



OaklandWorks

A School-To-Career Partnership

Transportation Career Cluster Standards

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WestEd

Participants in Development of the Transportation Career Cluster Standards

Ed Fincke, Monterey-Salinas Transit
Peter Rogoson, AC Transit
Mike Robertson, College of Alameda
Hattie Tate, Castlemont High School
Alice Topriner, Environmental Protection Agency
Mahna Schwager, WestEd

Introduction to the Transportation Industry

Transportation is emerging as a global industry. Because of environmental and economic considerations, workers in the transportation industry need stronger preparation than ever before, including higher levels of science and mathematics, and advanced technical skills, such as computer diagnostics. Background in history, social studies, and economics leads to greater understanding of the complex issues related to energy security and environmental quality that are becoming increasingly important in this industry. In addition, the advanced transportation industry is moving towards adoption and use of newer technologies, such as hybrid, electric, and fuel cell vehicles; advanced batteries for electric vehicles; high-speed mass transit systems; and emissions and fuel economy data for today's vehicles. These technologies promote energy efficiency, avoiding pollution by reducing petroleum fuel use in cars, trucks, buses, fleet vehicles, and public transportation.

Employers report that hands-on experience is an important factor in considering new hires and that it can be difficult to find experienced applicants for job openings. Given the challenge of new advanced technologies and alternative fuels, the need for trained technicians can be expected to increase. Some occupations that fall within this career cluster are automotive technicians, bus and truck technicians and diesel engine specialists, aircraft pilots and flight engineers, and aircraft mechanics.

Although nationwide transportation is a slow growth industry, California is expecting greater growth and demand in all these occupational categories according to the most recent 10-year forecast (1996-2006).¹

Career Pathways within the Industry/Education Partnership

The Transportation Career Cluster standards are targeted to the following:

- Career academies within the Oakland Unified School District that focus on International Trade and Transportation and Automotive Technology (Castlemont High School)
- Community college transportation technology programs including
 - ❖ College of Alameda - Aviation Technology, Diesel Mechanics, and Automotive
 - ❖ Vista College – International Trade and Travel
- California State University, Hayward program in Engineering, option available in Industrial Engineering

¹ California Apprenticeship Trade Programs with minimum entry age from 16-18 years old in this career cluster are: automotive trades, operating engineers, and stationary engineers.



The OaklandWorks Industry/Education career cluster approach to standards is to identify broad career-technical, rather than job-specific skills, that are common to a group or cluster of similar occupations, highlighting the integration of academic and vocational content. This approach helps to provide students with a general understanding of “all aspects of an industry.”

The OaklandWorks Standards Format

The standards in this document identify the core knowledge and skills for the Transportation career cluster for the OaklandWorks Industry/Education School-to-Work Partnership. The standards specify in broad terms the knowledge and skills necessary for initial success in each program area (grades 13-14). They consist of content standards (specifying what student should know and be able to do) and examples of performance indicators (products or actions and tasks that provide evidence of success).

The OaklandWorks standards format includes three different types/levels of standards. They include the following:

- *Employability Skills*—These skills and qualities are foundational to occupations in the cluster.
- *Career-Technical Standards*—These standards define general knowledge and skills—not job-specific skills—that are common across the multitude of occupations within the cluster.
- *Academic Standards*—The academic standards represent generic academic skills that support the career cluster. These standards have been synthesized from the district-adopted standards and highlight academic standards identified as important to this career cluster by the development teams. The performance indicators are examples of how the general academic skills can be contextualized by career-specific content.

The academic standards adopted by Oakland Unified School District in Language Arts, Mathematics, History/Social Science, and Science have been cross-referenced to related performance indicators to enhance their usability. For example, the sample performance indicator for Employability Skill Standard 4: Thinking and Problem Solving Skills, “Troubleshoots to prevent problems and develop solutions”, is cross-referenced to the district’s mathematics standard, Mathematics: Standard 5: Mathematical Reasoning (e.g., [Mathematics 5]). When more than one topic is identified for a standard an alphanumeric coding system is used (e.g., Language Arts Standard 1: Reading: Topic A: Reading Skills and Fluency is coded as Language Arts 1A). A complete list of the alphanumeric codes related to the district’s academic standards appears at the end of this document.



