

# State of Maryland Construction Industry Bachelor's Degree Demand Analysis

*Prepared for*  
Maryland Center for Construction Education and Innovation (MCCEI)

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June 26, 2015



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## 1.0 Executive Summary

The Regional Economic Studies Institute (RESI) of Towson University, in partnership with HR&A Advisors, Inc. (HR&A), has been tasked by the Maryland Center for Construction Education and Innovation (MCCEI) to conduct an analysis on the annual level of demand for Bachelor's degree candidates in Maryland's construction/built environment industry from 2015 to 2020. This research builds on the 2012 report, *The Critical Path*, where MCCEI outlined major trends of the construction industry in Maryland.<sup>1</sup>

RESI's demand analysis focuses on the labor needs of the Maryland construction industry from 2015 to 2020 in contrast to the expected number of graduates from Maryland academic institutions that currently offer construction/built environment Bachelor's degree programs. To do this, RESI, in partnership with HR&A, collected and analyzed data on the hiring trends of the Maryland construction/built environment industry from 2010 to 2015 and forecasted from 2015 to 2020. In addition, RESI, in partnership with HR&A, collected data on the graduation rates for the in-state academic institutions that can supply the industry. Understanding that the industry demand may be filled by graduates of out-of-state institutions, RESI also collected data on the regional out-of-state academic institutions that can also supply this industry.

Using these data, RESI estimated industry demand through 2020, assessed the economic impacts of employing in-state graduates versus out-of-state graduates, and provided recommendations based on out-of-state academic institution best practice cases. The key findings outlined in this report include the following:

- Despite the recession's significant impact on the construction industry in Maryland, the number of employees in the industry is starting to rebound. However, it has yet to reach pre-recession numbers.
- In terms of pay, some occupations within Maryland's construction industry are rebounding faster than others, with construction managers almost reaching their pre-recession pay in 2013.
- RESI forecasted that the Maryland construction industry will need to fill 9,715 positions requiring a Bachelor's degree from 2015 to 2020.
- Currently, four academic institutions in Maryland offer Bachelor's degree programs in the construction/built environment field. These programs focus primarily on civil engineering and secondarily on construction management.
- Holding their current graduation rates from 2015 to 2020, these institutions will provide 170 graduates per year during this period.
- The Maryland construction industry's demand for graduates with relevant Bachelor's degrees exceeds the number of graduates produced by the existing construction/built

<sup>1</sup> Maryland Center for Construction Education and Innovation, "The Critical Path: Positioning Maryland as an Innovation Leader in the Global Construction Industry," 3, accessed August 26, 2014, <http://www.mccei.org/mccei/Resources/TheCriticalPath.aspx>.



environment programs at Maryland academic institutions. This trend has resulted in the Maryland construction industry hiring graduates from out-of-state academic institutions.

- Taking into account the four possible trajectories that graduates entering the

Maryland construction industry can take, RESI found that the economic impacts (jobs, output, and wages) per graduate hired are 51.9 percent higher for students who earn their Bachelor's degree in Maryland and are retained in the Maryland construction industry as compared to graduates who earn their Bachelor's degree at out-of-state institutions and enter the Maryland construction industry.

- Many employers in the Maryland construction industry at both large and small firms focus their recruitment efforts on out-of-state academic institutions by attending career fairs, networking events, and open days.
- Best practice cases for out-of-state academic institutions providing high quality Bachelor's degree graduates to the Maryland construction industry identified in this report include
  - Drexel University,
  - Pennsylvania State University–Harrisburg,
  - Virginia Polytechnic Institute and State University, and
  - Pennsylvania College of Technology.
- The recommendations to improve the construction/built environment programs at in-state institutions are based on the information gleaned from the best practices cases as well as suggestions from the Maryland construction industry interviews, both of which highlight industry stereotypes and the need for interaction between academic institutions and industry firms.

This report and all of its contents will serve as an overview of this analysis.

## 2.0 Introduction

The Regional Economic Studies Institute of Towson University (RESI) in partnership with HR&A Advisors, Inc. (HR&A) has been tasked by the Maryland Center for Construction Education and Innovation (MCCEI) to conduct a demand analysis on the annual level of demand for Bachelor's degree candidates in Maryland's construction/built environment industry from 2015 to 2020. This research builds on the 2012 report, *The Critical Path*, where MCCEI outlined major trends of the construction industry in Maryland.<sup>2</sup>

### 2.1 The Critical Path—The Construction Industry in Maryland

The national and Maryland construction industries have seen vast changes from 2008 to 2015 during the height of and in the aftermath of the Great Recession.<sup>3</sup> Many of these changes reflect systemic changes in the economy. For example, there is an increased emphasis on new technologies, updated building techniques, and environmentally aware or “green” practices within the industry.<sup>4</sup> The industry is also greatly affected by the business cycle, as demand for new and renovated structures is what ultimately fuels the industry. Not surprisingly, the crash of the housing market and restrictions on government spending in light of the Great Recession have negatively impacted the industry and facilitated many of the changes being seen today.<sup>5</sup>

In its 2012 report, *The Critical Path*, MCCEI outlined major trends of the construction industry in Maryland.<sup>6</sup> As indicated in the report, there is an ongoing shortage of skilled craftspeople and supervisors, despite cyclical declines in the construction industry.<sup>7</sup> Furthermore, the workers who are available lack basic skills, many of which will be necessary to adapt to the ever-evolving industry.<sup>8</sup> The construction industry is at the forefront of major changes with respect to how the construction process is carried out, as indicated by the emergence of technologies such as building information modeling (BIM) and modular or prefabricated construction.<sup>9</sup> As these technologies become more commonplace, there will be an increased need for workers comfortable with these methods. Given the industry's current unmet demand for qualified workers, this shortage will only become more pronounced. The findings from MCCEI's 2012 study are supported by other sources, including a survey conducted by the Associated General Contractors of America.<sup>10</sup>

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<sup>2</sup> Maryland Center for Construction Education and Innovation, “The Critical Path,” 3.

<sup>3</sup> *Ibid.*, 3.

<sup>4</sup> *Ibid.*, 9.

<sup>5</sup> *Ibid.*, 12–13.

<sup>6</sup> *Ibid.*, 3.

<sup>7</sup> *Ibid.*, 9.

<sup>8</sup> *Ibid.*, 25.

<sup>9</sup> *Ibid.*, 18.

<sup>10</sup> Lucia Mutikani, “Skilled Worker Shortage Looms for U.S. Construction Firms,” *Reuters*, January 21, 2014, accessed April 8, 2015, <http://www.reuters.com/article/2014/01/21/usa-economy-construction-idUSL2NOKV1CE20140121>.

Another significant component of the *Critical Path* is the discussion of Maryland’s role as the construction industry moves forward. Of particular note is the lack of appropriately educated workers, especially for management and other higher-paying positions, from Maryland academic institutions.<sup>11</sup> In fact, the study notes that very few Bachelor’s degree-level hires come from Maryland colleges and universities—only thirty percent of college graduate recruits studied at Maryland-based schools.<sup>12</sup> This leads to questions regarding the supply of graduates in the Maryland system and the demand from the industry that will be addressed in this report, including the following:

1. How many Maryland construction/built environment graduates are being produced annually?
2. How many construction/built environment hires (that require Bachelor’s degree) have been needed by the construction industry in Maryland?
3. Where are the non-Maryland graduates that have entered the Maryland construction industry coming from?
4. Is the Maryland construction demand filled externally solely due to supply or do other factors contribute as well?

Focusing on Maryland, this report aims to answer these questions in relation to the existing demand in the construction industry as well as forecasting the demand of the construction industry over the next five years, until 2020.

## 2.2 Defining the Industry

For the purposes of the analyses in this report, RESI has developed a definition of the Maryland construction and built environment industry based upon MCCEI’s input and expertise. The definition is based on the North American Industrial Classification System (NAICS) at the six-digit level. Figure 1 outlines the NAICS codes for firms included in the definition. Data on the number of establishments for each industry group in Maryland come from the 2013 Quarterly Census of Employment and Wages (QCEW) database from the Bureau of Labor Statistics (BLS).

**Figure 1: Maryland’s Construction Industry**

NAICS Code	Industry Group Name	MD Establishments (2013)
2361	Residential Building Construction <ul style="list-style-type: none"> <li>• New single-family general contractors (236115)</li> <li>• New multi-family general contractors (236116)</li> <li>• New housing for-sale builders (236117)</li> <li>• Residential remodelers (236118)</li> </ul>	4,606
2362	Nonresidential Building Construction <ul style="list-style-type: none"> <li>• Industrial building construction (236210)</li> <li>• Commercial and institutional building construction (236220)</li> </ul>	1,025
2371	Utility System Construction	408

<sup>11</sup> Maryland Center for Construction Education and Innovation, “The Critical Path,” 26.

<sup>12</sup> Ibid, 10.

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NAICS Code	Industry Group Name	MD Establishments (2013)
	<ul style="list-style-type: none"> <li>Water and sewer line related construction (237110)</li> <li>Oil and gas pipeline and related construction (237120)</li> <li>Power and communication line and related construction (237130)</li> </ul>	
2372	Land Subdivision <ul style="list-style-type: none"> <li>Land subdivision (237210)</li> </ul>	145
2373	Highway, Street, and Bridge Construction <ul style="list-style-type: none"> <li>Highway, street, and bridge construction (237310)</li> </ul>	186
2379	Other Heavy and Civil Engineering Construction <ul style="list-style-type: none"> <li>Other heavy and civil engineering construction (237990)</li> </ul>	178
2381	Foundation, Structure, and Building Exterior Contractors <ul style="list-style-type: none"> <li>Poured concrete foundation and building exterior contractors (238110)</li> <li>Structural steel and precast concrete contractors (238120)</li> <li>Framing contractors (238130)</li> <li>Masonry contractors (238140)</li> <li>Glass and glazing contractors (238150)</li> <li>Roofing contractors (238160)</li> <li>Siding contractors (238170)</li> <li>Other foundation, structure, and building exterior contractors (238190)</li> </ul>	1,921
2382	Building Equipment Contractors <ul style="list-style-type: none"> <li>Electrical contractors and other wiring installation contractors (238210)</li> <li>Plumbing, heating, and AC contractors (238220)</li> <li>Other building equipment contractors (238290)</li> </ul>	4,406
2383	Building Finishing Contractors <ul style="list-style-type: none"> <li>Drywall and installation contractors (238310)</li> <li>Painting and wall covering contractors (238320)</li> <li>Flooring contractors (238330)</li> <li>Tile and terrazzo contractors (238340)</li> <li>Finish carpentry contractors (238350)</li> <li>Other building finishing contractors (238390)</li> </ul>	2,637
2389	Other Specialty Trade Contractors <ul style="list-style-type: none"> <li>Site preparation contractors (238910)</li> <li>All other specialty trade contractors (238990)</li> </ul>	1,185
5413	Architectural, Engineering, and Related Services <ul style="list-style-type: none"> <li>Architectural services (541310)</li> <li>Landscape architectural services (5413120)</li> <li>Engineering services (541330)</li> <li>Drafting services (541340)</li> <li>Building inspection services (541350)</li> </ul>	2,662

Sources: BLS QCEW, NAICS, RESI

This is a robust definition that encompasses an array of construction and built environment sectors. It should be noted that not all of these sectors within the wider construction industry will hire graduates with Bachelor’s degrees. For example, NAICS 238310 (Drywall and installation contractors) would most likely hire tradespeople. Alternatively, the NAICS 541310 (Architectural Services) would most likely hire those with graduate qualifications. The following report will focus on the demand for Bachelor’s degree holders by the construction industry in Maryland as well as the supply of graduates who are solely Bachelor’s degree holders.

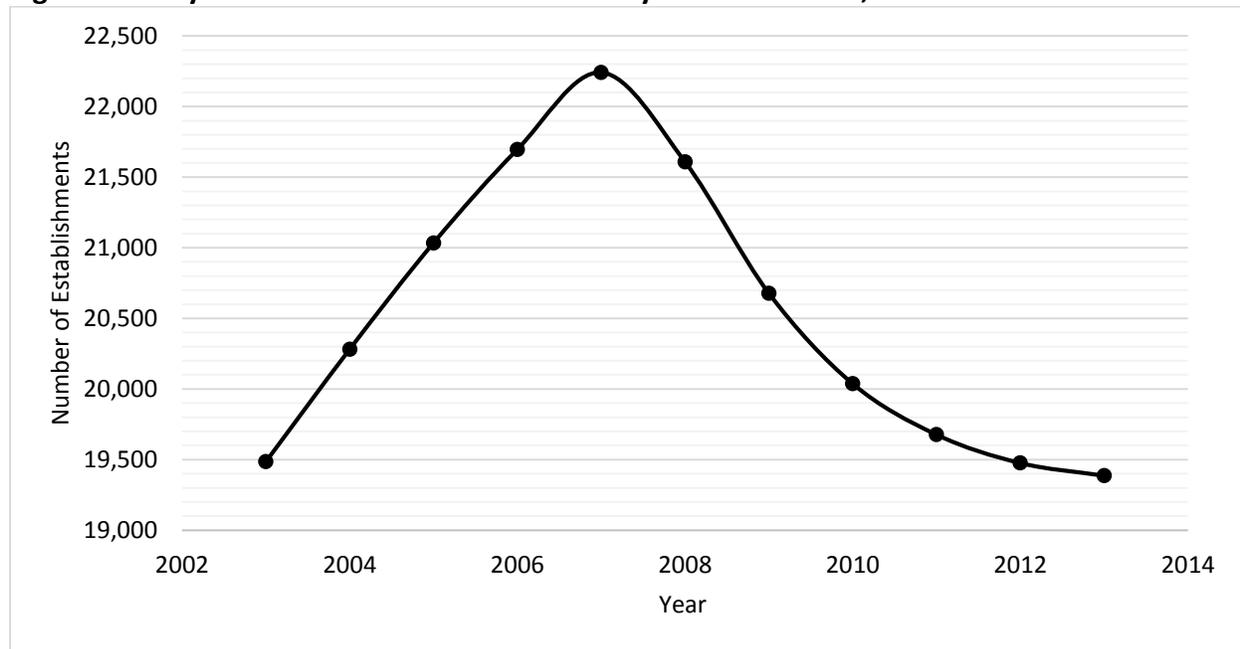
### 3.0 Trends in the Maryland Construction Industry

Using secondary data that RESI collected, the aim of this section is to define the construction industry in Maryland, explain the historic demand for graduates in the construction industry in Maryland, and review the major suppliers of construction/built environment graduates in Maryland academic institutions.

#### 3.1 Construction in Maryland—Establishments, Employment, and Wages

Using the definition detailed above in Section 2.0, the number of establishments in Maryland’s construction industry over time is shown in Figure 2. Using QCEW data from 2003 to 2013, Figure 2 shows recent historic trends.

**Figure 2: Maryland Construction Private Industry Establishments, 2003–2013**



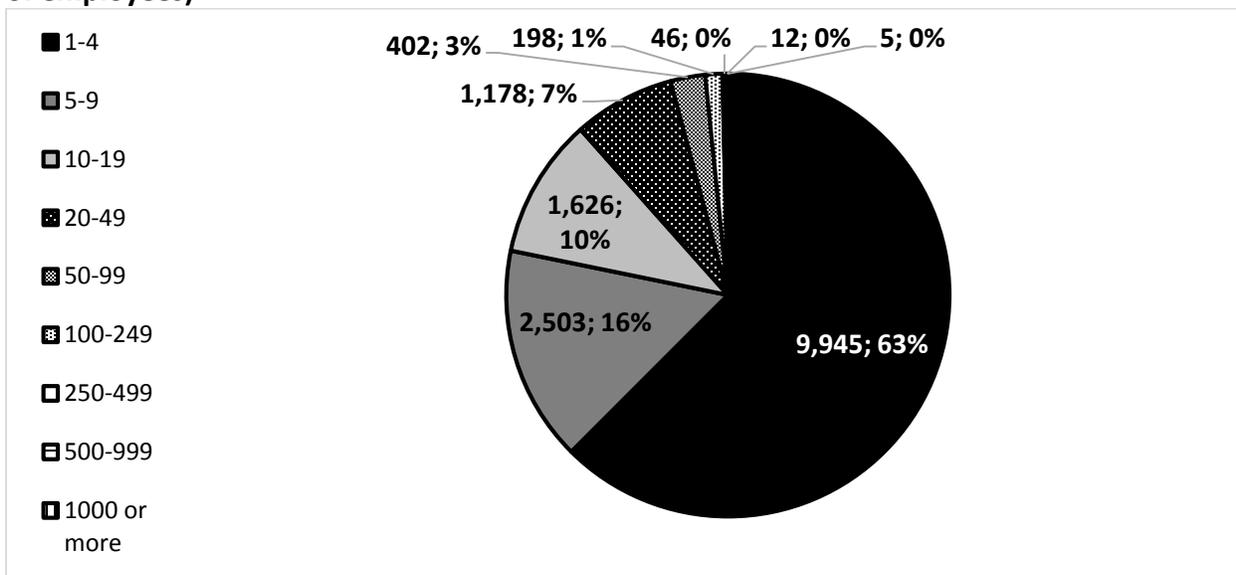
Sources: BLS QCEW, RESI

Figure 2 shows the number of establishments in Maryland’s construction private industry from 2003 to 2013. The number of establishments peaked in 2007, before the housing market crash

and recession of 2008. While the number of establishments declined from 2007 onward, it is important to note that the rate of decline is faster from 2008 to 2010, and the rate of decline slowed from 2011 onward.

Also of note is the composition of the Maryland construction industry by the size of the establishments of which it is comprised. The composition of the Maryland construction industry by establishment size, measured by the number of employees that an establishment has, is shown in Figure 3.

**Figure 3: Composition of the Maryland Construction Industry by Establishment Size (number of employees)**



Sources: US Census Bureau County Business Patterns, RESI

Different data sources have unique systems for reporting data, which can result in inconsistencies between data sets. For example, QCEW data are reported monthly or quarterly and come from primary survey data, whereas County Business Pattern data are reported annually and come from data provided by the Internal Revenue Service.<sup>13</sup>

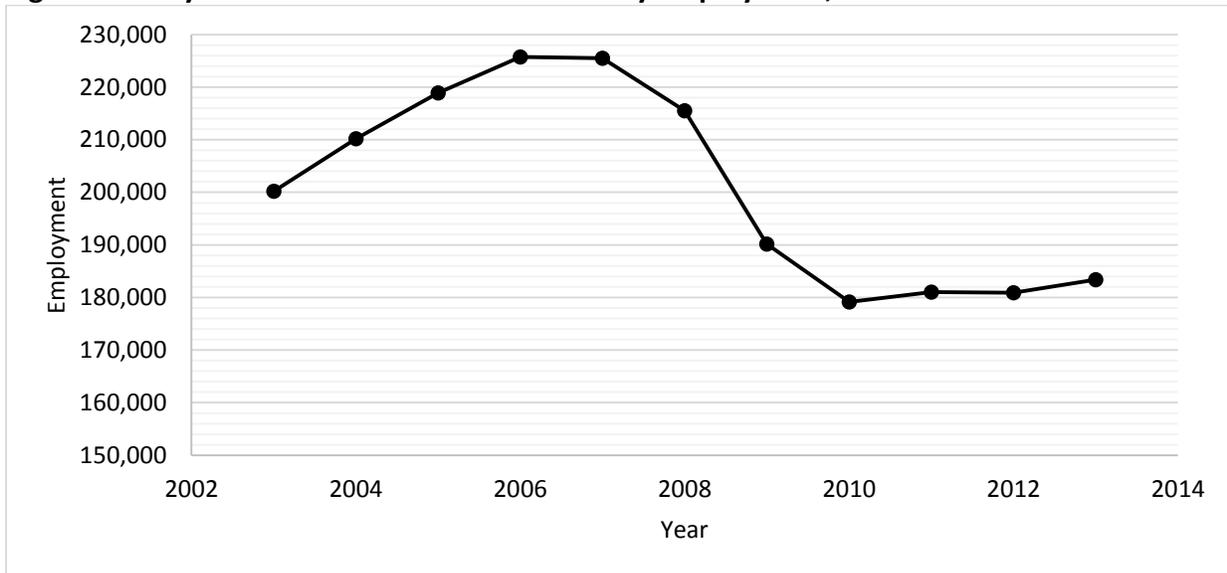
Figure 3 shows the composition of the Maryland construction industry by the size of the establishment, as measured by the number of employees at the establishment. The majority of establishments, 63 percent, or almost 10,000 establishments, in Maryland employ between one and four individuals, while 79 percent of the industry is comprised of companies with fewer than ten employees. These percentages highlight the composition of the construction industry

<sup>13</sup> Randy Becker, Joel Elvery, Lucia Foster, C.J. Krizan, Sang Nguyen, and David Talan, "A Comparison of the Business Registers Used by the Bureau of Labor Statistics and the Bureau of the Census," *Bureau of Labor Statistics*, August 2005, <http://www.bls.gov/ore/pdf/st050270.pdf>.

in Maryland with many small firms employing a small number of employees and a few large firms employing a large number of employees. Please note that these data reflect the 2012 Maryland construction industry as defined in Section 2.0.

