Surveying Engineering Technicians

An analysis of the current and future surveying engineering technician workforce in the Delmarva Region

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Mission: The Center for Industry Research & Workforce Alignment, in close partnership with local businesses, government, and academia, delivers future-focused labor-market data and workforce information enabling educational institutions to make proactive and flexible decisions in response to the evolving workforce needs of Delaware’s competitive industries.

Vision: The Center for Industry Research & Workforce Alignment strives to be Delaware’s key source of labor-market insight to enable educational institutions to better align their program and training resources to meet the skill demands of business and industry.

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Introduction
This occupational brief seeks to provide Delaware Tech faculty and administrators with data outcomes and recommendations specific to Surveying Engineering Technology that will aid in course development, curriculum delivery and non-credit training and certifications that will give students an advantage in the job market upon graduation.

This survey data contained within this occupational brief was taken from a larger study that examines several disciplines of engineering technology within a 13-county mid-Atlantic region that includes the three counties in the State of Delaware and ten bordering counties where graduates of Delaware Tech are likely to find employment. The purpose of that labor market study was to examine current and projected employment levels, how these jobs are changing due to a variety of market drivers, and what Delaware Tech and other community colleges can do to ensure that associate degree programs accurately reflect the skill needs of employers in the near future.

This brief primarily highlights data and information specific to surveying engineering technicians gleaned from an extensive workforce survey conducted in July of 2014 from a sample of over 7,400 companies in the region. Survey interviewers fully screened 400 firms for qualifying criteria. Surveying efforts resulted in 252 occupational-level completions from 153 firms. Several firms responded for more than a single occupation. Extrapolations of employment data were conducted to provide readers with a more comprehensive picture of current and projected workforce demographics and to perform a supply/demand gap analysis for the region. In addition, executive interviews were held with 17 individuals from 15 public and private sector firms and existing sources were researched for secondary supporting data.

A total of 46 employers responded to the regional survey for surveying engineering technicians. The proceeding sections of this brief provide an overview of data outcomes and executive interviews held with employers of this occupation. Aggregate data for all occupations such as market drivers, soft skill needs, and can be found in the full labor market study available on the CIRWA web page at www.dtcc.edu/cirwa.

Surveying Engineering Technicians - SOC 17-3031

Occupational Definition
Adjust and operate surveying instruments, such as the theodolite and electronic distance-measuring equipment, and compile notes, make sketches and enter data into computers.1

Figure 1 - Hiring Difficulty
Sixty-six percent of the 46 firms that responded for surveying engineering technicians find it difficult or very difficult to find a quality candidate to fill their position vacancies. Eighty-three percent find it at least somewhat difficult to find the right candidate.

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Table 1 - Current and Projected Employment – SURVEY DATA (n=46)
The data in the table below reflects data from survey responses only. Projected job change, retirements and turnover were combined to determine total 3YR and annual openings.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>159</td>
<td>177</td>
<td>+18 (11%)</td>
<td>12 (7.5%)</td>
<td>20 (13%)</td>
</tr>
</tbody>
</table>

Table 2 - Universe of Firms and Employment – EXTRAPOLATED REGIONAL ESTIMATES
From the survey’s qualifying incidence rate (percentage of firms screened that hire the occupation), CIRWA was able to determine the estimated total number of firms in the region that employ surveying engineering technicians. After eliminating outliers out 2 standard deviations, CIRWA utilized adjusted employment means to extrapolate regional estimates for current and projected employment. Projected job change, retirements and turnover were combined to determine total 3YR and annual openings.

<table>
<thead>
<tr>
<th>Total Firms that Employ Surveying Eng. Technicians</th>
<th>Current Employment</th>
<th>Projected Employment in 3 years</th>
<th>3YR Projected Openings</th>
<th>Total 3YR Openings incl. Growth</th>
<th>Annual Openings over next 3 yrs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>234</td>
<td>569</td>
<td>608</td>
<td>+39 (6.9%)</td>
<td>39 (6.9%)</td>
<td>68 (12%)</td>
</tr>
</tbody>
</table>

Figure 2 - Educational Attainment of the Current Workforce – Survey Data (n=46)
CIRWA was able to obtain current educational attainment data for approximately 95% of the surveying engineering technician workforce. Fifty percent of the workforce currently does not possess an associate degree. These individuals may hold some form of certification or vocational training while many may have also learned through on-the-job training. Roughly 30% of the workforce does have an associate degree and 15% of workers hold a bachelor’s degree.
Figure 3 - Educational Hiring Requirements and Preferences – Survey Data (n=46)
The figures below demonstrate survey respondents’ required versus preferred educational attainment for a surveying engineering technician position in their firm. The data shows that 67% (31 firms) only require a high school diploma for employment; however, 61% (28 firms) would prefer job candidates have an associate degree for employment. In addition, 28% would prefer job candidate have a bachelor’s degree. Of the 46 firms that responded to the survey, 41 (89%) indicated that they would prefer to hire at least one education level above what they currently require.