Employability Skill Standards for Transportation

Employability Skill Standards	Sample Performance Indicators
<p>Standard 1: Career Literacy Students will understand the depth and breadth of opportunities available in the transportation-providing companies. They will know the criteria and process for obtaining employment.</p>	<ul style="list-style-type: none"> • Demonstrates understanding of promotional ladders in public and private agencies • Experiences work environment through industry tours and work experience • Demonstrates understanding of how own strengths and weaknesses interact with career choices • Seeks opportunities for professional growth • Shows a desire to continually improve work processes and products • Maintains a current résumé • Accurately completes job applications and writes cover letters and letters of inquiry [Language Arts 3A-C] • Seeks out resources to learn about career options • Demonstrates understanding of the importance of enhancing skills for lifelong learning
<p>Standard 2: Technology Literacy Students will understand how technology is used in their chosen field now and in the future. They will effectively use technologies.</p>	<ul style="list-style-type: none"> • Accesses, inputs, manages, and manipulates information and data using modern technologies (i.e., computer resources, test equipment, networking, scanners, global positioning systems) • Demonstrates a working understanding of a fully equipped work station • Uses analytic equipment to acquire data

Employability Skill Standards for Transportation

Employability Skill Standards	Sample Performance Indicators
<p>Standard 3: Communication Skills Students will understand the principles of effective communication. They will communicate both orally and in writing. They will listen attentively and request clarification or additional information as needed.</p>	<ul style="list-style-type: none"> • Is clear and concise with a well-thought out manner in oral and written communication (e.g., note to supervisors, incident report, phone messages, basic facts, such as minimum and maximum for inventory) [Language Arts 3A-C, 4A, 4C] • Reads information and applies guidelines from a variety of sources (i.e., personnel manuals, schematics, specifications, shop drawings, policies and procedure manuals, contracts) [Language Arts 1A-D] • Uses appropriate terminology • Demonstrates effective communication in a variety of situations (i.e., customer complaints, work teams, coworkers, supervisors) [Language Arts 4C] • Interacts with diverse groups (i.e., ethnic, gender, cultural, socio-economic) [Language Arts 4C] • Learns from positive and negative feedback and learns from their own mistakes

Employability Skill Standards for Transportation

Employability Skill Standards	Sample Performance Indicators
<p>Standard 4: Thinking and Problem Solving Skills Students will demonstrate critical and creative thinking skills, logical reasoning, and problem solving. Students will understand and apply the universal, systematic problem solving model incorporating input, process, outcome, and feedback components in a variety of situations.</p>	<ul style="list-style-type: none"> • Prioritizes work flow • Locates and uses resources quickly and understands when to ask for help • Manages multiple tasks and organizes information • Given problem situations can develop appropriate questions for investigation [Mathematics 5] • Thinks outside the box • Identifies all possible factors to identify underlying causes (root cause analysis) [Mathematics 5] • Trouble-shoots to prevent problems and develop solutions [Mathematics 5] • Links academic skills to real applications (e.g., spatial geometry to wheel alignment, rotational force to linear action as shown in piston stroke as driven by cam shaft rotation) • Makes the nexus between abstract and concrete • Identifies the task at hand and organizes supporting activities in a logical and methodical manner [Mathematics 5] • Aware of consequences of actions or how an action or lack of action will affect those upstream or downstream in a process
<p>Standard 5: Quality Assurance Students will understand the importance of quality service indicators. They will identify indicators of excellence in their chosen job.</p>	<ul style="list-style-type: none"> • Demonstrates understanding of the scope and breadth of duties for a particular position • Explains how their work affects others in the organization (i.e., timeliness, quality of work, how it fits into overall mission of the organization)



Employability Skill Standards for Transportation

Employability Skill Standards	Sample Performance Indicators
<p>Standard 6: Personal Qualities Students will understand how personal skill development affects their employability. They will exhibit positive attitudes, self-confidence, honesty, perseverance, and self-discipline.</p>	<ul style="list-style-type: none"> • Sets and manages short- and long-term goals • Demonstrates resourcefulness and problem solving • Behaves with integrity, such as interacting with others honestly and reporting ethical conflicts to superiors • Follows through on assigned tasks and maintains excellent record of punctuality and attendance • Dresses, speaks, and presents oneself in a positive manner appropriate to the situation • Shows high level of perseverance over prolonged projects and maintains persistence in the face of difficulties and setbacks • Shows self-understanding (i.e., individual strengths and weaknesses) and is open to self evaluation • Contributes to customer satisfaction
<p>Standard 7: Teamwork Students will understand the role and responsibilities of individual members of the team, including their ability to promote quality service and production excellence. They will interact effectively and sensitively with all members of their team.</p>	<ul style="list-style-type: none"> • Interacts respectfully and without prejudice with others from diverse backgrounds and perspectives • Demonstrates a cooperative, courteous, and professional interaction with others using effective communication to arrive at a mutually agreeable result [Language Arts 4C] • Listens attentively, considers all issues, and strives to resolve conflicts [Language Arts 4B-C] • Shows initiative by following directions, listening, observing, and accepting new responsibilities as they arise