Employment in the Maryland construction industry is cyclical in nature. As such, employment numbers for the industry follow economic business cycle patterns, as shown in Figure 4.

**Figure 4: Maryland Private Construction Industry Employment, 2003–2013**

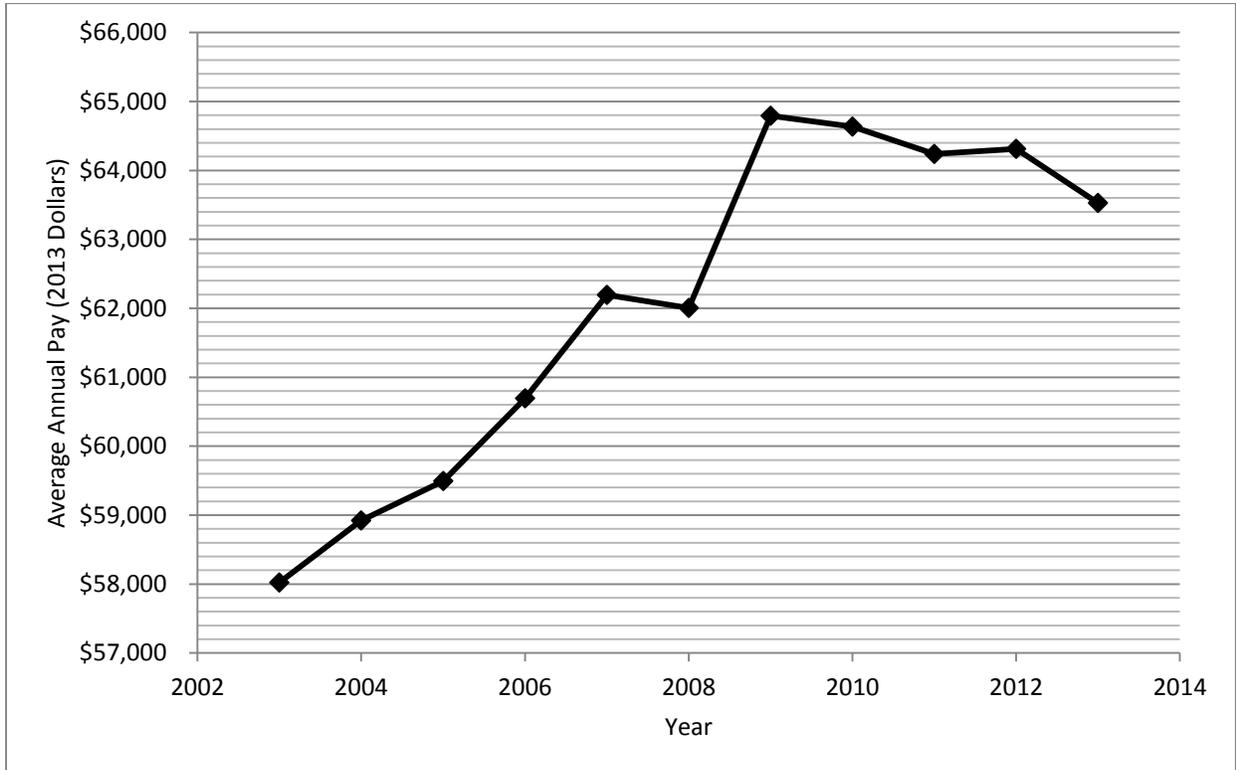


Sources: BLS QCEW, RESI

As shown in Figure 4, employment peaked at over 225,000 workers between 2006 and 2007, immediately before the housing market crash. The subsequent decline is to be expected given the interconnection between construction and real estate. It is interesting to note that, despite the economic recovery, employment in Maryland's construction industry has remained far below pre-recession levels, reaching only 183,395 workers in 2013. The same crash and lack of recovery depicted in Figure 4 with employment in the Maryland construction industry is also depicted in Figure 2 with establishments in the Maryland construction industry. Both the employment and the establishments listed in Figures 2 and 4 are derived from QCEW data.

In addition to total employment in the industry, it is also important to consider workers' wages. The average annual pay for workers in Maryland's construction industry from 2003 to 2013, presented in 2013 dollars, is shown in Figure 5.

Figure 5: Maryland Private Construction Industry Average Annual Pay (2013 Dollars), 2003-2013



Sources: BLS QCEW, RESI

As shown in Figure 5, the average annual pay for workers in the construction industry in Maryland increased in real terms from 2003 to 2013, though there were fluctuations throughout the decade. The average annual pay across the construction industry as defined by the NAICS codes in Figure 1 was approximately \$58,000 in 2003 and rose to over \$63,500 by 2013. The average annual pay peaked in 2009 at almost \$65,000, which coincides with the end of the recession. It should be noted that the salary data in Figure 5 is across the construction industry as defined in Figure 1, so it includes tradespeople, engineers, and architects.

The data presented in this section highlights the economic impact that the Great Recession continues to have on the construction industry in Maryland. The economic turmoil that the industry in Maryland has faced is indicative of the issues that the national construction industry has faced. Regardless of the decline in establishments, employment, and wages within Maryland, there is still a demand for graduates, albeit to a lesser extent than the pre-2008 period.

### 3.1.1 Civil Engineers and Construction Managers in Maryland

Much of the analysis contained in this report pertains to employment opportunities for university-educated individuals in the construction industry. Two of the most common areas for these workers are construction management and civil engineering.

According to the U.S. Bureau of Labor Statistics' Occupational Outlook Handbook, "construction managers plan, coordinate, budget, and supervise construction projects from development to completion."<sup>14</sup> Generally, a Bachelor's degree is required for entry-level positions, though work experience is important as well. The job outlook from 2012 to 2022 indicates that the field will grow by 16 percent, faster than the national average for all occupations.<sup>15</sup>

Civil engineers are responsible for the design, construction, and maintenance of large construction projects, structures, and systems.<sup>16</sup> Civil engineers must have a Bachelor's degree in either civil engineering or civil engineering technology, which is supplemented by graduate study and/or licensure. The occupation has a strong outlook and is expected to grow by 20 percent between 2012 and 2022, exceeding the national average.<sup>17</sup>

As shown in Figure 6, the average annual salary trends for civil engineers and construction managers follow a similar pattern until 2010, at which point they diverge.

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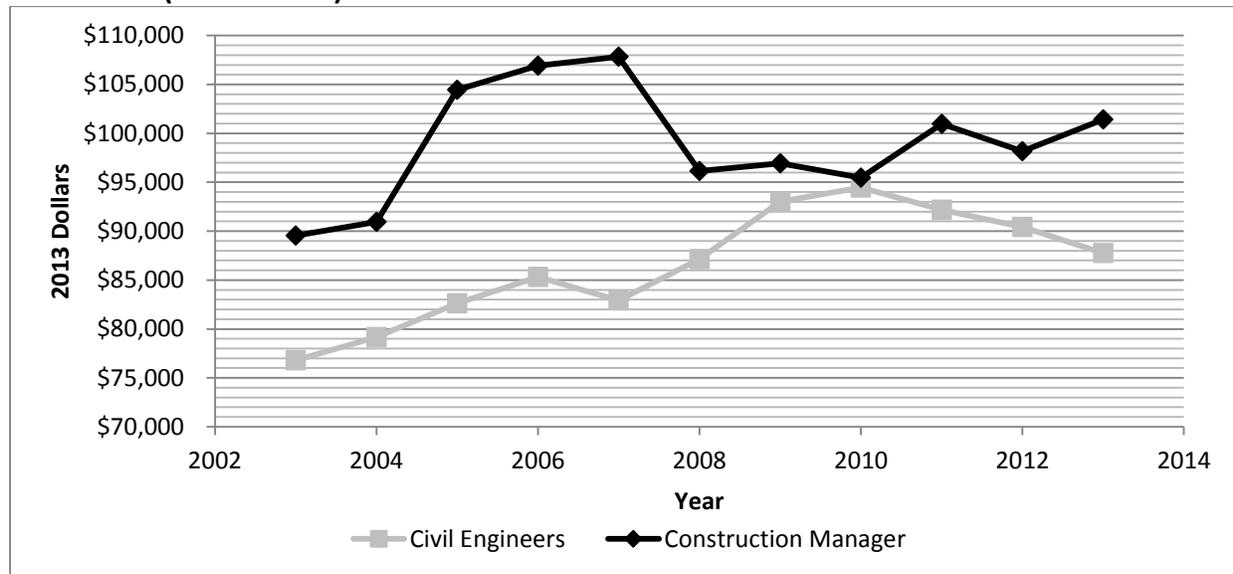
<sup>14</sup> "Construction Managers," *Bureau of Labor Statistics Occupational Outlook Handbook*, accessed September 18, 2014, <http://www.bls.gov/ooh/management/construction-managers.htm#tab-1>.

<sup>15</sup> Ibid.

<sup>16</sup> "Civil Engineers," *Bureau of Labor Statistics Occupational Outlook Handbook*, accessed September 18, 2014, <http://www.bls.gov/ooh/architecture-and-engineering/civil-engineers.htm#tab-1>.

<sup>17</sup> Ibid.

**Figure 6: Average Annual Pay for Civil Engineers and Construction Managers in Maryland, 2003–2013 (2013 dollars)**



Sources: BLS Occupational Employment Statistics, RESI

The average annual pay for civil engineers in Maryland increased from 2003 to 2013, though there were fluctuations throughout the decade. In 2003 the average annual pay in real (2013) terms was just under \$77,000, reached a peak of over \$94,000 in 2010, and was almost \$88,000 by 2013. The average annual pay in real (2013) terms for construction managers in Maryland increased from almost \$90,000 in 2003 to over \$101,000 in 2013, despite fluctuations throughout the decade. Average annual pay reached a peak in 2007, at almost \$108,000, which corresponds to right before the beginning of the recession. Interestingly, despite the ongoing impact of the recession felt by the wider construction industry in Maryland (See Section 3.1), in terms of wages, the construction managers' wages have successfully rebounded from the recession but have yet to reach pre-recession levels.

### 3.2 Construction/Built Environment Education in Maryland

Alongside the construction industry trends outlined in Section 3.1, RESI, in partnership with HR&A, reviewed the academic landscape in Maryland to understand which colleges and universities in the state have degree programs that prepare graduates for working in the construction industry in Maryland.

Using recommendations from MCCEI, RESI focused on the following academic institutions in Maryland:

- University of Maryland–Eastern Shore (UMES),
- Morgan State University (Morgan State),
- University of Maryland–College Park (UMCP), and
- Johns Hopkins University (JHU).

Data on the numbers of graduates from institutions in Maryland receiving Bachelor’s degrees in construction management are shown in Figure 7. From Figure 7, it is noticeable that only two institutions in Maryland have Bachelor’s degree programs focusing on construction management: UMES and Morgan State. The college and university programs outlined in the following sections are important to prepare future workers for these careers.

**Figure 7: Construction Management Bachelor’s Degree Graduates from Maryland Educational Institutions, Academic Years 2007–2008 to 2013–2014**

Academic Year		
2007–2008	13	-
2008–2009	19	-
2009–2010	14	-
2010–2011	19	-
2011–2012	28	1
2012–2013	10	7
2013–2014	24	6

Sources: University of Maryland–Eastern Shore, Morgan State University, RESI

UMES, in Princess Anne, Maryland, offers the state’s only Bachelor’s degree program in construction (specifically in construction management technology) accredited by the American Council for Construction Education (ACCE).<sup>18</sup> The program is designed for students entering immediately after high school, as well as for those transferring from community colleges. Twenty-eight students graduated from the program during the 2011–2012 academic year.<sup>19</sup> Morgan State University, located in Baltimore, offers a Bachelor of Science in Construction Management (BSCM) program within its School of Architecture and Planning.<sup>20</sup> While the program is not accredited by the ACCE, it follows the ACCE’s curriculum guidelines.<sup>21</sup> The program employs one full-time and two part-time faculty members and graduated seven students in May 2013.<sup>22</sup>

<sup>18</sup> “Construction Management Technology,” *UMES Department of Technology School of Business and Technology*, accessed September 17, 2014, <http://www.umes.edu/Tech/cmt.html>.

<sup>19</sup> “85-90-Degrees Awarded AY by program-school 2011-2012,” *University of Maryland Eastern Shore*, accessed September 17, 2014, <http://umes.edu/WorkArea/DownloadAsset.aspx?id=46638>.

<sup>20</sup> “Undergraduate Program in Construction Management,” *Morgan State University School of Architecture and Planning*, accessed September 17, 2014, [http://www.morgan.edu/school\\_of\\_architecture\\_and\\_planning/academic\\_programs/construction\\_management.html](http://www.morgan.edu/school_of_architecture_and_planning/academic_programs/construction_management.html).

<sup>21</sup> Ibid.

<sup>22</sup> “Maryland Higher Education Commission Degrees and Formal Awards by Program, Race, Gender, and Age Fall 2013, for Period July 1, 2012 through June 30, 2013,” *Morgan State University*, accessed September 19, 2014, <http://www.morgan.edu/Documents/ADMINISTRATION/Planning%20and%20Info%20Tech/InstitutionalResearch/2013DegreebyProgramRaceGenderAge.pdf>.

In addition to graduates from construction management programs, the Maryland construction industry also employs graduates from civil engineering programs. Figure 8 shows data on the number of graduates from Bachelor’s degree programs in civil engineering from institutions in Maryland from 2007–2008 to 2013–2014 (when available). It is noticeable in Figure 8 that only three institutions in Maryland have Bachelor’s degree programs focusing on civil engineering: Morgan State, UMCP and JHU.

**Figure 8: Civil Engineering Bachelor’s Degree Graduates from Maryland Educational Institutions, Academic Years 2007–2008 to 2013–2014**

Academic Year			
2007–2008	20	65	15
2008–2009	22	66	16
2009–2010	14	92	11
2010–2011	17	103	13
2011–2012	20	102	16
2012–2013	29	124	12
2013–2014	20	-	-

Sources: Morgan State University, National Center for Education Statistics, RESI

Morgan State’s Department of Civil Engineering, part of the Clarence M. Mitchell, Jr. School of Engineering, is accredited by the Accreditation Board for Engineering and Technology (ABET).<sup>23</sup> The program emphasizes preparing versatile graduates with the skills to work successfully under demanding conditions in a team setting.<sup>24</sup> Within the civil engineering curriculum, areas of specialization include environmental and water resources engineering, geotechnical engineering, structural engineering, and transportation engineering.<sup>25</sup>

UMCP has a comprehensive Department of Civil and Environmental Engineering within the A. James Clark School of Engineering.<sup>26</sup> The Bachelor’s degree program in Civil Engineering is accredited and requires that students choose a track of study, one of which is transportation

<sup>23</sup> “Dean’s Welcome,” *Morgan State University Clarence M. Mitchell, Jr. School of Engineering*, accessed March 9, 2015, <http://www.soe.morgan.edu/dean/index.html>.

<sup>24</sup> “Department Overview,” *Morgan State University Clarence M. Mitchell Jr. School of Engineering Civil Engineering Undergraduate Program*, accessed March 9, 2015, [http://www.soe.morgan.edu/academic\\_programs/civil\\_eng/overview.html](http://www.soe.morgan.edu/academic_programs/civil_eng/overview.html).

<sup>25</sup> Ibid.

<sup>26</sup> “Department of Civil and Environmental Engineering,” *University of Maryland A. James Clark School of Engineering*, accessed September 18, 2014, <http://www.cee.umd.edu/home>.

systems and project management.<sup>27</sup> Approximately 125 Bachelor's degrees in civil and environmental engineering are awarded annually.<sup>28</sup>

Located in Baltimore, the JHU's Department of Civil Engineering within the Whiting School of Engineering has been accredited by ABET since 1936.<sup>29</sup> The undergraduate program typically graduates between ten and twenty undergraduate students each academic year.<sup>30</sup> The small program emphasizes experiential learning, more theoretical research, and the societal implications of the field.<sup>31</sup>

### 3.3 Construction/Built Environment Education Supplying Maryland's Industry

In addition to workers educated within Maryland, the Maryland construction industry employs numerous graduates of out-of-state institutions with both construction management and civil engineering degrees. In this section, RESI focused on the following academic institutions outside Maryland:

- Drexel University,
- Ferris State University,
- The Pennsylvania College of Technology,
- Virginia Polytechnic Institute and State University,
- Pennsylvania State University–Harrisburg, and
- University of Virginia.

Drexel University in Philadelphia, Pennsylvania, offers a Construction Management (CM) program within the College of Engineering. The CM program offers both Bachelor's and Master's degrees in CM, in addition to undergraduate minors and certificates at the undergraduate and graduate level.<sup>32</sup> The Bachelor's degree program is accredited by the American Council for Construction Education (ACCE).<sup>33</sup> The program awarded 53 degrees during

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<sup>27</sup> "Undergraduate Program—Department of Civil and Environmental Engineering," *University of Maryland A. James Clark School of Engineering*, accessed September 18, 2014, <http://www.cee.umd.edu/undergrad>.

<sup>28</sup> "Facts and Figures," *University of Maryland A. James Clark School of Engineering*, accessed September 18, 2014, <http://www.eng.umd.edu/aboutus/facts-figures>.

<sup>29</sup> "Program Information," *Johns Hopkins Whiting School of Engineering Department of Civil Engineering*, accessed September 18, 2014, <http://engineering.jhu.edu/civil/undergraduate-studies/program-information/>.

<sup>30</sup> "Undergraduates," *Johns Hopkins Whiting School of Engineering Department of Civil Engineering*, accessed September 18, 2014, <http://engineering.jhu.edu/civil/people/undergraduates/>.

<sup>31</sup> "Undergraduate Studies," *Johns Hopkins Whiting School of Engineering Department of Civil Engineering*, accessed September 18, 2014, <http://engineering.jhu.edu/civil/undergraduate-studies/>.

<sup>32</sup> "Overview," *Drexel University College of Engineering, Construction Management*, accessed September 17, 2014, <http://drexel.edu/engmgmt/cmgt/academics/overview/>.

<sup>33</sup> "B.S. in Construction Management," *Drexel University College of Engineering, Construction Management*, accessed September 17, 2014, <http://drexel.edu/engmgmt/cmgt/academics/bs/>.

the 2012–2013 academic year, 29 of which were undergraduate degrees, 22 of which were Master's degrees, and 2 of which were graduate certificates.<sup>34</sup>

Ferris State University, located in Big Rapids, Michigan, offers a construction management Bachelor's degree program from its School of the Built Environment within the College of Engineering Technology.<sup>35</sup> The program is accredited by the ACCE and offers emphases in building construction technology and civil engineering technology.<sup>36</sup> During the 2012–2013 academic year, 71 degrees in construction management were awarded.<sup>37</sup> The school also offers a certificate program and Associate's degrees in related fields.<sup>38</sup>

The Pennsylvania College of Technology, an affiliate or “special mission campus” of the Pennsylvania State University, is located in Williamsport, Pennsylvania.<sup>39</sup> The college offers a Bachelor's degree in Construction Management, as well as a variety of additional Bachelor's and Associate's degrees and certificates within its School of Construction and Design Technologies.<sup>40</sup> The CM program is accredited by the ACCE. During the 2011–2012 academic year, 27 students graduated from the CM program, while 315 students graduated from the School of Construction and Design Technologies in all degree and certificate programs.<sup>41</sup>

Virginia Polytechnic Institute and State University (Virginia Tech) is located in Blacksburg, Virginia. The university houses the Myers-Lawson School of Construction, a joint school between the College of Architecture and Urban Studies and the College of Engineering.<sup>42</sup> For undergraduates, the school offers a Bachelor of Science degree in Building Construction (BSBC) and a Bachelor of Science degree in Construction Engineering and Management (BCEM).<sup>43</sup>

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<sup>34</sup> “Program Statistics,” *Drexel University College of Engineering, Construction Management*, accessed September 17, 2014, <http://drexel.edu/engmgmt/cmgt/public-info/program-statistics/>.

