

## Program of Study Justifications for Transportation, Distribution, & Logistics

<b>Program of Study</b>	<b>Page</b>
Automotive Collision Repair	2
Automotive Maintenance & Light Repair	7
Aviation Flight	13
Distribution & Logistics	21

## Automotive Collision Repair

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Automotive Collision Repair</b>	Introduction to Collision Repair	Collision Repair: Non-Structural (6062) -or- Collision Repair: Painting & Refinishing (6063)	Collision Repair: Non-Structural (6062) -or- Collision Repair: Painting & Refinishing (6063)	Collision Repair: Non-Structural (6062) -or- Collision Repair: Painting & Refinishing (6063) -or- Collision Repair: Damage Analysis, Estimating, & Customer Service (6149)

### Description

The *Automotive Collision Repair* program of study prepares students for entry into careers as professional service technicians. Content emphasizes customer service skills, proper use of tools and equipment, safety, shop operations, engine fundamentals, damage analysis, cost estimation, painting and refinishing, and structural and non-structural repair in a hands-on environment. Upon completion of this program of study, students will be eligible to take the examination for Automotive Student Excellence (ASE) Student Certification in Collision Repair or I-CAR ProLevel 1.

ASE Student Certification may be obtained any time during the third or fourth level course. No work requirements are necessary to sit for the exam. Upon completion of this program of study, students will be prepared to enter the workforce or further their training at technical schools such as Tennessee College of Applied Technology (TCAT) or enter university. Students who obtain the ASE student certification may be able to articulate hours at TCAT. Students may gain job experience while still in high school through local and CTSO competitions and work-based learning.

## Job Outlook

The TN Department of Labor and Workforce Development projects 75 average annual openings for automotive body and related repairers due to growth and replacement from 2014 to 2022 with a total of 3,320 employed in the group in 2022.<sup>1</sup> This reflects a 3.8 percent change in the occupation group in Tennessee. Nationally, the growth rate is higher with a 9 percent change predicted.<sup>2</sup> Students in Automotive Collision Repair may also pursue related careers as mobile heavy equipment mechanics where 100 annual average openings are anticipated or rail car repairer where 10 annual average openings are anticipated.

In recent years, the business layout of the automotive collision repair industry has shifted to fewer small shops and more “super shops.” A 2013 survey indicated that super shops (those with annual sales over \$1 million) have increased to a share of 66.5% of all shops in 2013 whereas the share was 15.3% in 1995.<sup>3</sup>

Related occupations requiring associate’s or bachelor’s degrees include mechanical engineers and mechanical engineering technicians. The TN Department of Labor and Workforce Development projects 170 annual average openings for mechanical engineers and 35 annual average openings for mechanical engineering technicians.

Anticipated openings for automotive body and related repairers are spread fairly evenly across the state with the greatest concentration in the Nashville area. (See **Figure 1**). The job outlook for the collision repair technology group statewide is competitive. Although the growth rate is positive, there were more training completers in recent years than job openings expected annually by a ratio of 2.8 (536 completers for 190 openings).

**Figure 1.** Annual Average Openings for Automotive Body and Related Repairers in Tennessee (2014-2022)



<sup>1</sup> TN Department of Labor and Workforce Development. (2016). Employment Security Division, R & S. Retrieved from <https://www.jobs4tn.gov>.

<sup>2</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Automotive Body and Glass Repairers, Retrieved from <http://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-body-and-glass-repairers.htm>.

<sup>3</sup> Snapshot of the Collision Repair Industry (2013). Collision Repair Education Foundation, I-CAR. Retrieved from <http://collisioneducationfoundation.org/2013/11/2013-snapshot-of-the-collision-industry/>.

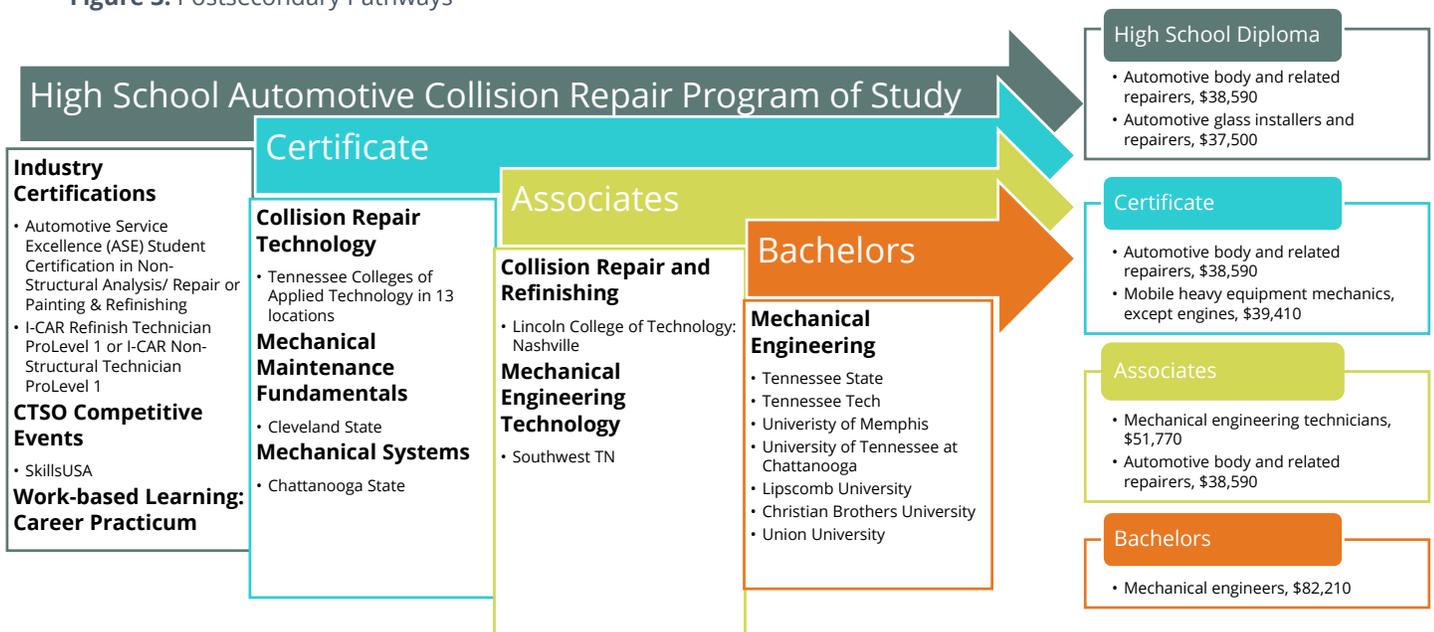
### Current Secondary Landscape

In the 2013-14 School Year, 2,389 students were enrolled in an Automotive Collision Repair course (not including the Transportation Core course). Between 2011 and 2013, the number of students enrolled in a collision repair course grew slightly by about 75 students. In 2014-15, the Automotive Collision Repair program of study was offered in 46 schools and 2,031 students were enrolled in an Automotive Collision Repair course.

### Postsecondary Pathways

Upon completion of this program of study, students will be prepared to enter the workforce or to further their training at postsecondary institutions.<sup>4</sup> The chart below outlines the related career opportunities and the training necessary for each. While a high school diploma is typically the minimum requirement for an automotive service technician, some employers may prefer mechanics with training from a postsecondary institution. Automotive Technology programs are available at technical and community colleges across Tennessee. Long term on-the-job training is essential for an individual to become fully qualified in the occupation. Students who are interested in pursuing related study in a four year university may seek bachelor's degrees in mechanical engineering.

Figure 3. Postsecondary Pathways



### Recommendation

No changes are recommended at this time.

<sup>4</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Automotive Body and Glass Repairers, Retrieved from <http://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-body-and-glass-repairers.htm>.