Transportation Technical Content Standards

Technical Content Standards	Sample Performance Indicators
<p>Standard 1: Transportation Modes Students will understand the resources used to transport people and goods from the past to the present day. They will demonstrate knowledge of various modes of transportation (vehicular and stationary) by comparing modes and their application.</p>	<ul style="list-style-type: none"> • Demonstrates knowledge of trade between countries • Describes the various methods of moving people and goods • Uses emerging technologies, such as alternative fuels [Science 1J, 1L] • Demonstrates understanding of the environmental impacts of different modes (i.e., inconvenience, noise pollution, water pollution, traffic congestion, smog, hazardous materials, workforce availability) [Science 1G, 1J, 2E, 3B] • Compares and contrasts different transportation modes in relation to a variety of factors • Describes how technological advances, as well as other factors, contribute to changes in transportation systems
<p>Standard 2: Propulsion, Control, and Structural Systems Students will understand and apply the basic principles of propulsion, control, and structural systems in transportation technology. These systems include:</p> <ul style="list-style-type: none"> • Internal and external combustion • Hydraulic and pneumatic power • Basic electricity and electronics 	<ul style="list-style-type: none"> • Explains the difference in need for and when it is appropriate to use gas and diesel combustion, internal and external combustion, and basic electric and electronic processes [Science 1E, 4E] • Explains the impact of factors such as air density, cylinder temperatures, and fuel properties on combustion • Explains electrical and magnetic force [Science 1E, 4E] • Demonstrates the importance and differences of polar diagrams and engine diagrams • Applies knowledge of alternative fuels, such as CNG or LNG or electric powered concepts, as determined by local need

Transportation Technical Content Standards

Technical Content Standards	Sample Performance Indicators
<p>Standard 3: Troubleshooting, Testing, and Repair Students will demonstrate the ability to analyze a problem and isolate the malfunction. Students will apply troubleshooting and problem solving skills.</p>	<ul style="list-style-type: none"> • Conducts analysis and investigates failure of components and systems [Mathematics 5] • Makes adjustments to deliver optimum performance • Conducts periodic testing to evaluate environmental impact • Knows how theory relates to the diagnostics of systems (i.e., engine, electrical, electronics, pneumatic, hydraulic, drivetrain, refrigeration, and process management)
<p>Standard 4: Occupational Safety Students will demonstrate a broad knowledge of workplace safety issues.</p>	<ul style="list-style-type: none"> • Safely handles and disposes of materials and waste • Uses general shop safety skills • Demonstrates knowledge of first-aid procedures • Demonstrates knowledge of how common accidents occur and steps to take to prevent their occurrence • Assesses work environment for safety concerns • Applies knowledge of federal, state, and local rules and regulations and environmental regulation agencies

Transportation Technical Content Standards

Technical Content Standards	Sample Performance Indicators
<p>Standard 5: Global Impact of Transportation Technology Students will understand the global environmental, economic, political, social, and geographic issues related to transportation of people and goods. Students will apply their understanding of the environmental impact of different transportation technologies.</p>	<ul style="list-style-type: none"> • Demonstrates knowledge of raw materials, waste, quality control, costs, and geological and environmental impact • Demonstrates knowledge of various methods for describing the location and distribution of land, sea, and air masses including their physical locations, relationships, and characteristics • Explains how combustion can affect energy consumption and how the products of combustion can affect air quality [Science 2E, 3D] • Demonstrates understanding of time zones, wind patterns, north/south hemisphere season differences, altitude’s effect on climate, names/locations and pronunciation of various continents, countries, rivers, oceans, mountain ranges, and major tourism sites [Science 1J, 1L]
<p>Standard 6: Laws and Ethics Students will understand and apply knowledge of business ethics and trade practices, governmental regulations, and public safety and security operations. They will understand issues related to trade policies, interstate transportation, and international travel.</p>	<ul style="list-style-type: none"> • Applies knowledge of public safety and security operations, rules, regulations, precautions, prevention, and the protection of people, data, and property • Applies knowledge of state and federal business codes and trade policies • Complies with applicable codes for work environment (high pressure, handling and disposal of hazardous materials, pollution control measures, fire protection, earthquake protection) • Complies with reporting requirements

Transportation Technical Content Standards

Technical Content Standards	Sample Performance Indicators
<p>Standard 7: International Business Students will understand the concept of creating a business venture. They will prepare and present a business proposal or action plan.</p>	<ul style="list-style-type: none"> • Applies knowledge of foreign currency and exchange rates [Mathematics 2] • Demonstrates understanding of the concepts of gross, net, net net, mark up, and profit margin [Mathematics 1-4, 6-8] • Demonstrates understanding of stock investments • Performs basic accounting skills and functions [Mathematics 1-4] • Applies knowledge of major business management concepts, such as finance, operations, human resources, and technology

