 26.2.8 Inspect, remove, replace and align front fenders, headers and other panels [HP-I].
- 26.2.9 Straighten and rough-out contours of damaged panels to a suitable condition for body filling or metal finishing using power tools, hand tools and weld-on pull attachments [HP-I].
- 26.2.10 Weld damaged or torn steel body panels; repair broken welds [HP-I].
- 26.2.11 Restore corrosion protection [HP-I].
- 26.2.12 Replace door skins [HP-G].
- 26.2.13 Restore sound deadeners and foam materials [HP-I].
- 26.2.14 Perform panel bonding [HP-G].
- 26.2.15 Diagnose and repair water leaks, dust leaks and wind noise [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	P	R

TPO: Using a given repair on a vehicle, perform metal finishing and body filling, with 90% accuracy.

Competency 26.3: Perform metal finishing and body filling.

Descriptors:

- 26.3.1 Remove paint from the damaged area of a body panel [HP-I].
- 26.3.2 Locate and reduce surface irregularities on a damaged body panel [HP-I].
- 26.3.3 Demonstrate hammer and dolly techniques [HP-I].
- 26.3.4 Heat shrink stretched panel areas to proper contour [HP-I].
- 26.3.5 Cold shrink stretched panel areas to proper contour [HP-I].
- 26.3.6 Mix body filler [HP-I].
- 26.3.7 Apply body filler; shape during curing [HP-I].
- 26.3.8 Rough sand cured body filler to contour; finish sand [HP-I].
- 26.3.9 Determine the proper metal finishing techniques for aluminum [HP-G].
- 26.3.10 Determine proper application of body filler to aluminum [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Using a given repair on a vehicle, repair moveable glass and hardware, with 90% accuracy.

Competency 26.4: Repair moveable glass and hardware.

Descriptors:

- 26.4.1 Inspect, adjust, repair or replace window regulators, run channels, glass, power mechanisms and related controls [HP-I].
- 26.4.2 Diagnose and repair water leaks, dust leaks and wind noises; inspect, repair and replace weather-stripping [HP-G].
- 26.4.3 Inspect, repair or replace and adjust removable, manual or power-operated roof panel and hinges, latches, guides, handles, retainer and controls for sunroofs [HP-G].
- 26.4.4 Inspect, remove, reinstall and align convertible top and related mechanisms [HP-G].

BIL: Essential

EDU:	12	AD
	P	R

TPO: Provided with an automotive shop and given situations, perform metal welding and cutting, with 90% accuracy to industry standards.

Competency 26.5: Perform metal welding and cutting.

Descriptors:

- 26.5.1 Identify weldable and non-weldable materials used in collision repair [HP-I].
- 26.5.2 Weld and cut high-strength steel and other steels [HP-I].
- 26.5.3 Weld and cut aluminum [HP-G].
- 26.5.4 Determine the correct GMAW (MIG) welder type, electrode, wire type, diameter and gas to be used in a specific welding situation [HP-I].

- 26.5.5 Set up and adjust the GMAW (MIG) welder to “tune” for proper electrode stick-out, voltage, polarity, flow rate and wire-feed speed required for the material being welded [HP-I].
- 26.5.6 Store, handle and install high-pressure gas cylinders [HP-I].
- 26.5.7 Determine work clamp (ground) location and attach [HP-I].
- 26.5.8 Use the proper angle of the gun to the joint and direction of gun travel for the type of weld being made in the flat, horizontal, vertical and overhead positions [HP-I].
- 26.5.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations [HP-I].
- 26.5.10 Protect computers and other electronic control modules during welding procedures [HP-I].
- 26.5.11 Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary, and clamp as required [HP-I].
- 26.5.12 Determine the joint type (e.g., butt weld with backing, lap) for weld being made [HP-I].
- 26.5.13 Determine the type of weld (e.g., continuous, butt weld with backing, plug) for each specific welding operation [HP-I].
- 26.5.14 Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing, and fillet [HP-I].
- 26.5.15 Perform visual and destructive tests on each weld type [HP-I].
- 26.5.16 Identify the causes of various welding defects; make necessary adjustments [HP-I].
- 26.5.17 Identify the cause of contact tip burn-back and failure of wire to feed; make necessary adjustments [HP-I].
- 26.5.18 Identify cutting process for different materials and locations; perform cutting operation [HP-I].
- 26.5.19 Identify different methods of attaching non-structural components (squeeze type resistant spot welds (STRSW), riveting, non-structural adhesive, silicon bronze, etc.) [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)
- Explain the ways in which the processes of technological design respond to the needs of society. (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given necessary supplies, repair plastics and adhesives, with 80% accuracy in accordance with NATEF.