2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Automotive Collision Repair</b>	Introduction to Collision Repair (6172)	Collision Repair: Non-Structural <sup>1</sup> (6062) -or- Collision Repair: Painting & Refinishing <sup>1</sup> (6063)	Collision Repair: Non-Structural <sup>1</sup> (6062) -or- Collision Repair: Painting & Refinishing <sup>1</sup> (6063) -or- <b>Dual Enrollment</b> Automotive & Collision Repair (4129)	Collision Repair: Non-Structural <sup>1</sup> (6062) -or- Collision Repair: Painting & Refinishing <sup>1</sup> (6063) -or- Collision Repair: Damage Analysis, Estimating, & Customer Service (6149) -or- <b>Dual Enrollment</b> Automotive & Collision Repair (4129)
			<p><b>Industry Certification for 6062:</b> I-CAR Refinish Technician ProLevel 1 or I-CAR Non-Structural Technician ProLevel 1 or Automotive Service Excellence Student Certification: Nonstructural Analysis/Repair</p> <p><b>Industry Certification for 6063:</b> Automotive Service Excellence Student Certification: Painting and Refinishing</p> <p><b>Industry Certification for 6064:</b> Automotive Service Excellence Student Certification: Structural Analysis/Repair</p>	

## ***References***

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Automotive Body and Glass Repairers, Retrieved from <http://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-body-and-glass-repairers.htm>.

Snapshot of the Collision Repair Industry (2013). Collision Repair Education Foundation, I-CAR. Retrieved from <http://collisioneducationfoundation.org/2013/11/2013-snapshot-of-the-collision-industry/>.

TN Department of Labor and Workforce Development. (2016). Employment Security Division, R & S. Retrieved from <https://www.jobs4tn.gov>.

## Automotive Maintenance & Light Repair

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Automotive Maintenance and Light Repair</b>	Maintenance and Light Repair I (5879)	Maintenance and Light Repair II (5880)	Maintenance and Light Repair III (5881)	Maintenance and Light Repair IV (5882)

### Description

*Automotive Maintenance and Light Repair* courses prepare students for entry into the automotive service industry with an ASE Student Certification or for entry into another maintenance occupation dealing with automotive technologies. Students study and service automotive HVAC systems, engine performance systems, automatic and manual transmission and transaxle systems, and practice workplace soft skills. Upon completion of this program of study, students will be equipped with the knowledge and skills to be a successful automotive service technician, have satisfied course requirements to meet the National Automotive Technicians Education Foundation (NATEF) standards, and be prepared to pursue further study at a technology center or other postsecondary institution.

ASE Student Certification may be obtained any time during the third or fourth level course. No work requirements are necessary to sit for the exam. Additionally, students completing the *MLR* program of study through a NATEF-certified program may receive work experience to count toward the requirements for ASE Auto Maintenance and Light Repair Certification (G1). With additional work experience outside the classroom, students could obtain the G1 certification at the completion of the program of study. Students may gain job experience while still in high school through local and CTSO competitions and work-based learning. Dual credit/dual enrollments opportunities may be established with local postsecondary institutions.

### Job Outlook

The TN Department of Labor and Workforce Development projects 420 average annual openings for automotive service technicians and mechanics due to growth and replacement from 2014 to 2022 with a total of 14,970 employed in the group in TN in 2022.<sup>5</sup> This reflects a 3 percent change in the occupation group in Tennessee. Nationally, the growth rate is a little higher with a 9% change predicted.<sup>6</sup> Median annual salaries in 2014 for automotive service technicians and mechanics in TN

<sup>5</sup> Tennessee Department of Labor and Workforce Development. (2016). Employment Security Division, R & S. Retrieved from <https://www.jobs4tn.gov>.

<sup>6</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Automotive Service Technicians and Mechanics, Retrieved from <http://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-service-technicians-and-mechanics.htm>.

was \$35,020. Additionally, 125 annual average openings are projected for tire repairers and changers who had an annual median wage of \$24,550 in 2014.

**Figure 1.** Automotive Maintenance and Light Repair Related Occupations with the Most Annual Average Openings in Tennessee (2014-2022)

Occupation	Total Percent Change	Annual Avg. Openings
Automotive Service Technicians and Mechanics	3.0%	420
First-Line Supervisors of Mechanics, Installers, and Repairers	6.3%	335
Bus and Truck Mechanics and Diesel Engine Specialists	5.4%	170
Mechanical Engineers	5.3%	170
Tire Repairers and Changers	10.5%	125
Mobile Heavy Equipment Mechanics, Except Engines	7.6%	100
Electrical Engineers	7.5%	80
Automotive Body and Related Repairers	3.8%	75
Electrical and Electronic Engineering Technicians	0.1%	55
Electronics Engineers, Except Computer	17.3%	50

Openings for automotive service technicians are available across the state with greater concentrations in urban and surrounding areas. (See **Figure 2**). The outlook for automotive service technicians and tire repairers and changers statewide is very competitive. Although the growth rates are positive, there were more training completers in recent years than job openings expected annually by a ratio of 3.8 (2,132 completers for 561 openings).

**Figure 2.** Annual Average Openings for Automotive Service Technicians and Mechanics in Tennessee (2014-2022)



Related occupations requiring associate’s or bachelor’s degrees include mechanical and electrical engineers and technicians. The TN Department of Labor and Workforce Development projects 170 annual average openings for mechanical engineers and 80 annual average openings for mechanical engineering technicians. These engineers may find opportunity in the growing automotive manufacturing industry in Tennessee. A recent study by the Brookings Institution found that Tennessee has more than 900 automotive-related manufacturers. In fact, most Tennessee counties have at least one automotive-related manufacturer (80 out of 95).<sup>7</sup> **Figure 3** illustrates the widespread presence of automotive manufacturing in Tennessee.

**Figure 3.** Location of industries and businesses in Tennessee devoted to auto manufacturing or supply. 80 out of 95 counties have at least one automotive business or industry.<sup>8</sup>



### ***Current Secondary Landscape***

In the 2013-14 School Year, 11,389 students were enrolled in an Automotive Maintenance & Light Repair course or the Transportation Core course. Between 2011 and 2013, the number of students enrolled in automotive repair courses of level 2 or above decreased from 6,978 in the 2011-12 school year to 6,295 in the 2013-14 school year.

In the 2014-15 school year, the Automotive Maintenance and Light Repair program of study was offered in 118 schools and the enrollment rose to 11,916 students in an Automotive Maintenance & Light Repair course or the Transportation Core course. The number of students enrolled in a Level 2 or above Maintenance & Light Repair course grew significantly between 2013-14 and 2014-15 from 3,302 students to 5,399 students. In particular, over 1,200 more students were enrolled in a Level 3 or 4 course, indicating an increase in concentrators in this program of study.

