

Connected Mobility

Oakland County, Michigan **SKILLS NEEDS ASSESSMENT PROJECT**



Report prepared and submitted by:

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2200 N. Squirrel Road | Rochester, MI 48309

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A portrait of L. Brooks Patterson, an older man with glasses, wearing a dark suit, white shirt, and patterned tie. He is smiling and has his arms crossed. The background is dark and out of focus.

L. BROOKS PATTERSON

OAKLAND COUNTY EXECUTIVE

On behalf our region's employers and educators, I present Oakland County's 2017 Skills Needs Assessment Program report on Connected Mobility.

This SNAP report – the first of its kind in the nation on Connected Mobility – is a comprehensive look at the specific employment needs of this rapidly evolving industry in Oakland County and Southeast Michigan. We believe the report provides vital information for educators as they prepare their curricula and students for employment in Connected Mobility. It benefits job seekers as it details the skills, knowledge and abilities needed to qualify for the jobs of the future and ensures that the pipeline of qualified talent will be available to meet industry needs.

This report is the fourth in a series of ground-breaking studies – funded by Oakland County and the Michigan Talent Investment Agency. They are helping shape the future of Oakland County's knowledge-based economy, providing industry-based research to identify and fill employment gaps. The initial report was prepared in 2009 and focused on Emerging Sectors® companies that are helping diversify the county's economy by replacing lost manufacturing jobs. The second report, completed in 2013, focused on the needs of advanced manufacturing and the 2014 report focused on the employment needs of the health systems in the region.

Connected Mobility research is highly competitive and Oakland County is a global leader. We're home to 70 percent of the world's automotive and mobility research. Google, Microsoft, Intel, Uber, Valeo, Lear, Continental, Snapchat, Nissan, GM, FCA and dozens of others are here creating things most people thought were impossible. Silicon Valley companies are expanding and relocating to Oakland County, strengthening our position in this rapidly changing landscape.

But there are many other parts of the world anxious to assume Oakland County's leadership position, which makes initiatives such as the Connected Mobility SNAP report an important tool for keeping our region relevant. If we don't lead, someone else will.

My sincere thanks go to the Oakland County Workforce Development Board, Oakland County Michigan Works! and the Oakland County Business Roundtable's Workforce and Education Committee for their support of this project as well as the Board of Commissioners for its continued support.

I'm confident you will find this 2017 Skills Needs Assessment Project report useful as Oakland County aggressively works to meet the needs of the Connected Mobility industry now and in the future.

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EXECUTIVE SUMMARY

During 2016, a Skills Needs Assessment Project (SNAP) was conducted by the Oakland County Michigan Works! Agency (MWA) on behalf of Oakland County Executive L. Brooks Patterson and the Oakland County Workforce Development Board. This project is a direct result of the SNAP initiatives that were conducted in 2009, 2013 and 2014, which targeted the County's Emerging Sectors[®], Advanced Manufacturing and Health Systems industries, respectively. Those published reports contained "customized job profiles" for the top jobs in each of the emerging sectors, advanced manufacturing and health systems industries. Individual profiles identified the knowledge, skills and abilities (KSAs) that job seekers and students needed to qualify for these positions. Given the efficacy of the initial SNAP projects, the Oakland County Executive and the Workforce Development Board sought to replicate and expand a SNAP for the Connected Mobility industry sector.

The focal point of the project was the development of a comprehensive web-based survey tool that collected data specific to the needs of Connected Mobility employers. Data categories on which feedback was collected included company demographics; greatest hiring challenges and suggested remedies; important but difficult to find personal competencies in job candidates; difficult to fill job openings within a particular job family; and the knowledge, skills and abilities associated with those occupations. Customized job profiles were then created for the jobs identified as most in demand and most difficult to fill.

For this study, the *Connected Mobility* sector represents the dual and separate concepts of "connected" – advanced technology to communicate with external systems, and "mobility" – technology and services that optimize the movement of goods and people.

To accomplish all the designated goals and objectives while ensuring the accuracy of the initiative, the project was conducted in four distinct phases: Research, Design, Validation and Implementation. The **Research** Phase included the review and analysis of extensive employment, skills and assessment data available through various web-based information sources that utilized historic and real time labor market information. The **Design** Phase resulted in an acceptable and preliminary survey instrument. As part of the **Validation** Phase, individuals from the educational and employer communities were engaged in the process. Educators were asked to provide feedback on job profile content, and employers assisted in the final development of databank components, including job specific content (job families/jobs/knowledge/skills/abilities) and survey dissemination strategies. Lastly, the **Implementation** Phase involved the comprehensive roll-out of the customized web-based survey designed to obtain quantifiable data from employers.

The Skills Needs Assessment Project survey was disseminated to employers and industry professionals through the partnership and cooperation of several organizations, including Warner Norcross & Judd LLP, Macomb Community College, Washtenaw Community College, the Mobile Technology Association of Michigan (MTAM), the Connected Vehicle Trade Association (CVTA), Oakland County Tech248, the Workforce Intelligence Network (WIN), Mobile Comply, the Michigan Academy for Green Mobility Alliance (MAGMA), and Opportunity Detroit Tech. The collective effort covered the entire nine county Southeast Michigan region to include:

- Genesee County
- Lapeer County
- Livingston County
- Macomb County
- Monroe County
- Oakland County
- St. Clair County
- Washtenaw County
- Wayne County

Employers from various Connected Mobility industry sectors were invited to complete the survey, and to provide direct feedback on the jobs for which qualified candidates may be difficult to find. Employer representatives received an initial email invitation with a direct link to the survey instrument. Several subsequent reminders were sent to the targeted population. Ultimately, sufficient survey responses allowing for further analysis were gathered.

In total, Connected Mobility employers were given the option to select occupations from three job families: Engineering, Technician & Skilled Trades, and Data & Security. Respondents selected the Engineering job family most frequently.

As a result of the survey data analysis, nine customized job profiles were created. The profiles reflect the occupations identified as *most in demand* and *most difficult to fill* with qualified candidates from the available labor pool. Job profiles are specific to the Connected Mobility industry sector only.

Job profiles were created for the following occupations (in alphabetical order):

- Business Intelligence Analyst
- Civil / Transportation Engineer
- Connected Systems Engineer
- Computer Systems Engineer
- Electrical / Electronics Engineering Technician
- Electrical Engineer
- Mechatronics Engineer
- Software Applications Developer
- Software Systems Developer

In addition to information on estimated annual job openings, desired education level and regional completions, specialty knowledge areas and important personal competencies, each job profile contains the most important KSAs.

The survey analysis also provides insight into the greatest hiring challenges regional employers encounter and suggested remedies. Most frequently identified challenges in rank order include:

- Insufficient pipeline of qualified workers
- Engineering degrees in outdated engineering disciplines
- Perception of Southeast Michigan
- Visa restrictions and/or limits
- Deficient Connected Mobility training programs
- Perception of the automotive industry
- Inconsistent job titles and descriptions which confuse the job seeker
- An aging workforce nearing retirement

The Oakland County Executive and the Oakland County Workforce Development Board issued the Connected Mobility Industry's SNAP in 2017.

PROJECT SUMMARY BY PHASE

RESEARCH PHASE

During the Research Phase, extensive employment, skills and assessment data available through various web-based information sources were reviewed and analyzed. This initial data analysis and contextual research were used to identify Connected Mobility jobs spanning multiple industry sectors. This data, coupled with other data sources, including Economic Modeling Specialist Intl (EMSI), allowed for the creation of a list of in-demand Connected Mobility occupations within the region. Comparative analyses against other federal labor sources were then completed, allowing for the segmentation of the occupations into job families. Feedback from industry professionals was also considered to appropriately categorize occupations into the following three job families: Engineering, Technician & Skilled Trades and Data & Security. These job families were selected to minimize confusion for survey participants when they selected occupations. As much as possible, real-time labor market data was used to provide a springboard for creating the underlying survey databank, including knowledge, skills and abilities associated with specific occupations.

A preliminary list of targeted employers was then compiled with the assistance of the Oakland County Department of Economic Development & Community Affairs and the Oakland County Michigan Works! One Stop Service Centers.

DESIGN PHASE

The Design Phase developed an acceptable and preliminary survey instrument targeting Connected Mobility employers. In brief, the EdEn team created structured and user-friendly survey instrument(s) designed to collect business information on survey takers in addition to specific input in the following broad categories: hiring challenges and remedies; important but difficult to find personal competencies in job candidates; in-demand jobs for which employers are having difficulty finding qualified candidates; associated knowledge, skills and abilities for those jobs; specialty skills or knowledge; and the required degrees, certificates or credentials.