Competency 26.6: Repair plastics and adhesives.

Descriptors:

- 26.6.1 Identify types of plastics and determine their repairability [HP-I].
- 26.6.2 Identify types of plastic repair procedures; clean and prepare the surface of plastic parts [HP-I].
- 26.6.3 Replace or repair rigid, semi-rigid and flexible plastic panels [HP-G].
- 26.6.4 Remove or repair damaged areas from rigid exterior composite panels [HP-G].
- 26.6.5 Replace bonded rigid exterior composite body panels; straighten or align panel supports [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number, Number Sense and Operations G, 8-10)
- Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
- Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines. (Geometry and Spatial Sense C, 8-10)

Correlated Science Academic Content Benchmarks

Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)

Unit 27: Mechanical and Electrical Components

Note: Throughout Unit 27, students are expected to learn and use vocabulary specific to the collision repair technician career field. Correlations to the English Language Arts **Acquisition of Vocabulary** standards include the following benchmarks:

- *Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary.* (Acquisition of Vocabulary D, 11-12); and
- *Use multiple resources to enhance comprehension of vocabulary.* (Acquisition of Vocabulary F, 8-10; Acquisition of Vocabulary E, 11-12).

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BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a vehicle with related problems using shop references, inspect, diagnose and repair suspension and steering, with 80% accuracy in accordance with NATEF.

Competency 27.1: Inspect, diagnose and repair suspension and steering.

Descriptors:

- 27.1.1 Identify one-time use fasteners [HP-I].
- 27.1.2 Remove, replace, inspect or adjust power steering pump, pulleys, belts, hoses, fittings and pump mounts [HP-G].
- 27.1.3 Remove and replace power steering gear (non-rack and pinion type) [HP-G].
- 27.1.4 Remove and replace power rack and pinion steering gear; inspect and replace mounting bushings, tie rod ends, bellow boots and brackets; ensure proper mounting location [HP-G].
- 27.1.5 Inspect and adjust (where applicable) steering linkage geometry (attitude and parallelism) [HP-G].
- 27.1.6 Inspect and replace pitman arm [HP-G].
- 27.1.7 Inspect and replace relay (center link/intermediate) rod [HP-G].
- 27.1.8 Inspect, remove and replace idler arm and mountings [HP-G].
- 27.1.9 Inspect, remove and replace tie rod sleeves, clamps and tie rod ends [HP-G].
- 27.1.10 Inspect, remove and replace steering linkage damper [HP-G].
- 27.1.11 Inspect, remove and replace upper and lower control arms [HP-G].
- 27.1.12 Inspect, remove and replace upper and lower control arm bushings, shafts and rebound bumpers [HP-G].
- 27.1.13 Inspect, remove and replace upper and lower ball joints [HP-G].
- 27.1.14 Inspect, remove and replace steering knuckle/spindle/hub assemblies (including bearings, races, seals, etc.) [HP-G].
- 27.1.15 Inspect, remove and replace front suspension coil springs and spring insulators (silencers) [HP-G].