![Bar Chart](chart1.png)

Figure 4 - Entry-Level Wages – Survey Data (n=46)
Nineteen of 46 (41%) firms that employ surveying technicians offer an entry-level salary between $30,000 and $39,000. Three firms offer starting salaries of $50,000 a year or higher.

![Bar Chart](chart2.png)

Figure 5 – Barriers to Hiring Qualified Surveying Engineering Technicians – Survey Data (n=46)
Sixty-six percent (66%) of firms that employ surveying technicians find it either difficult or very difficult to find a highly-qualified worker for these positions. Respondents were asked to indicate all of the challenges they encounter during the resume review and interview processes. Responses are summarized below:

- Lack of relevant work experience: 79%
- Lack of required education/training: 63%
- Lack of job position-related technical skills: 55%
- Lack of "soft" or "employability" skills: 47%
- Lack of applicants: 53%
- None of the above: 0%
Figure 6 – Top Technical Skill Needs based on Survey Data (n=46)
The figure to the right illustrates the skills most frequently selected as “Extremely” or “Very Important” on a 5-point scale with an option for “Not applicable”. Larger circles reflect higher response counts. Of the 46 companies that responded to this question for surveying technicians, Survey Grade GPS Equipment and GPS Systems were both chosen by 93% of firms. Other frequently selected items include Surveying Data Collectors, Total Station Equipment and Automatic Level.

Figure 7 - Preferred and Required Industry Certifications – Survey Data (n=46)
Survey completers were provided with a list of industry recognized certifications for surveying technicians and asked to indicate which certifications they require for employment and which they prefer. Employers were also provided a “neutral” option if they had no preference. A summary of responses is provided below:

<table>
<thead>
<tr>
<th>Certification</th>
<th>Required</th>
<th>Preferred</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSHA 10-Hour</td>
<td>3</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td>OSHA 30-Hour</td>
<td>9</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>NICET Stormwater and Wastewater</td>
<td>1</td>
<td>14</td>
<td>31</td>
</tr>
<tr>
<td>NSPS Certified Survey Technician (CST) Level 1</td>
<td>3</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>DNREC Contractors Certification (Blue Card)</td>
<td>9</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>LEED Green Associate</td>
<td>7</td>
<td></td>
<td>39</td>
</tr>
</tbody>
</table>

There are only a few firms in the region that require industry recognized certifications for employment as a surveying technician. The most in-demand certification is the NSPS Certified Survey Technician (CST) Level 1 with three employers requiring the certification for employment and another 27 that prefer it for hire. The majority of firms responded “neutral” to all other certifications listed.
Figure 8 - Top Software Needs for Surveying Engineering Technicians – Survey Data (n=46)
In an effort to determine what software programs students should be exposed to, employers of surveying technicians were given a list of software commonly used in the industry. They were asked to select all of the programs that their technicians use on a day-to-day basis. The chart below provides a summary count of the selected software:

<table>
<thead>
<tr>
<th>Software</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>AutoDesk Civil 3D / Map3D</td>
<td>30</td>
</tr>
<tr>
<td>AutoCAD Classic</td>
<td>24</td>
</tr>
<tr>
<td>Carlson Civil Suite (Civil, Survey,...)</td>
<td>17</td>
</tr>
<tr>
<td>Topcon TopSurv</td>
<td>16</td>
</tr>
<tr>
<td>HydroCAD</td>
<td>15</td>
</tr>
<tr>
<td>Survey Pro in TDS Recon Data Collectors</td>
<td>10</td>
</tr>
<tr>
<td>ESRI ArcGIS</td>
<td>10</td>
</tr>
<tr>
<td>Microstation</td>
<td>9</td>
</tr>
<tr>
<td>Bentley civil and survey programs</td>
<td>8</td>
</tr>
<tr>
<td>Bently storm and sanitary programs</td>
<td>7</td>
</tr>
<tr>
<td>Win TR-55</td>
<td>5</td>
</tr>
<tr>
<td>Win TR-20</td>
<td>4</td>
</tr>
<tr>
<td>Other CAD software</td>
<td>4</td>
</tr>
</tbody>
</table>

Employer Insight based on Executive Interviews
Employers of surveying technicians cited advancing technology as one of the most dominant factors impacting skill needs for this occupation. In particular, the increasing need for GIS knowledge and experience is driving demand for workers that can demonstrate skill using Google Earth and ArcGIS. Firms that employ both civil and surveying technicians emphasized the importance of making students more aware of how civil and surveying technology overlap in the field. They suggested that more interaction between these programs, as well as with construction management, may be beneficial to students. Two firms that specialize in both surveying and civil engineering commented that their civil engineering technicians tend to absorb much of the work that a typical surveying technician might do on the job indicating that for some firms in the region, there is a significant amount of crossover between the two occupations while in the field.