Critical to the Design Phase was the engagement of Dr. Ty Partridge, Wayne State University professor and statistician, and the Lindner Technology Group, Inc. (LTGI), a technology consulting, software and services company. Dr. Partridge was instrumental in developing appropriate qualitative and quantitative survey questions; question type and rating scale selection; data associations; and appropriate database structure to allow for valid statistical analysis. LTGI provided the information technology services required for the development of the web-based survey and the secure collection of survey data.

LTGI has years of experience in developing custom database-driven websites for education partners. LTGI applications are built using industry-standard technologies, with data easily exportable to SPSS and/or Microsoft Excel for further analysis. Both platforms are compatible with Oakland County technology.

VALIDATION PHASE

Concurrent to the Design Phase, the EdEn team began to solicit feedback from the educational and employer communities. Education stakeholders from the previous SNAP projects were asked to assess the usefulness of the initial SNAP job profiles for the Connected Mobility SNAP. EdEn sought to determine which components within these profiles were the most useful to educators and which other data components could be added to the job profiles. Several employers were also engaged in 1:1 interview sessions. Each session sought to obtain specific feedback from employers on the survey databank prior to implementation. Additional research was conducted by the EdEn team to determine the validity of suggestions, and those deemed valid and appropriate were then incorporated into the survey instrument.

IMPLEMENTATION PHASE

Upon completion of the validation process, EdEn began widespread distribution of the survey to Connected Mobility employers. Several email and web-based communications, clearly articulating the goals and objectives of the project, were developed to appropriately disseminate the survey to the target audience. EdEn also coordinated the design of a webpage interface that mimicked Oakland County's brand, and that linked directly to the survey. Through a collective effort involving Warner Norcross & Judd LLP, Macomb Community College, Washtenaw Community College, the Mobile Technology Association of Michigan (MTAM), the Connected Vehicle Trade Association (CVTA), Oakland County's Tech248, Mobile Comply, the Workforce Intelligence Network (WIN), the Michigan Academy for Green Mobility Alliance (MAGMA), and Opportunity Detroit Tech, the survey was distributed to Connected Mobility employers in the region. Ultimately, survey responses were gathered from employers representing three sectors of the Connected Mobility industry: Communications, Connected Vehicle and Infrastructure.



CONNECTED MOBILITY SKILLS NEEDS ASSESSMENT PROJECT

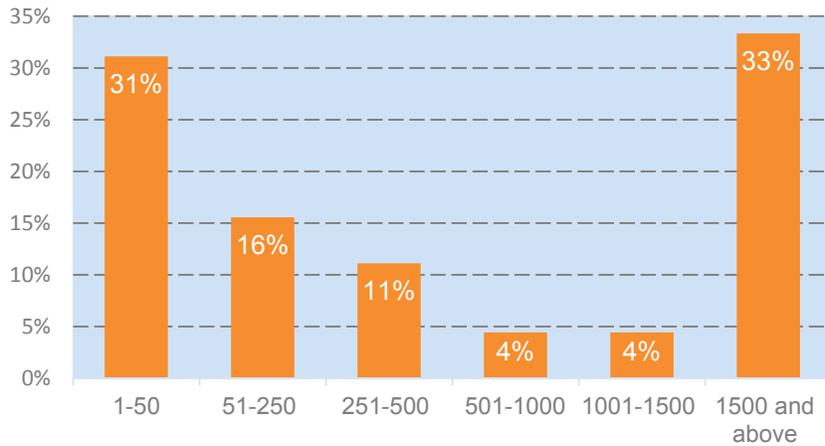
SURVEY FINDINGS

The Skills Needs Assessment Project targeting the Connected Mobility industry is another landmark study for Oakland County. In an ongoing effort to advance the economic prosperity of Southeast Michigan, the County sought a regional perspective on employment data. Research and analysis conducted during the project coupled historical and real-time labor market data, which allowed for the accumulation of an empirical data set. This data set then served as a baseline for verification by survey participants. Adaptive technology was used to develop customized survey instruments for distribution to Connected Mobility employers across the region.

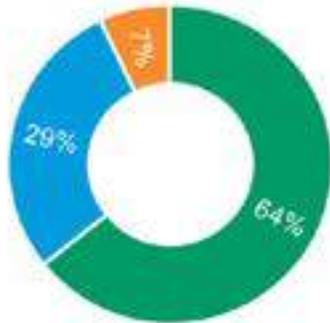
The information presented here represents the survey findings based upon feedback from Connected Mobility employers within the Southeast Michigan region only.

SURVEY RESPONDENT DEMOGRAPHICS

EMPLOYER SIZE DISTRIBUTION

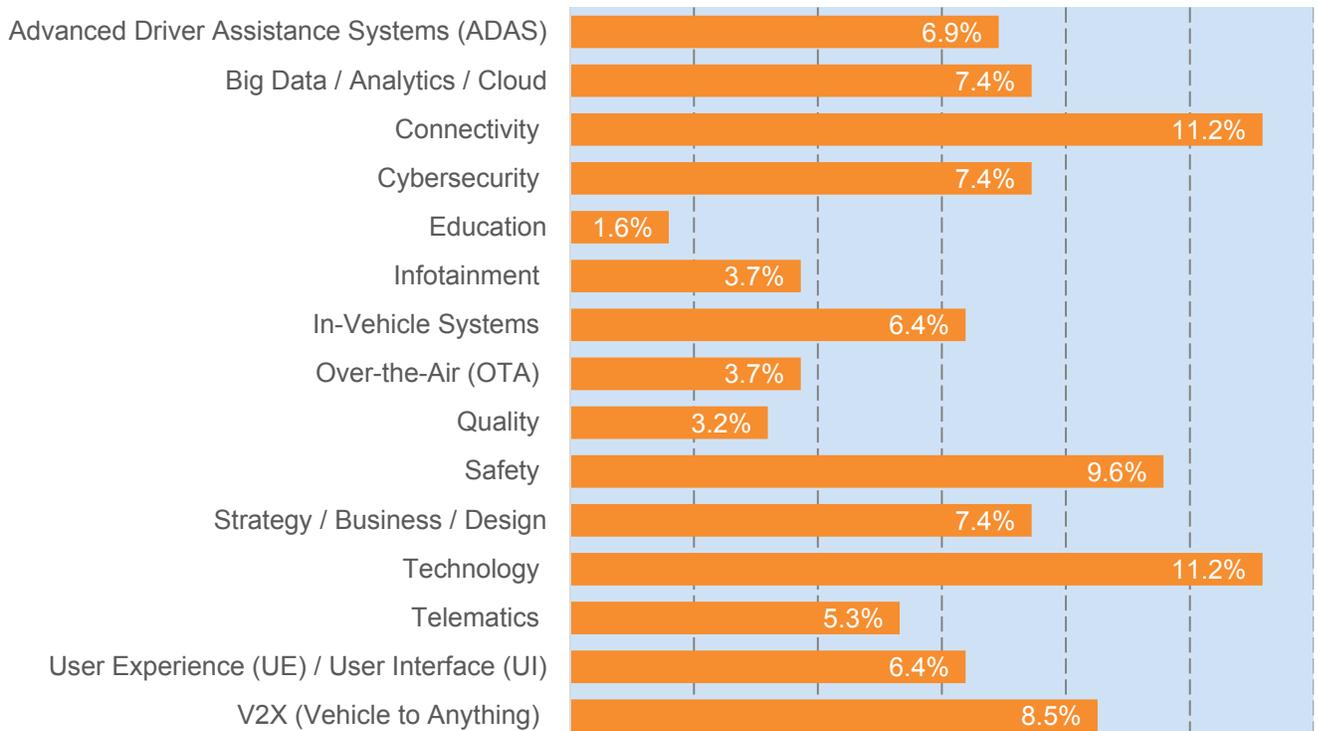


INDUSTRY REPRESENTATION



- Connected Vehicle
- Communication
- Infrastructure

INDUSTRY SUB-SECTOR REPRESENTATION



DEMOGRAPHIC QUICK FACTS

MOST REPRESENTED INDUSTRY SUB-SECTORS:

Connectivity
Safety
Technology
V2X (Vehicle to Anything)