- 27.1.16 Inspect, remove, replace and adjust suspension system torsion bars and inspect mounts [HP-G].
- 27.1.17 Inspect, remove and replace stabilizer bar bushings, brackets and links [HP-G].
- 27.1.18 Inspect, remove and replace MacPherson strut cartridge or assembly, upper bearing and mount [HP-G].
- 27.1.19 Inspect, remove and replace rear suspension system transverse links, control arms, stabilizer bars, bushings and mounts [HP-G].
- 27.1.20 Inspect, remove and replace suspension system leaf spring(s), leaf spring insulators (silencers), shackles, brackets, bushings and mounts [HP-G].
- 27.1.21 Inspect axle assembly for damage and misalignment [HP-G].
- 27.1.22 Inspect, remove and replace shock absorbers [HP-G].
- 27.1.23 Diagnose, inspect, adjust and repair or replace active suspension systems and associated lines and fittings [HP-G].
- 27.1.24 Measure vehicle ride height and determine needed repairs [HP-I].
- 27.1.25 Inspect, remove, replace and align front and rear frame (cradles/sub) [HP-G].
- 27.1.26 Diagnose steering column damage, looseness and binding problems, including tilt mechanisms, and determine needed repairs [HP-G].
- 27.1.27 Inspect, remove and replace steering shaft U-joint(s), flexible coupling(s), collapsible columns and steering wheels [HP-G].
- 27.1.28 Diagnose manual and power steering gear (non-rack and pinion type) noises, binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs [HP-G].
- 27.1.29 Diagnose power rack and pinion steering gear noises, vibration, looseness, hard steering, and fluid leakage problems, and ensure proper mounting location; determine needed repairs [HP-G].
- 27.1.30 Diagnose non-MacPherson front and rear suspension system noises and body sway problems; determine needed repairs [HP-G].
- 27.1.31 Diagnose MacPherson strut suspension system noises and body sway problems; determine needed repairs [HP-G].
- 27.1.32 Diagnose vehicle wandering, pulling, hard steering, bump steering, memory steering, torque steering and steering return problems; determine needed repairs [HP-G].
- 27.1.33 Adjust front and rear wheel camber on suspension systems with camber adjustments [HP-I].
- 27.1.34 Check front and rear wheel camber on adjustable and non-adjustable suspension systems; determine needed repairs [HP-I].
- 27.1.35 Adjust caster on suspension systems with caster adjustments [HP-I].
- 27.1.36 Check caster on adjustable and non-adjustable suspension systems; determine needed repairs [HP-I].
- 27.1.37 Check and adjust wheel toe, including centering steering wheel; determine needed adjustment or repair [HP-I].
- 27.1.38 Identify toe-out-on-turns (turning radius) related problems, and determine needed repairs [HP-I].
- 27.1.39 Identify steering axis inclination (SAI), included angle, and king pin inclination (KPI) related problems; determine needed repairs [HP-I].
- 27.1.40 Identify thrust angle related problems; determine needed repairs [HP-I].

- 27.1.41 Check for front wheel setback; determine needed repairs [HP-I].
- 27.1.42 Diagnose tire wear patterns; determine needed repairs [HP-I].
- 27.1.43 Inspect tires, identify direction of rotation and location; check and adjust air pressure [HP-I].
- 27.1.44 Diagnose wheel and tire vibration, shimmy, and tramp (wheel hop) problems; determine needed repairs [HP-G].
- 27.1.45 Measure wheel, tire, axle and hub run-out; determine needed repairs [HP-I].
- 27.1.46 Diagnose tire pull (lead) problems; determine corrective actions [HP-G].
- 27.1.47 Reinstall wheels and torque lug nuts [HP-I].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)
- *Solve increasingly complex non-routine measurement problems and check for reasonableness of results.* (Measurement A, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)
- *Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.* (Physical Sciences D, 11-12)
- *Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter.* (Physical Sciences G, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Providing electrical circuits and test equipment, diagnose and perform electrical repairs, with 80% accuracy in accordance with NATEF.

Competency 27.2: Diagnose and perform electrical repairs.

Descriptors:

- 27.2.1 Check voltages in electrical wiring circuits with a digital multimeter (DMM) [HP-I].
- 27.2.2 Check for voltage drop and/or current flow in electrical wiring circuits and components with a DMM [HP-I].
- 27.2.3 Repair electrical circuits, wiring and connectors [HP-I].
- 27.2.4 Inspect, test and replace fusible links, circuit breakers and fuses [HP-I].
- 27.2.5 Perform battery state-of-charge test; determine needed service [HP-I].
- 27.2.6 Inspect, clean and replace battery [HP-I].
- 27.2.7 Dispose of batteries and battery acid according to local, state and federal requirements [HP-G].
- 27.2.8 Perform slow and fast battery charge [HP-I].
- 27.2.9 Identify programmable electrical and electronic components, and record data for reprogramming before disconnecting the battery [HP-I].
- 27.2.10 Inspect, clean, repair or replace battery cables, connectors and clamps [HP-I].
- 27.2.11 Inspect alignment, adjust, remove and replace alternator (generator), drive belts, pulleys and fans [HP-I].
- 27.2.12 Check operation of exterior lighting; determine needed repairs [HP-I].
- 27.2.13 Aim headlamp assemblies (e.g., fog, driving lamps) and determine needed repairs [HP-I].
- 27.2.14 Inspect, test, repair or replace switches, relays, bulbs, sockets, connectors and wires of interior and exterior light circuits [HP-I].
- 27.2.15 Remove and replace horn(s); check operation [HP-I].
- 27.2.16 Check operation of wiper/washer systems; determine needed repairs [HP-I].
- 27.2.17 Check operation of power side and tailgate window; determine needed repairs [HP-I].
- 27.2.18 Inspect, remove and replace power seat, motors, linkages, cables, etc. [HP-G].
- 27.2.19 Inspect, remove and replace components of electric door and hatch/trunk lock [HP-G].
- 27.2.20 Inspect, remove and replace components of keyless locking devices and alarm systems [HP-G].
- 27.2.21 Inspect, remove and replace components of electrical sunroof and convertible top [HP-G].
- 27.2.22 Check the operation of electrically heated mirrors, windshields, backlights and panels, and repair as necessary [HP-I].
- 27.2.23 Inspect, remove and replace components of power antenna circuits [HP-I].