Academic Standards for Transportation

Academic Standards	Sample Performance Indicators
<p>Standard 1: Language Arts Students will demonstrate reading, writing, speaking, and listening skills, and an appreciation for cultural diversity in literature and language.</p>	<ul style="list-style-type: none"> • Uses a wide range of strategies to read, comprehend, interpret, evaluate, and apply a variety of written materials (e.g., technical manuals, schematics, specifications, shop drawings, business, policy, and personnel documents) [Language Arts 1A-B, 1D] • Reads and comprehends a range and breadth of written material including public and functional documents [Language Arts 1A-B, 1D] • Expresses ideas and information in written form clearly and accurately and tailors to the intended purpose and audience (e.g., technical reports and business documents) [Language Arts 3A-C] • Actively listens and communicates in a clear, courteous, and complete manner on personal and professional levels [Language Arts 4B-C] • Applies proper workplace and academic English language usage in professional communication situations (e.g., writing and speaking) [Language Arts 3C; 4C]

Academic Standards for Transportation

Academic Standards	Sample Performance Indicators
<p>Standard 2: Mathematics Students are able to reason, communicate, solve problems and develop understanding of numbers, measurement, geometry, functions, statistics and probability, logic, and algebra.</p>	<ul style="list-style-type: none"> • Performs basic computations without use of a calculator (e.g., add, subtract, multiply, and divide; converts fractions, decimals, percentages, and metric values) [Mathematics 1] • Analyzes and solves transportation problems (e.g., business and technical) by selecting and applying appropriate quantitative methods [Mathematics 1-2, 5] • Analyzes and interprets numeric information (e.g., technical charts and data and financial information) [Mathematics 1-5] • Applies mathematical equations and formulas in technical troubleshooting and business management [Mathematics 2-5] • Applies mathematical concepts (e.g., numbers, geometry, statistics and probability) to solve transportation-related problems [Mathematics 1-4]

Academic Standards for Transportation

Academic Standards	Sample Performance Indicators
<p>Standard 3: History/Social Science Students will demonstrate historical thinking (e.g., examining evidence, diversity/multiple perspectives, interpretation, significance, participation) and understanding of government (e.g., legislature and executive branches and contemporary issues) and economics (e.g., fundamental economic concepts and international economic concepts) in transportation.</p>	<ul style="list-style-type: none"> • Analyzes major economic trends (e.g., globalization, rapid growth of the Internet) and how they impact transportation [History/Social Science 1A, 1C-D, 3A, 3E] • Describes major trade and transportation principles as they relate to the role of government and policymaking [History/Social Science 2C, 2F] • Identifies how contemporary issues and fundamental economic concepts impact global trade and transportation [History/Social Science 1A, 1C, 2F, 3A] • Demonstrates understanding of environmental and transportation law concepts (e.g., government relations, laws, and policies) as they relate to the role of transportation in the national and international marketplace [History/Social Science 1A, 3D, 3E] • Uses maps to make sophisticated assumptions about physical and cultural features of neighborhoods, cities, states, and countries [History/Social Science 1A-B] • Applies understanding of diversity of viewpoints and linguistic and cultural backgrounds in transportation environments [History/Social Science 1C, 1E]



Academic Standards for Transportation

Academic Standards	Sample Performance Indicators
<p>Standard 4: Science Students will demonstrate understanding of physics (e.g., motion and forces, conservation of energy and momentum, heat and thermodynamics, waves, and electronic and magnetic phenomena), chemistry (e.g., atomic and molecular structure, chemical bonds, conservation of matter and stoichiometry, gases, acids and bases, and nuclear processes), biology/life sciences (e.g., ecology), and earth sciences (e.g., earth’s place in the universe, dynamic earth processes, energy, biochemical cycles, and structure and composition of the atmosphere) and the connections and applications of these concepts as they relate to transportation.</p>	<ul style="list-style-type: none"> • Explains basic scientific concepts as they relate to health and safety in transportation environments [Science 1A-M, 2E, 3A-E, 3J, 4A-E] • Demonstrates understanding of the impact of technology and science as they have contributed to the development and expansion of trade and transportation systems [Science 1A-M, 2E, 3A-E, 3J, 4A-E] • Explains the impact of science (e.g., historical and contemporary contributions) and interactions between science and society in relation to trade and transportation [Science 1A-M, 2E, 3A-E, 3J, 4A-E]

Resources

America's Career InfoNet: Skills, Tasks and Activities, and Job Outlook information for: Automotive Master Mechanics, Automotive Specialty Technicians, Diesel Engine Erectors and Fitters, Diesel Engine Mechanics, Aircraft Body and bonded Structure Repairers, Airframe-and-Power-Plant Mechanics, Commercial Airplane Pilots, Commercial Helicopters Pilots, Flight Engineers, Flight Instructors, Flight Navigators, and Small Aircraft Pilots.

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Energy Technology Training Center. (1998). *Advanced Transportation Technologies: Tech Prep Associate Degree, Skill Standards Taxonomy*. Palm Desert, CA: College of the Desert.

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