93% of survey respondents selected more than one industry sub-sector

36% of survey respondents have a business presence in Oakland County

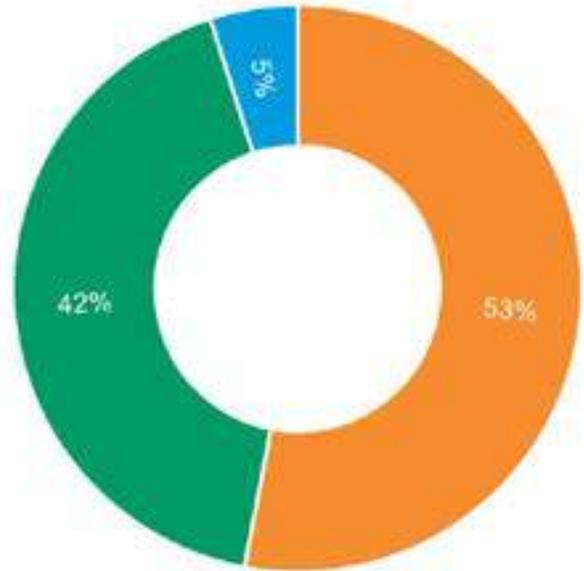
93% of survey respondents have a presence in the Southeast Michigan Region

RESULTS BY JOB FAMILY

MOST FREQUENTLY SELECTED JOBS ACROSS ALL FAMILIES

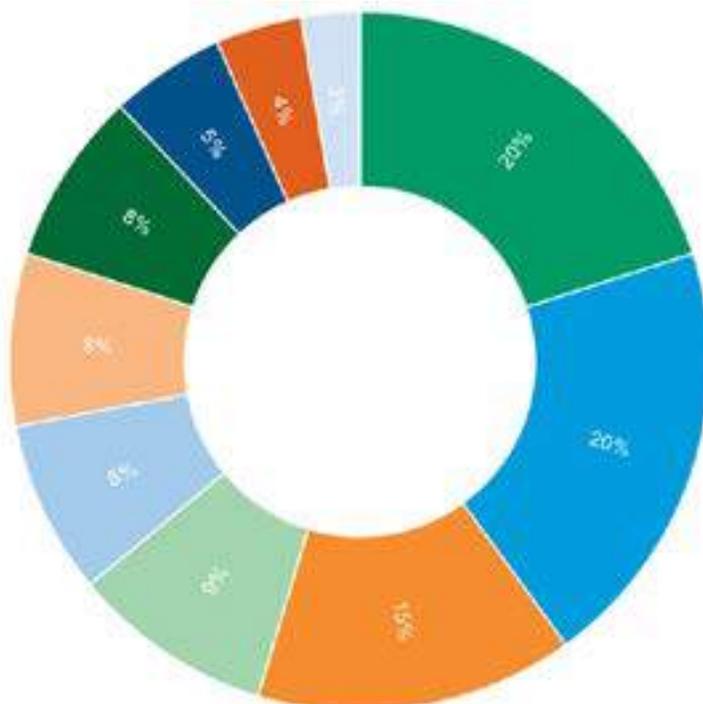
JOB	JOB FAMILY
Software Engineer	Engineering
Systems Engineer	Engineering
Electrical Engineer	Engineering
Computer Systems Engineer	Data & Security
Software Applications Developer	Data & Security
Software Systems Developer	Data & Security
Transportation Engineer	Engineering
Mechatronics / Controls Engineer	Engineering
Business Intelligence Analyst	Data & Security
Programmer	Data & Security
Information Security Analyst	Data & Security
IT Project Manager	Data & Security
Civil Engineer	Engineering
Electronics Engineering Technician	Technician & Skilled Trades

MOST FREQUENTLY SELECTED JOB FAMILIES



- CM Data and Security Jobs
- CM Engineering Jobs
- CM Technician and Skilled Trades Jobs

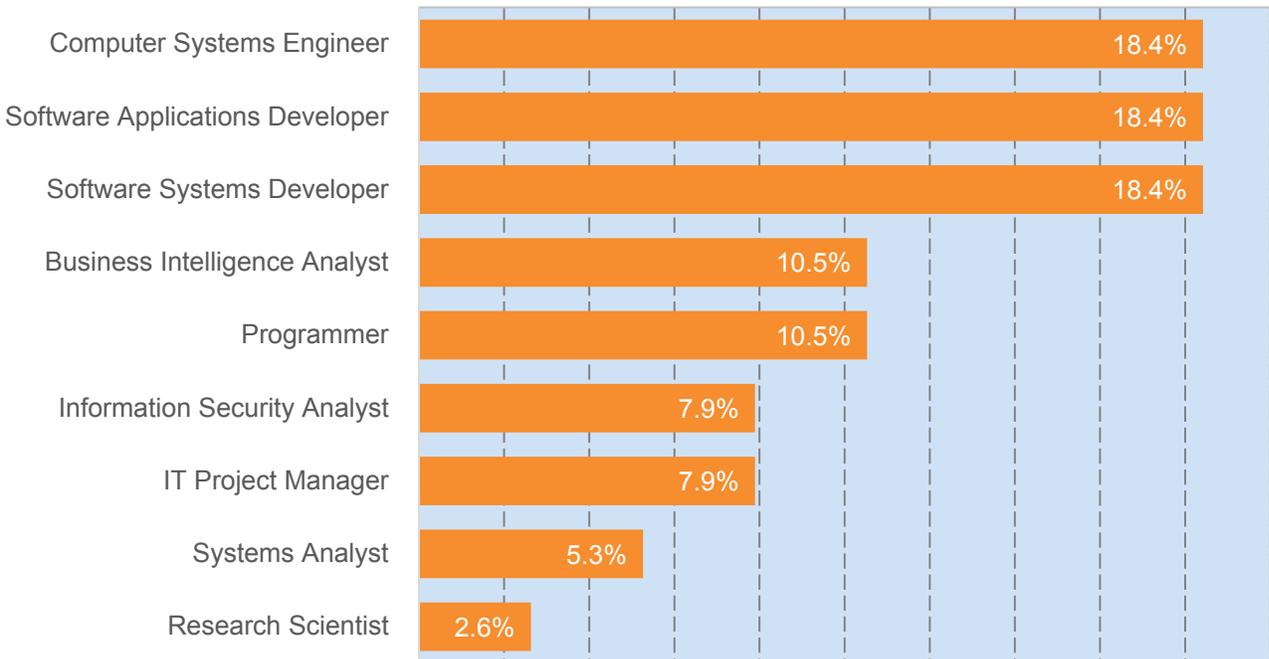
MOST DIFFICULT TO FIND PERSONAL COMPETENCIES ACROSS ALL JOB FAMILIES



- Critical & Analytical Thinking
- Problem Solving & Decision Making
- Project & Time Management
- Adaptability & Flexibility
- Accountability
- Customer Focus
- Initiative
- Dependability & Reliability
- Attention to Detail & Organization
- Multi-Tasking

CONNECTED MOBILITY DATA & SECURITY JOB FAMILY

TOP JOBS SELECTED WITHIN FAMILY



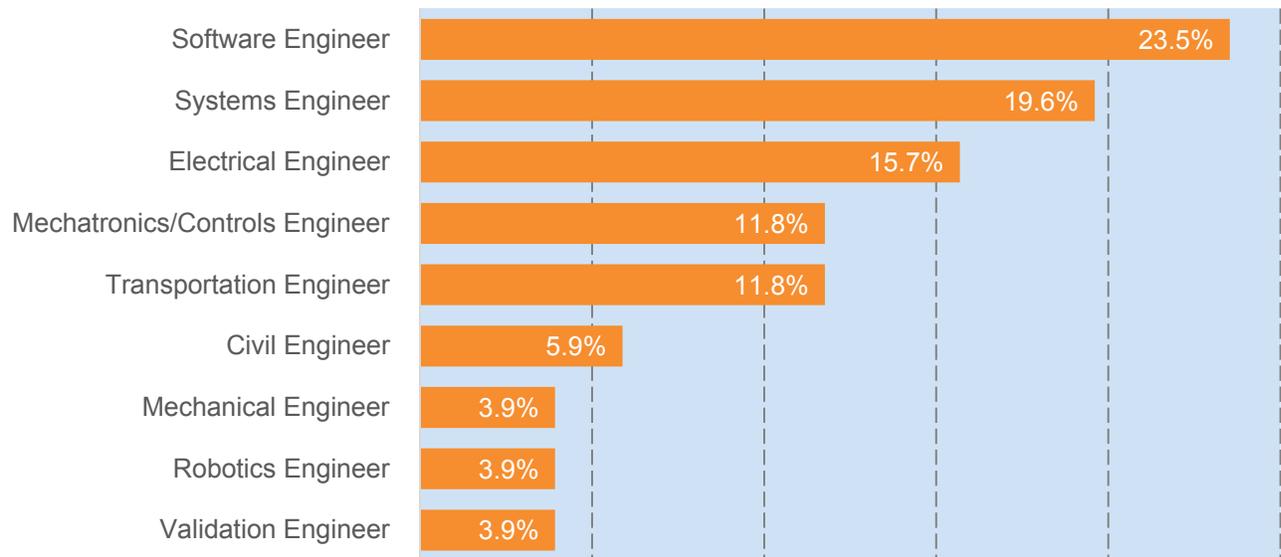
KNOWLEDGE, SKILLS AND ABILITIES (KSA) — MOST FREQUENTLY SELECTED WITHIN JOB FAMILY