- 27.2.24 Demonstrate the proper self-grounding procedures for handling electronic components [HP-I].
- 27.2.25 Check for module communication errors using a scan tool [HP-G].
- 27.2.26 Use wiring diagrams and diagnostic flow charts during diagnosis of electrical circuit problems [HP-G].
- 27.2.27 Demonstrate safe disarming techniques of high voltage systems on hybrid vehicles [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
- *Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.* (Geometry and Spatial Sense C, 8-10)
- *Model and solve problem situations involving direct and inverse variation.* (Patterns, Functions and Algebra I, 8-10)
 - *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations.* (Scientific Inquiry A, 9-10)
- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Presented with a vehicle or training aid diagnosis and perform repairs to brake systems, with 100% accuracy in accordance with NATEF.

Competency 27.3: Diagnosis and perform repairs to brake systems.

Descriptors:

- 27.3.1 Inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear; tighten loose fittings and supports; replace brake lines (double flare and International Standards Organization [ISO] types), fittings and supports [HP-I].
- 27.3.2 Inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear; remove and replace hoses; and tighten loose fittings and supports [HP-I].
- 27.3.3 Identify, handle, store and install appropriate brake fluids, and dispose in accordance with federal, state and local regulations [HP-G].
- 27.3.4 Bleed (manual, pressure, vacuum or surge) hydraulic brake system [HP-I].
- 27.3.5 Pressure test brake hydraulic system and determine needed repair [HP-G].
- 27.3.6 Adjust brake shoes; remove and reinstall brake drums or drum/hub assemblies and wheel bearings [HP-I].
- 27.3.7 Reinstall wheel and torque lug nuts [HP-I].
- 27.3.8 Remove and reinstall caliper assembly [HP-I].
- 27.3.9 Clean and inspect caliper mountings for wear and damage [HP-I].
- 27.3.10 Check parking brake system operation [HP-I].
- 27.3.11 Identify and replace antilock brake system (ABS) wheel speed sensor components [HP-G].
- 27.3.12 Depressurize ABS hydraulic or electronic system [HP-G].
- 27.3.13 Identify the proper procedures for handling brake dust [HP-G].
- 27.3.14 Check for bent or damaged brake system components [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.* (Measurement E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
 - *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)
- *Explain the movement of objects by applying Newton's three laws of motion.* (Physical Sciences D, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Provided with a vehicle with air conditioning and necessary equipment, diagnose and repair heating and air conditioning (A/C) systems, with 80% accuracy in accordance with NATEF.

Competency 27.4: Diagnose and repair heating and air conditioning (A/C) systems.

Descriptors:

- 27.4.1 Identify and comply with environmental concerns relating to refrigerants and coolants [HP-G].
- 27.4.2 Maintain and verify the correct operation of certified refrigerant recovery and recharging equipment [HP-G].
- 27.4.3 Locate and identify A/C system service ports [HP-I].
- 27.4.4 Identify and recover refrigerant from A/C systems [HP-G].
- 27.4.5 Recycle refrigerant in accordance with EPA regulations [HP-G].
- 27.4.6 Identify, label and store refrigerant [HP-G].
- 27.4.7 Test recycled refrigerant for non-condensable gases [HP-G].
- 27.4.8 Evacuate A/C system and check for leaks [HP-G].
- 27.4.9 Recharge A/C system with refrigerant and perform leak test [HP-G].
- 27.4.10 Identify oil type and maintain the correct amount in A/C system [HP-G].
- 27.4.11 Inspect, adjust and replace A/C compressor drive belts; check pulley alignment [HP-G].
- 27.4.12 Remove and replace A/C compressor; inspect, repair or replace A/C compressor mount [HP-G].
- 27.4.13 Inspect and repair or replace A/C system mufflers, hoses, lines, fittings, orifice tube, expansion valve and seals [HP-G].
- 27.4.14 Inspect, test and replace A/C system condenser and mounts [HP-G].
- 27.4.15 Inspect and replace receiver/drier or accumulator/drier [HP-G].
- 27.4.16 Inspect and repair A/C component wiring [HP-G].