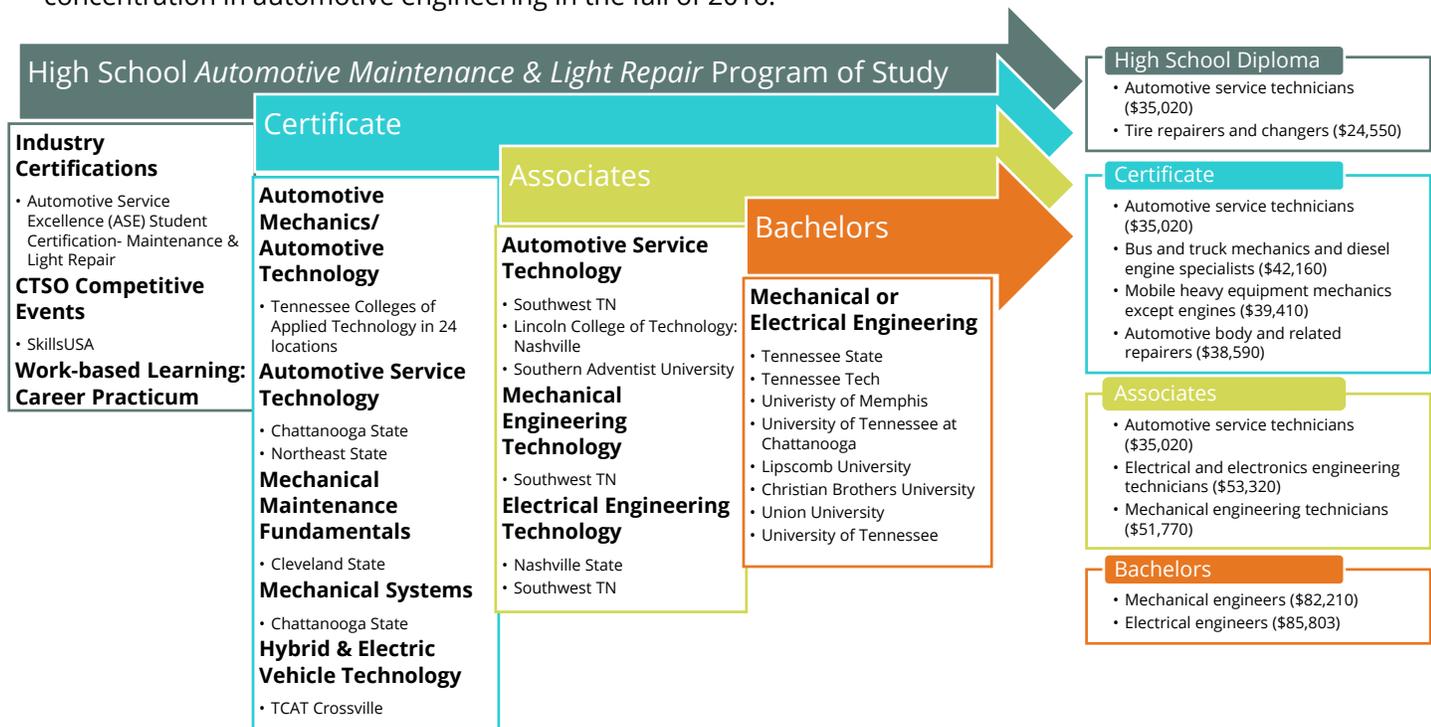
<sup>7</sup> Muro, M., Andes, S., Fikri, K., Ross, M., Lee, J., Ruiz, N., and Marchio, N., (4 Oct. 2013). Drive! Moving Tennessee’s Automotive Sector UP the Value Chain. Retrieved from [http://www.brookings.edu/research/reports/2013/10/04-tennessee-automotive?mc\\_cid=edf4e54454&mc\\_eid=a30e70b6c6](http://www.brookings.edu/research/reports/2013/10/04-tennessee-automotive?mc_cid=edf4e54454&mc_eid=a30e70b6c6).

<sup>8</sup> Tennessee Department of Economic and Community Development. Retrieved from [http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc\\_cid=edf4e54454&mc\\_eid=a30e70b6c6](http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc_cid=edf4e54454&mc_eid=a30e70b6c6).

## Postsecondary Pathways

Upon completion of this program of study, students will be prepared to enter the workforce or to further their training at postsecondary institutions.<sup>9</sup> The chart below outlines the related career opportunities and the training necessary for each. While a high school diploma is typically the minimum requirement for an automotive service technician, some employers may prefer mechanics with training from a postsecondary institution. Automotive Technology programs are available at technical and community colleges across Tennessee. Long term on-the-job training is essential for an individual to become fully qualified in the occupation.

Students who are interested in pursuing related study in a four year university may seek bachelor's degrees in mechanical or electrical engineering. In response to the large automotive manufacturing presence in Tennessee, the University of Tennessee at Knoxville plans to add a graduate concentration in automotive engineering in the fall of 2016.<sup>10</sup>



<sup>9</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Automotive Service Technicians and Mechanics, Retrieved from <http://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-service-technicians-and-mechanics.htm>.

<sup>10</sup> UT Announces Plans to Begin Automotive Engineering Concentration (11 Jan. 2016). Retrieved from [http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc\\_cid=edf4e54454&mc\\_eid=a30e70b6c6](http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc_cid=edf4e54454&mc_eid=a30e70b6c6).



### Recommendation

#### Transportation Core

Transportation Core should be retired. The course is no longer be needed since program of study specific Level 1 courses are now available for every program of study in the cluster. Enrollment has declined significantly in recent years. 2015-16 enrollment data should be considered to analyze what guidance should be given to districts who are still enrolling students in the course. We should analyze the use of this course in 2015-16 and questions from LEAS and teachers, to determine if a Transportation Core type course is needed in the future and make a decision on whether to revise or retire this course.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Automotive Maintenance and Light Repair</b>	Maintenance and Light Repair I (5879)	Maintenance and Light Repair II (5880)	Maintenance and Light Repair III (5881) -or- <b>Dual Enrollment</b> Automotive Maintenance & Light Repair (4128)	Maintenance and Light Repair IV (5882) -or- <b>Dual Enrollment</b> Automotive Maintenance & Light Repair (4128)
				<b>Industry Certification:</b> Automotive Service Excellence Student Certification: Maintenance & Light Repair

## **References**

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Automotive Service Technicians and Mechanics, Retrieved from <http://www.bls.gov/ooh/installation-maintenance-and-repair/automotive-service-technicians-and-mechanics.htm>.

Muro, M., Andes, S., Fikri, K., Ross, M., Lee, J., Ruiz, N., and Marchio, N., (4 Oct. 2013). Drive! Moving Tennessee's Automotive Sector UP the Value Chain. Retrieved from [http://www.brookings.edu/research/reports/2013/10/04-tennessee-automotive?mc\\_cid=edf4e54454&mc\\_eid=a30e70b6c6](http://www.brookings.edu/research/reports/2013/10/04-tennessee-automotive?mc_cid=edf4e54454&mc_eid=a30e70b6c6).

Tennessee Department of Economic and Community Development. Retrieved from [http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc\\_cid=edf4e54454&mc\\_eid=a30e70b6c6](http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc_cid=edf4e54454&mc_eid=a30e70b6c6).

Tennessee Department of Labor and Workforce Development. (2016). Employment Security Division, R & S. Retrieved from <https://www.jobs4tn.gov>.

UT Announces Plans to Begin Automotive Engineering Concentration (11 Jan. 2016). Retrieved from [http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc\\_cid=edf4e54454&mc\\_eid=a30e70b6c6](http://tntoday.utk.edu/2016/01/11/ut-announces-plans-automotive-engineering-concentration/?mc_cid=edf4e54454&mc_eid=a30e70b6c6).

## Aviation Flight

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Aviation Flight</b>	Introduction to Aerospace (6068)	Aviation I: Principles of Flight (6070)	Aviation II: Advanced Flight (6148)	

### **Description**

Aviation Flight is a pathway intended to prepare students to be successful in a range of aviation careers, such as pilots, aircraft engineers, air traffic control specialists, aircraft mechanics, or airline statisticians. Course content covers the knowledge and skills of all aspects of flight needed to pass the Federal Aviation Administration (FAA) Private Pilot written exam, including aircraft structures, flight environment, procedures and regulations, aerodynamics of flight, judgment training, navigation, communications, and more. Upon completion of this program of study, students will be prepared to take the FAA Private Pilot written exam and will be able to advance more quickly through the training hours typically required to solo in an aircraft after graduating. Students may gain related job experience while still in high school through work-based learning and local and CTSO competitions. Dual credit/dual enrollment opportunities may be established with local postsecondary institutions.