<sup>35</sup> “Degrees Offered at Ferris,” *Ferris State University*, accessed September 18, 2014, <http://www.ferris.edu/all-degrees.htm>.

<sup>36</sup> “Construction Mgmt/emphasis in Building Construction Technology CMBT,” *Ferris State University*, accessed September 18, 2014, <http://catalog.ferris.edu/programs/258/>.

<sup>37</sup> Ferris State University, “Fact Book,” 93, accessed September 18, 2014, <http://www.ferris.edu/HTMLS/Admision/testing/factbook/FactBook13-14.pdf>.

<sup>38</sup> Ibid.

<sup>39</sup> “About Us,” *Penn College of Technology*, accessed September 17, 2014, <http://www.pct.edu/about/>.

<sup>40</sup> “Academic Majors,” *Penn College of Technology*, accessed September 17, 2014, <http://www.pct.edu/schools/majors.asp>.

<sup>41</sup> “2011-2012 Graduate Survey: Graduate Primary Placement by School, Degree Level and Major,” *Penn College of Technology*, accessed September 17, 2014, <http://www.pct.edu/ARP/documents/GraduatePlacementbySchoolDegreeLevelandMajor2011-12.pdf#zoom=75>.

<sup>42</sup> “Academic Departments,” *Virginia Tech*, accessed September 17, 2014, <http://www.vt.edu/academics/academic-departments.html>.

<sup>43</sup> “Academics,” *Virginia Tech—The Myers-Lawson School of Construction*, accessed September 17, 2014, <http://www.mlsoc.vt.edu/academics>.

Both Bachelor's degree programs are accredited by their respective accrediting organizations.<sup>44</sup> The school also offers Master's degrees in Building Construction and Civil Engineering with an emphasis in construction engineering and management, and Doctorates in Civil Engineering with a construction track and Environmental Design and Planning.<sup>45</sup> Thirty-three students graduated from the BSBC during the 2013–2014 academic year, down from a high of seventy-six students in 2009–2010.<sup>47</sup> Thirty-seven students graduated from the BSCEM program during the 2013–2014 academic year.<sup>48</sup>

Pennsylvania State University has accredited civil engineering programs at two of its campuses, University Park and Harrisburg.<sup>49</sup> One hundred sixty-three undergraduate degrees in civil engineering were awarded by the University Park campus during the 2013–2014 academic year.<sup>50</sup> At the University Park campus, undergraduate students pursuing a degree in civil engineering have the option to specialize in structural engineering, which provides additional training with respect to large public structures such as bridges and buildings.<sup>51</sup> The Harrisburg campus awarded thirty-three Bachelor's degrees in civil engineering during the 2012–2013 academic year.<sup>52</sup> The program includes concentrations in both construction and structural engineering.<sup>53</sup>

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<sup>44</sup> "MLSoC—CEM Program," *Virginia Tech—The Myers-Lawson School of Construction*, accessed September 17, 2014, <http://cem.mlsoe.vt.edu/>.

<sup>45</sup> "Accredited Baccalaureate Programs," *Baccalaureate Programs—American Council for Construction Education*, accessed September 17, 2014, [http://www.acce-hq.org/accredited\\_programs/category/baccalaureate-programs/#](http://www.acce-hq.org/accredited_programs/category/baccalaureate-programs/#).

<sup>46</sup> Ibid.

<sup>47</sup> "Degrees Awarded 2009-10 through 2013-14: College of Architecture and Urban Studies (Includes First and Second\* Majors)," *Virginia Tech Institutional Research*, accessed September 17, 2014, [www.ir.vt.edu/work\\_we\\_do/retention\\_graduation/degree/degrees\\_conferred\\_degree\\_level\\_caus.xlsx](http://www.ir.vt.edu/work_we_do/retention_graduation/degree/degrees_conferred_degree_level_caus.xlsx).

<sup>48</sup> "Degrees Awarded 2009-10 through 2013-14: College of Engineering (Included First and Second\* Majors)," *Virginia Tech Institutional Research*, accessed September 17, 2014, [www.ir.vt.edu/work\\_we\\_do/retention\\_graduation/degree/degrees\\_conferred\\_degree\\_level\\_coe.xlsx](http://www.ir.vt.edu/work_we_do/retention_graduation/degree/degrees_conferred_degree_level_coe.xlsx).

<sup>49</sup> "Find Accredited Programs," *American Board for Engineering and Technology*, accessed September 17, 2014, <http://main.abet.org/aps/Accreditedprogramsearch.aspx>.

<sup>50</sup> "Undergraduate Degrees Awarded, 2011-12 to 2013-14," *Penn State College of Engineering*, accessed September 17, 2014, <http://www.engr.psu.edu/AboutCOE/UndergraduateDegrees.aspx>.

<sup>51</sup> "Department of Civil and Environmental Engineering," *Penn State College of Engineering*, accessed September 17, 2014, <http://www.engr.psu.edu/ce/undergraduate.html>.

<sup>52</sup> "Bachelor of Science in Civil Engineering," *Penn State Harrisburg*, accessed September 17, 2014, <https://harrisburg.psu.edu/science-engineering-technology/civil-structural-engineering/bachelor-science-civil-engineering>.

<sup>53</sup> "Civil Engineering 130-131 Credit Course Sequence," *Penn State Harrisburg*, accessed September 17, 2014, [http://harrisburg.psu.edu/sites/default/files/ce\\_curr\\_flowchart-final.pdf](http://harrisburg.psu.edu/sites/default/files/ce_curr_flowchart-final.pdf).

The University of Virginia (Charlottesville) offers accredited undergraduate and graduate programs in civil engineering.<sup>54</sup> Undergraduate students choose a track of study, with structural engineering as an option.<sup>55</sup> Fifty-eight undergraduate students graduated from the civil engineering program during the 2012–2013 academic year.<sup>56</sup>

This section has highlighted the economic fluctuations in the construction industry with regard to employment, establishments and wages as well as the number of construction/built environment graduates produced by in-state institutions and notable out-of-state institutions. While this information has shed considerable light on questions one and three as posed in Section 2.1, the demand from the industry for graduates over the past five years, as well as the demand into the future, still needs to be assessed. The gap between the number of construction/built environment graduates produced in Maryland (or the supply of labor) and the number of hires that the Maryland construction industry plans to recruit (or the demand for labor) are of particular importance in addressing the remaining questions. The following section will focus on the historic and forecasted demand from the construction industry in Maryland as well as the number of construction/built environment graduates that will be produced in Maryland and in the mid-Atlantic region over the next five years.

## **4.0 Analysis of the Construction Industry in Maryland**

This section analyzes the labor gap faced in the construction industry in Maryland between 2015 and 2020 as well as the trajectories of potential employees for these positions. The end of this section will review each trajectory's economic impacts on the State of Maryland, and the per person impact against each type of trajectory.

### **4.1 Trajectories of Workers in the Maryland Construction Industry**

Considering the various ways that Bachelor's degree students can enter the Maryland construction industry post-graduation, RESI created trajectories using four scenarios. It was important to consider the multitude of paths that students can take as the economic impacts for the State of Maryland will vary based on the path taken. The trajectories are outlined in Figure 9. The trajectories describe the pathways for each individual entering into a Bachelor's degree field.

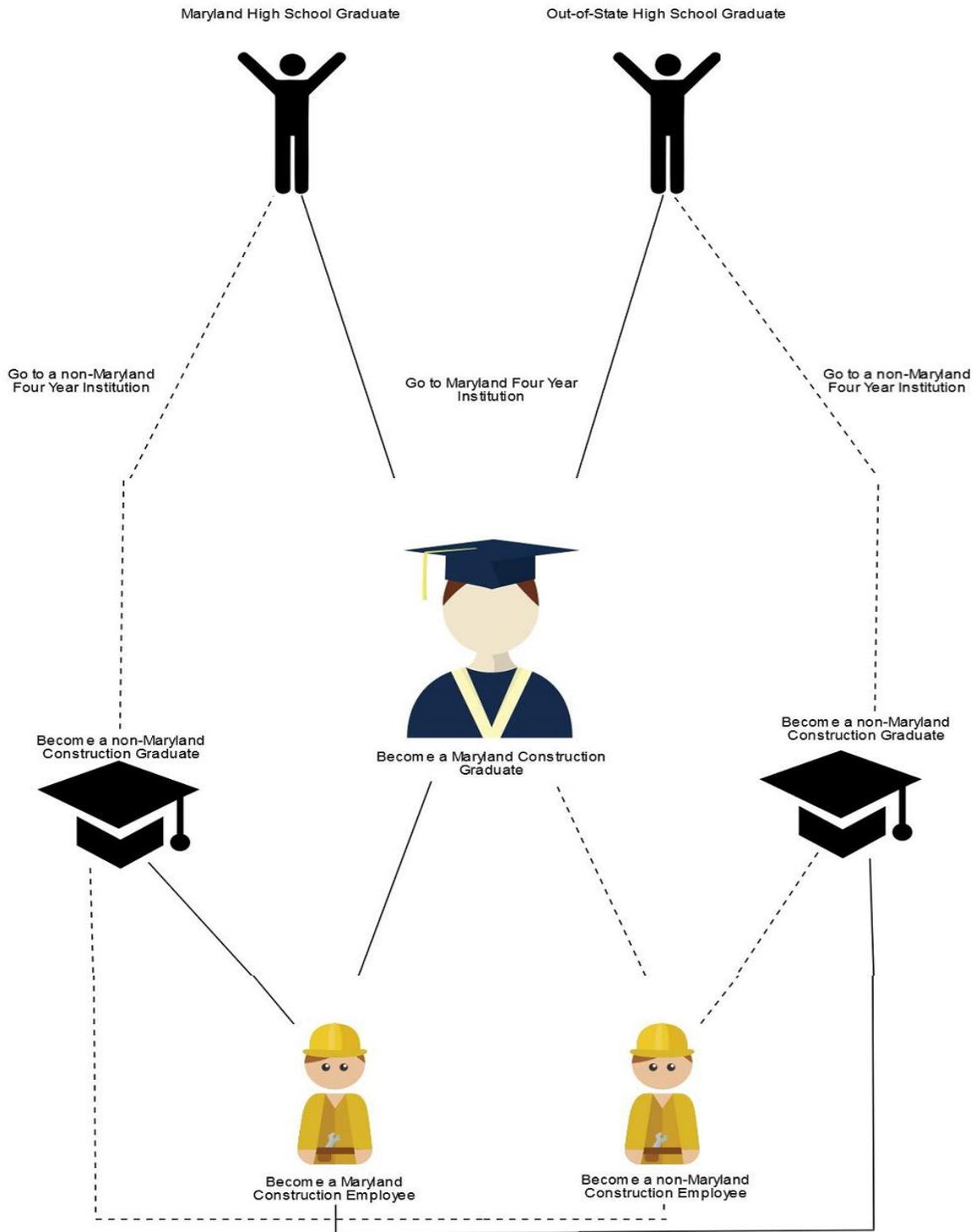
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<sup>54</sup> "Civil Engineering Undergraduate Program," *University of Virginia Engineering Department of Civil and Environmental Engineering*, accessed September 17, 2014, <http://ce.virginia.edu/academics/ugprograms.html>.

<sup>55</sup> "Civil Engineering Undergraduate Program," *University of Virginia Engineering Department of Civil and Environmental Engineering*.

<sup>56</sup> "Data Digest: Degrees," *University of Virginia Institutional Assessment and Studies*, accessed September 17, 2014, [http://avillage.web.virginia.edu/iaas/instreports/studat/dd/deg\\_major.htm](http://avillage.web.virginia.edu/iaas/instreports/studat/dd/deg_major.htm).

Figure 9: Potential College Graduate Trajectory for Construction Graduates



Sources: Piktochart, RESI

Figure 9 details the potential trajectories for those who are seeking Bachelor's degrees within the construction industry. For the purpose of this analysis, RESI focused on the trajectories related to those ending with jobs in Maryland regardless of starting point and education. To better assess the types of individuals analyzed in this analysis, RESI looked at four main types.

1. **Staters**—These are individuals who claim residency in Maryland, graduated from a four-year institution in Maryland, and then obtained employment within the construction industry in Maryland immediately upon graduation.
2. **Returner**—These are individuals who claim residency in Maryland, graduated from a four-year institution outside Maryland, and then obtained employment within the construction industry in Maryland immediately upon graduation.
3. **Scholars**—These are individuals who claim residency outside Maryland, graduated from a four-year institution in Maryland, and then obtained employment within the construction industry in Maryland immediately upon graduation.
4. **Careerist**—These are individuals who claim residency outside Maryland, graduated from a four-year institution outside Maryland, and obtained employment within the construction industry in Maryland immediately upon graduation.

Using the above trajectories, RESI will identify the economic impacts associated with each trajectory for Maryland. Section 4.1 will discuss the current construction industry labor demand between 2015 and 2020. RESI projects the labor demand for these individuals from 2015 to 2020. Section 4.2 uses the information presented in Section 4.1 and estimates the gap between Maryland's labor supply for construction industry graduates with a four-year degree or higher, as well as the supply that will need to be filled by non-Maryland graduates. Section 4.3 will discuss the economic impacts associated with this gap analysis, defining the trajectory that provides the highest level of economic impact.

#### 4.2 Industry Forecast

Using the REMI PI+ model and the definition of the industry in Section 2.0, RESI analyzed the potential industry forecast for construction through 2020.<sup>57</sup> Figure 10 highlights all jobs in the construction industry forecast between 2015 and 2020 for Maryland.

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<sup>57</sup> For more information on the REMI PI+ forecast conducted for this industry, please reference Appendix C.

**Figure 10: Forecast of the Construction Industry for Maryland, 2015–2020**

Year	
2015	188,475
2016	191,035
2017	194,465
2018	195,454
2019	198,340
2020	200,834

Sources: REMI PI+, RESI

Maryland’s construction industry will go from 188,475 jobs in 2015 to 200,834 jobs in 2020. This total includes the current jobs and added jobs over the next five years. The total of 200,834 jobs represents the overall number of jobs that will be present within the industry by 2020 and could include positions that do not require a Bachelor’s degree. To better assess the level of jobs demanded requiring a Bachelor’s degree within this industry, RESI looked at four key occupational sectors:

1. Supervisors of construction and extraction workers;
2. Architects, surveyors, and cartographers;
3. Drafters, engineering technicians, and mapping technicians; and
4. Engineers.

Construction managers are captured in the first category, “Supervisors of construction and extraction workers.”

The total jobs forecast reported in Figure 11 is the sum across these four occupational groups within the construction industry in Maryland. As the forecasted information in Figure 11 is solely for these four occupational sectors, it is possible that the demand for Bachelor’s degrees across the construction industry in Maryland is higher. As a result, the information in Figure 11 should be considered a conservative estimate of the demand for Bachelor’s degree holders over the next five years in Maryland. Figure 11 is the forecast of jobs that will be on payrolls by 2020. Therefore, the industry will end in 2015 with 83,754 individuals who have Bachelor’s degrees on payrolls, but will need to have 91,005 by the end of 2020.

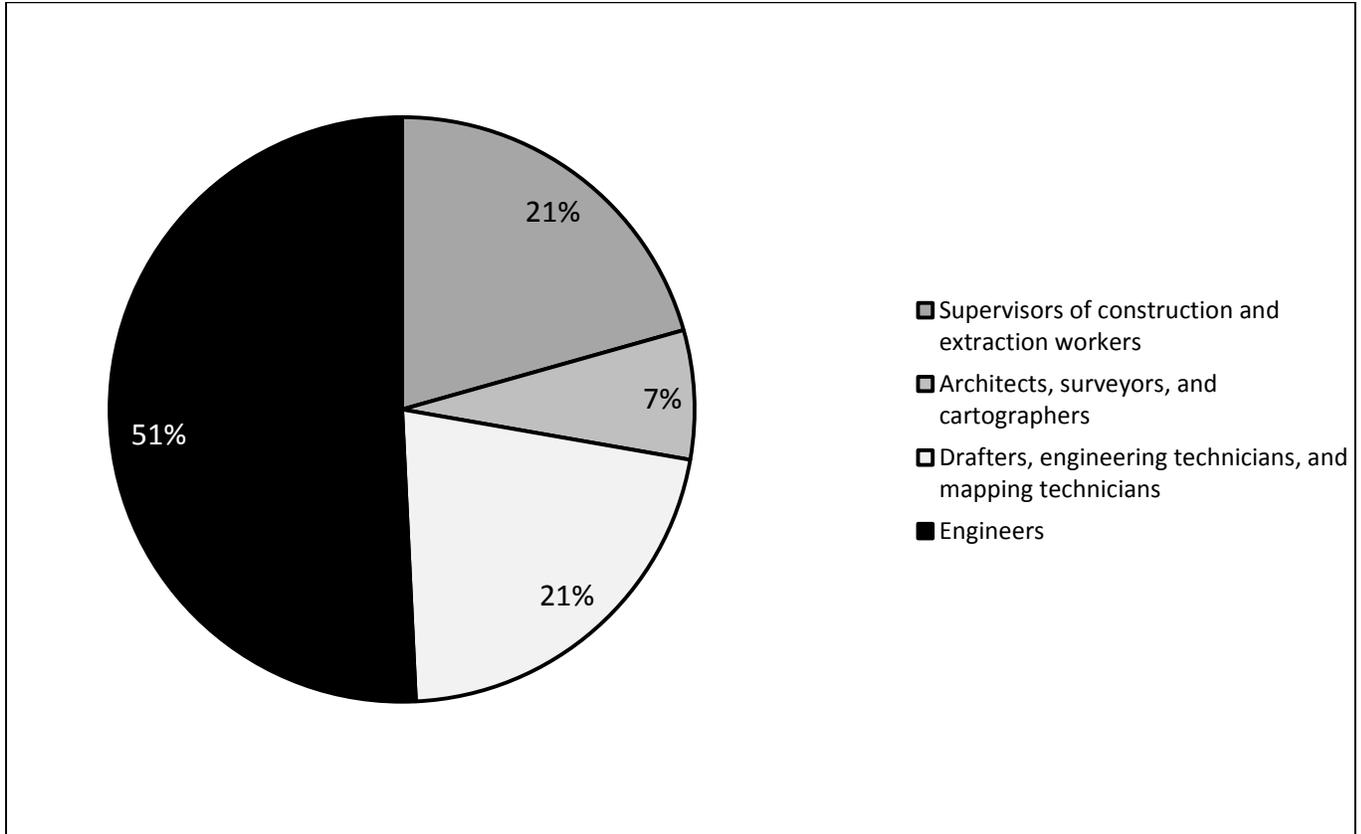
**Figure 11: Forecast for Construction Occupations Requiring a Bachelor’s Degree, 2015–2020**

Year	
2015	83,754
2016	86,037
2017	87,827
2018	89,075
2019	90,163
2020	91,005

Sources: REMI PI+, RESI

According to Figure 11, Maryland's construction industry will have approximately 91,000 individuals who possess a Bachelor's degree for their position on payrolls by 2020. This total includes the current jobs and additional jobs from 2015 to 2020. The share of those jobs held by each occupation listed within this analysis is detailed in Figure 12.