	%		%
Programming Languages	55%	Technical Support	21%
Software Architecture	45%	Applied Data Analytics	18%
Big Data	39%	Artificial Intelligence (AI)	18%
Data Analysis	39%	Business Analytics Tools	18%
Cybersecurity	37%	Cloud Communications	18%
Relational Database Technologies	34%	Database Principles and Application	18%
Hardware / Software Configuration	29%	Software Architecture	18%
Technical Writing / Editing	29%	Statistical Modeling	18%
Connected Vehicle Technologies	26%	Business Processes	18%
Software Testing	26%	Scripting Languages	16%
Project Management	24%	Web Application Development	16%
Debugging	24%	Internet Protocols	16%
Operating Systems	24%	Mobile Operating Systems	16%
Software Engineering	21%	Risk Assessment	16%

Blue Skills = Traditional Skills, Orange Skills = Specialty Skills

CONNECTED MOBILITY ENGINEERING JOB FAMILY

TOP JOBS SELECTED WITHIN FAMILY



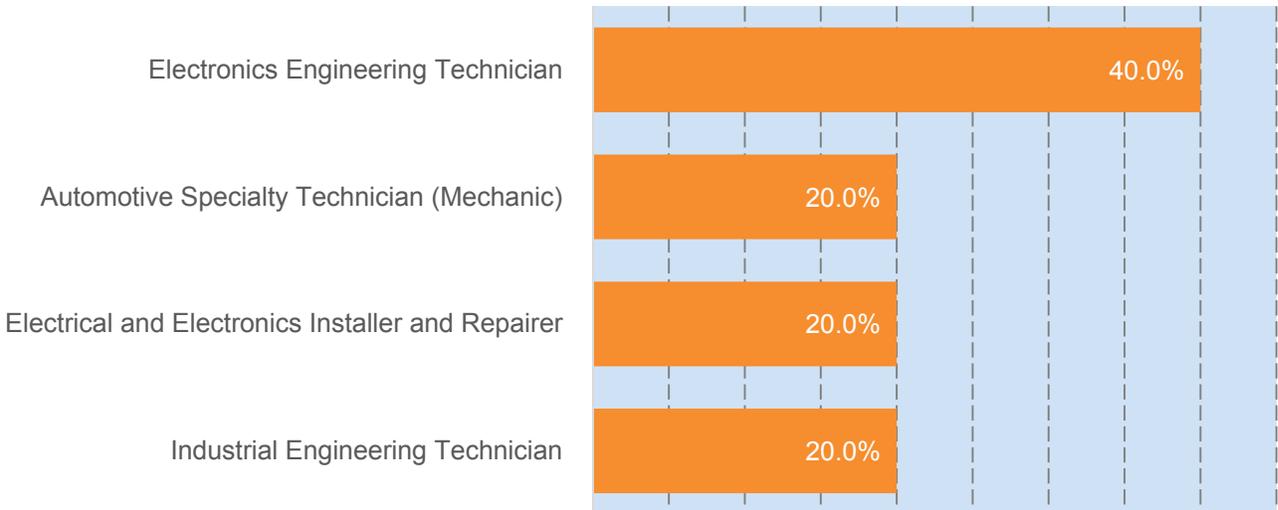
KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN JOB FAMILY

	%		%
Systems Engineering	53%	MATLAB / Simulink / dSpace	18%
Requirements Development	37%	Product Development	18%
Simulation	35%	Quality Processes	18%
Engineering Design	27%	Controller Area Networks	16%
Systems Architecture	27%	Hardware / Software / Model in the Loop	16%
Advanced Driver Assistance Systems (ADAS)	25%	Human Machine Interface (HMI)	16%
Connected Vehicle Technologies	25%	Process Improvement	16%
Electrical Engineering	25%	Vehicle Connectivity Technologies	16%
Mathematics	25%	Cloud Communications	14%
Validation	24%	Embedded Systems	14%
Systems Integration	22%	Process Controls	14%
AUTomotive Open System ARchitecture (AUTOSAR)	20%	Product Design	14%
Cybersecurity	20%	Programming Languages	14%
Engineering Management	20%	Robotics	14%
Software Architecture	20%	Software Development Processes	14%
Concept Development	18%	Artificial Intelligence (AI)	12%

Blue Skills = Traditional Skills, Orange Skills = Specialty Skills

CONNECTED MOBILITY TECHNICIAN & SKILLED TRADES JOB FAMILY

TOP JOBS SELECTED WITHIN FAMILY



KNOWLEDGE, SKILLS AND ABILITIES (KSA) – MOST FREQUENTLY SELECTED WITHIN JOB FAMILY

	%		%
Electrical Schematics / Circuit Diagrams	60%	Measurement	40%
Electrical Systems and Components	60%	Original Equipment Manufacturer Systems	40%
Power Tools	60%	Product Development	40%
Sensors (Camera, Radar, Lidar, GPS, Inertial)	60%	Programmable Logic Control (PLC)	40%
Vehicle Connectivity Technologies	60%	Software System Integration	40%
Wiring	60%	Advanced Diagnosis, Service and Repair	20%
Automotive Electronics	40%	Aftermarket Installation of ITS Equipment	20%
Automotive Testing and Development	40%	Battery Knowledge	20%
Blueprints	40%	Communication Infrastructure	20%
Controller Area Networks	40%	Computer Networking	20%
Electronic Control Unit	40%	Cybersecurity	20%
Embedded Systems	40%	Data Analytics	20%
Hand tools	40%	Programming Languages	20%
Mathematics	40%	Repair	20%
MATLAB / Simulink / dSpace	40%	Systems Engineering	20%

Blue Skills = Traditional Skills, Orange Skills = Specialty Skills

CUSTOMIZED JOB PROFILE GUIDE

The cumulative result of the Connected Mobility Skills Needs Assessment Project is the creation of customized job profiles. The profiles contain information specific to employers in the region. Below is a **CUSTOMIZED JOB PROFILE GUIDE** for navigating each profile.

JOB TITLE

O*NET Code SOC Code

JOB DESCRIPTION

Based upon O*Net Online occupational information created for the U.S. Department of Labor

OTHER REPORTED JOB TITLES

Based upon O*Net Online occupational information created for the U.S. Department of Labor



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

KSA	KSA
KSA	KSA

This table contains the 10 most important TRADITIONAL knowledge, skills or abilities (KSAs) associated with the specified job based upon (and ordered by) frequency of responses. Respondents were presented with a list of traditional KSAs, by job family, based on the results of the 2013 Skills Needs Assessment Project for Advanced Manufacturing.

#1

Overall ranking across job families as it relates to the difficulty employers have filling the job

#1

Ranking within the specific job family

40

Estimated annual job openings regionally (2016-2026) for the specified job*

\$23.77

Median hourly earnings for the specified job*

EDUCATION LEVEL

Most desired education level*

SOFT SKILLS IN DEMAND

This block contains a listing of the soft skills most often reported as important in candidates for the specified job.



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES (IN ORDER OF FREQUENCY)

	TI*		TI*
KSA #1	4.25	KSA #3	9.00
KSA #2	8.75	KSA #4	2.38

This table contains the 20 most important SPECIALTY knowledge, skills or abilities (KSAs) associated with the specified job based upon (and ordered by) frequency of responses. Respondents were presented with a list of specialty KSAs, by job family, based on the results of personal interviews, group feedback and online job postings.

Each KSA has an associated Training Index (TI) score. The TI score compares the IMPORTANCE of each KSA to the DIFFICULTY employers have finding job candidates with the KSA. A KSA may have a TI score between 0 and 10. A higher score indicates a greater need for training for that particular KSA. Individual KSAs with a training score of 8.00 or greater are shown in **BLUE**.



TASKS

This section contains a listing of tasks often associated with the specified job as documented by O*Net Online and created for the U.S. Department of Labor.

*DATA SOURCES:

Economic Modeling Specialist Intl (EMSI) Analyst is a web based tool that provides in-depth regional employment labor market data.

O*NET Online is the nation's primary source of occupational information containing data on hundreds of standardized and occupation-specific descriptors.