### **Job Outlook**

#### **Air Transportation Workers**

The air transportation workers occupation group is projected to grow by 32.5 percent in Tennessee between 2014 and 2022 with a total annual average of 165 openings and a total of 2,880 projected to be employed in the group in 2022. This occupation group includes air traffic controllers, airfield operation specialist, airline pilots, copilots, and flight engineers, commercial pilots, and flight attendants. Employment of airline pilots, copilots, and flight engineer is expected to grow by 60.4% with 45 annual average openings projected per year. Growth is also anticipated for commercial pilots, yet this is a smaller occupation with 20 annual average openings expected. Additional opportunities for students in this program of study are available in air traffic control where 40 annual average openings are projected.

## Aerospace Engineering

Students enrolled in the Aviation Flight program of study may also use their training to pursue careers as aerospace engineers. In 2014, 300 aerospace engineers were reported to be employed in Tennessee. This accounts for a low concentration in the state with a location quotient of only 0.21 reported.<sup>11</sup> Nationally, the occupation group is expected to change by 4 percent (slower than average).<sup>12</sup> However, a large cluster of aerospace engineers are employed just south of Middle Tennessee in the Huntsville, Alabama area. Huntsville was the metropolitan area with the third highest employment level in this occupations and the metropolitan area with the highest concentration with a location quotient of 28.49. **Figure 1** provides more information about aviation flight careers including average salaries.

## Unmanned Aerial Systems

Although the Bureau of Labor Statistics has not yet categorized unmanned aerial system (UAS) operators outside of military specific occupations, the rise in interest of commercial use of this technology is significant. Currently, the lack of regulatory structure is prohibiting large scale increase in commercial use of UAS; however, it is possible that rules will be finalized by late spring of 2016.<sup>13</sup> A recent study by the Association for Unmanned Vehicle Systems International (AUVSI), projects that if UAS were allowed in the National Airspace System (NAS) in 2015 more than 100,000 new jobs would be created in the UAS field by 2025. In 2015, an employment of 99 was reported in the UAS field in Tennessee. The report indicates that the number will triple to 297 within two years and grow to 439 within 10 years.<sup>14</sup> Starting salaries of least \$60,000 are available for UAS pilots.<sup>15</sup>

Knowledge and skills needed for those working in the UAS field include a strong understanding of aerodynamics, operation skills, and engineering skills.<sup>16</sup> The FAA currently requires UAS operators to hold an FAA-issued pilot certificate to be granted an experimental airworthiness certificate for civil

---

<sup>11</sup> Bureau of Labor Statistics, U.S. Department of Labor, (2015, March 25). *Occupational Employment and Wages, May 2014*. (17-2011 Aerospace Engineers). Retrieved from <http://www.bls.gov/oes/current/oes172011.htm>.

<sup>12</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Aerospace Engineering and Operations Technicians. Retrieved from <http://www.bls.gov/ooh/architecture-and-engineering/aerospace-engineering-and-operations-technicians.htm>.

<sup>13</sup> Vanian, J. (1 Feb. 2016). Amazon's Drone Testing Takes Flight in Yet Another Country. Retrieved from <http://fortune.com/2016/02/01/amazon-testing-drones-netherlands/>.

<sup>14</sup> Jenkins, D., & Vasigh, B. (March 2013). The Economic Impact of Unmanned Aircraft Systems Integration in the United States. Retrieved from <http://www.auvsi.org/auvsiresources/economicreport>.

<sup>15</sup> Bergqvist, P. (16 June 2014). Drone Jobs: What It Takes to Fly a UAV. Retrieved from <http://www.flyingmag.com/aircraft/drone-jobs-what-it-takes-fly-uav>.

<sup>16</sup> Wynbrandt, J., (19 Feb. 2015). Growing Job Demand in Unmanned Aerial Systems. Retrieved from <http://www.flyingmag.com/careers/growing-job-demand-unmanned-aerial-systems>.

operations (not recreational).<sup>17</sup> UAS have application in a broad spectrum of fields including agriculture, delivery services, A/V production, telecommunications, disaster management, law enforcement, mapping, weather monitoring, and freight transport. Jenkins and Vasigh conclude that public safety and agriculture are the “most promising commercial and civil markets.”

**Figure 1.** Annual Average Openings Projected for Aerospace Occupations in Tennessee (2014-2022)

\*State Data Unavailable

**Annual Average Openings Projected for Aerospace Occupations in Tennessee (2014-2022)**

	Annual Average Openings	Total Percent Change	TN 2014 Median Salary	Education level	On-the-job training
Airline Pilots, Copilots, and Flight Engineers	45	60.4%	\$98,830	Bachelor's	Moderate-term on-the-job training
Commercial Pilots	20	11.0%	\$75,240	HS diploma	Moderate-term on-the-job training
Aerospace Engineers	*	*	\$88,920	Bachelor's	None
Aerospace Engineering and Operations Technicians	*	*	*	Associate's	None
Atmospheric and Space Scientists	5	11.2%	\$83,400	Bachelor's	None
Air Traffic Controllers	40	17.1%	\$123,400	Associate's	Long-term on-the-job training
Aircraft Mechanics and Service Technicians	80	11.6%	\$52,330	Varies	Varies
Avionics Technicians	30	38.5%	\$51,320	Associate's	None
First-Line Supervisors of Mechanics, Installers, and Repairers	335	6.3%	\$55,550	HS Diploma	None
First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	175	9.9%	\$53,870	HS Diploma	None
Transportation, Storage, and Distribution Managers	130	8.0%	\$73,950	HS diploma	None
Aircraft Cargo Handling Supervisors	10	9.8%	\$66,830	HS diploma	None

The Memphis area was reported to have the highest concentration of employment of airline pilots, copilots, and flight engineers in May 2014 with 310 reported to be employed.<sup>1</sup> The Greater Memphis Chamber has named Memphis as America's Aerotropolis because of its large airport and surrounding transportation linkages from distribution centers and manufacturing facilities to its roadways, waterways, and railways.<sup>18</sup> The Memphis-Shelby County International Airport sees

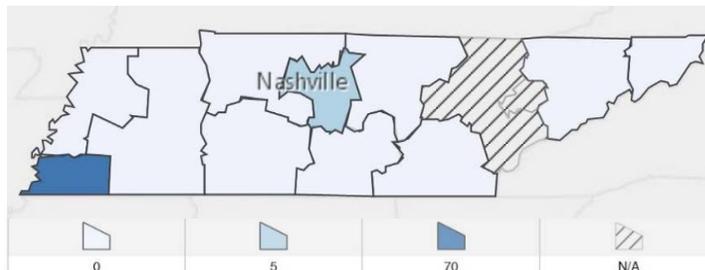
<sup>17</sup> Unmanned Aircraft Systems (UAS) Frequently Asked Questions, (12 Feb. 2016). *Federal Aviation Administration*. Retrieved from <https://www.faa.gov/uas/faq/>.

<sup>18</sup> *Memphis: America's Aerotropolis, Executive Summary, 2009*. Greater Memphis Chamber. On the internet at [http://www.memphischamber.com/Articles/DoBusiness/Aero\\_Exec\\_Summ.aspx](http://www.memphischamber.com/Articles/DoBusiness/Aero_Exec_Summ.aspx) (visited February 12, 2015).

approximately 300 daily cargo flights mostly through FedEx and many additional flights in airline passenger service. Because of this, Memphis has a higher concentration of airline and commercial pilots with a location quotient of 1.61 and employment of 0.89 per thousand jobs.<sup>19</sup>

The Tri-Cities area also has an aviation industry presence. Bell Helicopter has teamed up with Northeast State to provide aviation maintenance training. An aviation park has been designed for aerospace industry to move into the area.<sup>20</sup> As the industry grows, the need for pilots and air traffic controllers in this area may increase as well.