**Figure 12: Average Annual Share of Bachelor's Degrees by Occupation for the Construction Industry**

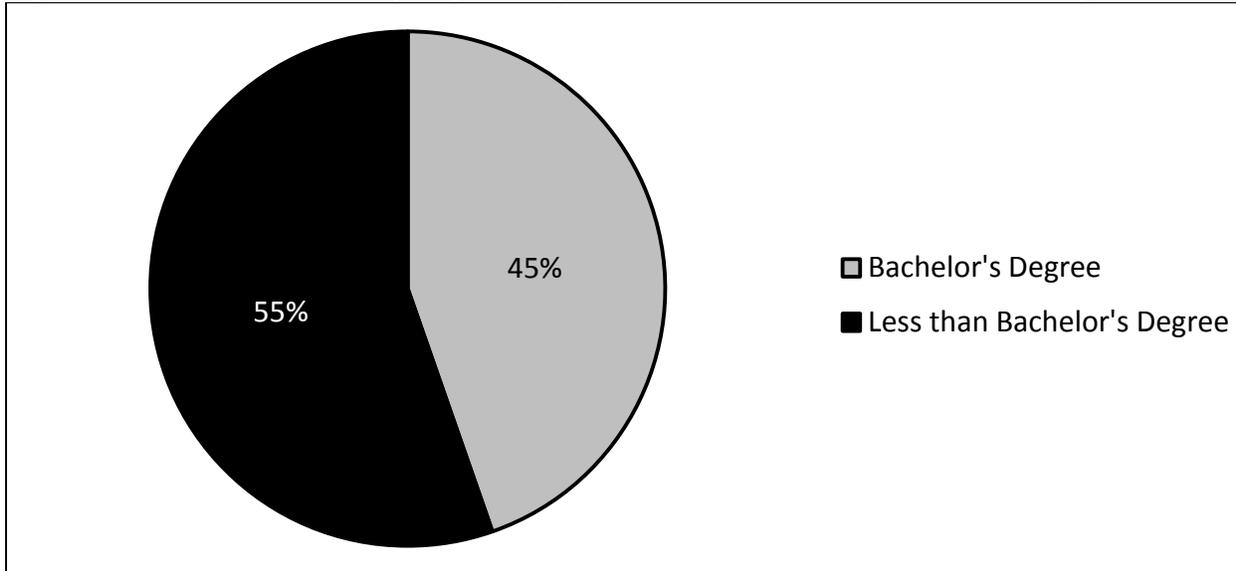


Sources: REMI PI+, RESI

As reported in Figure 12, over the next five years, 51 percent of the jobs requiring a Bachelor's degree will be engineers. Approximately 42 percent of the jobs will be held by supervisors of construction and extraction workers and drafters, engineering technicians, and mapping technicians. Finally, nearly 7 percent of the jobs requiring a Bachelor's degree in the construction industry will be held by architects, surveyors, and cartographers.

With reference to the industry as a whole, Figure 13 shows the percentage breakdown of those positions that required less than a Bachelor's degree and those that required a Bachelor's degree as of 2010.

Figure 13: Division of Labor by Degree Requirements for the Construction Industry, 2010

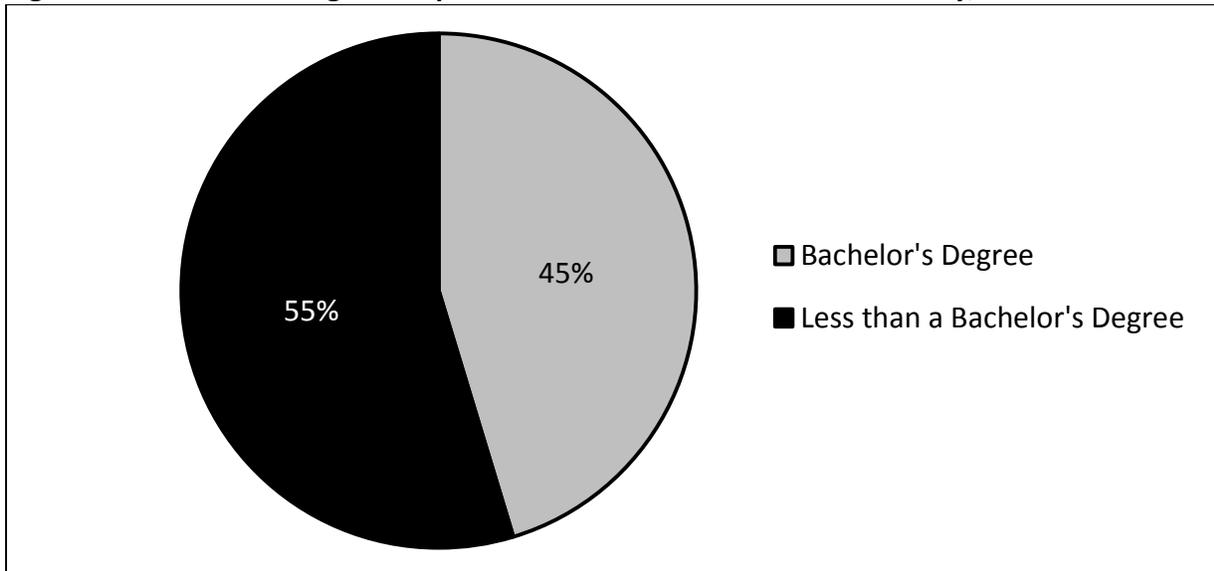


Sources: REMI PI+, RESI

In 2010, 44.7 percent of positions within the Construction industry required at least a Bachelor's degree. When analyzing the data regarding the forecast through 2020, RESI found that this percentage has increased by nearly one percent bringing the division nearly equal.

Figure 14 reports the new division between positions requiring a Bachelor's degree and those that require less than a Bachelor's degree.

Figure 14: Division of Degree Requirements for the Construction Industry, 2020



Sources: REMI PI+, RESI

According to Figure 14, by 2020, the demand for Bachelor's degree positions within the construction industry begins to bring the division to nearly half. With more than 91,000 jobs requiring a Bachelor's degree within the construction industry by 2020, RESI analyzed the supply of labor available to meet this demand over the next five years. When analyzing the amount of labor generated by Maryland four-year institutions, RESI found that a gap did exist in the labor supply that will need to be filled using out-of-state labor. Section 4.2 describes this gap, as well as the stock of labor that will be used to fill the growing demand by 2020.

### 4.3 Gap Analysis

According to the survey that RESI conducted and sent to Maryland construction/built environment firms, nearly 89.4 percent of respondents anticipated the possibility of hiring at least one graduate from a Maryland institution in the future. However, the same firms responded with the likelihood of hiring an individual from an institution outside Maryland as an 84.8 percent likelihood. These responses give weight to the optimism that firms exhibited with hiring individuals who graduate within the region, but the understanding that the labor supply of graduates from Maryland remains fairly lower than rival states such as Virginia and Pennsylvania. This section analyzes the existing level of labor supply from Maryland and the demand that will exist between 2015 and 2020. Findings from the Maryland construction industry interviews will also be included in this section to support the gap analysis.

Using the forecast presented in Section 4.1, RESI established that the demand for individuals with Bachelor's degrees or higher by 2020 in the construction industry will be approximately 91,000 jobs. At the end of 2013, RESI discovered the total current labor supply available to the

region as 80,796 individuals.<sup>58</sup> Between 2013 and 2020, Maryland’s construction industry will require 10,209 new graduates to fill positions require a Bachelor’s degree or higher. Using the information presented in Section 3.2 regarding in-state programs for Bachelor’s degrees related to the construction industry, RESI extrapolated the data to produce a potential labor supply and demand gap analysis.

Figure 15 highlights the in-state labor supply and potential out-of-state Bachelor’s degree recipients needed to meet construction labor demand in Maryland from 2015 to 2020.

**Figure 15: Labor Demand and Supply Type for Bachelor’s Degree positions in the Construction Industry, 2015–2020**

Year			
2015	2,464	170	2,294
2016	2,283	170	2,113
2017	1,790	170	1,620
2018	1,248	170	1,078
2019	1,088	170	918
2020 <sup>60</sup>	842	170	672
<b>Total</b>	<b>9,715</b>	<b>1,020</b>	<b>8,695</b>

Sources: REMI PI+, RESI

Assuming a constant graduation rate of approximately 170 students a year from all Maryland four-year institution programs in Construction Management and Civil Engineering, RESI estimated the labor shortage between 2015 and 2020. As reported in Figure 15, Maryland’s labor supply does not meet the labor demand for construction industry professions requiring a Bachelor’s degree over the five-year period. By 2020, Maryland will experience a labor shortage of 8,695 jobs that will be filled by out-of-state workers. Out-of-state employees can be either new graduates from out-of-state schools who once lived in Maryland (returners) or students from out-of-state schools who never lived in Maryland before (careerists). The 1,020 estimated workers Maryland will produce is split between 80 percent stater and 20 percent scholars.

Despite the shortage within the labor supply, according to the survey that RESI conducted, several firms rank the quality of the program for out-of-state students higher. In retrospect,

<sup>58</sup> REMI PI+ v1.6.7 forecast and RESI.

<sup>59</sup> RESI calculated the in-state labor supply from the estimated number of graduates from Maryland four-year institutions for construction management and civil engineering degrees for the last three years. RESI assumed this estimate annual average will remain constant through 2020.

<sup>60</sup> Since 2020 numbers are a forecasted estimate, these numbers are based on prior year sales and demand within the industry. The industry is expected to grow within five years; however, shifts in prices and wages may lessen the expected number of future construction projects in the region. This is a conservative estimate, so the actual number for 2020 may be greater than reported here.

19.4 percent of firms responded that the quality of the program only mattered if graduates came from Maryland schools, whereas 21.7 percent of firms stated that quality of program was a primary characteristic when hiring graduates from out-of-state schools. Quality control of the labor supply is key for employers in hiring recent college graduates from four-year institutions regardless of whether they are in state or out of state. Many respondents commented on the small pool of qualified graduates, and, given the number of four-year institutions, 170 newly qualified individuals does not give employers a variety. Figure 14 does not take into account labor turnovers or retirements from the field in Maryland. If RESI takes these factors into account, the estimated shortage could be slightly higher and the count should be considered a conservative estimate.

The forecasted gap in Maryland graduates to supply the Maryland construction industry is supported by the construction industry interview findings. RESI, in partnership with HR&A, conducted the construction industry interviews. Ayers Saint Goss stated in their interview regarding the labor demand and supply shortage: "There's a much greater need in Maryland [for construction and architecture graduates] than there is number of graduates."<sup>61</sup> In addition, Bozzuto highlighted that "From our construction, and other contractors....they hire so many kids from other schools because we don't produce enough in this state."<sup>62</sup> The interview findings from Gilbane also echo these sentiments:

Again, I think the dialogue is centered around the pool and how many we can get access to. There isn't enough just to go to Maryland, Morgan State and UMES to satisfy our consistent needs. I don't think there's a particular programmatic issue in how they are preparing the students. I just don't think there's enough students available.<sup>63</sup>

Furthermore, Bozzuto also noted that this lack of supply is not just an issue in Maryland: ...Maryland I know has many more construction positions open and available requiring a bachelor's degree than we produce in the state. We really need to ramp up the programs that exist not only at Maryland, possibly some of the other schools, such that we can produce more students and keep them within our state.<sup>64</sup>

As reported in Figure 15, without intervention, the state's grown labor supply to meet labor demand within the construction industry for those individuals with a Bachelor's degree will be short by approximately 8,700 employees over the next five years. As Section 4.3 describes, the loss of economic impact from those 8,700 out-of-state employees could be significant to Maryland's economy within in the next five years.

<sup>61</sup> Ayers Saint Goss, interview by Ellen Bast, October 21, 2014.

<sup>62</sup> Bozzuto, interview by Ellen Bast, October 30, 2014.

<sup>63</sup> Gilbane, interview by Ellen Bast, October 24, 2014.

<sup>64</sup> Bozzuto, interview by Ellen Bast, October 30, 2014.

**4.4 Economic Impact in Maryland**

Using the information presented in Sections 4.1 through 4.3, RESI analyzed the economic impacts of each of the four trajectories (stater, scholar, returner, and careerist) on Maryland immediately upon graduation. To understand the levels of economic impacts associated with the individuals in each trajectory, RESI used data on consumer expenditures from the Bureau of Labor Statistics Consumer Expenditure Survey as well as average college tuition at the four-year institutions offering degree programs in Construction Management and Civil Engineering for in-state and out-of-state students. Each categorical level that RESI used within the analysis is broken down by trajectory in Figure 16. Figure 16 helps to identify what each type of impact is and its inclusion by trajectory within the analysis.

**Figure 16: Economic Activity Included within the REMI PI+ Model by Trajectory**

Trajectory	In-state Tuition for MD	Out-of-State Tuition for MD	Migrate or Stay in Maryland for Employment
Stater	Yes	No	Yes
Scholar	No	Yes	Yes
Returner	No	No	Yes
Careerist	No	No	Yes

Source: RESI

In this analysis, RESI analyzed student spending patterns from the Bureau of Labor Statistics consumer expenditure surveys as well as tuition, room, and board spending at the four-year institutions applicable in Maryland to construction management and civil engineering degrees. The results are split into the four trajectories of students pathways described above: stater, scholar, returner, and careerist. The level of economic impacts depends on a student’s time and costs while in Maryland. In addition to the students currently attending, RESI included those who did take jobs in the industry each year between 2015 and 2020 into the economic model for analysis. Sections 4.4.1 through 4.4.4 detail each trajectory’s economic impact from their spending and acquiring employment upon graduation within Maryland.

**4.4.1 Economic Impacts in the Construction Industry—Staters**

Staters, as described in the beginning of Section 4.1, are individuals who live in Maryland pre-college, attend a four-year institution, then continue to reside in Maryland post-graduation. These individuals are considered to spend most of their money and time in Maryland within this analysis. Using in-state tuition data from the four-year institutions in Maryland for construction management and civil engineering degrees, as well as Bureau of Labor Statistics spending patterns data, RESI analyzed the potential impacts that stater have on Maryland’s economy. Figure 17 describes the level of impacts from 2015 through 2020 that Maryland can expect to receive from these individuals.

**Figure 17: Economic Impacts of Staters, 2015–2020**

Year	Jobs	Output	Wages
2015	247	\$30,371,980	\$11,962,427
2016	481	\$61,028,570	\$25,095,736
2017	716	\$92,740,284	\$39,854,378
2018	949	\$125,109,540	\$55,972,954
2019	1,177	\$157,661,693	\$73,147,482
2020	1,400	\$190,587,178	\$88,305,175

Sources: REMI PI+, RESI

As described in Figure 17, from Maryland resident students continuing their construction management and civil engineering degrees within Maryland, Maryland’s economy would receive significant impacts. By 2020 jobs associated with the economic activity from these students remaining here for work and those new students attending university would result in 1,400 jobs and \$190.6 million and \$88.3 million in output and wages, respectively. Staters would add 584 indirect and induced jobs to payrolls from their attendance of Maryland four-year institutions and retention to Maryland through employment after graduation.<sup>65</sup>

Firms in the construction industry stated in interviews their desire to retain these graduates within Maryland post-graduation. Hensel Phelps stated in their interview:

...we want to support the local economy and the local workforce. I would much prefer to hire students that grew up in this area, went to school in this area, because I think they're more passionate about this market in everything that they do.<sup>66</sup>

#### **4.4.2 Economic Impacts in the Construction Industry—Scholars**

Scholars, as described in the beginning of Section 4.1, are individuals who lived outside Maryland pre-college, attend a four-year institution in Maryland, and then continued to reside in Maryland post-graduation. These individuals are considered to spend the second highest amount of their money and time in Maryland within this analysis. Using out-of-state tuition data from the four-year institutions in Maryland for construction management and civil engineering degrees, as well as Bureau of Labor Statistics spending patterns data, RESI analyzed the potential impacts that scholars have on Maryland’s economy. Figure 18 describes the level of impacts from 2015 through 2020 that Maryland can expect to receive from these individuals.

<sup>65</sup> Indirect and induced jobs are those jobs that are not directly related to the industry but are a subsequent impact from the industries activities within the state.

<sup>66</sup> Hensel Phelps, interview by Ellen Bast, October 24, 2014.

**Figure 18: Economic Impacts of Scholars, 2015–2020**

Year	Jobs	Output	Wages
2015	64	\$7,819,000	\$3,101,000
2016	123	\$15,453,000	\$6,379,000
2017	182	\$23,483,000	\$10,111,000
2018	240	\$31,562,000	\$14,145,000
2019	297	\$39,736,000	\$18,458,000
2020	352	\$47,900,000	\$22,984,000

Sources: REMI PI+, RESI

As described in Figure 18, from scholars earning their construction management and civil engineering degrees within Maryland, Maryland’s economy would receive significant impacts. By 2020 jobs associated with the economic activity from these students remaining here for work and those new students attending university would result in 352 jobs and \$47.9 million and \$23.0 million in output and wages, respectively. Scholars would add 148 indirect and induced jobs to payrolls from their attendance of Maryland four-year institutions and retention to Maryland through employment after graduation by 2020.<sup>67</sup>

Despite not being from Maryland, the knowledge of the program that scholars graduate from gives some employers familiarity with their training. Furthermore, as the survey found, those who attended a four-year institution within Maryland had a lower turnover rate than those who came from an out-of-state university. DPR Construction, for example, stated:

If someone is graduating from Maryland, even if they weren't from here, they've been in the state for at least four years, they know where they want to live, they've got a friends, family, some sort of support system here, and they're coming to work to start work.<sup>68</sup>

#### **4.4.3 Economic Impacts in the Construction Industry—Returners**

Returners, as described in the beginning of Section 4.1, are individuals who lived in Maryland pre-college, attended a four-year institution outside Maryland, and then returned to reside in Maryland post-graduation. These individuals are considered to spend the third highest amount of their money and time in Maryland within this analysis. To analyze this potential, RESI split the gap employment in Figure 15 from Section 4.3 in half and analyzed the new employees as being half initially Maryland residents, and half as non-Maryland residents. Bureau of Labor Statistics spending patterns data were included in this analysis for the four months that returners spend in Maryland on holiday from school. Figure 19 describes the level of impact from 2015 through 2020 that Maryland can expect to receive from these individuals.

<sup>67</sup> Indirect and induced jobs are those jobs that are not directly related to the industry but are a subsequent impact from the industries activities within the state.

<sup>68</sup> DPR Construction, interview by Ellen Bast, October 23, 2014.

**Figure 19: Economic Impacts of Returners, 2015–2020**

Year	Jobs	Output	Wages
2015	1,950	\$245,622,100	\$95,267,700
2016	3,787	\$485,566,300	\$198,195,400
2017	5,205	\$679,017,800	\$291,460,800
2018	6,136	\$813,453,800	\$365,774,800
2019	6,882	\$926,291,600	\$433,331,600
2020	7,391	\$1,009,796,900	\$489,352,000

Sources: REMI PI+, RESI

As described in Figure 19, from returners returning to Maryland post-graduation for employment, Maryland’s economy would receive significant impacts. By 2020 jobs associated with the economic activity from these students returning here for work would result in 7,391 jobs and \$1.0 billion and \$489.4 million in output and wages, respectively. Returners would add 3,043 indirect and induced jobs to payrolls by returning to Maryland for employment and school holidays by 2020.<sup>69</sup>

The significant impacts associated with returners stem from the significant size of the population returning to Maryland for employment. Mainly these students were potential candidates for Maryland four-year institutions, but due to the small size of many programs, decided to attend school outside the state. Although these individuals do return, the loss of educational income to Maryland-based institutions as well as their spending while attending school is significant. Overall, for each returner that the construction industry hired post-graduation, they will add only 0.72 jobs to the economy.

#### **4.4.4 Economic Impacts in the Construction Industry—Careerists**

Careerists, as described in the beginning of Section 4.1, are individuals who lived outside Maryland pre-college, attended a four-year institution outside Maryland, and then came to Maryland post-graduation. These individuals are considered to spend the least amount of their money and time in Maryland within this analysis. To analyze this potential, RESI split the gap employment in Figure 15 from Section 4.3 in half and analyzed the new employees as being half initially Maryland residents, and half as non-Maryland residents. Figure 20 describes the level of impact from 2015 through 2020 that Maryland can expect to receive from these individuals.

<sup>69</sup> Indirect and induced jobs are those jobs that are not directly related to the industry but are a subsequent impact from the industries activities within the state.