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
 - *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain how energy may change form or be redistributed but the total quantity of energy is conserved.* (Physical Sciences F, 9-10)
- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Provided with a vehicle and reference material, diagnose and repair cooling systems, with 80% accuracy in accordance with to NATEF guidelines.

Competency 27.5: Diagnose and repair cooling systems.

Descriptors:

- 27.5.1 Check engine cooling and heater system hoses and belts; determine needed repairs [HP-I].
- 27.5.2 Inspect, test, remove and replace radiator, pressure cap, coolant recovery system and water pump [HP-G].
- 27.5.3 Recover, refill and bleed system with proper coolant; check level of protection; leak test system and dispose of materials in accordance with EPA specifications [HP-I].
- 27.5.4 Remove and replace fan (both electrical and mechanical), fan pulley, fan clutch and fan shroud [HP-G].
- 27.5.5 Inspect, remove and replace auxiliary oil/fluid coolers; check oil levels [HP-G].
- 27.5.6 Inspect, remove and replace electric fan sensors; check operation [HP-G].

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)
 - *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain how energy may change form or be redistributed but the total quantity of energy is conserved.* (Physical Sciences F, 9-10)
- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Provided with a vehicle and reference material, diagnose and repair drive train, with 80% accuracy in accordance with to NATEF guidelines.

Competency 27.6: Diagnose and repair drive train.

Descriptors:

- 27.6.1 Remove, replace and adjust shift or clutch linkage as required [HP-G].
- 27.6.2 Remove, replace and adjust cables or linkages for throttle valve (TV), kick-down and accelerator pedal [HP-G].
- 27.6.3 Remove and replace electronic sensors, wires and connectors [HP-G].
- 27.6.4 Remove and replace power train assembly; inspect, replace and align power train mounts [HP-G].
- 27.6.5 Remove and replace drive axle assembly [HP-G].
- 27.6.6 Inspect, remove and replace half shafts and axle constant velocity (CV) joints [HP-G].
- 27.6.7 Inspect, remove and replace drive shafts and universal joints [HP-G].

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematical Processes B, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)
- *Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems.* (Physical Sciences D, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a running engine and test equipment, Diagnose and repair fuel, intake and exhaust systems, with 80% accuracy in accordance with NATEF.

Competency 27.7: Diagnose and repair fuel, intake and exhaust systems.

Descriptors:

- 27.7.1 Inspect, remove and replace exhaust pipes, mufflers, converters, resonators, tail pipes and heat shields [HP-G].
- 27.7.2 Inspect, remove and replace fuel tank, fuel tank filter, fuel cap, fuel filler hose and inertia switch; inspect and replace fuel lines and hoses; check fuel for contaminants [HP-G].
- 27.7.3 Inspect, remove and replace engine components of air intake systems [HP-G].
- 27.7.4 Inspect, remove and replace canister, filter and vent, and purge lines of fuel vapor Automotive EVAPorative System (EVAP) control systems [HP-G].

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematical Processes B, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Provided with a late model vehicle, diagnose and repair restraint systems, with 80% accuracy in accordance with NATEF.

Competency 27.8: Diagnose and repair restraint systems.

Descriptors:

- 27.8.1 Identify and perform vehicle manufacturer’s recommended procedures for inspecting or replacing restraint systems and components [HP-I].
- 27.8.2 Inspect, remove and replace seatbelt and shoulder harness assembly and components [HP-G].
- 27.8.3 Inspect restrain system mounting areas for damage; repair as needed [HP-G].
- 27.8.4 Verify proper operation of seatbelt [HP-G].
- 27.8.5 Deactivate and reactivate Supplemental Restraint System (SRS) [HP-G].
- 27.8.6 Inspect, remove and replace Supplemental Restraint System (SRS) sensors and wiring; ensure sensor orientation [HP-G].
- 27.8.7 Verify that Supplemental Restraint System (SRS) is operational [HP-I].
- 27.8.8 Inspect, remove, replace and dispose of deployed and non-deployed airbag(s) and pretensioners [HP-G].
- 27.8.9 Use Diagnostic Trouble Codes (DTC) to diagnose and repair the Supplemental Restraint System (SRS) [HP-G].