**Figure 2.** Annual Average Openings for Airline Pilots, Copilots, and Flight Engineers in Tennessee (2012-2022)



### ***Current Secondary Landscape***

In the 2013-14 school year, 234 were enrolled in *Introduction to Aerospace* and 165 students were enrolled in *Aviation I: Principles of Flight*. In 2014-15, 7 schools offered the Aviation Flight program of study. West Tennessee (Shelby County) has one of these schools, Middle Tennessee has two schools, and East Tennessee has 4 schools. Enrollment numbers grew in 2014-15 to 297 students enrolled in *Introduction to Aerospace* and a total of 179 students enrolled in *Aviation I: Principles of Flight* and *Aviation II: Advanced Flight*.

<sup>19</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Employment and Wages, May 2013*, Retrieved from <http://www.bls.gov/oes/current/oes271025.htm> (visited Feb. 9, 2015).

<sup>20</sup> Lowery, L., (5 Sept. 2014). Northeast State will offer 2-year aviation program. *Bristol Herald Courier*. Retrieved from [http://www.tricitie.com/news/article\\_6dd96efe-356c-11e4-b6e0-001a4bcf6878.html](http://www.tricitie.com/news/article_6dd96efe-356c-11e4-b6e0-001a4bcf6878.html).

## ***Postsecondary Opportunities***

Upon completion of this program of study, students will be prepared to further their training at technical schools and universities in various areas of aerospace. Students may pursue bachelor's degrees with majors in aerospace engineering, aerospace technology, professional pilot, and more. Students may pursue associate's degrees in air traffic control. Students may enter the workforce as commercial pilots. Students may pursue educational opportunities available through the United States Air Force or other military divisions.

Training available in Tennessee includes the MTSU Aerospace Program which awards bachelor's degrees in the following concentrations: aerospace technology, flight dispatch, professional pilot, maintenance management, aviation administration, and UAS operations. A Master's degree in Aviation Administration is also available. In addition to this program, students may complete the Air Traffic Control program at MTSU and be prepared to attend the FAA Training Academy in Oklahoma City and become an air traffic controller.<sup>21</sup> The University of Tennessee of Knoxville offers a bachelor's degree in Aerospace Engineering. Tennessee State University offers a bachelor's degrees in Aviation Flight Training and Aviation Management in which the first two years may be taken at Columbia State Community College. Northeast Tennessee Community College was reported to begin offering courses in aviation technology in the fall of 2014 and is making plans to add aviation to the offerings at East Tennessee State University.<sup>22</sup>

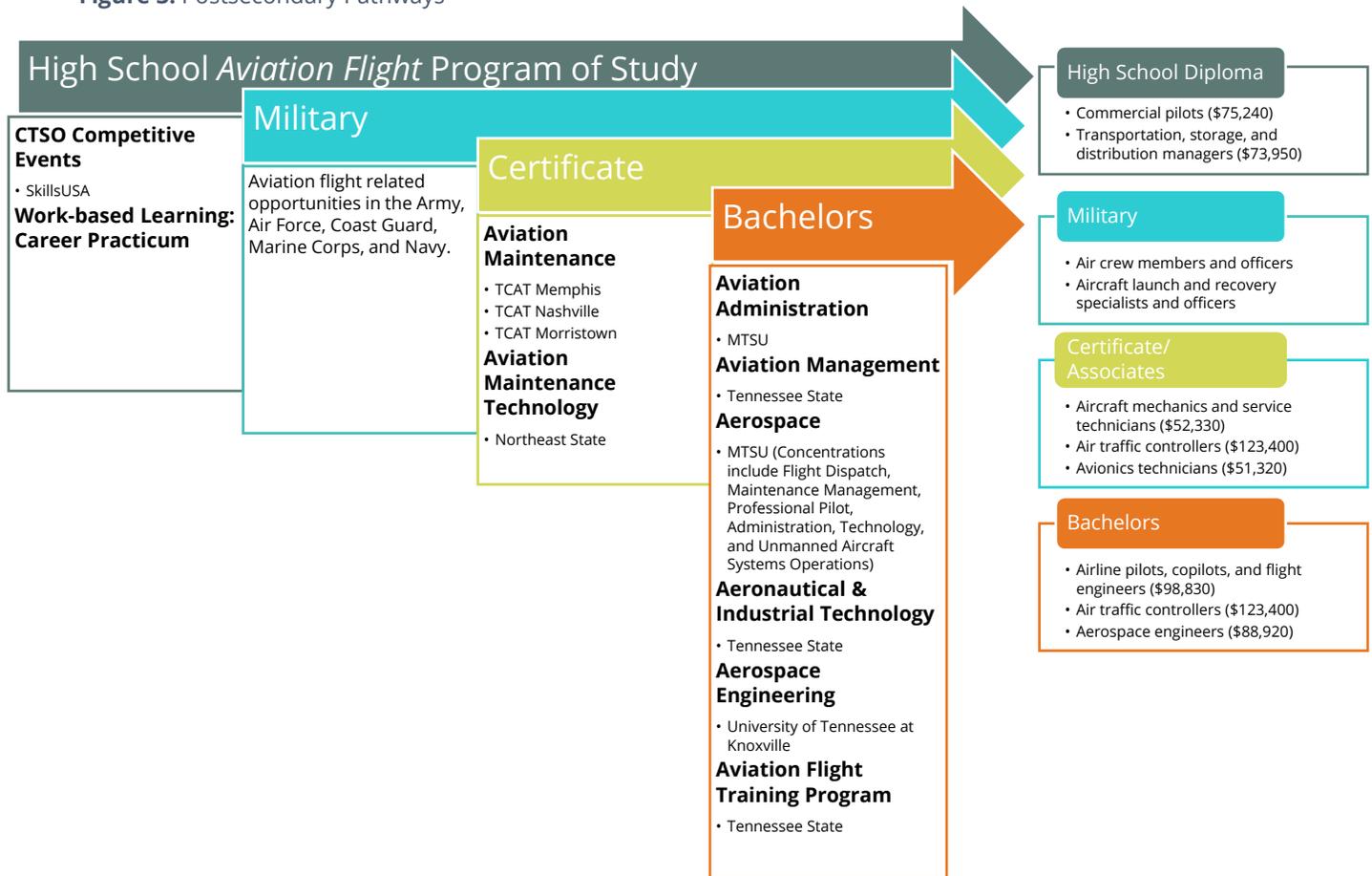
The study of unmanned aerial systems is emerging within postsecondary programs across the country and worldwide. At least 50 accredited colleges worldwide offer bachelor's degrees in UAS, including Embry-Riddle Aeronautical University who also offers a Master of Science in Unmanned Systems. MTSU added a concentration in UAS operations within the B.S. in Aerospace degree in the Fall of 2015. The aligned coursework for the UAS operations concentration requires students to build and fly UAS in addition to preparing for the private pilot license for manned vehicles and studying in many interdisciplinary areas including electricity, computer science, GIS, agriculture, and business. **Figure 3** on the following page provides more information about the available aviation flight pathways in Tennessee.

---

<sup>21</sup> Middle Tennessee State University Department of Aerospace. Retrieved from <http://www.mtsu.edu/aerospace/>.

<sup>22</sup> Lowery, L., (5 Sept. 2014). Northeast State will offer 2-year aviation program. *Bristol Herald Courier*. Retrieved from [http://www.tricitie.com/news/article\\_6dd96efe-356c-11e4-b6e0-001a4bcf6878.html](http://www.tricitie.com/news/article_6dd96efe-356c-11e4-b6e0-001a4bcf6878.html).