**Figure 20: Economic Impacts of Careerists, 2015–2020**

Year	Jobs	Output	Wages
2015	1,938	\$244,334,400	\$94,800,300
2016	3,766	\$483,134,200	\$197,263,700
2017	5,177	\$675,687,900	\$290,109,600
2018	6,104	\$809,536,000	\$364,114,900
2019	6,852	\$922,486,900	\$431,633,800
2020	7,362	\$1,006,096,800	\$487,627,800

Sources: REMI PI+, RESI

As described in Figure 20, from careerists entering into Maryland post-graduation for employment, Maryland’s economy would receive significant impacts. By 2020 jobs associated with the economic activity from these students coming here for work would result in 7,362 jobs and \$1.0 billion and \$487.6 million in output and wages, respectively. Careerists would add 3,014 indirect and induced jobs to payrolls by migrating into Maryland for employment after graduation by 2020.<sup>70</sup>

The significant impacts associated with careerists stems from the significant size of the population migrating into Maryland for employment. Although these individuals do migrate into Maryland, the turnover rate associated with careerists is somewhat higher given their personal attachments outside Maryland. As Kimball Construction pointed out in their interview, “Hopefully, we could have less turnover. We’d be hiring Maryland residents that went to school in Maryland and would not want to relocate at some point—go home to their family or to their girlfriend who was in Pennsylvania, Virginia, or something else.”<sup>71</sup> Furthermore, the individuals relocating here as pointed out by DPR Construction often experience a rougher transition as they may not have the support system in place for determining where to live and recreate in Maryland. Overall, for each careerist hired by the construction industry post-graduation, they will add only 0.71 jobs to the economy.

#### 4.4.5 Economic Impacts of Each Trajectory at a Glance

As described in Sections 4.4.1 through 4.4.4, each trajectory has its own economic impacts. For the most part, given the gap analysis performed in Section 4.3, Maryland’s construction industry will need to fill its demand with significantly large portions of returners and careerists by 2020 due to the limited number of construction/built environment graduates being produced in Maryland. This large hiring from this trajectory is the main reason that their economic impacts are significantly higher than stater or returners. However, reviewing Figure

<sup>70</sup> Indirect and induced jobs are those jobs that are not directly related to the industry but are a subsequent impact from the industries activities within the state.

<sup>71</sup> Kimball Construction Company, interview by Ellen Bast, October 30, 2014.

21, on a per-hired scale, the return to Maryland’s economy is higher from stater and scholars than from returners and careerists.

**Figure 21: Economic Impacts of Each Trajectory per Hire**

Impact	Stater	Scholar	Returner	Careerist
Jobs	1.06	1.07	0.72	0.71
Output	\$152,619	\$154,108	\$99,261	\$98,410
Wages	\$64,494	\$69,838	\$44,461	\$44,064

Sources: REMI PI+, RESI

As reported in Figure 21, with each hire of a stater, Maryland’s economy earns one additional job, \$152,619 in additional output, and \$64,494 in additional wages. Additional economic impacts associated with a scholar account for one additional job, \$154,108 in output, and \$69,838 in wages. Since these students stay here for four-years of college, then continue residency through employment, they generate the most economic impact on Maryland’s economy through their spending and continued presence within the state. For each returner hired, Maryland’s economy gains less than one job, \$99,261 in output, and \$44,461 in wages. Furthermore, for each careerists hired by the industry, Maryland’s economy gains fewer than one additional job, \$98,410 in output, and \$44,064 in wages.

Overall, RESI found that individuals either beginning as Maryland residents or coming into Maryland to attend school and then staying for employment have the highest economic impact on Maryland’s economy. However, as stated in Section 4.2, there is a significant gap in the labor supply grown through Maryland four-year institutions and the labor demand within the construction industry for professions requiring a four-year degree. Overall, the labor demand will need to be filled by more returners and careerists to fill orders within the construction industry from 2015 through 2020.

## 5.0 Best Practices

Drawing on the recommendations from MCCEI, the findings from the surveys, and the industry interviews, RESI completed visits with four out-of-state institutions. The visits occurred between February and April 2015 at the following schools:

- Drexel University ,
- Virginia Polytechnic Institute and State University,
- Pennsylvania College of Technology, and
- Pennsylvania State University–Harrisburg.

Each visit was approximately three to four hours in length and included interviews with department representatives as well as tours of the facilities available to students in the departments. More information on these visits can be found in Appendix A. This section will

provide an overview of the lessons learned during these visits with this information contributing to the recommendations in Section 6.0.

### **5.1 Drexel University**

The Construction Management program is based in the College of Engineering at Drexel University, located in Center City, Philadelphia. Over the last five years, the students enrolled have ranged from 120 to 140 students with 75 percent of students in the program coming from the wider Philadelphia region and New Jersey. On average, approximately 5 percent of students are from Maryland. The majority of students entering the program during their sophomore year are transfers from other programs. Nonetheless, the department actively reaches out to high school students to increase their knowledge and interest in construction management and to reduce the stereotype of construction as a dirty, low-paying field with few job opportunities. Focusing on this last point, one of the key attractions to this program for both new and transfer students is the employment prospects upon graduation. On average, 90 percent of the students enrolled in the program graduate and, upon graduation, 100 percent of the graduates are employed in the construction industry immediately after graduation.

The program is set up to take five years to complete and focuses on a combination of construction, technology, and business courses. The student calendar is structured in quarters with three three- to six-month work sessions in the construction industry. The salary (on average \$14 to \$20 an hour) during this time is paid by the employer. The co-op nature of the program provides students with experience working in the industry and enables the students to have significant contact with potential future employers. In addition to the co-op, the program offers students other opportunities to interact with potential employers through networking events that are held twice a year. All students within the program, regardless of their year of study, are invited to attend these events. Students are able to prepare for events of this kind through a mandatory course that teaches the students how to write resumes, prepare for job interviews, and network.

The students are also invited to attend on-campus events with guest lecturers as well as to engage in competitions between other schools. For the former, the Joseph Lambert Sr. distinguished lecture series events started in June 2014. The lecturer for the inaugural event was Dr. Christine Fiori, who is the Associate Director of the Myers-Lawson School of Construction at Virginia Tech. For the latter, Drexel students form teams, with a faculty member coaching them, and compete in the Associated Schools of Construction ASC Region 1 Competition against other colleges and universities in the region. Traditionally, Drexel teams enter the Commercial Building Construction group as well as the Heavy Construction group. The faculty that support the program include 2 full-time tenure track positions, 5.5 full-time non-tenure track positions, and 28 adjunct faculty members. With the exception of the tenure track positions, the faculty supporting the program has extensive industry experience—the full-

time non-tenure track faculty each average over 30 years of industry experience between them. Please see Figure 22 for a summary of the strengths and weaknesses of the program.

**Figure 22: Strengths and Weaknesses—Drexel University**

<b>Strengths</b>	<b>Weaknesses</b>
Co-op program; student salary	Price of DU tuition
Networking events	
100% graduate placement in construction industry post-graduation	
ACCE-accredited program with active board	
Emphasis on business	
Industry experience of faculty (PT & FT)	
Addition of technology components	
Location factor (central Philadelphia)	

Sources: Drexel University, RESI

## 5.2 Virginia Polytechnic Institute and State University

The Myers-Lawson (ML) School of Construction at Virginia Tech in Blacksburg, Virginia, was formed through a \$10 million endowment in 2006. Virginia Tech alumni A. Ross Myers and John R. Lawson II are CEOs of major construction companies and both contributed \$5 million to create the school.<sup>72</sup> The school is a bridge between the College of Engineering and the College of Architecture and Urban Studies. Under the College of Engineering, ML is one of 13 departments and runs the Bachelor’s in Construction Engineering and Management (CEM) program. Under the College of Architecture and Urban Studies, ML is one of four schools and runs the Bachelor’s in Building Construction (BC) program.<sup>73</sup> The position of ML between these two colleges, as well as the focus on research at the undergraduate and graduate levels, encourages collaboration within each college as well as across each college. In addition, through combining these two colleges, the school effectively reflects the industry reality of design build with engineers and architects working together.

As a brief overview, the BC currently has 232 students, which is a five-year high for enrollment. With no cap on enrollment, continued growth is expected for the next five years. The program is accredited by the ACCE. Students can enter the program in their freshman year and, as a result, there are high school and community college recruitment efforts to attract new students to the program. While in the program, students have access to state-of-the-art labs, internship experiences, and undergraduate research opportunities for credit. In addition, there is a 100 percent placement rate in the construction industry for graduates of the program immediately

<sup>72</sup> “Founding History of Our School,” *Myers-Lawson School of Construction—Virginia Tech*, accessed April 6, 2015, <http://www.mlsoc.vt.edu/founding-history>.

<sup>73</sup> A Bachelor’s degree in Real Estate or more aptly described as a degree in property development is also available. While the program was created due to industry demand, it will not be featured in this review.

after graduation. The main focus of this section will be on the CEM program with many of the highlights applicable to both the BC and CEM degrees.

The CEM program, accredited by ABET, is currently capped at 120 students (40 per year) but has steadily grown from 65 students to 120 students since 2007. As a result of this growth, it is expected that by 2020 the cap will need to be removed, if demand is to be met, and that the student enrollment will increase to over 160 students for the CEM program if this occurs. Approximately 20 percent of students in the program are out-of-state from states including Maryland, North Carolina, New Jersey, and Pennsylvania. Students can apply to enter the program in their sophomore year as all students that enter CEM start out in the College of Engineering (General Engineering) in their freshman year. In addition, approximately 20 percent of the students in CEM are female; this percentage matches or exceeds the percentage of women in the College of Engineering as a whole each year.

As the students in CEM do not enter the program in their first year, there is competition amongst the freshman applicants to enter the CEM program with approximately 100 applications for the program denied per year. The pool of engineering applicants is generally not recruited from high school; little recruitment is needed for engineering at VT due to the reputation of the program. In regard to articulation from community colleges, there are agreements set up with Virginia community colleges as well as community colleges outside the state, such as Anne Arundel Community College in Maryland and Southern Maryland. The ML offers students the opportunity to interact with industry representatives in five different ways.

1. Students have access to industry representatives through the mentorship program, where students are mentored by industry representatives during their time at VT.
2. The CEM program offers companies in the construction industry the opportunity to teach classes one to two times per year to have the students learn new practices directly from those people currently using them in the wider market.
3. The students are encouraged to take part in internships (paid by the company) during their breaks. Many of the internships are funded by the 50 industries that sit on the Board for ML.
4. Students are encouraged to take advantage of undergraduate research opportunities for credit, which, in some cases, are sponsored by industry.
5. ML hosts a job fair twice a year specifically for the construction industry where all students can attend. The event is so popular that several companies are turned away.

Students use all of these opportunities to meet with prospective employers, find out what type of work they would like to do in the future and build their networking skills.

The faculty are a vital component to the program's success. There are 20 principal faculty within the school that are in the roles of either full-time tenure track or full-time non-tenure track positions, also referred to as "professors of practice." There are no adjunct faculty

currently working in the ML school. Five professors of practice have significant industry experience, and there are a number of female faculty members in the school. Several of the faculty positions are funded by endowments—a structure that allows ML to move away from using adjunct faculty. To fill demand for faculty created by uncapped students as well as the growing enrollment in BC, it is expected that two additional faculty will need to be recruited per year. In addition to filling the demand, it will also enable the school to retain its desired student-to-faculty ratio of 18 to 1.

Through this support system, almost 100 percent of students who join CEM graduate through that program. Every CEM graduate has job offers in the construction industry upon graduation, with the average starting salary ranging from \$55,000 to \$62,000. Due to a significant number of construction companies operating across several states, it is difficult to pinpoint how many graduates are employed in Maryland companies post-graduation. However, major employers of CEM graduates with bases in Maryland include Whiting-Turner, Clarke, Gilbane, and Chaney Enterprises.

**Figure 23: Strengths and Weaknesses—Virginia Polytechnic Institute and State University**

<b>Strengths</b>	<b>Weaknesses</b>
Reputation of program	Cap on students in program
Student engagement with industry (i.e., job fair)	
100% graduate placement in construction industry post-graduation	
Gender diversity of students and faculty	
Significant financial endowments	
Industry experience of faculty/composition of faculty (no adjuncts)	
Addition of technology components/open labs	
Undergraduate research	

Sources: Virginia Polytechnic Institute and State University, RESI

**5.3 Pennsylvania College of Technology**

The Penn College of Technology (PCT), located in Williamsport, Pennsylvania, is a special mission campus of the Pennsylvania State University. It offers a range of construction/built environment programs including the Bachelor’s in Construction Management (four-year degree), a 2+2 degree in Residential Construction Technology and Management, and a two-year Associate’s degree in Building Construction Technology. Enrollment for all fields is open, but students are required to take standardized tests to enroll in a B.S. degree (such as the SAT and the ACT).

Focusing on the Construction Management (BCM) course, accredited by the ACCE, the student enrollment has changed over time, and this change has largely paralleled the fluctuations in the construction industry overall. For example, from 2008 to 2010 enrollment declined but, in the post-recession period, the enrollment has started to increase, with 30 to 40 new freshman per year and an average of 120 students in the program each year. The majority of students enroll in this course as freshmen with approximately 12 percent transferring from other institutions. The great number of students entering the BCM as freshmen can be attributed partially to PCT's high school student recruitment efforts, particularly through the ACE (Architecture, Construction, Engineering) mentoring program. Students in the course are largely coming from Pennsylvania, but approximately 15 percent come from out of state, with 4-6 percent coming from Maryland area. In addition, the reputation of PCT in the region and the alumni engagement with students enables enrollment to grow.

Once students start the BCM program, they take courses specific to BCM starting their freshman year. While this makes it difficult for students to transfer into the program, it also makes the learning more intensive so students understand at an early stage of their matriculation if they are interested in this line of work. The BCM is less focused on hands-on learning and more focused on theoretical learning than the building construction technology/associate's program/2+2. The program has a management emphasis within the curriculum (taught in the management department), and learning BIM is also a component. Students are taught by faculty with an array of industry experience. There are four full-time "tenure" faculty with the program.<sup>74</sup> Adjunct faculty are used as needed. There is currently one adjunct faculty member with BCM. The student-to-faculty ratio for the majority of the courses in the program is 18:1. The faculty emphasis on industry experience is based on the desire to have real-world insight to share with students as well as make potential contacts with the wider industry. However, there are other opportunities beyond the faculty for students to interact with the industry.

Students have the opportunity to interact with industry through industry-funded scholarships, career fairs at PCT, and optional internships. Many regional construction firms fund scholarships for students; this funding enables the recipient to engage more directly with the industry. The career fairs are hosted two times per year at PCT. While they are not specific to BCM, construction is a major component. PCT does not have to ask construction companies to attend; these companies view the career fair as a "one-stop shop" for acquiring new talent such as civil engineers, construction managers, and heavy equipment specialists. Approximately 2,400 job/internship opportunities are available at these career fairs. BCM students in all years are encouraged to attend. PCT does not offer preparatory courses. However, the career services office provides students with any support and information they need to prepare for the career fairs.

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<sup>74</sup> PCT does not have the traditional "tenure track" for faculty members. In this case, "tenure" refers to the successful completion of a three year probationary period.

On average, approximately 75 percent of students who start the BCM course graduate. For those students who do not graduate, the major hurdle is the theoretical coursework that is integral to the BCM. Of the 75 percent who do graduate, 98 percent enter jobs in the construction industry. These positions are not based in Pennsylvania but are widely dispersed throughout the U.S. The average starting salary for these graduates in the construction industry is \$52,000. The two percent of students who do not enter the construction industry go on to a range of other opportunities, including self-employment, graduate school, and military service. Moving forward, PCT would like to continue to increase its enrollment in BCM and return to the pre-recession figures. While general trends within the construction industry may have previously dictated enrollment figures, there is an increasing sense that overcoming stigmas associated with the construction industry is equally important. The stigma of the construction industry as a dirty job or a low-paying job is lessening for PCT students, but the biggest stigma is that anyone can do this kind of work, or that there is no critical thinking needed.

**Figure 24: Strengths and Weaknesses—Pennsylvania College of Technology**

<b>Strengths</b>	<b>Weaknesses</b>
Open enrollment	Program silos
High graduate placement in construction industry post-graduation	
Industry experience of faculty/composition of faculty (little use of adjuncts)	
BIM integrated into curriculum	
Opportunities for students to engage with industry	

Sources: Pennsylvania College of Technology, RESI

#### **5.4 Pennsylvania State University–Harrisburg**

Penn State–Harrisburg (PSH U–H), located on the periphery of Harrisburg, Pennsylvania, is a branch campus of the Pennsylvania State University. Unlike the other examples provided in this section, Construction Management is an option for the wider Structural Design and Construction Engineering Technology (SDCET) Bachelor’s degree program, which is based in the School of Science, Engineering and Technology. It should be noted that Penn State–University Park also offers a construction option within the Architectural Engineering 5 year degree program. This is not viewed as competition for this program due to the differing focuses and durations of the programs. Approximately 120 students enrolled in the SDCET program at PSH U–H. The program offers a specialization in Construction Management. The majority of these students are residents of Pennsylvania, but approximately 5 to 8 percent are from Maryland. This figure has steadily grown over the past five years.

Students do not need to declare their majors until their junior year, meaning that many students may enter the SDCET program in their junior year. Nonetheless, realizing the number

of colleges and universities in the region, the program is active in recruiting high school students from the local area as well as out of state. PSH's U–H's high school recruitment process is done through the ACE program and, perhaps more innovatively, through their advisory board hosting a high school counselors to the campus for a luncheon and to meet existing students. While some counselors will bring interested high school students with them, the overarching aim of this approach is to highlight the strengths of the program to those select individuals who can influence a great number of students and parents about their future education. In addition, the university has articulation agreements in place with community colleges in Pennsylvania as well as several out-of-state institutions, including Montgomery College in Maryland.

For the wider SDCET program as well as the Construction Management option, the faculty have industry experience. Seven full-time faculty members and two emeritus professors are associated with the program. The program is not reliant on adjunct faculty. The student-to-faculty ratio for the majority of the program-specific courses in the program is 20:1; the ratios for the general education courses vary but are usually higher. Emphasis on the industry experience of the faculty is based on the desire to have real-world examples to share with students as well as make potential contacts with the wider industry. Students in the SDCET program have numerous opportunities in addition to the faculty to interact with the industry. Through career fairs, alumni engagement, and internships, students in the program at PSH U–H have access to the construction industry. The career fair held at PSH U–H is specific to the school, allowing a broad range of employers in the construction industry to access a pool of students. These employers are from both small and large companies based in Pennsylvania and the surrounding states. Students in all grades are encouraged to attend. Preparation for the career fair as well as for resume writing and mock interviews is provided through the career services office. It is not mandatory that students work with career services, but it is strongly encouraged. Beyond the PSH U–H career fair, the University's career fair also welcomes all PSU students participate in their services and to attend the university-wide and college career fairs. As students from PSH U–H finish with a PSU degree, the career fair provides students with an opportunity to meet with a wide array of employers that may be directly or indirectly related to the SDCET program.

Beyond the career fairs, students in the SDCET program are able to interact with industry through alumni engagement, with many alumni returning to PSH U–H to give informal talks or guest lectures to students. The aim of this alumni engagement is two-fold. First, it provides students with insight into what they could be doing upon graduation from people who were once, sometimes recently, in their position. Second, it provides students with the platform to talk with industry representatives and network for future internships or employment opportunities. A one credit hour internship is a requirement to graduate. However, realizing the benefits of having students engaging with the industry, PS U-H offers additional internship courses to students who wish to pursue home practical experience.

Being an engineering technology program has basic engineering applications as well as practical class technology exercises. The construction laboratories includes surveying, concrete, bituminous, soils, estimating, planning & scheduling and construction methods & materials. These on hands exercises enriches the student’s education experience. In addition, students in the SDCET program requires all options to take the fundamental structural design and construction management courses. This provides all graduates an understanding of these areas and enables them to interact better with other construction related professionals. This also support firms that both design and construct projects as well as government agencies.

Due to the students formally declaring their major in their junior year and the rigorous coursework, students take four and a half years on average to complete the program. Approximately 50 percent of the students graduate with the Construction Management option. Of those who graduate, 90 percent are employed in the construction industry after graduation. The remaining 10 percent are employed in a range of other industries or continue their education.

**Figure 25: Strengths and Weaknesses—Pennsylvania State University–Harrisburg**

<b>Strengths</b>	<b>Weaknesses</b>
High school recruitment process	Experiential opportunities
High graduate placement in construction industry post-graduation	
Industry experience of faculty/composition of faculty (no use of adjuncts)	
Alumni engagement	
Opportunities for students to engage with industry	
Affiliation with large university	
Name of Penn State University	
Practical lab exercises	

Sources: Pennsylvania State University–Harrisburg, RESI

## 6.0 Recommendations

The findings from these visits, the findings from the Maryland academic institution interviews, and the findings from the construction industry interviews form the basis of the recommendations that are presented here. These recommendations focus on what Maryland institutions can do to increase the attractiveness of their programs to new recruits as well as how to make their graduates more competitive in the labor market, particularly in Maryland, post-graduation.