Supply and Demand Gap Analysis
Table 3, on the next page, provides data on regional graduates for surveying technicians. An annual average was calculated by pulling program (CIP code) completion data from the IPEDS database for a 3-year period (2011, 2012, and 2013) for all schools within the region that offer these programs and report completions to IPEDS. These average annual completions were added together to produce a total annual completion number for the region.
Delaware Tech was found to be the only technical college in the region producing surveying technician graduates. Over the past 3 years, there have only been 3 graduates from the program for an average of one graduate annually. However, it is important to note that the surveying technology program at Delaware Tech is still relatively new and there were 10 graduates from the program in May of 2014. Given that IPEDS was not updated with 2014 graduates at the time of this analysis, CIRWA did not factor in 2014 graduates.

Table 3 - Regional Annual Program Completions

<table>
<thead>
<tr>
<th>CIP Codes &amp; Descriptions</th>
<th>Regional Educational Programs</th>
<th>Delaware Technical Community College</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.11 - Other Engineering Related Technologies</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>15.1102 - Surveying Technology/Surveying</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

The extrapolated data below in Table 4 reflects a 3-year supply gap of 143 technicians or about 48 technicians annually. However, it is important to remember that currently, about 50% of this workforce holds less than an associate degree. Therefore, this supply gap does not specifically represent a shortage of associate degree-prepared workers, but rather people to fill these positions in general. This possible shortage could force employers to continue to hire workers without a formal degree for the foreseeable future despite 91% of employers preferring to hire an associate degree or higher. In addition, growth projections may be slightly inflated due to inherent bias of self-reported data.

Table 4 - Extrapolated Employment Demand versus Supply

<table>
<thead>
<tr>
<th>Current Employment</th>
<th>Employment in 3 Years</th>
<th>3YR Growth</th>
<th>3YR Retirements</th>
<th>3YR Turnover</th>
<th>Total 3YR Openings</th>
<th>3YR Completions</th>
<th>3YR Shortage</th>
<th>Annual Shortage</th>
</tr>
</thead>
<tbody>
<tr>
<td>569</td>
<td>608</td>
<td>+39 (6.9%)</td>
<td>68 (12%)</td>
<td></td>
<td>146</td>
<td>3</td>
<td>(143)</td>
<td>(48)</td>
</tr>
</tbody>
</table>

Conclusions and Recommendations

Overall, the employment outlook for surveying engineering technicians in the region appears positive. Survey completers are generally optimistic about their ability to add jobs to the workforce over the next three years. Of the 247 firms screened that do not currently employ any of the engineering technicians examined in the survey, seven firms indicated that they plan to hire for 11 new surveying engineering technician positions over the next 3 years. These conclusions were taken from the full study and have been adapted to reflect findings specific to surveying engineering technology.

Conclusions

1. The region is not producing enough of these types of technicians to fill the replacement or growth need projected through 2018. Table 1 shows that survey takers are predicting approximately 32 position openings over the next 3 years due solely to replacements needed within their firms. Without extrapolating the data and
without factoring in any growth, the region is still not producing enough graduates to fill the predicted number of replacement openings identified by survey completers. Until the region is able to increase the supply of associate degree-prepared workers to enter these jobs, employers will be forced to continue hiring individuals that may not have the level of educational preparation and experience they desire for employment at their firms.

2. **Computer technology, software applications and knowledge of mandates and regulations are changing the “must-have” skills needed for these jobs.** Forty-nine percent (49%) of all survey respondents feel that advancements in technology, particularly software packages, is a key factor that will impact technical skill need over the next few years. The integration of hand-held technology into everyday work responsibilities and the continued advancement of 3D drafting, GPS/GIS applicability and project management software are changing the way these firms do business and remain competitive in the marketplace. As a result, knowledge of these software programs is in high-demand and, over the next few years, could become “must-have” for employment. In addition, federal, state and local codes, regulations and mandates such as Delaware’s new stormwater management regulations are constantly changing and surveying technicians must put in the necessary time and effort to remain knowledgeable on all of these requirements to avoid heavy fines and penalties for their employer or clients.