**Figure 3.** Postsecondary Pathways



### Recommendation

Due to the increasing interest in commercial use of UAS in a broad range of industries and the quickly anticipated release of FAA regulations allowing widespread commercial use, a UAS course should be considered for addition to the available aerospace course coverings. The UAS course should be focused on the operation of UAS and should be highly application based with multidisciplinary collaboration throughout. The course should fall in Level 3 or Level 4 of the Aviation Flight program of study. Since a strong knowledge base in aerodynamics and FAA pilot licenses are required for civil UAS operators, it is appropriate for this course to be an extension of the current Aviation Flight program of study.

Job data and industry news should be carefully monitored in the coming year to determine if a critical mass of demand warrants the addition of a full UAS program of study.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Aviation Flight</b>	Introduction to Aerospace (6068)	Aviation I: Principles of Flight (6070)	Aviation II: Advanced Flight (6148) -or- <b>Dual Enrollment</b> Aviation Flight (4130)	Work-Based Learning: Career Practicum (6105) -or- <b>Dual Enrollment</b> Aviation Flight (4130)

## References

Bergqvist, P. (16 June 2014). Drone Jobs: What It Takes to Fly a UAV. Retrieved from <http://www.flyingmag.com/aircraft/drone-jobs-what-it-takes-fly-uav>.

Bureau of Labor Statistics, U.S. Department of Labor, (2015, March 25). *Occupational Employment and Wages, May 2014*. (17-2011 Aerospace Engineers). Retrieved from <http://www.bls.gov/oes/current/oes172011.htm>.

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook, 2016-17 Edition*, Aerospace Engineering and Operations Technicians. Retrieved from <http://www.bls.gov/ooh/architecture-and-engineering/aerospace-engineering-and-operations-technicians.htm>.

Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Employment and Wages, May 2013*, Retrieved from <http://www.bls.gov/oes/current/oes271025.htm> (visited Feb. 9, 2015).

Jenkins, D., & Vasigh, B. (March 2013). The Economic Impact of Unmanned Aircraft Systems Integration in the United States. Retrieved from <http://www.auvsi.org/auvsiresources/economicreport>.

Lowery, L., (5 Sept. 2014). Northeast State will offer 2-year aviation program. *Bristol Herald Courier*. Retrieved from [http://www.tricitie.com/news/article\\_6dd96efe-356c-11e4-b6e0-001a4bcf6878.html](http://www.tricitie.com/news/article_6dd96efe-356c-11e4-b6e0-001a4bcf6878.html).

*Memphis: America's Aerotropolis, Executive Summary, 2009*. Greater Memphis Chamber. On the internet at [http://www.memphischamber.com/Articles/DoBusiness/Aero\\_Exec\\_Summ.aspx](http://www.memphischamber.com/Articles/DoBusiness/Aero_Exec_Summ.aspx) (visited February 12, 2015).

Middle Tennessee State University Department of Aerospace. Retrieved from <http://www.mtsu.edu/aerospace/>.

Unmanned Aircraft Systems (UAS) Frequently Asked Questions, (12 Feb. 2016). *Federal Aviation Administration*. Retrieved from <https://www.faa.gov/uas/faq/>.

Vanian, J. (1 Feb. 2016). Amazon's Drone Testing Takes Flight in Yet Another Country. Retrieved from <http://fortune.com/2016/02/01/amazon-testing-drones-netherlands/>.

Wynbrandt, J., (19 Feb. 2015). Growing Job Demand in Unmanned Aerial Systems. Retrieved from <http://www.flyingmag.com/careers/growing-job-demand-unmanned-aerial-systems>.

## Distribution & Logistics

2016-17 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Distribution &amp; Logistics</b>	Foundations of Transportation, Distribution, and Logistics (6069)	Distribution and Logistics I (6072)	Distribution and Logistics II: Management (6024)	

### Description

The Distribution & Logistics program of study prepares students for many management and operations careers in the transportation industry. In this program of study, students learn about the dynamics of distribution networks, the managing and tracking of inventory, how distribution and logistics operations fit within the supply chain of a product or a business, and the problem solving skills to design logistics solutions for businesses. Students will have had the opportunity to participate in a *Work-based Learning: Career Practicum* in a classroom setting or in a transportation, distribution, and logistics-related business, and be prepared for advanced postsecondary study in transportation, distribution, and logistics related fields.

### Job Outlook

Tennessee stands out among other states with high employment numbers in the transportation and material moving occupations. In May 2014, Tennessee was ranked 2<sup>nd</sup> for the highest concentration of jobs and location quotient in this occupation group with a location quotient of 1.41 and employment of 96.69 per thousand jobs.<sup>23</sup> The Transportation and Material Moving occupation group is expected to add 21,340 jobs between 2014 and 2022 with 294,410 total employed and 9,230 average annual openings projected.<sup>24</sup>

Nationally, the occupation group is projected to grow, as well. For transportation and material moving workers, over 2.8 million openings are projected between 2014 and 2024. The majority of these openings will be due to filling the vacancies due to a retiring workforce. In 2012, approximately 47 percent of current transportation and material moving workers were 45 years or older.<sup>25</sup> Of the

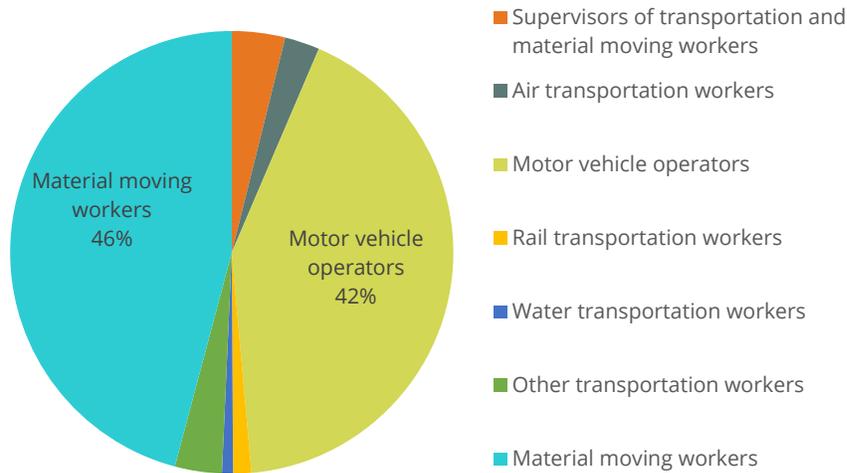
<sup>23</sup> Bureau of Labor Statistics, U.S. Department of Labor, (2015, March 25). *Occupational Employment and Wages, May 2014*. (53-0000 Transportation and Material Moving Occupations, Major Group). Retrieved from <http://www.bls.gov/oes/current/oes530000.htm>.

<sup>24</sup> TN Department of Labor and Workforce Development. (2016). Employment Security Division, R & S. Retrieved from <https://www.jobs4tn.gov>.

<sup>25</sup> Bureau of Labor Statistics, U.S. Department of Labor, (2016, Feb. 10) *Current Population Survey (CPS)*. Retrieved from <http://www.bls.gov/cps/tables.htm>.

2.8 million projected openings, only 476,000 are due to growth, while the remaining 2.3 million projected openings are due to replacement.