CONNECTED SYSTEMS ENGINEER

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
The Connected Systems Engineer is a unique position emphasizing sound engineering principles layered with state-of-the-art software competencies and technologies.	Autonomous Vehicle Engineer, Connected Mobility Engineer, Embedded Systems Engineer, Software and System Engineer, Software Engineer, Systems Engineer, System Requirement Engineer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Systems Engineering	Electrical Engineering
Requirements Development	Product Development
Simulation	Product Design
Mathematics	Quality Processes
Validation	Concept Development / Engineering Design - Tie

#1

Overall Ranking of Most Difficult Job to Fill

#1

Ranking within the CM Engineering Job Family

1,388

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$43.01

Median Hourly Earnings

BACHELOR OR MASTER OF SCIENCE IN ELECTRICAL, SYSTEMS OR COMPUTER ENGINEERING



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Computer Networking	6.41	AUTomotive Open System ARchitecture (AUTOSAR)	7.80
Controller Area Networks	6.25	Connected Vehicle Technologies (V2V, V2I, V2X)	5.47
Telematics	5.13	Artificial Intelligence (AI)	5.27
Surface-Mount Technology	7.56	Mobile Device Development	3.77
Systems Architecture	7.26	Statistical Modeling	7.65
Enterprise Mobility Management	6.98	Automotive Electronics	6.75
Advanced Driver Assistance Systems (ADAS)	6.65	Data Analytics	6.50
Sensors (Camera, Radar, Lidar, GPS, Inertial)	6.30	MATLAB / Simulink / dSpace	5.70
Hardware / Software / Model in the Loop	5.98	Cloud Communications	5.55
Software Architecture	5.15	Intrusion Detection and Prevention Systems (IPS)	5.00

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Critical & Analytical Thinking

Project & Time Management

Verbal Communication

Problem Solving & Decision Making



TASKS

- Utilize systems thinking principles and software knowledge to define, design, develop and manage complex systems over their life cycles.
- Interface with electrical engineering, mechanical engineering, software engineering, purchasing, manufacturing, test engineering, quality and sales to gather customer and internal requirements.

ELECTRICAL ENGINEER

O*NET Code 17-2071.00

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Research, design, develop, test or supervise the manufacturing and installation of electrical equipment, components or systems for commercial, industrial, military or scientific use.	Circuits Engineer, Electrical Controls Engineer, Electrical Design Engineer, Electrical Project Engineer, Instrumentation and Electrical Reliability Engineer, Power Systems Engineer, Project Engineer, Test Engineer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Requirements Development	Product Design
Systems Engineering	Quality Processes
Electrical Engineering	Simulation
Engineering Design	Validation
Mathematics	Engineering Management

#2

Overall Ranking of Most Difficult Job to Fill

#2

Ranking within the CM Engineering Job Family

869

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$42.60

Median Hourly Earnings

BACHELOR OR MASTER OF SCIENCE IN ELECTRICAL OR COMPUTER ENGINEERING

Most Desired Education Level



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Mobile Operating Systems (Android or iOS)	7.53	Cloud Communications	3.95
Systems Integration	5.90	Cybersecurity	3.60
Systems Architecture	5.17	Advanced Driver Assistance Systems (ADAS)	9.00
Hardware / Software / Model in the Loop	8.10	Sensors (Camera, Radar, Lidar, GPS, Inertial)	8.10
MATLAB / Simulink / dSpace	6.95	Big Data	8.00
Programming Languages (C, C++, Java, .NET, Visual Basic)	6.30	Robot Operating System (ROS)	8.00
Controller Area Networks (CAN bus, FLEXray)	5.65	Software Architecture	8.00
Electrical Schematics / Circuit Diagrams	5.55	Software Development Processes (Agile, ITIL, Scrum)	6.40
Embedded Systems	5.20	Navigation / Mapping Systems	6.00
Connected Vehicle Technologies (V2V, V2I, V2X)	4.80	Statistical Modeling	3.50

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Critical & Analytical Thinking

Problem Solving & Decision Making

Team Focus & Collaboration

Written Communication



TASKS

- Operate computer-assisted engineering / design software or equipment to perform engineering tasks.
- Prepare technical drawings, specifications of electrical systems or topographical maps to ensure that installation and operations conform to standards and customer requirements.
- Confer with engineers, customers or others to discuss existing or potential engineering projects or products.
- Design, implement, maintain or improve electrical instruments, equipment, facilities, components, products or systems for commercial or industrial purposes.
- Direct or coordinate manufacturing, construction, installation, maintenance, support, documentation or testing activities to ensure compliance with specifications, codes or customer requirements.

COMPUTER SYSTEMS ENGINEER

O*NET Code 15-1199.02

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Design and develop solutions to complex applications problems, system administration issues or network concerns. Perform systems management and integration functions.	Electronic Data Interchange System Developer (EDI System Developer), System Architect, Systems Engineer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Programming Languages	Data Analysis
Software Architecture	Technical Support
Relational Database Technologies	Technical Writing / Editing
Hardware / Software Configuration	Debugging
Operating Systems	Business Processes

#3

Overall Ranking of Most Difficult Job to Fill

#1

Ranking within the CM Data & Security Job Family

205

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$34.08

Median Hourly Earnings

BACHELOR OR MASTER OF SCIENCE IN ELECTRICAL OR COMPUTER ENGINEERING

Most Desired Education Level



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Cybersecurity	7.83	Cloud Communications	6.05
Systems Engineering	9.50	Software Development Processes (Agile, ITIL, Scrum)	5.80
Software Architecture	9.05	System Modeling Languages (SysML)	5.25
Software Engineering	8.50	Advanced Driver Assistance Systems (ADAS)	10.00
Embedded Systems	8.10	Applied Data Analytics	10.00
Software Testing	8.05	Business Analytics Tools (Cognos QlikView, Business Objects)	10.00
Statistical Modeling	7.45	Connected Vehicle Technologies (V2V, V2I, V2X)	10.00
Mobile Operating Systems (Android or iOS)	7.30	In-Vehicle Platform Security Design	9.00
Big Data	6.15	Intrusion Detection and Prevention Systems (IPS)	8.10
Internet Protocols (TCP/IP, UDP, DNS)	6.15	Project Management	8.10

* TI-Training Index = Importance/Difficulty; higher [score \(>8.0\)](#) indicates greater need for training.

SOFT SKILLS IN DEMAND

Project & Time Management

Critical & Analytical Thinking

Problem Solving & Decision Making

Team Focus & Collaboration



TASKS

- Communicate with staff or clients to understand specific system requirements.
- Provide advice on project costs, design concepts or design changes.
- Document design specifications, installation instructions and other system-related information.
- Verify stability, interoperability, portability, security or scalability of system architecture.
- Collaborate with engineers or software developers to select appropriate design solutions or ensure the compatibility of system components.

SOFTWARE APPLICATIONS DEVELOPER O*NET Code 15-1132.00

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Develop, create and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design or customize software for client use to optimize operational efficiency. May analyze and design databases within an application area, working individually or as part of a team. May supervise programmers.	Software Engineer, Software Development Engineer, Information Technology Analyst (IT Analyst), Application Integration Engineer, Technical Consultant, Software Architect, Computer Consultant, Application Developer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Data Analysis	Technical Writing / Editing
Debugging	Relational Database Technologies
Extensible Markup Language	Hardware / Software Configuration
Programming Languages	Operating Systems
Software Architecture	Technical Support

#4

Overall Ranking of Most Difficult Job to Fill

#2

Ranking within the CM Data & Security Job Family

2,257

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$40.32

Median Hourly Earnings

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

Most Desired Education Level



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Connected Vehicle Technologies (V2V, V2I, V2X)	6.97	Risk Assessment	7.20
Cybersecurity	5.83	Controller Area Networks	6.40
Software Engineering	5.85	Hardware / Software / Model in the Loop (HIL / SIL / MIL)	5.60
Mobile Operating Systems (Android or iOS)	5.25	Mobile Device Development	5.60
Advanced Driver Assistance Systems (ADAS)	9.00	Project Management	5.60
Database Disaster Recovery	8.10	Cloud Communications	5.40
Database Management Software (Hadoop, Hive, MongoDB, Spark)	8.10	In-Vehicle Platform Security Design	5.40
Software Architecture	8.10	Electrical Engineering	4.90
Security Strategies	8.00	Embedded Systems	4.90
Big Data	7.20	Encryption	4.90

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Accountability

Critical & Analytical Thinking

Problem Solving & Decision Making

Dependability & Reliability



TASKS

- Modify existing software to correct errors, allow it to adapt to new hardware or to improve its performance.
- Analyze user needs and software requirements to determine feasibility of design within time and cost constraints.
- Confer with systems analysts, engineers, programmers and others to design systems and to obtain information on project limitations and capabilities, performance requirements and interfaces.
- Store, retrieve and manipulate data for analysis of system capabilities and requirements.
- Design, develop and modify software systems using scientific analysis and mathematical models to predict outcomes.