Correlated Mathematics Academic Content Benchmarks

- *Construct convincing arguments based on analysis of data and interpretation of graphs.* (Data Analysis and Probability F, 8-10)
- *Apply mathematical knowledge and skills routinely in other content areas and practical situations.* (Mathematical Processes B, 8-10)

Correlated Science Academic Content Benchmarks

- *Explain the ways in which the processes of technological design respond to the needs of society.* (Science and Technology A, 9-10)

Unit 28: Painting and Refinishing

BIL: **Essential**

EDU:	12	AD
	P	R

TPO: Given a display of safety items and supplies students will demonstrate safety precautions, with 100% accuracy according to OSHA.

Competency 28.1: Demonstrate safety precautions.

Descriptors:

- 28.1.1 Identify and follow necessary precautions with hazardous operations and materials, according to federal, state and local regulations [HP-I].
- 28.1.2 Identify safety and personal health hazards according to Occupational Safety and Health Administration (OSHA) guidelines and the “Right to Know” law [HP-I].
- 28.1.3 Inspect spray environment to ensure compliance with federal, state and local regulations, and for safety and cleanliness hazards [HP-I].
- 28.1.4 Select and use the National Industrial Occupational Safety & Health (NIOSH) approved personal sanding respirator; inspect its condition and ensure fit and operation; perform proper maintenance in accordance with OSHA regulation 1910.134 and applicable state and local regulations [HP-I].
- 28.1.5 Select and use the NIOSH approved (Fresh Air Make-up System) personal painting/ refinishing respirator system; perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulations [HP-I].
- 28.1.6 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 (e.g., gloves, suits, hoods, eye and ear protection) [HP-I].

Correlated English Language Arts Academic Content Benchmarks

- *Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)*

Correlated Science Academic Content Benchmarks

- *Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of these investigations. (Scientific Inquiry A, 9-10)*
- *Make appropriate choices when designing and participating in scientific investigations by using cognitive and manipulative skills when collecting data and formulating conclusions from the data. (Scientific Inquiry A, 11-12)*

BIL: Essential

EDU:	12	AD
	P	R

TPO: Recalling from memory and handouts, Prepare surface for refinishing, pass a test with 90% accuracy.

Competency 28.2: Prepare surface for refinishing.

Descriptors:

- 28.2.1 Inspect, remove, store and replace exterior trim and components necessary for proper surface preparation [HP-I].
- 28.2.2 Soap and water wash entire vehicle; use appropriate cleaner to remove contaminants [HP-I].
- 28.2.3 Inspect and identify substrate, type of finish, surface condition and film thickness; develop and document a plan for refinishing using a total product system [HP-I].
- 28.2.4 Remove paint finish [HP-I].
- 28.2.5 Dry or wet sand areas to be refinished [HP-I].
- 28.2.6 Featheredge damaged areas to be refinished [HP-I].
- 28.2.7 Apply suitable metal treatment or primer in accordance with total product systems [HP-I].
- 28.2.8 Mask and protect other areas that will not be refinished [HP-I].
- 28.2.9 Mix primer, primer-surfacer or primer-sealer [HP-I].
- 28.2.10 Apply primer onto surface of repaired area [HP-I].
- 28.2.11 Apply two-component finishing filler to minor surface imperfections [HP-I].
- 28.2.12 Dry or wet sand area to which primer-surfacer has been applied [HP-I].
- 28.2.13 Dry sand area to which two-component finishing filler has been applied [HP-I].
- 28.2.14 Remove dust from area to be refinished, including cracks or moldings of adjacent areas [HP-I].
- 28.2.15 Clean area to be refinished using a final cleaning solution [HP-I].

- 28.2.16 With a tack rag, remove any dust or lint particles from the area to be refinished [HP-I].
- 28.2.17 Apply a suitable sealer to the area being refinished when sealing is needed or desirable [HP-I].
- 28.2.18 Scuff sand to remove nibs or imperfections from a sealer [HP-I].
- 28.2.19 Apply stone chip resistant coating [HP-G].
- 28.2.20 Restore corrosion-resistant coatings, caulking, and seam sealers to repaired areas [HP-I].
- 28.2.21 Prepare adjacent panels for blending [HP-I].
- 28.2.22 Identify the types of rigid, semi-rigid or flexible plastic parts to be refinished; determine the materials, preparation and refinishing procedures [HP-I].
- 28.2.23 Identify aluminum parts to be refinished; determine the materials, preparation and refinishing procedures [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)

Correlated Mathematics Academic Content Benchmarks

- *Compare, order and determine equivalent forms of real numbers.* (Number, Number Sense and Operations E, 8-10)
- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)

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BIL: Essential

EDU:	12	AD
	P	R

TPO: Given equipment, properly operate spray gun and related equipment, with 90% accuracy in accordance with NATEF.