It should be noted that these recommendations are not occurring in isolation, and there are many areas for overlap. For example, increased marketing of the industry to high school students and their parents to overcome the stereotypes of the industry provides a new pool of applications in the short term. In the long term, with the increased enrollment in Bachelor's degree programs relating to the field and the proven demand from the industry, new faculty can be hired and new programs can be developed. All of these points will be reviewed in this section.

### **6.1 Overcome Industry Stereotypes**

From the institution interviews (both in-state and out-of-state) as well as the construction industry interviews, RESI found that there are stereotypes associated with careers in the construction industry that would need to be corrected to both recruit and attract new students. These stereotypes include but are not limited to the following:

- Construction is a dirty job,
- Construction work is precarious, and
- Construction is underpaid.

While these stereotypes are not only applicable in Maryland, they are important to consider when encouraging students to enter a career in the industry to increase the number of graduates in Maryland. To overcome these barriers at Maryland academic institutions that are trying to attract students to their construction/built environment Bachelor's degree programs, RESI recommends that marketing campaigns specifically addressing these points be used during high school and college recruiting sessions as well in academic advising offices on campus for those existing students looking to change programs. In addition, RESI recommends that either successful alumni or industry representatives work alongside the department to highlight the demand for positions and the day-to-day experiences of employees.

### **6.2 Program Connections with Industry**

The out-of-state visits as well as the industry interviews highlighted the need for connections between academia and the industry, for both the faculty and students. This relationship can be mutually beneficial to the program, students, and industry over time. For the industry, this provides access to knowledge transfer opportunities with the next generation of employees. In addition, it provides an alternative environment for using existing skills through teaching. For the program, the faculty with industry experience can be a networking opportunity as well as a source for advisory group participation for program accreditation. In addition, the connections between academia and the industry can spill over to the students through networking and possibly employment opportunities.

#### **6.2.1 Industry Experience of Faculty**

The construction industry interview findings highlighted a deficit of faculty with industry experience in Maryland construction/built environment programs. This was particularly the

case for full-time faculty, regardless of their tenure status. The argument in favor of increasing the industry experience of all faculty highlights the need for more interaction between the industry and academia in Maryland. The in-state institution interviews supported this finding; many adjunct faculty have industry experience but few full-time faculty have any experience in the industry.

From the out-of-state visits, RESI found that all of the adjunct faculty and the overwhelming majority of the full-time, non-tenure track faculty have extensive industry experience. In this regard, the tenure track faculty positions are held for those applicants on a traditional academic tenure track. For the other positions, the industry experience is viewed as necessary to get students engaged in the course material through providing real-world examples. This connection to the industry also provides in roads for the department to host internships and co-op programs with specific companies that the current faculty work with in the past.

Based on these findings, RESI recommends increasing the number of faculty with construction industry experience in the departments. Adopting this recommendation could support traditional department goals of providing graduates with employment opportunities and strengthening the reach of the university.

### **6.2.2 Networking Events**

Strengthening the connections between the industry and university can directly benefit students, particularly those interested in industry-based employment post-graduation. Both in-state institutions and several out-of-state institutions noted that their programs participated in a university-wide job fair with invitations sent to major regional employers. However, the out-of-state institutions with programs that have a high graduate placement in the industry noted that they had exceptional results from networking events.

The networking events are held two times per year and include all of the students in the program as well as regional industry representatives from both large and small firms. Particular emphasis is placed on the ratio of student to industry representatives as well as the inclusion of students who are early in their academic career. For the former, the industry representatives range from the CEOs of companies to project managers to give students a true understanding of the company. For the latter, the emphasis on including all students is that first time attendees may be nervous but, after attending several events, will be comfortable approaching CEOs and highlighting what they can do for their company. Also, as part of their program, students are required to take a graduate preparation class that is geared toward resume writing, networking skills, and interview preparation. The networking events provide students with an opportunity to practice these skills with potential employers. In addition, in the case of Drexel University, the students also used these networking events to build connections to the industry for their co-op placements.

Due to the more one-to-one experience that the networking events provide as well as the experience that students gain from preparing for these events, RESI recommends that networking events be integrated into the student calendar for construction/built environment programs in Maryland. The students can showcase their work to the industry and potentially impress future employers.

### **6.2.3 Co-op Programs/Mandatory Internships**

The construction industry survey findings highlighted that most employers in the sample of the Maryland construction industry are looking to hiring graduates with a combination of education and experience. The survey respondents did not provide much information on what type of experience they wanted to see in graduates. It could be internship or co-op experience, experience in the wider labor market, or experience in the construction industry. Due to the emphasis on what universities can do to increase the employability of their graduates, as well as the success of out-of-state programs with a co-op, RESI recommends that construction programs at Maryland institutions adopt co-op programs.

The co-op programs can be run a number of ways, but the best results usually arise under the following conditions—the employer pays the student a salary during the co-op and, during several co-ops throughout the program, the student engages with different firms in the construction industry. In many cases, one if not more of the firms with which students complete their co-op experience will treat the co-op as an extended interview and approach students with a job offer upon graduation. This is a form of experience that students can acquire while still studying. Programs such as Drexel University's program, with 100 percent graduate placement in the construction industry, are integral in providing students with real world experience, thereby preparing them for their first full-time job post-graduation.

### **6.3 Increase the Number of Programs in the State**

RESI recommends an increase in the number of Bachelor's degree programs specific to the construction/built environment industry in Maryland in the following three ways:

1. Increase the number of university and colleges offering construction/built environment Bachelor's degree programs;
2. Increase the number of students who can be enrolled in new and existing programs; and
3. Increase the course content for new and existing programs.

As highlighted in Sections 3.0 and 4.0 of this report, the number of colleges and universities in Maryland greatly surpass the number of colleges and universities that are offering construction/built environment Bachelor's degrees in Maryland. The Maryland construction industry's demand is clear, yet the graduates produced both within Maryland and within the larger Mid-Atlantic region are insufficient to meet this demand. Based on this gap, RESI recommends increasing the number of universities and colleges offering these programs in Maryland.

For in-state institutions that already have programs or will implement these programs in the near future, the number of students should be increased. This may be more difficult for the latter group; for the former group, the institutions with existing programs, the industry is aware of the quality graduates that are being produced regionally. The issue is that the number of graduates who can enter the construction industry from existing programs in Maryland are significantly fewer than the demand—this is particularly the case for the construction management degree holders. It should be highlighted that, even if the enrollment doubled in these in-state programs, the demand for construction/built environment Bachelor's degree positions in Maryland over the next 10 years would not be met. Due to this forecasted future demand, the emphasis should be placed on increasing enrollment in these programs through increasing the attractiveness of the program and the industry as well as increasing the field-specific faculty in these in-state institutions.

Regardless of the new or existing status of the construction/built environment program, the courses that are a part of the program should be augmented to include business courses, career preparation courses, and technology-related courses. The business and technology courses are needed to align the graduate with the shifting needs of the industry. The career preparation courses are needed for two reasons. First, in the current labor market, graduates need to understand how to market themselves effectively, which a course that focuses on mock interviews and resume writing can provide. Second, in entering the construction industry, graduates should have existing knowledge in soft skills (i.e., how to act in meetings, take notes, etc.) which can be a part of their undergraduate curriculum.

#### **6.4 Creating a New Construction/Built Environment Program**

The previous recommendations repeatedly mention creating new programs focusing on the construction/built environment industry in Maryland. Using data gathered from visits to out-of-state academic institutions, predominantly Virginia Tech and Drexel University, this recommendation focuses on outlining what a new Construction Management program would consist of and where it would be created in Maryland. The programs reviewed in Section 5.0 have grown over time with the introduction of new courses, new faculty, and increasing enrollment. Yet, there are valuable lessons to be learned from these examples about structuring a successful construction/built environment program due to their ongoing success. Their success is gauged by their enrollment growth and by their reputation for producing high-quality graduates.

The new program would be an interdisciplinary five-year program taught by high-quality faculty in a central location. In regard to the interdisciplinary nature of the program, similar to the Construction Engineering and Management program at Virginia Tech, as outlined in Section 5.2, this program would bridge several schools. Due to the business emphasis within the wider construction management curriculum as well as the combination of theory and hands-on experience provided in engineering curriculum, one option could be for this program to bridge

existing engineering and business schools. There would also be a number of technology and professional development courses that are mandatory for students to complete in this program. For the former, to ensure that technology is specific to the field, it is expected to come from the engineering school. For the latter, to ensure that students are ready to operate in a professional environment upon graduation, courses from the business school on interview preparation, technical writing, and professionalism in the workplace would also be mandatory.

The program would be five years in length, with two six-month co-ops as a requirement for students starting after their third semester in the program. Similar to Drexel University's program outlined in Section 5.1, the co-op would consist of students actively networking and engaging with industry employers when choosing the site of their co-op. This requirement will prepare the students for navigating the labor market upon graduation while also introducing the students to potential employers. During the co-op period, students would work for their employer in a traditional entry-level role, and their salary would be paid for by the employer. Students would be encouraged to complete their co-op placements at different companies. The length of the program could be reduced if students completed their co-ops during summer months.

As demonstrated throughout Section 5.0, the industry experience of faculty is beneficial to students in a number of ways. This program would require all faculty, with the exception of two tenure-track positions, to have industry experience. The program would not rely on adjunct faculty whatsoever. The number of faculty needed for the program would be dependent on enrollment. It is expected that, due to the program offering being new as well as the industry stereotypes, enrollment will grow over time. For program-specific courses, it is expected that the faculty-to-student ratio of 18:1 will always be maintained. The funding for this faculty could be provided by industry endowments, alumni contributions, or other sources of funding.

The location of the program is of importance in terms of attracting students, transport for commuter students, accessibility for networking events, and the reputation of the larger academic institution. It is also important to consider the structure of the institution as some students may inevitably want to change majors leaving this program, enter this program during their matriculation, or take this program as a minor (similar to the Penn State–Harrisburg model). Focusing on the aforementioned points as well as the in-state institutions that already offer commensurate programs outlined in Section 3.2, the University of Maryland system may be best placed to initiate a program of this kind in Maryland.

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## Appendix A—Methodology and Analysis

Appendix A will provide an overview of the methods that RESI and, where applicable, HR&A used to gather the data in this report as well as an explanation of how RESI analyzed the data. The follow methods were used to gather data for this report: online surveys, industry interviews, in-state institution interviews, and out-of-state visits. Each method, along with the subsequent analysis of the data gathered through these methods, will be reviewed in this appendix.

### A.1 Survey Methodology and Analysis

This section details the results from RESI's industry demand survey. With the input of MCCEI as well as HR&A, RESI developed the survey, and MCCEI employed the use of the web survey tool. SurveyGizmo was used to disseminate the survey to almost 400 entities in the construction and built environment industry in Maryland. The entities that were sent the survey and compose the survey sample were identified by MCCEI as being integral to the Maryland construction and built environment industry. The survey was disseminated over a three-week period during September to October 2014. Survey participation included 66 responses during the survey window. RESI then analyzed the survey data collected during this period.

#### A.1.1 Survey Development

The aim of the survey was to determine the demand for Bachelor's degree candidates in Maryland's construction and built environment industry. To meet this goal, RESI used a variety of sources to collect the required data. These sources included an extensive consultation period with MCCEI due to its knowledge of the industry, a thorough literature review process, and consultation with the subcontractor HR&A. Please see Appendix B.1 for a list of the survey questions.

The instructions for the survey participants on how to complete the survey and how the survey data would be used were outlined in the introductory page to the survey as well as in the initial email that was disseminated by MCCEI. The information on how to complete the survey noted how long the survey should take to complete and that the survey responses would not be saved unless the survey was completed. The information on how the survey data would be used noted that the survey information was confidential and would only be viewed by RESI analysts and MCCEI representatives. The confidentiality extended to all identifying information at the entity level and at the personal level.

The survey findings are presented in Section A.1.3 below. For each survey question and its corresponding figure, RESI discussed the findings and included any conclusions that can be drawn from the data. RESI then used the survey findings to complete an economic and fiscal impact analysis.

**A.1.2 Survey Response Quality Control**

A total of 66 surveys were submitted during the survey period. RESI checked for duplicate responses using the IP address field. One response was deemed to be a duplicate and removed from the analysis, bringing the number of viable survey responses to 65. Several additional survey responses were incomplete; five respondents only answered the first question, four respondents only answered through the fifteenth question. Responses of this type are represented under “no response” in the analysis.

For the purpose of the economic impact analysis, RESI removed these additional survey responses. Please refer to the subsequent subsection for more information.

**A.1.3 Survey Responses**

Of the 66 survey responses, 65 surveys were deemed viable. Please note that due to rounding, totals throughout the report may not exactly equal summed responses. In most cases, responses are reported as a percentage of the total 65 respondents. However, in cases such as follow-up questions or questions that allowed for multiple responses, responses are reported as a percentage of the total responses for that given question.

**Figure 26: Is your company headquartered in Maryland?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Yes	51	77.3%
No	15	22.7%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

The majority of respondents, 77.3 percent, reported that their company is headquartered in Maryland.

**Figure 27: If your company is headquartered in Maryland, in which county is your company headquartered?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Allegany County	0	0.0%
Anne Arundel County	4	7.8%
Baltimore County	10	19.6%
Baltimore City	19	37.3%
Calvert County	0	0.0%
Caroline County	0	0.0%
Carroll County	0	0.0%
Cecil County	0	0.0%
Charles County	1	2.0%
Dorchester County	0	0.0%
Frederick County	3	5.9%
Garrett County	0	0.0%
Harford County	2	3.9%
Howard County	2	3.9%
Kent County	1	2.0%
Montgomery County	5	9.8%
Prince George's County	2	3.9%
Queen Anne's County	0	0.0%
St. Mary's County	0	0.0%
Somerset County	0	0.0%
Talbot County	1	2.0%
Washington County	1	2.0%
Wicomico County	0	0.0%
Worcester County	0	0.0%
No response		
<b>Total</b>	<b>51</b>	<b>100.0%</b>

Source: RESI

Of those respondents that indicated that their company is headquartered in Maryland, 37.3 percent indicated that their company is headquartered in Baltimore City.

**Figure 28: If your company is not headquartered in Maryland, in which county or counties does your company have facilities in?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Allegany County	0	0.0%
Anne Arundel County	4	11.4%
Baltimore County	4	11.4%
Baltimore City	5	14.3%
Calvert County	1	2.9%
Caroline County	0	0.0%
Carroll County	1	2.9%
Cecil County	0	0.0%
Charles County	0	0.0%
Dorchester County	0	0.0%
Frederick County	3	8.6%
Garrett County	0	0.0%
Harford County	1	2.9%
Howard County	6	17.1%
Kent County	1	2.9%
Montgomery County	4	11.4%
Prince George's County	4	11.4%
Queen Anne's County	0	0.0%
St. Mary's County	0	0.0%
Somerset County	0	0.0%
Talbot County	0	0.0%
Washington County	1	2.9%
Wicomico County	0	0.0%
Worcester County	0	0.0%
No response		
<b>Total</b>	<b>35</b>	<b>100.0%</b>

Source: RESI

Of those respondents that indicated that their company is not headquartered in Maryland, 17.1 percent indicated that their company has facilities in Howard County.

**Figure 29: Please indicate the size of your company by the number of employees on your payroll.**

Response	Count	Percent
Less than 50	32	48.5%
51 to 100	10	15.2%
101 to 500	20	30.3%
501 to 1,000	3	4.5%
More than 1,001	1	1.5%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

The plurality of respondents, 48.5 percent, indicated that their company has less than 50 employees on payroll.

**Figure 30: What is your company’s area of specialization?**

Response	Count	Percent
Residential Building Construction (NAICS code 2361)	1	1.5%
Nonresidential Building Construction (NAICS code 2362)	27	40.9%
Utility System Construction (NAICS code 2371)	2	3.0%
Land Subdivision (NAICS code 2372)	0	0.0%
Highway, Street, and Bridge Construction (NAICS code 2373)	5	7.6%
Other Heavy and Civil Engineering Construction (NAICS code 2379)	1	1.5%
Foundation, Structure, and Building Exterior Contractor (NAICS code 2381)	0	0.0%
Building Equipment Contractor (NAICS code 2382)	1	1.5%
Building Finishing Contractor (NAICS code 2383)	1	1.5%
Other Specialty Trade Contractor (NAICS code 2389)	6	9.1%
Architectural, Engineering, and Related Services (NAICS code 5413)	14	21.2%
Other	8	12.1%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

The plurality of respondents, 40.9 percent, indicated that their company specializes in Nonresidential Building Construction—followed by Architectural, Engineering, and Related Services. Other responses included “supportive and community services with real estate,” “commercial developer,” “commercial real estate development and construction,” “commercial development,” “roofing and sheet metal contractor,” “general contractor,” “construction supply,” and “construction manager/owner rep/project manager.”

**Figure 31: Over the past three years for non-trade job openings at your firm, please indicate how important it is for applicants to have the selected education or training backgrounds regardless of position or experience level.**

Response	Absolutely Vital	Very important	Important	Moderately Important	Of Little Importance	Unimportant						
High School Diploma or GED	0	0.0%	52	78.8%	9	13.6%	2	3.0%	1	1.5%	2	3.0%
Professional Certification	0	0.0%	11	16.7%	17	25.8%	24	36.4%	11	16.7%	3	4.5%
Associate's Degree	0	0.0%	14	21.2%	13	19.7%	17	25.8%	13	19.7%	9	13.6%
Bachelor's Degree	0	0.0%	35	53.0%	13	19.7%	12	18.2%	1	1.5%	5	7.6%
Graduate Degree	0	0.0%	4	6.1%	12	18.2%	13	19.7%	24	36.4%	13	19.7%
Apprenticeship	0	0.0%	6	9.1%	6	9.1%	11	16.7%	21	31.8%	22	33.3%
Journeyman or Master Trade License	0	0.0%	3	4.5%	4	6.1%	9	13.6%	23	34.8%	27	40.9%
On-the-job Experience Only	0	0.0%	14	21.2%	16	24.2%	20	30.3%	10	15.2%	6	9.1%

Source: RESI

Respondents most often indicated that a High School Diploma or GED and Bachelor's Degree were “very important,” while Professional Certification is “important,” when hiring for non-trade job openings. Most often respondents indicated that a Journeyman or Master Trade License is “unimportant” when hiring for non-trade job openings.

**Figure 32: Over the past three years, please indicate how frequent it is for non-trade hires at your firm to have the selected degree or educational background.**

<b>Response</b>	<b>Always</b>		<b>Frequently</b>		<b>Occasionally</b>		<b>Rarely</b>		<b>Never</b>	
Associate's Degree in Building Construction or Construction Management	3	4.5%	18	27.3%	18	27.3%	14	21.2%	13	19.7%
Bachelor's Degree in Architectural/Structural Engineering	2	3.0%	24	36.4%	13	19.7%	10	15.2%	17	25.8%
Bachelor's/Master's Degree in Architecture	6	9.1%	11	16.7%	10	15.2%	16	24.2%	23	34.8%
Bachelor's Degree in Business/Finance/Management	3	4.5%	9	13.6%	23	34.8%	13	19.7%	18	27.3%
Bachelor's Degree in Civil Engineering	2	3.0%	20	30.3%	16	24.2%	7	10.6%	21	31.8%
Bachelor's Degree in Construction Engineering	2	3.0%	18	27.3%	13	19.7%	13	19.7%	20	30.3%
Bachelor's Degree in Construction Management/Building Construction	4	6.1%	23	34.8%	13	19.7%	12	18.2%	14	21.2%
Bachelor's Degree in Mechanical Engineering	2	3.0%	8	12.1%	16	24.2%	15	22.7%	25	37.9%
Bachelor's Degree in Project Management	2	3.0%	13	19.7%	15	22.7%	15	22.7%	21	31.8%
Bachelor's/Master's Degree in Real Estate	1	1.5%	2	3.0%	9	13.6%	16	24.2%	38	57.6%

Source: RESI

The majority of respondents, 54.6 percent, indicated that non-trade hires at the firm frequently or occasionally have an Associate’s degree in building construction/construction management. A plurality of respondents, 36.4 percent, indicated that non-trade hires frequently have a Bachelor’s degree in architectural/structural engineering. A plurality of respondents, 34.8 percent, indicated that non-trade hires never have a Bachelor’s or Master’s degree in architecture, while 9.1 percent indicated that non-trade hires always have one of these degrees. A plurality of respondents, 34.8 percent, indicated that non-trade hires occasionally have a Bachelor’s degree in business, finance, or management. A plurality of respondents, 31.8 percent, indicated that non-trade hires never have a Bachelor’s degree in civil engineering, while 30.3 percent of respondents indicated that non-trade hires frequently have a Bachelor’s degree in civil engineering. A plurality of respondents, 30.3 percent, indicated that non-trade hires never have a Bachelor’s degree in construction engineering, while 30.3 percent indicated that non-trade hires always or frequently have a Bachelor’s degree in construction engineering. A plurality of respondents, 34.8 percent, indicated that non-trade hires frequently have a Bachelor’s degree in construction management/building construction. A plurality of respondents, 37.9 percent, indicated that non-trade hires never have a Bachelor’s degree in mechanical engineering, while 39.3 percent of respondents indicated that non-trade hires at least occasionally have a Bachelor’s degree in mechanical engineering. A plurality of respondents, 31.8 percent, indicated that non-trade hires never have a Bachelor’s degree in project management, while 45.4 percent of respondents indicated that non-trade hires at least occasionally have a Bachelor’s degree in project management. The majority of respondents, 57.6 percent, indicated that non-trade hires never have a Bachelor’s or Master’s degree in real estate.