3. **On-site work experience (preferably on a construction site) gives new program graduates a significant advantage over job applicants lacking this experience.** Eleven out of 15 firms (more than 70%) interviewed noted that they prefer to see some sort of construction experience on a job applicant’s resume. While several of these jobs focus on design or activities specific to one particular element of a construction project, familiarity with scheduling, budgeting, safety protocol and the sequence of activities that occur on a job site gives workers the perspective needed to plan, anticipate and predict in their specialty areas. It also exposes the student to several of the local, state, and federal codes, standards and regulations that govern these industries.

4. **Employers in the region are cautiously optimistic about the growth and resurgence of surveying engineering technology jobs.** Survey data clearly shows that firms in the region are predicting growth of their workforce over the coming 3 years. Raw survey data shows an overall 3-year growth rate of roughly 11% for these jobs. Much of this growth they attribute to the slow, but steady, recovery of the economy and stricter regulatory requirements. This is good news for educational institutions that are faced with the opportunity to provide employers throughout the region with highly-skilled, experienced workers that not only meet their hiring requirements, but also their preferences for hire.

**Recommendations**

The recommendations below are listed so as to correspond to the conclusions listed above and can be generalized into two broad objectives:

- Closing the Gap in Projected Demand; and
- Improving Educational Programs to Better Meet Employer Needs.

1. **Promote involvement and partnerships with K-12 and other related organizations in an effort to increase teachers’, counselors’, parents’, and middle and high school students’ awareness of engineering technology options available to them.** Addressing a shortage of workers to meet demand begins with targeted efforts to boost awareness, interest, and enrollment in these programs. These efforts can be bolstered by developing statewide and regional strategies that engage not only K-12 education, but also organizations such as the Delaware STEM Council, trade associations, and other business and economic development agencies. Several survey respondents indicated that one of the drivers for increased technician employment will be greater
recognition of the affordability and return on investment of 2-year degrees. The College would be well-served to emphasize these aspects to individuals looking to enter into a STEM occupation or who are currently in the process of choosing a career path.

2. **Continue working toward developing a 4-year engineering technology degree within the State of Delaware to stimulate more connected degree opportunities for Delaware Tech graduates in these fields.** While survey data shows that only about 30% of employers prefer someone with a bachelor’s degree or higher to fill survey technicians job openings, employers that were interviewed for this scan all agreed that creating more opportunity for students to continue their education seamlessly into a bachelor’s degree program may help draw more students into these programs, thus alleviating the projected supply gap. Currently, several of these programs offer a transfer opportunity to either a business management or an organizational management bachelor’s degree, but none transfer to a bachelor’s degree such as Surveying Engineering/Engineering Technology.

3. **Consider adopting a cooperative workplace education experience or internship as a requirement for graduation.** Similar to the last CIRWA study focused on Mechanical and Electrical-related engineering technologies, interviewees were surprised to find that this is not already a requirement for Delaware Tech graduates given that many employers are moving away from hiring graduates without relevant experience. This requirement would help Delaware Tech accomplish the following:
   a. Expand the College’s network of companies that hire program graduates;
   b. Expose a greater number of companies to the variety of programs offered at the college;
   c. Demonstrate the skills and abilities of Delaware Tech program graduates over other hiring options available to companies;
   d. Provide students with relevant, real-life workplace experiences and situations that will enable them to be more competitive and attractive to local employers upon graduation; and
   e. Open students up to the possibility of securing employment prior to graduation which may, in effect, provide increased incentive to complete the program and improve graduation and placements rates for the College.

2. **Consider curriculum updates or changes that would place increased emphasis on exposing students to software applications, state codes and regulations and the importance of developing interpersonal and networking skills.** Programs may be well-served to integrate more exercises that utilize the software programs and applications identified by employers in this scan. In addition, emphasizing the importance and implications of federal, state, and local mandates and codes will help students recognize that continually staying updated and knowledgeable about regulatory changes is a requirement of these jobs. Finally, exercises or group projects that focus on developing a student’s professionalism and confidence as well as business and marketing skills will help enable graduates to facilitate relationships and catalyze business opportunities for their employer.

The full labor market scan available at [www.dtcc.edu/cirwa](http://www.dtcc.edu/cirwa) contains more generalized data for surveying engineering technology and other related occupations. Supplemental employment data for surveying engineering technicians is provided in Appendix B of the full study. For further detail on the methodology of extrapolating employment estimates, please see the *Methodology* section in Appendix C of the full study.
Delaware Technical Community College established the Center for Industry Research & Workforce Alignment (CIRWA) in October 2011 as part of a U.S. Department of Labor Trade Adjustment Assistance Community College Career Training Grant.

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