Competency 28.3: Properly operate spray gun and related equipment.

Descriptors:

- 28.3.1 Inspect, clean and determine the condition of spray guns and related equipment, including air hoses, regulators, air lines, air source and spray environment [HP-I].
- 28.3.2 Check and adjust spray gun operation for high volume, low pressure (HVLP) or low volume, low pressure (LVLP) guns [HP-I].
- 28.3.3 Set-up (fluid needle, nozzle and cap), adjust and test spray gun using fluid, air and pattern control valves [HP-I].

Correlated Mathematics Academic Content Benchmarks

- *Apply various measurement scales to describe phenomena and solve problems.* (Measurement B, 11-12)

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given equipment, mix, match and apply paint, with 90% accuracy in accordance with industry standards.

Competency 28.4: Mix, match and apply paint.

Descriptors:

- 28.4.1 Determine the type and color of paint already on the vehicle by manufacturer’s vehicle information label [HP-I].
- 28.4.2 Shake, stir, reduce, catalyze/activate and strain paint [HP-I].
- 28.4.3 Apply finish using appropriate spray techniques (gun arc, gun angle, gun distance, gun speed and spray pattern overlap) for the finish being applied [HP-I].
- 28.4.4 Apply selected product on test and letdown panel; check for color match [HP-I].
- 28.4.5 Apply a single stage topcoat [HP-I].
- 28.4.6 Apply basecoat/clearcoat for panel blending or partial refinishing [HP-I].
- 28.4.7 Apply basecoat/clearcoat for overall refinishing [HP-G].
- 28.4.8 Denib, buff and polish finishes where necessary [HP-I].
- 28.4.9 Refinish rigid, semi-rigid and flexible plastic parts [HP-G].
- 28.4.10 Apply multi-stage coats for panel blending or overall refinishing [HP-G].
- 28.4.11 Identify and mix paint using a formula [HP-G].
- 28.4.12 Identify poor hiding colors; determine necessary action [HP-G].
- 28.4.13 Tint color using a formula to achieve a blendable match [HP-G].
- 28.4.14 Identify an alternative color formula to achieve a blendable match [HP-G].

Correlated English Language Arts Academic Content Benchmarks

- *Use appropriate self-monitoring strategies for comprehension.* (Reading Process C, 8-10; Reading Process C, 11-12)**Correlated Mathematics Academic Content Benchmarks**
- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.* (Number, Number Sense and Operations G, 8-10)

Correlated Science Academic Content Benchmarks

- *Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance.* (Physical Sciences C, 9-10)

- *Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter. (Physical Sciences G, 9-10)*

BIL: Essential

EDU:	12	AD
	I	P

TPO: Given a variety of conditions, Identify and correct paint defects, with 90% accuracy to industry standards.

Competency 28.5: Identify and correct paint defects.

Descriptors:

- 28.5.1 Identify blistering (raising of the paint surface); determine the cause(s) and correct the conditions [HP-G].
- 28.5.2 Identify blushing (milky or hazy formation); determine the cause(s) and correct the condition [HP-G].
- 28.5.3 Identify a dry spray appearance in the paint surface; determine the cause(s) and correct the condition [HP-G].
- 28.5.4 Identify the presence of fish-eyes (crater-like openings) in the finish; determine the cause(s) and correct the condition [HP-G].
- 28.5.5 Identify lifting; determine the cause(s) and correct the conditions [HP-G].
- 28.5.6 Identify clouding (mottling and streaking in metallic finishes); determine the cause(s) and correct the condition [HP-G].
- 28.5.7 Identify orange peel; determine the cause(s) and correct the condition [HP-I].
- 28.5.8 Identify overspray; determine the cause(s) and correct the condition [HP-G].
- 28.5.9 Identify solvent popping in a freshly painted surface; determine the cause(s) and correct the condition [HP-G].
- 28.5.10 Identify sags and runs in paint surface; determine the cause(s) and correct the condition [HP-G].
- 28.5.11 Identify sanding marks (sand-scratch swelling); determine the cause(s) and correct the condition [HP-G].
- 28.5.12 Identify contour mapping (shrinking and splitting) while finish is drying; determine the cause(s) and correct the condition [HP-G].
- 28.5.13 Identify color difference (off-shade); determine the cause(s) and correct the condition [HP-G].
- 28.5.14 Identify tape tracking; determine the cause(s) and correct the condition [HP-G].
- 28.5.15 Identify low gloss condition; determine the cause(s) and correct the condition [HP-G].
- 28.5.16 Identify poor adhesion; determine the cause(s) and correct the conditions [HP-G].
- 28.5.17 Identify paint cracking (crowsfeet or line-checking, micro-checking, etc.); determine the cause(s) and correct the condition [HP-G].
- 28.5.18 Identify corrosion; determine the cause(s) and correct the condition [HP-G].
- 28.5.19 Identify dirt or dust in the paint surface; determine the cause(s) and correct the condition [HP-I].