**Figure 33: Approximately, what is the annual salary associated with entry-level bachelor’s degree positions in your company?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Less than \$30,000	3	4.5%
\$30,001 to \$40,000	2	3.0%
\$40,001 to \$50,000	21	31.8%
\$50,001 to \$60,000	24	36.4%
\$60,001 to \$70,000	14	21.2%
Over \$70,000	2	3.0%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

The plurality of respondents, 36.4 percent, indicated that the annual salary associated with entry-level bachelor’s degree positions in their company is between \$50,001 and \$60,000.

**Figure 34: Over the past three years, what percentage of total non-trade hires was from colleges or universities in Maryland?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
None	14	21.2%
Less than 20%	28	42.4%
21 to 40%	9	13.6%
41 to 60%	7	10.6%
61 to 80%	4	6.1%
80 to 100%	4	6.1%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

Most often, 42.4 percent, respondents indicated that some but less than 20 percent of non-trade hires over the past three years were from colleges or universities in Maryland.

**Figure 35: If your company has hired from colleges or universities in Maryland over the past three years, from which institutions did your company hire?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
University of Maryland Baltimore County	12	12.2%
University of Maryland College Park	32	32.7%
University of Maryland Eastern Shore	5	5.1%
Johns Hopkins University	7	7.1%
Morgan State University	13	13.3%
Salisbury University	3	3.1%
Towson University	7	7.1%
Local Community College	12	12.2%
Other-Please list all that apply.	7	7.1%
<b>Total</b>	<b>98</b>	<b>100.0%</b>

Source: RESI

Of those respondents with non-trade hires from a college or university in Maryland in the past three years most, 32.7 percent, respondents indicated that hires were made from University of Maryland College Park. Other responses included Montgomery College (which was re-categorized into “local community college”), MICA, Loyola, (CCBC and) University of Baltimore, VT/PSU, Frostburg State, McDaniel College, Bowie State, and Frostburg.

**Figure 36: If your company has hired from local community colleges in Maryland over the past three years, from which institutions did your company hire?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Anne Arundel Community College	2	16.7%
Baltimore City Community College	3	25.0%
College of Southern Maryland	1	8.3%
Frederick Community College	1	8.3%
Montgomery Community College	4	33.3%
Prince George's Community College	0	0.0%
Wor-Wic Community College	0	0.0%
Other-Please list all that apply.	1	8.3%
<b>Total</b>	<b>12</b>	<b>100.0%</b>

Source: RESI

Of those respondents with non-trade hires in the past three years from local community colleges in Maryland most respondents, 58.3 percent, indicated that hires were made from Montgomery Community College or Baltimore City Community College. Other responses included the Community College of Baltimore County (CCBC).

**Figure 37: Over the past three years, what factors encouraged you to hire a graduate from a Maryland education institution? Please select all that apply.**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
College program	27	19.4%
GPA	12	8.6%
Internship experience	27	19.4%
Past employment	29	20.9%
Place of training (apprenticeships)	4	2.9%
References	18	12.9%
Years of experience	14	10.1%
Years of training (apprenticeships)	5	3.6%
Other	3	2.2%
<b>Total</b>	<b>139</b>	<b>100.0%</b>

Source: RESI

Of those respondents with non-trade hires from a college or university in Maryland in the past three years most respondents, 59.7 percent, indicated that past employment, internship experience, and the college program encouraged the company to hire from a Maryland education institute. Other responses included the individual’s personality/work ethic and the reputation of the education institute.

**Figure 38: What is the construction industry's biggest challenge for hiring non-trade applicants from Maryland-based institutions?**

Response	Count	Percent
Small number of total applicants	28	53.8%
Small number of specialized applicants	14	26.9%
Too many total applicants	1	1.9%
Too many qualified specialized (not enough general) applicants	2	3.8%
Other	7	13.5%
<b>Total</b>	<b>52</b>	<b>100.0%</b>

Source: RESI

Respondents most often indicated that the construction industry's biggest challenge for hiring non-trade applicants from Maryland-based institutions is the small number of total applicants. Other responses most often included the quality/qualifications of candidates.

**Figure 39: Approximately, what is the annual rate of turnover of non-trade workers hired from Maryland institutions?**

Response	Count	Percent
Less than 10%	40	76.9%
11% to 30%	9	17.3%
31% to 50%	3	5.8%
Over 50%	0	0.0%
<b>Total</b>	<b>52</b>	<b>100.0%</b>

Source: RESI

Respondents most often indicated that the annual rate of turnover of non-trade workers hired from Maryland institutions was less than 10 percent.

**Figure 40: If your turnover is 31 percent or greater, how has this high turnover impacted your company?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Hiring costs	3	33.3%
Retraining costs	3	33.3%
Decreased total output	2	22.2%
Decreased quality of output	1	11.1%
Other	0	0.0%
<b>Total</b>	<b>9</b>	<b>100.0%</b>

Source: RESI

Of the respondents that indicated their turnover is 31 percent or more, 66.6 percent indicated that this high turnover impacts their company primarily in increased hiring and/or retraining costs.

**Figure 41: On average, how long is the tenure of employment of non-trade workers hired from Maryland educational institutions?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Less than one year	1	1.9%
One year to less than two years	1	1.9%
Two years to less than three years	5	9.6%
Three years to less than five years	20	38.5%
Five years to less than ten years	19	36.5%
Ten years or more	6	11.5%
<b>Total</b>	<b>52</b>	<b>100.0%</b>

Source: RESI

Most respondents, 38.5 percent, indicated that the tenure of employment of non-trade workers hired from Maryland educational institutions with their company is three years to less than five years, followed closely by five years to less than ten years (36.5 percent).

**Figure 42: What is the most likely reason for a non-trade employee hired from a Maryland educational institution to resign voluntarily?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Salary and compensation	8	15.4%
Desire for increased responsibilities	2	3.8%
Career advancement	18	34.6%
Change in career direction	7	13.5%
Leaving the region/state for another area	15	28.8%
Other	2	3.8%
<b>Total</b>	<b>52</b>	<b>100.0%</b>

Source: RESI

A plurality of respondents, 34.6 percent, indicated that the most likely reason for a non-trade employee hired from a Maryland educational institution to resign voluntarily is for career advancement. Other responses included “recruited by another company” and “travel and relocation,” which RESI reassigned to the “leaving the region/state for another area” response.

**Figure 43: Over the past three years, what percentages of total non-trade hires were from colleges or universities outside of Maryland?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
None	16	24.2%
Less than 20%	9	13.6%
21% to 40%	5	7.6%
41% to 60%	6	9.1%
61% to 80%	13	19.7%
81% to 100%	17	25.8%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

Most often, 25.8 percent, respondents indicated that between 81 and 100 percent of non-trade over the past three years were from colleges or universities outside of Maryland. The next most frequent response, 24.2 percent, was that none of the total non-trade hires were from colleges or universities outside of Maryland.

**Figure 44: If any of our non-trade hires over the past three years were from colleges or universities outside of Maryland, which out-of-state institutions?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Bucknell University	5	3.1%
Catholic University of America	6	3.8%
Clarkson University	3	1.9%
Clemson University	9	5.6%
Drexel University	4	2.5%
East Carolina University	7	4.4%
Ferris State University	2	1.3%
George Washington University	3	1.9%
Georgia Institute of Technology	5	3.1%
Harvard University	2	1.3%
Penn College of Technology	5	3.1%
Penn State University	28	17.5%
Purdue University	9	5.6%
University of Delaware	5	3.1%
University of Virginia	12	7.5%
Virginia Polytechnic Institute and State University	25	15.6%
West Virginia University	8	5.0%
Other	22	13.8%
<b>Total</b>	<b>160</b>	<b>100%</b>

Source: RESI

Of those respondents with non-trade hires from colleges or universities outside of Maryland in the past three years most, 17.5 percent, respondents indicated that hires were made from Penn State University. Other responses included Syracuse, Penn, George Mason, WPI, U of Rhode Island, SUNY, Alfred State, New York, Rutgers, Syracuse University, University of Belgrade, UMass, RIT, SUNY-Buffalo, UMO, Brown, Florida State, Michigan State University, Columbia, Yale, UCLA, University of Miami, and Miami University.

**Figure 45: Over the past three years, what factors encouraged you to hire a graduate from an out-of-state education institution?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
College program	33	21.7%
GPA	12	7.9%
Internship experience	23	15.1%
Past employment	28	18.4%
Place of training (apprenticeships)	3	2.0%
References	18	11.8%
Years of experience	23	15.1%
Years of training (apprenticeships)	4	2.6%
Other	8	5.3%
<b>Total</b>	<b>152</b>	<b>100.0%</b>

Source: RESI

Of those respondents with non-trade hires from a college or university outside of Maryland in the past three years most, 40.1 percent, respondents indicated that the college program and past employment encouraged the company to hire from an out-of-state education institution. Other responses included the number and characteristics of applicants and familiarity with the applicant's alma mater.

**Figure 46: Approximately, what is the annual rate of turnover of non-trade workers hired from institutions outside of Maryland over the last three years?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
None	7	14.0%
Less than 10%	29	58.0%
11%-30%	12	24.0%
31-50%	2	4.0%
Over 50%	0	0.0%
<b>Total</b>	<b>50</b>	<b>100.0%</b>

Source: RESI

Respondents most often indicated that the annual rate of turnover of non-trade workers hired from outside of Maryland institutions was less than 10 percent.

**Figure 47: How has this high rate of turnover impacted your company?**

Response	Count	Percent
Hiring costs	2	28.6%
Retraining costs	2	28.6%
Decreased total output	2	28.6%
Decreased quality of output	1	14.3%
Other	0	0.0%
<b>Total</b>	<b>7</b>	<b>100.0%</b>

Source: RESI

Of the two respondents that indicated their turnover is 31 percent of more, the respondents indicated that this high turnover impacts their company primarily in increased hiring and retraining costs, as well as overall output.

**Figure 48: On average, how long is the tenure of employment of non-trade workers hired from out-of-state educational institutions?**

Response	Count	Percent
Less than one year	0	0.0%
One year to less than two years	4	8.0%
Two years to less than three years	6	12.0%
Three years to less than five years	16	32.0%
Five years to less than ten years	16	32.0%
Ten years or more	8	16.0%
<b>Total</b>	<b>50</b>	<b>100.0%</b>

Source: RESI

Most respondents, 32.0 percent each, indicated that the tenure of employment of non-trade workers hired from outside of Maryland educational institutions with their company is three years to less than five years, or five years to less than ten years.

**Figure 49: What is the most likely reason for a non-trade employee hired from an out-of-state educational institution to resign voluntarily?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Salary and compensation	4	8.0%
Desire for increased responsibilities	0	0.0%
Career advancement	17	34.0%
Change in career direction	9	18.0%
Leaving the region/state for another area	18	36.0%
Other	2	4.0%
<b>Total</b>	<b>50</b>	<b>100.0%</b>

Source: RESI

A plurality of respondents, 36.0 percent, indicated that the most likely reason for a non-trade employee hired from an out-of-state educational institution to resign voluntarily is because they are leaving the region/state or for career advancement. Other responses included location and that no non-trade employees from hired from an out-of-state educational institution have resigned voluntarily.

**Figure 50: Would expanding existing two year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland’s community colleges?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Strongly agree	4	6.1%
Agree	8	12.1%
Not sure	18	27.3%
Disagree	28	42.4%
Strongly disagree	8	12.1%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

When asked if expanding existing two year degree programs in construction related majors would lead to the hiring of more non-trade workers educated by Maryland’s community colleges, respondents most often disagreed.

**Figure 51: Would increasing the number of two year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland's community colleges?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Strongly agree	5	7.6%
Agree	9	13.6%
Not sure	17	25.8%
Disagree	28	42.4%
Strongly disagree	7	10.6%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

When asked if increasing the number of two year degree programs in construction related majors would lead to the hiring of more non-trade workers educated by Maryland's community colleges, respondents most often disagreed.

**Figure 52: Would expanding existing four year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland colleges or universities?**

<b>Response</b>	<b>Count</b>	<b>Percent</b>
Strongly agree	1	1.5%
Agree	2	3.0%
Not sure	16	24.2%
Disagree	25	37.9%
Strongly disagree	22	33.3%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

When asked if expanding existing four year degree programs in construction related majors would lead to the hiring of more non-trade workers educated by Maryland's community colleges, respondents most often disagreed.

**Figure 53: Would increasing the number of four year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland colleges or universities?**

Response	Count	Percent
Strongly agree	1	1.5%
Agree	2	3.0%
Not sure	19	28.8%
Disagree	24	36.4%
Strongly disagree	20	30.3%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

When asked if increasing the number of four year degree programs in construction related majors would lead to the hiring of more non-trade workers educated by Maryland's community colleges, respondents most often disagreed.

**Figure 54: In the future, do you anticipate hiring non-trade applicants from an educational institution in Maryland?**

Response	Count	Percent
No	2	3.0%
Maybe	22	33.3%
Yes	37	56.1%
Don't know	5	7.6%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

Most respondents, 56.1 percent, indicated that they do anticipate hiring non-trade applicants from an educational institution in Maryland.

**Figure 55: In the future, do you anticipate hiring non-trade applicants from an educational institution outside of Maryland?**

Response	Count	Percent
No	4	6.1%
Maybe	27	40.9%
Yes	29	43.9%
Don't know	6	9.1%
<b>Total</b>	<b>66</b>	<b>100.0%</b>

Source: RESI

Most respondents, 43.9 percent, indicated that they do anticipate hiring non-trade applicants from an educational institution outside of Maryland.

**Figure 56: Please indicate the number of hires by degree type for anticipated job openings with your company over the next 3 years:**

Response	Number of Hires	Experience Level	Most likely from which institution(s)?
Associate's Degree- Construction Management	48		
	5	Intern	
	10	Entry Level	
	1	3 years	
	3	2 years	
	5	0-5 years	
	24	Did not specify	
Bachelor's Degree- Architectural/Structural Engineering	60		
	18	Entry Level	
	5	Bachelor's Degree	
	10	College Graduates	
	1	5-7 years	
Bachelor's/Master's Degree-Architecture	26	Did not specify	
	133		
	2	0	
	6	0 to 15 years	
	100	0-20	
	2	3 to 5 years	
	5	3 years	
	0	4-12	
	2	5 years min	
16	Did not specify		
Bachelor's Degree- Business/Finance	36		
	13	Entry Level	
	5	New hire	
	1	4	
	1	5 years +	
	3	0-7 years	
	1	10-20 years	
	12	Did not specify	

**Maryland Center for Construction Education and Innovation**  
**State of Maryland Construction Industry Bachelor's Degree Demand Analysis**  
 RESI of Towson University

Response	Number of Hires	Experience Level	Most likely from which institution(s)?
Bachelor's Degree-Civil Engineering	109		
	3	Basic	
	20	Entry Level	
	10	Bachelor's degree	
	10	0	
	1	5-7 years	
	4	mid-level	
	1	0-10 years	
	2	College graduates	
	1	undergrad	
	1	5 years	
	5	PM and PE	
	51	Did not specify	
Bachelor's Degree-Construction Engineering	75		
	3	3-4	
	14	Entry Level	
	4	1	
	1	3 yrs	
	1	0-5 years	
	20	PM and PE	
32	Did not specify		
Bachelor's Degree-Construction Management	183		
	50	New hire	
	0	3-4	
	23	Entry Level	
	0	Varying	
	4	1	
	15	0	
	1	5-7 years	
	2	summer jobs	
	1	mid-level to senior	
	2	4 year degree	
	5	0-5 years	
	1	3	
	30	PM, PE, and Supt.	
	3	2	
46	Did not specify		

**Maryland Center for Construction Education and Innovation**  
**State of Maryland Construction Industry Bachelor's Degree Demand Analysis**  
 RESI of Towson University

Response	Number of Hires	Experience Level	Most likely from which institution(s)?
Bachelor's Degree-Economics	2		
	2	Did not specify	
Bachelor's Degree-Liberal Arts	19		
	19	Did not specify	
Bachelor's Degree-Logistics	1		
	1	Did not specify	
Bachelor's Degree-Project Management	25		
	1	5 years +	
	24	Did not specify	
Bachelor's/Master's Degree-Real Estate	6		
	6	Did not specify	
Degrees are irrelevant	22		
	4	all levels	
	3	2-10 years	
	1	8	
	1	0-5 years	
	3	irrelevant	
	2	5	
	5	interns	
	3	Did not specify	

Source: RESI

As shown in Figure 56, companies in the Maryland construction industry have varied hiring needs.

Figure 57 presents cross-tabulations of degree requirements by company type.