SOFTWARE SYSTEMS DEVELOPER

O*NET Code 15-1133.00

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Research, design, develop and test operating systems-level software, compilers and network distribution software. Set operational specifications and formulate and analyze software requirements. May design embedded systems software. Apply principles and techniques of computer science, engineering and mathematical analysis.	Software Development Engineer, Systems Analyst, Software Engineer, Software Developer, Software Architect, Systems Engineer, Systems Coordinator, Senior Software Engineer, Publishing Systems Analyst, Network Engineer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Programming Languages	Debugging
Software Architecture	Operating Systems
Data Analysis	Relational Database Technologies
Technical Writing / Editing	Technical Support
Hardware / Software Configuration	Business Processes

#5

Overall Ranking of Most Difficult Job to Fill

#3

Ranking within the CM Data & Security Job Family

1,117

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$42.53

Median Hourly Earnings

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

Most Desired Education Level



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Cybersecurity	7.50	Cloud Communications	5.95
Software Development Processes (Agile, ITIL, Scrum)	6.30	Risk Assessment	5.10
Big Data	6.23	Applied Data Analytics	4.90
Software Testing	5.03	Systems Engineering	3.50
Software Architecture	7.20	Artificial Intelligence (AI)	9.00
Software Engineering	6.70	Embedded Systems	9.00
Debugging	6.70	Database Disaster Recovery	7.20
Connected Vehicle Technologies (V2V, V2I, V2X)	6.35	Encryption	7.20
Database Principles and Application	6.35	Internet Protocols (TCP/IP, UDP, DNS)	7.20
Mobile Operating Systems (Android or iOS)	6.00	System Modeling Languages (SysML)	7.00

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Accountability

Critical & Analytical Thinking

Dependability & Reliability

Problem Solving & Decision Making



TASKS

- Modify existing software to correct errors, to adapt it to new hardware or to upgrade interfaces / improve performance.
- Develop or direct software system testing or validation procedures.
- Direct software programming and development of documentation.
- Consult with customers or other departments on project status, proposals, or technical issues, such as software system design or maintenance.
- Analyze information to determine, recommend and plan installation of a new system or modification of an existing system.

CIVIL / TRANSPORTATION ENGINEER

O*NET Code 17-2051.01

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Develop plans for surface transportation projects per established engineering standards and state or federal construction policy. Prepare designs, specifications or estimates for transportation facilities. Plan modifications of existing streets, highways or freeways to improve traffic flow.	Design Engineer, Project Engineer, Project Manager, Traffic Operations Engineer, Traffic Engineer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Systems Engineering	Engineering Drawings
Engineering Design	Requirements Development
Engineering Management	Process Improvement
Simulation	Electrical Engineering
Engineering Support	Validation

#6

Overall Ranking of Most Difficult Job to Fill

#3

Ranking within the CM Engineering Job Family

1,544

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$33.80

Median Hourly Earnings

BACHELOR OF SCIENCE IN CIVIL ENGINEERING WITH PROFESSIONAL ENGINEER LICENSE

Most Desired Education Level



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Telematics	5.86	Computer Networking	5.50
Security	6.13	Version Control	5.50
Controller Area Networks	6.27	Navigation / Mapping Systems	3.65
Systems Architecture	4.27	Connected Vehicle Technologies (V2V, V2I, V2X)	9.00
Automotive Electronics	9.00	Intrusion Detection and Prevention Systems (IPS)	9.00
Automotive Testing and Development	9.00	Mobile Device Development	8.10
Electrical Schematics / Circuit Diagrams	8.10	Advanced Diagnosis, Service and Repair	7.20
Electronic Control Unit	8.10	System Modeling Language	7.20
Software Development Processes	7.30	Computer Networking	6.40
Safety Technologies	6.00	Surface-Mount Technology	6.30

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Verbal & Written Communication

Accountability

Critical & Analytical Thinking

Team Focus & Collaboration



TASKS

- Design or prepare plans for new transportation systems or parts of systems such as airports, commuter trains, highways, streets, bridges, drainage structures or roadway lighting.
- Investigate traffic problems and recommend methods to improve traffic flow or safety.
- Check construction plans, design calculations or cost estimations to ensure completeness, accuracy or conformity to engineering standards or practices.
- Prepare administrative, technical or statistical reports on traffic-operation matters, such as accidents, safety measures or pedestrian volume or practices.
- Prepare project budgets, schedules or specifications for labor or materials.

MECHATRONICS ENGINEER

O*NET Code 17-2199.05

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Research, design, develop or test automation, intelligent systems, smart devices or industrial systems controls.	Automation Engineer, Automation Specialist, Controls Engineer, Development Engineer, Equipment Engineer, Principal Engineer, Process Engineer, Project Engineer, Senior Design Engineer, Senior Project Engineer



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Systems Engineering	Concept Development
Simulation	Requirements Development
Electrical Engineering	Engineering Design
Mathematics	Product Development
Validation	Quality Processes

#7

Overall Ranking of Most Difficult Job to Fill

#4

Ranking within the CM Engineering Job Family

679

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$43.69

Median Hourly Earnings

BACHELOR OR MASTER OF SCIENCE IN MECHANICAL ENGINEERING

Most Desired Education Level



20 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Advanced Driver Assistance Systems (ADAS)	6.10	Telematics	8.10
Risk Assessment	7.65	Vehicle Functions	8.10
Internet Protocols	6.30	Applied Data Analytics	8.00
Artificial Intelligence (AI)	10.00	Security	7.20
Intrusion Detection and Prevention Systems (IPS)	9.00	Data Analytics	6.40
Rapid Prototyping	9.00	Sensors (Camera, Radar, Lidar, GPS, Inertial)	5.60
Systems Architecture	9.00	Statistical Modeling	5.60
Controller Area Networks	8.10	ITIL Processes & Tools	4.90
Enterprise Mobility Management	8.10	Surface-Mount Technology	4.80
Software Architecture	8.10	Software System Integration	3.50

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Critical & Analytical Thinking

Problem Solving & Decision Making

Team Focus & Collaboration

Verbal & Written Communication



TASKS

- Design engineering systems for the automation of industrial tasks.
- Create mechanical design documents for parts, assemblies or finished products.
- Maintain technical project files.
- Implement or test design solutions.
- Create mechanical models and tolerance analyses to simulate mechatronic design concepts.

BUSINESS INTELLIGENCE ANALYST

O*NET Code 15-1199.08

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Produce financial and market intelligence by querying data repositories and generating periodic reports. Devise methods for identifying data patterns and trends in available information sources.	Business Intelligence Manager; Commercial Intelligence Manager; Competitive Intelligence Analyst; Consultant, Strategic Business and Technology Intelligence; Director of Enterprise Strategy; Director of Market Intelligence; Director, Global Intelligence; Intelligence Analyst; Manager, Market Intelligence



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Data Analysis	Debugging
Programming Languages	Technical Support
Relational Database Technologies	Business Processes
Software Architecture	Scripting Languages
Technical Writing / Editing	Web Application Development

#8

Overall Ranking of Most Difficult Job to Fill

#4

Ranking within the CM Data & Security Job Family

205

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$34.08

Median Hourly Earnings

BACHELOR OF BUSINESS ADMINISTRATION

Most Desired Education Level



18 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Statistical Modeling	9.05	Machine Learning	6.40
Artificial Intelligence (AI)	7.25	Navigation / Mapping Systems	6.40
Business Analytics Tools (Cognos, QlikView, Business Objects)	6.80	Project Management	6.40
Big Data	6.20	Software Architecture	5.60
Applied Data Analytics	10.00	Security Strategies	5.60
Connected Vehicle Technologies (V2V, V2I, V2X)	10.00	Software Engineering	5.60
Database Management Software (Hadoop, Hive, MongoDB, Spark)	7.20	Software Testing	4.90
Database Principles and Application	7.20	Risk Assessment	4.90
Enterprise Mobility Management	6.40	Sensors (Camera, Radar, Lidar, GPS, Inertial)	6.40

* TI-Training Index = Importance/Difficulty; higher score (>8.0) indicates greater need for training.

SOFT SKILLS IN DEMAND

Adaptability & Flexibility

Project & Time Management

Team Focus & Collaboration

Written Communication



TASKS

- Analyze competitive market strategies through analysis of related product, market or share trends.
- Synthesize current business intelligence or trend data to support recommendations for action.
- Communicate with customers, competitors, suppliers, professional organizations or others to stay abreast of industry or business trends.
- Manage timely flow of business intelligence information to users.
- Collect business intelligence data from available industry reports, public information, field reports or purchased sources.