**Figure 1.** Breakdown of Total U.S. Employment of Transportation and Material Moving Occupations by SubGroup, 2014



**Figure 2.** Transportation and material moving occupations with more than 50 annual average openings projected in Tennessee, 2014-22

Occupation	Total Percent Change	Annual Avg. Openings
Laborers and Freight, Stock, and Material Movers, Hand	7.6%	3,460
Heavy and Tractor-Trailer Truck Drivers	11.0%	1,610
Packers and Packagers, Hand	6.4%	655
Light Truck or Delivery Services Drivers	3.9%	585
Supervisors, Transportation and Material Moving Workers	7.9%	425
Industrial Truck and Tractor Operators	0.6%	410
Bus Drivers, School or Special Client	8.8%	275
Driver/Sales Workers	8.4%	215
Cleaners of Vehicles and Equipment	3.7%	185
Water Transportation Workers	10.0%	145
Refuse and Recyclable Material Collectors	23.6%	140
Bus Drivers, Transit and Intercity	21.7%	130
Transportation, Storage, and Distribution Managers	8.0%	130
Conveyor operators	0.3%	115
Rail transportation workers	10.2%	110
Automotive and Watercraft Service Attendants	10.0%	105
Parking Lot Attendants	1.8%	100
Captains, Mates, and Pilots of Water Vessels	10.7%	70
Logisticians	19.1%	70
Sailors and Marine Oilers	11.1%	55

### Material Moving Workers

In Tennessee, the occupation group with the largest number of openings expected is the material moving workers group with 5,150 annual average openings projected from 2014 to 2022 with a total of 139,510 estimated to be employed in the group in TN in 2022. However, median salaries in this group are low. Specific occupations available within the material moving workers occupation group and median salaries for each are illustrated in Figure 3.

**Figure 3.** Material Moving occupations with 50 or more annual average openings projected in Tennessee, 2014-22

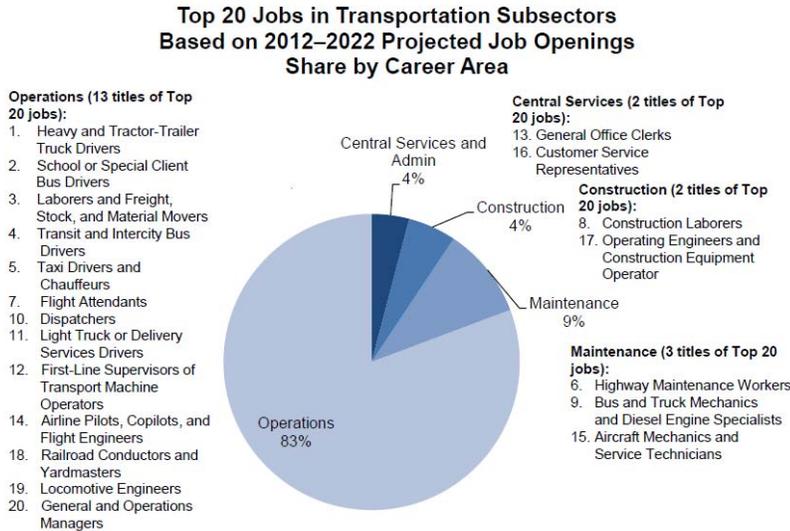
Occupation	Total Percent Change	Annual Avg. Openings	Median Salary
Laborers and Freight, Stock, and Material Movers, Hand	7.6%	3,460	\$24,570
Packers and Packagers, Hand	6.4%	655	\$19,230
Industrial Truck and Tractor Operators	0.6%	410	\$27,900
Cleaners of Vehicles and Equipment	3.7%	185	\$20,690
Refuse and Recyclable Material Collectors	23.6%	140	\$23,940
Conveyor Operators	0.3%	115	\$30,110
Machine Feeders and Offbearers	-0.40%	50	\$24,810

### Transportation Subsectors

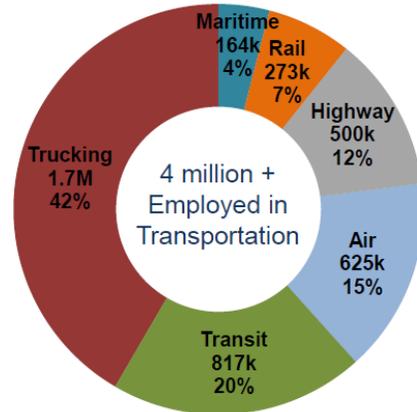
“The jobs in greatest demand are semi-skilled and skilled jobs in operations and maintenance,” according to a national report by the U.S. Department of Education. Opportunities in operations jobs greatly exceed the demand for those in central services. In fact, 83 percent of the top 20 jobs with the most projected openings falling in the operations category. (See Figure 4).<sup>26</sup> Nationally and in Tennessee, heavy and tractor-trailer truck drivers has the largest number of projected job openings within the occupation groups not including material moving workers. Of the six subsectors identified in the U.S. Department of Education report, trucking accounted for 42 percent of the industry employment in 2014. Figure 5 illustrates the additional breakout by sector.

<sup>26</sup> U.S. Department of Education, Office of Career, Technical, and Adult Education. (2015, August). *Strengthening Skills Training and Career Pathways across the Transportation Industry*. Washington, D.C. Retrieved from <http://cte.ed.gov/initiatives/advancing-cte-in-state-and-local-career-pathways-system>.

**Figure 4.4** Top 20 Jobs Nationally in Transportation Subsectors Based on 2012-2022 Projected Job Openings Share by Career Area



**Figure 5.4** Top 20 Jobs Nationally in Transportation Subsectors Based on 2012-2022 Projected Job Openings Share by Career Area.



### Motor Vehicle Operators

The motor vehicle operators occupation group is expected to see 3,025 annual average openings within the same time frame with a total of 119,530 employed in the group in 2022. Specific occupations available within the material vehicle operator group and median salaries for each are illustrated in Figure 6.

**Figure 6.** Motor vehicle operator occupations with 50 or more annual average openings projected in Tennessee, 2014-22

Occupation	Total Percent Change	Annual Avg. Openings	Median Salary
Heavy and Tractor-Trailer Truck Drivers	11.0%	1,610	\$38,680
Light Truck or Delivery Services Drivers	3.9%	585	\$29,080
Bus Drivers, School or Special Client Driver/Sales Workers	8.8%	275	\$21,800
	8.4%	215	\$25,200

### Managers, Supervisors, & Logisticians

While the large bulk of occupations in Tennessee in Distribution and Logistics are material moving workers and motor vehicle operators (jobs where a high school diploma or less is needed), occupations for logisticians, transportation managers, and supervisors of transportation and material workers are anticipated to grow. These occupations also typically have higher salaries. Annual average openings 2014-22 and 2014 median salaries are listed in Figure 7.

**Figure 7.** Transportation managers, supervisors, & logistician occupations with 50 or more annual average openings projected in Tennessee, 2014-22

Occupation	Total Percent Change	Annual Avg. Openings	Median Salary
First-Line Supervisors of Helpers, Laborers, and Material Movers, Hand	6.6%	240	\$44,560
First-Line Supervisors of Transportation and Material-Moving Machine and Vehicle Operators	9.9%	175	\$53,870
Transportation, Storage, and Distribution Managers	8.0%	130	\$73,950
Logisticians	19.1%	70	\$60,380

The Memphis area has been identified as a sweet spot for infrastructure jobs, a designation which includes occupations in both transportation and construction industries. A Brookings Institution report ranks Memphis as No. 1 among the nation’s largest metro areas for its 17.8% share of infrastructure jobs out of the total employed.<sup>27</sup> The study also identified Chattanooga as No. 5 with 13.8% infrastructure share, Knoxville No. 18 with 12.3% infrastructure share, and Nashville-Davidson No. 24<sup>th</sup> with 12.0% infrastructure share.<sup>28</sup> Figure 8 illustrates this finding.