- 28.5.20 Identify water spotting; determine the cause(s) and correct the condition [HP-G].
- 28.5.21 Identify finish damage caused by bird droppings, tree sap, and other natural causes; correct the condition [HP-G].
- 28.5.22 Identify finish damage caused by airborne contaminants (acids, soot, rail dust, and other industrial-related causes); correct the condition [HP-G].
- 28.5.23 Identify die-back conditions (dulling of the paint film showing haziness); determine the cause(s) and correct the conditions [HP-G].
- 28.5.24 Identify chalking (oxidation); determine the cause(s) and correct the condition [HP-G].
- 28.5.25 Identify bleed-through (staining); determine the cause(s) and correct the condition [HP-G].
- 28.5.26 Identify pin-holing; determine the cause(s) and correct the condition [HP-G].
- 28.5.27 Identify buffing-related imperfections (swirl marks, wheel burns); correct the condition [HP-G].
- 28.5.28 Identify pigment flotation (color change through film build); determine the cause(s) and correct the condition [HP-G].
- 28.5.29 Measure mil thickness [HP-I].

Correlated English Language Arts Academic Content Benchmarks

- *Formulate open-ended research questions suitable for investigation and adjust questions as necessary while research is conducted. (Research A, 8-10)*
- *Formulate open-ended research questions suitable for inquiry and investigation and adjust questions as necessary while research is conducted. (Research A, 11-12)*

Correlated Mathematics Academic Content Benchmarks

- *Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number, Number Sense and Operations G, 8-10)*
- *Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)*

Correlated Science Academic Content Benchmarks

- *Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)*
- *Demonstrate that waves (e.g., sound, seismic, water and light) have energy and waves can transfer energy when they interact with matter. (Physical Sciences G, 9-10)*
- *Explain the ways in which the processes of technological design respond to the needs of society. (Science and Technology A, 9-10)*

BIL: Essential

EDU:	12	AD
	P	R

TPO: Provided with a automotive shop and a vehicle, perform final detailing, with 90% accuracy to industry standards.

Competency 28.6: Perform final detailing.

Descriptors:

- 28.6.1 Apply decals, transfers, tapes, wood-grains and/or pinstripes (painted and taped) [HP-G].
- 28.6.2 Buff and polish finish to remove defects as required [HP-I].
- 28.6.3 Clean interior, exterior and glass [HP-I].
- 28.6.4 Clean body openings (e.g., door jambs and edges) [HP-I].
- 28.6.5 Remove overspray [HP-I].

STUDENT ASSESSMENT POLICY CLEVELAND HEIGHTS – UNIVERSITY HEIGHTS SCHOOL DISTRICT

The student shall perform competencies and competency builders in a manner acceptable to the auto collision repair industry. The standards set for these competencies are recommended by the advisory committee members and employers in the auto collision repair industry and evaluated by the teacher following these guidelines. Competencies will be identified which must be mastered in order to receive credit for the course.

In order to measure the progress of each student in the program and to measure the effectiveness of the total program, the following assessment procedures will be used:

- Pretests
- Post tests
- Teacher observation and evaluations
- Self evaluations
- Class discussions and demonstrations
- Projects Development and Construction
- Oral Tests
- Daily Grades
- Lab and Related Class performance
- Training Plan
- Board Adopted rules and regulations
- Work/field experiences, business partnership evaluations
- Final Exam

Measurement of learning will be an ongoing activity with emphasis on laboratory activities and competency improvement. Assessment will be accomplished through pre-assessment of student skills, frequent formative assessment, both orally and written, and summative assessment to determine mastery of competencies. The number of competencies mastered will be translated into appropriate grades consistent with both the schools grading system and school district policy. When a student, grades nine through twelve, accumulates six unexcused absences or fifteen excused and/or unexcused absences in a class at any time during the semester, the student automatically receives a grade of "FA" to indicate failure due to absence.

100 – 90 = A

89 - 80 = B

79 - 70 = C

69 - 60 = D

59 - 0 = F

At the completion of the program each student will receive a Career Passport indicating competencies in which student is proficient.