ELECTRICAL / ELECTRONICS ENGINEERING TECHNICIAN O*NET Code 17-3023.00

JOB DESCRIPTION	OTHER REPORTED JOB TITLES
Lay out, build, test, troubleshoot, repair and modify developmental and production electronic components, parts, equipment and systems such as computer equipment, electron tubes, test equipment and machine tool numerical controls. Apply principles and theories of electronics, electrical circuitry, engineering mathematics, electronic and electrical testing and physics. Usually work under the direction of engineering staff.	Digital Tech (Digital Technician), Electrical Technician, Electronics Engineering Technician, Electronics Technician, Engineering Technician (Engineering Tech), Failure Analysis Technician (FA Technician), Refurbish Technician (Refurb Tech), Senior Electronics Technician, Technician, Test Technician



10 MOST IMPORTANT TRADITIONAL KNOWLEDGE, SKILLS AND ABILITIES

Electrical Schematics / Circuit Diagrams	Mathematics
Electrical Systems and Components	Measurement
Hand and Power Tools	Original Equipment Manufacturer (OEM) Systems
Wiring	Product Development
Blueprints	Repair

#9

Overall Ranking of Most Difficult Job to Fill

#1

Ranking within the CM Technician & Skilled Trades Job Family

468

Estimated Annual Job Openings for the SE MI Region (2016-2026)

\$24.12

Median Hourly Earnings

ASSOCIATE DEGREE

Most Desired Education Level



17 MOST IMPORTANT SPECIALTY KNOWLEDGE, SKILLS AND ABILITIES

	TI*		TI*
Sensors (Camera, Radar, Lidar, GPS, Inertial)	9.00	Cybersecurity	5.60
Vehicle Connectivity Technologies (4G, DSRC, LTE, WiFi, Bluetooth)	6.40	Aftermarket Installation of ITS Equipment	7.00
Automotive Electronics	9.00	Battery Knowledge	7.00
Automotive Testing and Development	9.00	Communication Infrastructure	7.00
Software System Integration	9.00	Controller Area Networks	7.00
Embedded Systems	8.10	Data Analytics	7.00
Advanced Diagnosis, Service and Repair	7.20	MATLAB / Simulink / dSpace	7.00
Electronic Control Unit	7.20	Programming Languages (C, C++, Java, .NET, Visual Basic)	7.00
Systems Engineering	7.20		

SOFT SKILLS IN DEMAND

Verbal & Written Communication

Adaptability & Flexibility

Critical & Analytical Thinking

Team Focus & Collaboration

* TI-Training Index = Importance/Difficulty; higher **score (>8.0)** indicates greater need for training.



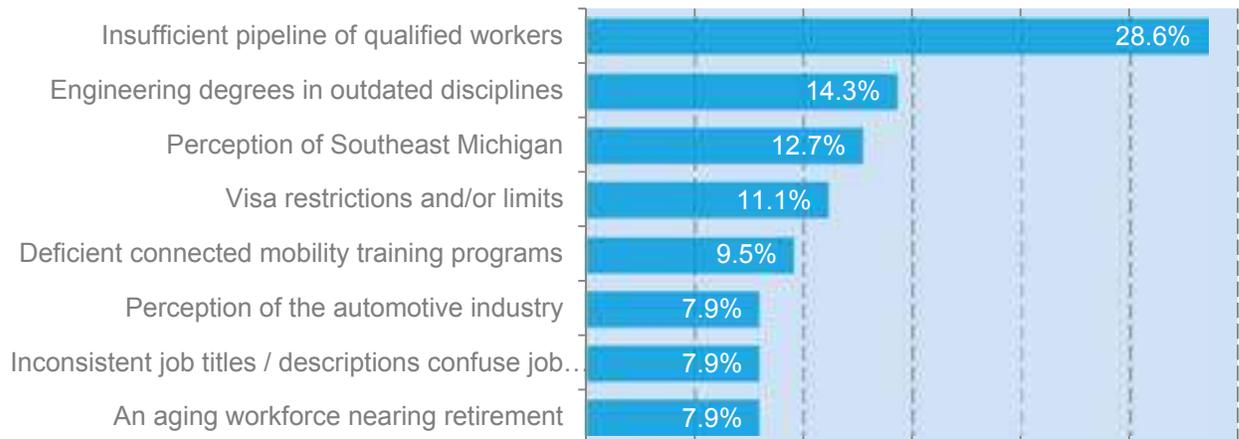
TASKS

- Read blueprints, wiring diagrams, schematic drawings or instructions for assembling electronics units; apply knowledge of electronic theory & components.
- Identify and resolve equipment malfunctions, work with manufacturers / field representatives to procure replacement parts.
- Test electronics units using standard test equipment; analyze results to evaluate performance and make adjustments.
- Adjust or replace defective or improperly functioning circuitry or electronics components.
- Assemble, test or maintain circuitry or electronic components per instructions, technical manuals or knowledge of electronics (using hand or power tools).

REGIONAL HIRING CHALLENGES & REMEDIES

Survey respondents were asked to identify the greatest hiring challenges they face as they attempt to fill open positions. Respondents were invited to select all applicable challenges from a list of eight possible options. Survey findings based upon frequency of responses are shown below.

GREATEST HIRING CHALLENGES FACING EMPLOYERS



Respondents were then invited to elaborate upon the challenges selected and/or to write another challenge based upon individual experience. Comments received through the open-ended response question have been categorized and summarized below.

INSUFFICIENT PIPELINE OF QUALIFIED WORKERS

Southeast Michigan stakeholders are actively pursuing qualified employees to establish, grow and sustain their stake in Connected Mobility but significant challenges hinder their efforts. For today and the immediate short term, engineering professionals with advanced degrees are still in short supply. The challenge of bridging the gap between experienced automotive workers who lack technology skills and college graduates with technical skills but limited automotive knowledge still exists. This challenge is compounded by a lack of Connected Mobility skills, which would allow candidates to make an immediate impact on the rapidly evolving industry. Employers are left to poach qualified candidates from other companies or to recruit from outside the Southeast Michigan region.

Further, state and local municipalities are also seeking technicians and engineers with Connected Mobility skills to meet transportation infrastructure needs. These employers indicate that they cannot compete with the private sector's wages and benefits and this challenge will increase as the Connected Mobility industry grows.

ENGINEERING DEGREES IN OUTDATED ENGINEERING DISCIPLINES

Employers and industry professionals universally indicated that the Connected Mobility ecosystem is very complex, requiring a hybrid of engineering, computer and technical skills. Educational offerings must be updated to reflect current technologies and nimble enough to keep pace with the skills that industry seeks. Respondents expressed frustration with those educational institutions that have not embraced the shift to engineers with skills in critical thinking, software and a systems approach to design and development. Respondents also suggested that young people are not drawn to engineering due to a generally perceived outdated educational approach that is not aligned with the industry's new and exciting needs.

PERCEPTION OF SOUTHEAST MICHIGAN

Michigan is in a heated contest to be recognized as a leader in the Connected Mobility industry. The state is competing for qualified talent with cities like Los Angeles, Seattle, Philadelphia, Austin and San Francisco. Respondents indicated that Southeast Michigan is fighting an uphill recruiting battle due to the perception of the area as an outdated traditional manufacturing environment. Regional stakeholders are challenged with marketing Southeast Michigan as a “cool” place to live and work.

VISA RESTRICTIONS AND/OR LIMITS

Employers are quick to acknowledge their desire to hire local talent but the challenges identified in this study currently make this an unrealistic task. As in the past with other highly technical occupations, employers again find themselves relying on talent from overseas and Mexico. Until the talent shortage is resolved, employers indicate that they are inclined to support relaxing Visa restrictions.

DEFICIENT CONNECTED MOBILITY TRAINING PROGRAMS

At a federal level, the Connected Mobility industry and governmental agencies are collaborating to set new standards, create a common language and write regulations. Education and training providers will be challenged to follow suit. Some employers, in recognition of both a critical need and a belief that they currently know their industry best, are developing their own internal training programs. Developing specialized training programs in general, and particularly those that result in an industry recognized credential, will be a major requirement for meeting employer’s education and training needs.

PERCEPTION OF THE AUTOMOTIVE INDUSTRY

The recruiting challenges presented by the perception of Southeast Michigan are further hindered by an antiquated perception of the automobile industry. Young and talented professionals are drawn to industries that are on the leading edge, dynamic in nature and “cool.” Suppliers and OEMs alike are adamant that Southeast Michigan’s automotive industry, and particularly the Connected Mobility segment, is one of the most exciting places to be. Disseminating that message quickly and effectively is a major challenge.