**Figure 8.** Annual average openings for transportation and material moving occupations in Tennessee (2014-2022)



### **Current Secondary Landscape**

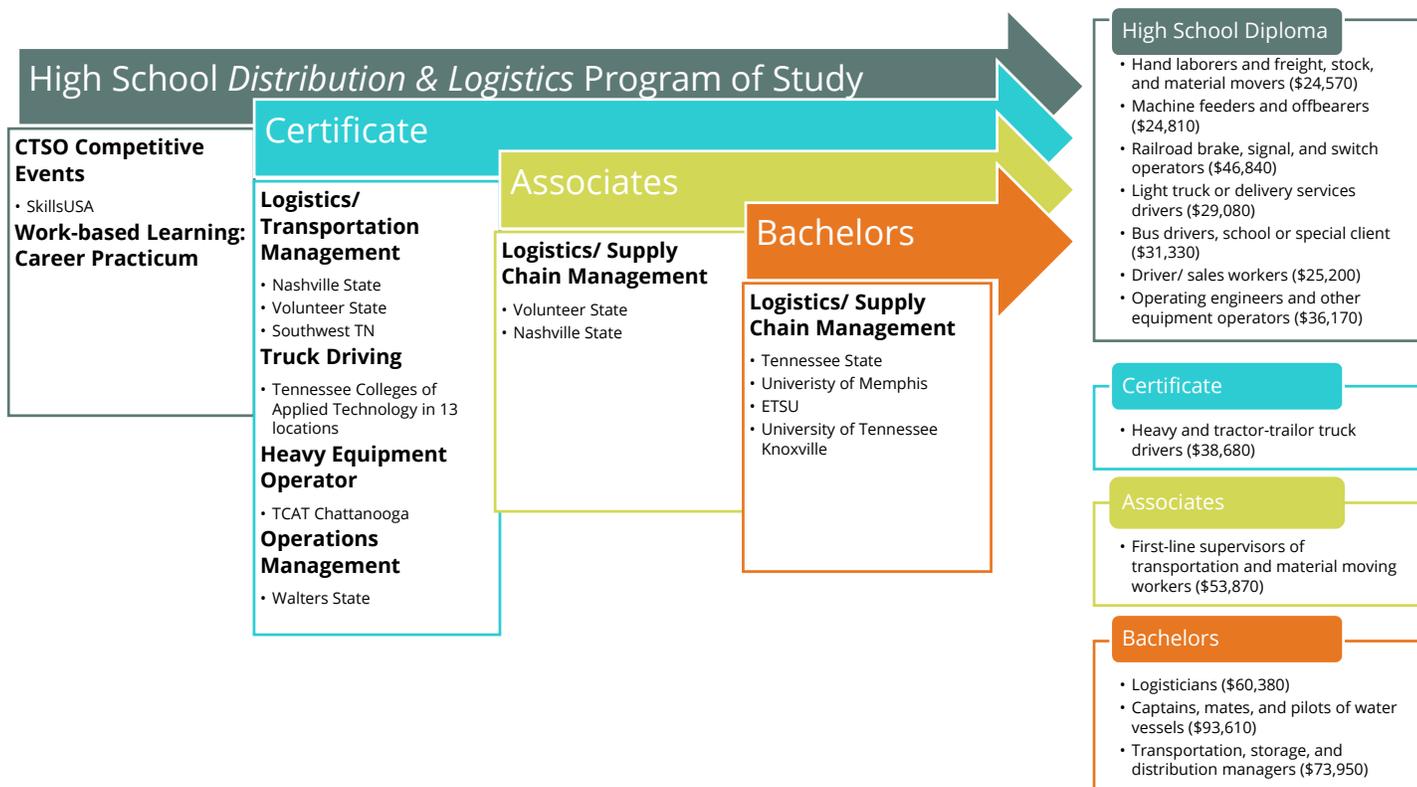
This program of study was offered in only two schools during the 2014-15 and 2015-16 school year. Both of the schools are located in Shelby County.

<sup>27</sup> McKenzie, K. (2014, May 10). New Study Highlights Memphis Area as No. 1 in Infrastructure Jobs. The Commercial Appeal. Retrieved from <http://www.commercialappeal.com/business/new-study-highlights-memphis-area-as-no-1-in-infrastructure-jobs-ep-457579999-323693121.html>.

<sup>28</sup> Kane, J., & Puentes, R. (2014, May 9). Beyond Shovel-Ready: The Extent and Impact of U.S. Infrastructure Jobs. Retrieved March 02, 2016, from <http://www.brookings.edu/research/interactives/2014/infrastructure-jobs#/M10420>

## Postsecondary Opportunities

Upon completion of this program of study, students will be prepared to enter the workforce or to further their training at postsecondary institutions. The chart below outlines the related career opportunities and the training necessary for each. A high school diploma is entry level expectation for many occupations, but postsecondary education is necessary for many. Almost 40 percent of jobs in transportation, distribution, and logistics will require at least some postsecondary education by 2018.<sup>29</sup> A high school diploma is typically the minimum requirement for hand material movers, light truck drivers, water and rail transportation workers, and operating engineers. Heavy and tractor-trailer drivers complete training courses and must obtain a Commercial Driver’s License (CDL). An individual must be 18 years old to truck intrastate and 21 years old to truck interstate in a heavy truck or tractor-trailer. For logisticians and transportation managers, a bachelor’s degree is usually necessary, but the salaries for these individuals are at least double many of those requiring a high school diploma.



<sup>29</sup> Carnevale, A. P., Smith, N., Stone III, J. R., Kotamraju, P., Steuernagel, B., & Green, K. A. (2011). *Career Clusters: Forecasting Demand for High School Through College Jobs*. Washington, DC: Georgetown University Center on Education and the Workforce.

### **Recommendation**

No changes are recommended to the course standards in the program of study at this time; however, the aligned teacher endorsements should be explored in more detail. Due to the large amount of business content in the program of study, teachers with a business endorsement and specific coursework or work experience in supply chain management may be qualified to teach these courses. Because of the large number of job opportunities available, more schools should be offering this program of study across the state. Allowing current business teachers to teach the program of study will make it easier for schools to transition to offering this program of study. Also, marketing materials may help promote this program of study and breakdown any preconceived notions about the nature of the work.

2017-18 Program of Study	Level 1	Level 2	Level 3	Level 4
<b>Distribution and Logistics</b>	Foundations of Transportation, Distribution, and Logistics (6069)	Distribution and Logistics I (6072)	Distribution and Logistics II: Management (6024) -or- <b>Dual Enrollment</b> Distribution & Logistics (4132)	Work-Based Learning: Career Practicum (6105) -or- <b>Dual Enrollment</b> Distribution & Logistics (4132)

## References

Bureau of Labor Statistics, U.S. Department of Labor, (2016, Feb. 10) *Current Population Survey (CPS)*. Retrieved from <http://www.bls.gov/cps/tables.htm>.

Bureau of Labor Statistics, U.S. Department of Labor, (2015, March 25). *Occupational Employment and Wages, May 2014*. (53-0000 Transportation and Material Moving Occupations, Major Group). Retrieved from <http://www.bls.gov/oes/current/oes530000.htm>.

Carnevale, A. P., Smith, N., Stone III, J. R., Kotamraju, P., Steuernagel, B., & Green, K. A. (2011). *Career Clusters: Forecasting Demand for High School Through College Jobs*. Washington, DC: Georgetown University Center on Education and the Workforce.

Kane, J., & Puentes, R. (2014, May 9). Beyond Shovel-Ready: The Extent and Impact of U.S. Infrastructure Jobs. Retrieved March 02, 2016, from <http://www.brookings.edu/research/interactives/2014/infrastructure-jobs#/M10420>.

McKenzie, K. (2014, May 10). New Study Highlights Memphis Area as No. 1 in Infrastructure Jobs. The Commercial Appeal. Retrieved from <http://www.commercialappeal.com/business/new-study-highlights-memphis-area-as-no-1-in-infrastructure-jobs-ep-457579999-323693121.html>.

TN Department of Labor and Workforce Development. (2016). Employment Security Division, R & S. Retrieved from <https://www.jobs4tn.gov>.

U.S. Department of Education, Office of Career, Technical, and Adult Education. (2015, August). *Strengthening Skills Training and Career Pathways across the Transportation Industry*. Washington, D.C. Retrieved from <http://cte.ed.gov/initiatives/advancing-cte-in-state-and-local-career-pathways-system>.