INCONSISTENT JOB TITLES / DESCRIPTIONS CONFUSE JOB SEEKERS

The Connected Mobility skill set is rapidly evolving and so are the job titles. Human resource professionals are struggling to marry new skills with traditional jobs and often develop job titles and descriptions “on the fly” and without collaboration. Such inconsistencies are causing confusion for job seekers who are unclear about the nature of the job and whether they qualify for the position.

Respondents also used this category to voice concern about the dilemma professional recruiters face. In many cases, technical recruiters lack the fundamental knowledge of the Connected Mobility industry, which leads to a lack of clarity in the recruiting process. They must recognize that recruiting engineering and technical talent is much less a science for the area of Connected Mobility and requires a more sophisticated and subjective approach to their analysis.

AN AGING WORKFORCE NEARING RETIREMENT

The Connected Mobility industry faces the same challenge as many industries nationwide: a current workforce at or nearing retirement. Given the relative infancy of the industry coupled with its equal focus on manufacturing, information technology and infrastructure, the challenge is minimized. The challenge is not so much replacing the knowledge and abilities of those who have left the workforce – it is finding talent that has a unique and evolving skill set.

EMPLOYER PROPOSED REMEDIES TO HIRING CHALLENGES

Employer remedies focused on three key factors:

- The growing need to expand education and training offerings in the Connected Mobility space.
- The recognition of a shift in recruiting methodologies that better reflects the complexity of the Connected Mobility occupations.
- The need for a regional approach to branding Southeast Michigan as a cool place to live and work.

The following are specific remedies that survey respondents suggested within each topic area.

EDUCATION AND TRAINING

- Retraining incumbent workers is an immediate need and provides the quickest short term solution. Given the disruptive nature of Connected Mobility, funding should focus on incumbent workers as much as it is on those who are displaced.
- Education and training programs should embrace the idea of cross training. Not only is it important to bridge the gap between theory and application, but IT professionals now need a comprehensive understanding of vehicle dynamics, structure and mechanics, while vehicle engineers require an understanding of IT connectivity networks, infrastructure and delivery.
- Colleges and universities must start NOW to create and develop certificate and degree programs or, at least, specific courses tailored to the Connected Mobility industry. They should also concentrate on developing a consistent curriculum that focuses on the practices and not just the one or two leading technologies.
- Colleges and universities should develop degree-related mainstream programs or courses in V2X and associated technology.
- The Connected Mobility industry needs IT professionals who understand cybersecurity as well as vehicle networks.
- It is critically important to develop educational programs that build the skills to handle the mobile cybersecurity challenges, particularly in the automobile. The Connected Mobility industry's foundation for cybersecurity must be designed differently. Currently, most security foundations are designed to address vulnerability **when** it occurs. Connected Mobility foundations must be built to avoid vulnerability **before** it occurs.
- More collaboration between colleges and employers on Connected Mobility intern programs is highly recommended.
- Further increase the focus on science, technology, engineering, art and math (STEAM) activities (example FIRST Robotics) in K-12.
- Create more excitement and awareness of vehicle to anything (V2X) technologies at an early age (early middle school) and generate enthusiasm for the engineering profession in general.

RECRUITING

- Employers are poaching for skilled talent. Employers need an influx of qualified local candidates to address industry's needs as Connected Mobility grows.
- Recruiting is even less of a science for Connected Mobility. Qualified candidates are harder to find because very seldom does the recruiter see the perfect person on the resume. Recruiters must become more sophisticated in evaluating talent. In addition to technical knowledge and experience, they must also assess a candidate's decision making ability, entrepreneurial spirit, flexibility and creativity.

REGIONAL BRANDING OF SOUTHEAST MICHIGAN

- To succeed, the Connected Mobility industry needs talent. For the short term, the Southeast Michigan region must develop a plan to "recruit/persuade away" qualified talent from the West Coast.
- Employers consistently suggested that Oakland County, working collaboratively with other areas of the Southeast Michigan region, needs to lead in advancing the area as a "cool" place to live and relocate. Further, a concerted effort should be made to brand the region as a national hub for automotive technology research and development.
- Employers who relocated from the West Coast to Michigan indicated that they were surprised to discover the high number of world class educational institutions. To put this region on the leading edge for high-tech development in Connected Mobility, employers recommended that academic leaders pool their resources and expertise. One specific recommendation was to model Southeast Michigan after the Research Triangle in North Carolina.
- The region should collaborate to polish, if not re-boot, the image of the automotive industry and the engineering profession through a marketing/image campaign focused on the "new" engineer. Develop a campaign that shows engineers with a renewed emphasis on problem-solving, change management, robotics, risk management and project management.

DATA ANALYSIS METHODOLOGY

DATA SCREENING

As a first step in the data analysis process, all variables were screened to assure that the properties of the data met the assumptions of the statistical procedures to be used. Specifically, data values were screened to ensure that there were no errant values (i.e., values that were outside the possible range), that the distribution of values adequately followed the normal bell shaped curve with extreme values occurring with a low frequency and more mid-range values occurring with a high frequency, and that there were no statistical outliers, which are values that are substantially different from the bulk of the values.

Traditional statistical analyses are sensitive to deviations from these distributional properties and, if such deviations are not accounted for, the analyses will produce biased results. As the majority of the data collected from this survey were categorical frequency counts, distributional properties are of less concern for the majority of the analyses reported. The data screening procedures found that both of these continuous variables had distributional properties which sufficiently approximated those assumed by traditional statistical analyses and so no further adjustments or corrections were made.

MISSING VALUE ANALYSIS

One of the most common concerns with large scale survey data collection is missing data. Missing values occur for a wide array of reasons, but they can be categorized into three broad groups based on their statistical properties. The first is missing completely at random (MCAR). This type of missing data occurs when a respondent does not record a value for some reason that does not occur systematically; for example, the respondent might accidentally skip over a question while reading. The important thing is that the reason they did not respond had nothing to do with either their potential response or any characteristic of the respondent. This type of missing data does not negatively impact statistical findings.

The second type of missing data is missing at random (MAR). While this seems an odd distinction from the MCAR category, there is a subtle but meaningful difference. MAR data might be missing for some systematic reason, such as the order of the question on a survey with the amount of missing data increasing towards the end of the survey, but the pattern of missingness is statistically independent of the potential value of the individual's response. In other words, a respondent might have chosen not to answer a question for a specific reason, such as fatigue or running out of time, but the reason had nothing to do with the answer he/she would have given had he/she answered the question. This type of missing data has less impact on the validity of statistical conclusions and adjustments can be made to the analyses to account for this pattern of missingness.

The third type of missing data is referred to as missing not at random (MNAR). This pattern of missingness is a direct function of the potential value of the missing data. Here, the respondent chose not to answer a particular question specifically due to what his/her answer would have been. This final pattern of missing data is highly detrimental to statistical findings and cannot be corrected statistically.

On examination, most of the missingness did appear to be related to the order of questions on the questionnaire, such that as the respondents continued with the survey process they were more likely to skip questions at the end, or end the survey prematurely. Additionally, there did appear to be a considerable amount of missing data that could be considered missing by design. In other words, there were patterns of missing data that were due to the questions not being applicable for a given respondent, given his/her earlier responses. This is not an uncommon finding in branching survey structures, such as was implemented in this study. While various statistical imputation techniques are available for estimating missing values, there was too much globally missing data to implement them in this dataset. In cases where the data seemed to be missing by design there is no need to impute data in any case. In only one set of reported analyses was missing data of any concern, and it was corrected for within the analyses.

CONSULTANT INFORMATION

EdEn Inc., located in Rochester, Michigan, is a project management firm focused on helping clients navigate the economic development landscape. Over the years, EdEn has earned a reputation for excellence as a "bridge" firm connecting Southeast Michigan businesses, educational institutions, workforce development agencies, and economic development entities. As a direct result of experience working with and for regional stakeholders, EdEn has gained a unique working knowledge and perspective on collaborative initiatives. EdEn team members involved in this Oakland County Skills Needs Assessment Project included:

- David Banchiu, President
- Kristina Arnone, Vice President and SNAP Project Manager

In addition, EdEn collaborated with the following individuals to complete various project components:

- Troy Lindner, Founder and President, LTGI.net
- Alec Beardsly, Senior Programmer, LTGI.net
- Dr. Ty Partridge, Associate Professor and Statistician, Wayne State University

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- L. Brooks Patterson, Oakland County Executive
- Oakland County Economic Development & Community Affairs
- Oakland County Workforce Development / Oakland County Michigan Works! Agency
- Oakland County Workforce Development Board
- Oakland County Business Roundtable Workforce & Education Committee
- Michigan Talent Investment Agency
- U.S. Department of Labor

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