**Figure 57: Over the past three years for non-trade job openings at your firm, please indicate how important it is for applicants to have the selected education or training backgrounds regardless of position or experience level.**

7. Over the past three years for non-trade job openings at your firm, please indicate how important it is for applicants to have the selected education or training backgrounds regardless of position or experience level.						
Residential Building Construction (NAICS code 2361)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	1	0	0	0	0
Professional Certification	0	0	0	0	1	0
Associate's Degree	0	0	0	0	1	0
Bachelor's Degree	0	1	0	0	0	0
Graduate Degree	0	0	0	0	1	0
Aprenticeship	0	0	0	0	1	0
Journeyman or Master Trade License	0	0	0	0	1	0
On-the-job Experience Only	0	1	0	0	0	0
Nonresidential Building Construction (NAICS code 2362)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	23	2	1	0	1
Professional Certification	0	1	7	11	7	1
Associate's Degree	0	5	6	7	6	3

**Maryland Center for Construction Education and Innovation**  
**State of Maryland Construction Industry Bachelor's Degree Demand Analysis**  
 RESI of Towson University

Bachelor's Degree	0	11	8	6	0	2
Graduate Degree	0	1	3	2	14	7
Apprenticeship	0	2	2	3	9	11
Journeyman or Master Trade License	0	1	1	3	12	10
On-the-job Experience Only	0	6	5	11	3	2
Utility System Construction (NAICS code 2371)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	1	1	0	0	0
Professional Certification	0	0	0	0	1	1
Associate's Degree	0	0	0	1	0	1
Bachelor's Degree	0	0	1	0	0	1
Graduate Degree	0	0	0	1	0	1
Apprenticeship	0	0	0	0	1	1
Journeyman or Master Trade License	0	0	0	1	0	1
On-the-job Experience Only	0	0	1	1	0	0
Land Subdivision (NAICS code 2372)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt

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High School Diploma or GED	0	0	0	0	0	0
Professional Certification	0	0	0	0	0	0
Associate's Degree	0	0	0	0	0	0
Bachelor's Degree	0	0	0	0	0	0
Graduate Degree	0	0	0	0	0	0
Apprenticeship	0	0	0	0	0	0
Journeyman or Master Trade License	0	0	0	0	0	0
On-the-job Experience Only	0	0	0	0	0	0
Highway, Street, and Bridge Construction (NAICS code 2373)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	3	0	1	1	0
Professional Certification	0	1	0	3	1	0
Associate's Degree	0	1	3	0	1	0
Bachelor's Degree	0	2	1	1	1	0
Graduate Degree	0	0	0	2	3	0
Apprenticeship	0	0	1	1	3	0
Journeyman or Master Trade License	0	0	1	1	3	0
On-the-job Experience Only	0	0	1	3	1	0
Other Heavy and Civil Engineering Construction (NAICS code 2379)						

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	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	1	0	0	0	0
Professional Certification	0	1	0	0	0	0
Associate's Degree	0	1	0	0	0	0
Bachelor's Degree	0	1	0	0	0	0
Graduate Degree	0	1	0	0	0	0
Aprenticeship	0	1	0	0	0	0
Journeyman or Master Trade License	0	1	0	0	0	0
On-the-job Experience Only	0	1	0	0	0	0
Foundation, Structure, and Building Exterior Contractor (NAICS code 2381)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	0	0	0	0	0
Professional Certification	0	0	0	0	0	0
Associate's Degree	0	0	0	0	0	0
Bachelor's Degree	0	0	0	0	0	0
Graduate Degree	0	0	0	0	0	0
Aprenticeship	0	0	0	0	0	0
Journeyman or Master Trade License	0	0	0	0	0	0

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On-the-job Experience Only	0	0	0	0	0	0
Building Equipment Contractor (NAICS code 2382)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	1	0	0	0	0
Professional Certification	0	0	0	1	0	0
Associate's Degree	0	0	0	0	1	0
Bachelor's Degree	0	0	0	1	0	0
Graduate Degree	0	0	0	0	1	0
Aprenticeship	0	1	0	0	0	0
Journeyman or Master Trade License	0	1	0	0	0	0
On-the-job Experience Only	0	1	0	0	0	0
Building Finishing Contractor (NAICS code 2383)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	1	0	0	0	0
Professional Certification	0	0	0	1	0	0
Associate's Degree	0	1	0	0	0	0
Bachelor's Degree	0	1	0	0	0	0

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Graduate Degree	0	0	0	1	0	0
Apprenticeship	0	0	0	1	0	0
Journeyman or Master Trade License	0	0	0	1	0	0
On-the-job Experience Only	0	1	0	0	0	0
Other Specialty Trade Contractor (NAICS code 2389)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	5	1	0	0	0
Professional Certification	0	0	4	1	0	1
Associate's Degree	0	1	2	3	0	0
Bachelor's Degree	0	2	1	3	0	0
Graduate Degree	0	0	1	0	3	2
Apprenticeship	0	0	1	1	2	2
Journeyman or Master Trade License	0	0	1	1	2	2
On-the-job Experience Only	0	0	4	0	1	1
Architectural, Engineering, and Related Services (NAICS code 5413)						
	Abso lutel y Vital	Very imp orta nt	Imp orta nt	Mod erate ly Impo rtant	Of Little Impo rtanc e	Unim porta nt
High School Diploma or GED	0	11	2	0	0	1

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Professional Certification	0	5	5	3	1	0
Associate's Degree	0	3	1	4	4	2
Bachelor's Degree	0	13	1	0	0	0
Graduate Degree	0	2	8	2	1	1
Apprenticeship	0	2	1	3	2	6
Journeyman or Master Trade License	0	0	1	0	3	10
On-the-job Experience Only	0	2	4	4	2	2

Source: RESI

Figure 58 presents a cross-tabulation of the importance of various degrees by company type.

**Figure 58: Importance of Degree Type by Company Type**

Bachelor's or Grad degree	Absolutely Vital	Very important	Important	Moderately Important	Of Little Importance	Unimportant
Residential Building Construction (NAICS code 2361)	0	1	0	0	1	0
Nonresidential Building Construction (NAICS code 2362)	0	12	11	8	14	9
Utility System Construction (NAICS code 2371)	0	0	1	1	0	2
Land Subdivision (NAICS code 2372)	0	0	0	0	0	0
Highway, Street, and Bridge Construction (NAICS code 2373)	0	2	1	3	4	0
Other Heavy and Civil Engineering Construction (NAICS code 2379)	0	2	0	0	0	0
Foundation, Structure, and Building Exterior Contractor (NAICS code 2381)	0	0	0	0	0	0
Building Equipment Contractor (NAICS code 2382)	0	0	0	1	1	0
Building Finishing Contractor (NAICS code 2383)	0	1	0	1	0	0
Other Specialty Trade Contractor (NAICS code 2389)	0	2	2	3	3	2
Architectural, Engineering, and Related Services (NAICS code 5413)	0	15	9	2	1	1
On-the-job only	Absolutely Vital	Very important	Important	Moderately Important	Of Little Importance	Unimportant

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Residential Building Construction (NAICS code 2361)	0	1	0	0	0	0				
Nonresidential Building Construction (NAICS code 2362)	0	6	5	11	3	2				
Utility System Construction (NAICS code 2371)	0	0	1	1	0	0				
Land Subdivision (NAICS code 2372)	0	0	0	0	0	0				
Highway, Street, and Bridge Construction (NAICS code 2373)	0	0	1	3	1	0				
Other Heavy and Civil Engineering Construction (NAICS code 2379)	0	1	0	0	0	0				
Foundation, Structure, and Building Exterior Contractor (NAICS code 2381)	0	0	0	0	0	0				
Building Equipment Contractor (NAICS code 2382)	0	1	0	0	0	0				
Building Finishing Contractor (NAICS code 2383)	0	1	0	0	0	0				
Other Specialty Trade Contractor (NAICS code 2389)	0	0	4	0	1	1				
Architectural, Engineering, and Related Services (NAICS code 5413)					0	0	1	0	3	10

Source: RESI

Figure 59 presents a cross-tabulation of hires of graduates by firm size.

**Figure 59: Hires of Graduates by Firm Size**

10. Over the past three years, what percentage of total non-trade hires was from colleges or universities in Maryland?					
	Less than 50	51 to 100	101 to 500	501 to 1,000	More than 1,001
None	8	5	1	0	0
Less than 20%	11	2	12	3	0
21 to 40%	6	1	2	0	0
41 to 60%	3	2	2	0	0
61 to 80%	2	0	1	0	1
81 to 100%	2	0	2	0	0
	32	10	20	3	1
25. Over the past three years, what percentages of total non-trade hires were from colleges or universities outside of Maryland?					
	Less than 50	51 to 100	101 to 500	501 to 1,000	More than 1,001
None	9	2	5	0	0
Less than 20%	5	2	2	0	0
21% to 40%	0	2	2	0	1
41% to 60%	3	1	2	0	0
61% to 80%	6	0	4	3	0
81% to 100%	9	3	5	0	0
	32	10	20	3	1

Source: RESI

Survey respondents also included qualitative data, which informed the analysis contained in Section 4.0. A copy of the complete survey instrument is included below.

## **A.2 Construction Industry Interviews**

RESI and HR&A conducted 19 interviews in total with construction industry executives in Maryland. Independently, MCCEI interviewed 30 construction industry executives in Maryland.<sup>75</sup> The contact details for all of the industry interviews were provided by MCCEI. The interviews were conducted over the phone during October 2014. Each interview lasted between 30 and 60 minutes. The following firms participated in the interviews conducted by RESI and HR&A: Ayers Saint Goss, Barton Malow Company, Bozzuto, Chaney Enterprises, DPR Construction, Free State Electric, GEDCO, Gilbane, Hensel Phelps, Kimball Construction Company, Mahogany, Morgan Keller, Plano-Coudon, Pool and Kent, Shapiro and Duncan, the JBG Companies, Therrian Waddell, Turner Construction Company, and Willow Construction.

During the interview, the participants were asked questions that RESI created, HR&A reviewed, and MCCEI approved. The interview was semi-structured, which allowed the interviewer to ask follow-up questions and probe deeper into specific topics where deemed necessary. The aim of the interviews was to understand how to make Maryland graduates more attractive to the Maryland construction industry. Please see the interview questions in Appendix B.2.

RESI and HR&A transcribed and analyzed the interview text that appears in the report. The analysis was completed through searching the text for specific themes that were generated from the data. This process was repeated three times. For example, if several firms discussed hiring graduates, RESI analysts searched for the term “graduates” in the first phase of the process. From the interviews that mentioned this term, they were searched a second time for “universities” in the second phase of the process. From the interviews that mentioned this term, they were searched a third time for “in-state” or “out-of-state” in the third phase of the process. Once this thematic coding was completed, the remaining text was reviewed as part of the original interviews to ensure that quotes were not taken out of context.

## **A.3 In-State Institution Interviews**

Using questions created by RESI and approved by MCCEI, HR&A and RESI conducted interviews with eleven in-state institutions that have construction/built environment Bachelor's degree programs. The contact details for all of the in-state institutions were provided by MCCEI. The interviews were conducted over the phone from November 2014 to January 2015. Each interview lasted between 30 and 45 minutes. The following in-state institutions participated in these interviews Anne Arundel Community College, College of Southern Maryland, Community College of Baltimore County, Frederick Community College, Johns Hopkins University, Montgomery College, Morgan State University, Prince George's Community College, University of Baltimore, University of Maryland College Park, and University of Maryland Eastern Shore.

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<sup>75</sup> All of the data collected by RESI and HR&A was analyzed. Only the quantitative data collected by MCCEI was analyzed. All analyzed data informed the findings presented in this report.

During the interview, the participants were asked questions that RESI created, HR&A reviewed, and MCCEI approved. The interview was semi-structured, which allowed the interviewer to ask follow-up questions and probe deeper into specific topics where deemed necessary. The aim of the interviews was to understand how the existing construction/built environment programs at Maryland schools are run and what they can do to improve. Please see the interview questions in Appendix B.3.

RESI and HR&A transcribed and analyzed the interview text that appears in the report. The analysis was completed through searching the text for specific themes that were generated from the data. This process was repeated three times. For example, if several firms discussed hiring graduates, RESI analysts searched for the term “graduates” in the first phase of the process. From the interviews that mentioned this term, they were searched a second time for “universities” in the second phase of the process. From the interviews that mentioned this term, they were searched a third time for “in-state” or “out-of-state” in the third phase of the process. Once this thematic coding was completed, the remaining text was reviewed as part of the original interviews to ensure that quotes were not taken out of context.

#### **A.4 Out-of-State Visits**

The findings from the construction industry interviews highlighted that several universities and colleges outside Maryland were considered to be best in practice regarding their construction management Bachelor's degree programs as well as their construction/built environment Bachelor's degree programs. MCCEI supported this information. As a result, RESI conducted site visits at four out-of-state institutions, including Penn State Harrisburg, Drexel University, Penn College of Technology, and the Virginia Polytechnic Institute and State University. RESI established contact with these institutions through introductions from MCCEI.

The aim of these visits was to get a better understanding of how these institutions are recruiting students to their programs, what their curriculum of their construction/built environment Bachelor's degree programs involve, the size of enrollment in these programs, the demand for their graduates, and where the demand for their graduates exist (i.e., in Maryland). To meet these aims, RESI visited each of these institutions and met with the head of the programs relevant to the study. Themes about which RESI asked during these meetings are listed in Appendix B.4.

As part of each visit, RESI gauged factors that may attract students to the general university and to the specific program. In addition, through physically being on the campus, RESI could gauge more latent factors that could attract students to the university and the program, such as location and access to state-of-the-art facilities. It should be noted that these visits were not intended to evaluate or rank the out-of-state institutions. Rather, they were intended to collect information on what these institutions, which rate very highly with the Maryland construction industry, are doing that sets them apart from other institutions either in or outside Maryland.

The data collected from these visits inform both the visit overview in Section 5.0 as well as the recommendations in Section 6.0. In several cases, the recommendations can be viewed as a contrast between what the in-state institutions are implementing in their construction/built environment programs and what the out-of-state institutions are implementing as best practices in their construction/built environment programs.

## Appendix B—Documentation

RESI compiled all of the supporting documentation that lead the methods and the analysis outlined in Appendix A in this section.

### B.1 Survey Questions

#### Part A: Background

1. Is your company headquartered in Maryland?
  - a. Yes
  - b. No
  
2. If (a) to Q1, in which county is your company headquartered?
  - a. Allegany
  - b. Anne Arundel
  - c. Baltimore
  - d. Baltimore City
  - e. Calvert
  - f. Caroline
  - g. Carroll
  - h. Cecil
  - i. Charles
  - j. Dorchester
  - k. Frederick
  - l. Garrett
  - m. Harford
  - n. Howard
  - o. Kent
  - p. Montgomery
  - q. Prince George's
  - r. Queen Anne's
  - s. Saint Mary's
  - t. Somerset
  - u. Talbot
  - v. Washington
  - w. Wicomico
  - x. Worcester
  
3. If (b) to Q1, in which county does your company have facilities?
  - a. Allegany
  - b. Anne Arundel
  - c. Baltimore

- d. Baltimore City
  - e. Calvert
  - f. Caroline
  - g. Carroll
  - h. Cecil
  - i. Charles
  - j. Dorchester
  - k. Frederick
  - l. Garrett
  - m. Harford
  - n. Howard
  - o. Kent
  - p. Montgomery
  - q. Prince George's
  - r. Queen Anne's
  - s. Saint Mary's
  - t. Somerset
  - u. Talbot
  - v. Washington
  - w. Wicomico
  - x. Worcester
4. Please indicate the size of your company by the number of employees on your payroll.
- a. Less than 50
  - b. 51 to 100
  - c. 101 to 500
  - d. 501 to 1,000
  - e. More than 1,001
5. What is your company's area of specialization? Please select one.
- a. Residential Building Construction (NAICS code 2361)
  - b. Nonresidential Building Construction (NAICS code 2362)
  - c. Utility System Construction (NAICS code 2371)
  - d. Land Subdivision (NAICS code 2372)
  - e. Highway, Street, and Bridge Construction (NAICS code 2373)
  - f. Other Heavy and Civil Engineering Construction (NAICS code 2379)
  - g. Foundation, Structure, and Building Exterior Contractor (NAICS code 2381)
  - h. Building Equipment Contractor (NAICS code 2382)
  - i. Building Finishing Contractor (NAICS code 2383)
  - j. Other Specialty Trade Contractor (NAICS code 2389)
  - k. Architectural, Engineering, and Related Services (NAICS code 5413)

I. Other

6. If answered (h) to Q5, please explain.

a. \_\_\_\_\_

**Part B: Education**

7. Over the past three years for non-trade job openings at your firm, please indicate how important it is for applicants to have the selected education or training backgrounds regardless of position or experience level.

	Absolutely Vital	Very important	Important	Moderately Important	Of Little Importance	Unimportant
High school diploma or GED						
Professional certification						
Associate's degree						
Bachelor's degree						
Graduate degree						
Apprenticeship						
Journeyman or Master Trade License						
On-the-job experience only						

8. Over the past three years, please indicate how frequent it is for non-trade hires at your firm to have the selected degree or educational background.

	Always	Frequently	Occasionally	Rarely	Never
Associate Degree in Building Construction or Construction Management					
Bachelor Degree in Construction management/building construction					
Business/finance/management					
Architectural/structural engineering					
Civil engineering					
Architecture					
Mechanical engineering					
Real Estate					
Construction engineering					
Project management					
Other					

9. Approximately, what is the annual salary associated with entry-level bachelor's degree positions in your company?

- a. Less than \$30,000
- b. \$30,000-\$40,000
- c. \$40,001-\$50,000
- d. \$50,001-\$60,000
- e. \$60,001-\$70,000
- f. Over \$70,000

**Part C: In-State Graduates in the Workplace**

10. Over the past three years, what percentage of total non-trade hires was from colleges or universities in Maryland?

- a. None. If A, go to question 23.
- b. Less than 20%
- c. 21% to 40%
- d. 41% to 60%
- e. 61% to 80%
- f. 81% to 100%

11. If B, C, D, E, F to question 10, from which institutions? Please check all that apply.
- a. University of Maryland, Baltimore County
  - b. University of Maryland, College Park
  - c. University of Maryland, Eastern Shore
  - d. Towson University
  - e. Morgan State University
  - f. Salisbury University
  - g. Johns Hopkins University
  - h. Local Community College
  - i. Other
12. If answered (i) to Q11, please explain.
- a. \_\_\_\_\_
13. If answered (h) to Q11, please indicate which institution(s). Select all that apply.
- a. Anne Arundel Community College
  - b. Baltimore City Community College
  - c. College of Southern Maryland
  - d. Community College of Baltimore County
  - e. Frederick Community College
  - f. Montgomery College
  - g. Prince George's Community College
  - h. Wor-Wic Community College
  - i. Other
14. If answered (i) to Q13, please explain.
- a. \_\_\_\_\_
15. Over the past three years, what factors encouraged you to hire a graduate from a Maryland education institution? Please select all that apply.
- j. college program
  - k. GPA
  - l. years of experience
  - m. past employment
  - n. references
  - o. place of training (apprenticeships)
  - p. years of training (apprenticeships)
  - q. Other
16. If h, then: \_\_\_\_\_

17. Of the options below, what is the construction industry's biggest challenge for hiring non-trade applicants from Maryland-based institutions?
- Small number of total applicants
  - Small number of specialized applicants
  - Too many total applicants
  - Too many qualified specialized (not enough general) applicants
  - Other
18. If answered (e) to Q15, please explain.
- \_\_\_\_\_
19. Approximately, what is the annual rate of turnover of non-trade workers hired from Maryland institutions?
- Less than 10%
  - 11% to 30%
  - 31% to 50%
  - Over 50%
20. If answered (c) or (d) to Q17, how has this high turnover impacted your company? Please select all that apply.
- Hiring costs
  - Retraining costs
  - Decreased total output
  - Decrease quality of output
  - Other
21. If answered (e) to Q18, please explain.
- \_\_\_\_\_
22. On average, how long is the tenure of employment of non-trade workers hired from Maryland educational institutions?
- Less than one year
  - One year to less than two years
  - Two years to less than three years
  - Three years to less than five years
  - Five years to less than ten years
  - Ten years or more
23. What is the most likely reason for a non-trade employee hired from a Maryland educational institution to resign voluntarily?
- Salary and compensation

- b. Desire for increased responsibilities
- c. Career advancement
- d. Change in career direction
- e. Leaving the region/state for another area
- f. Other

24. If answered (f) to Q21, please explain.

- g. \_\_\_\_\_

**Part D: Out-of-State Graduates in the Workplace**

25. Over the past three years, what percentages of total non-trade hires were from colleges or universities outside of Maryland?

- a. None. If A, go to question 29.
- b. Less than 20%
- c. 21% to 40%
- d. 41% to 60%
- e. 61% to 80%
- f. 81% to 100%

26. If B, C, D, E, F to Q23 which out-of-state institutions? Please check all that apply.

- a. Bucknell University
- b. Catholic University
- c. Clarkson University
- d. Clemson University
- e. Drexel University
- f. East Carolina University
- g. Ferris State University
- h. George Washington University
- i. Georgia Tech University
- j. Harvard University
- k. Penn College of Technology
- l. Penn State University
- m. Purdue University
- n. University of Delaware
- o. University of Virginia
- p. University of West Virginia
- q. Virginia Tech University
- r. Other

27. If answered (r) to Q24, please explain.

- b. \_\_\_\_\_

28. On average, how long is the tenure of employment of non-trade workers hired from out-of-state educational institutions?
- Less than one year
  - One year to less than two years
  - Two years to less than three years
  - Three years to less than five years
  - Five years to less than ten years
  - Ten years or more
29. Over the past three years, what factors encouraged you to hire a graduate from an out-of-state education institution? Please select all that apply.
- college program
  - GPA
  - years of experience
  - past employment
  - references
  - place of training (apprenticeships)
  - years of training (apprenticeships)
  - Other
30. If h, then: \_\_\_\_\_
31. What is the most likely reason for a non-trade employee hired from an out-of-state educational institution to resign voluntarily?
- Salary and compensation
  - Desire for increased responsibilities
  - Career advancement
  - Change in career direction
  - Leaving the region/state for another area
  - Other
32. If answered (f) to Q27, please explain.
- \_\_\_\_\_

**Part E: Future Needs**

33. Would expanding existing two year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland's community colleges?
- Strongly agree
  - Agree
  - Not sure
  - Disagree

- e. Strongly disagree
34. Would increasing the number of two year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland's community colleges?
- a. Strongly agree
  - b. Agree
  - c. Not sure
  - d. Disagree
  - e. Strongly disagree
35. Would expanding existing four year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland colleges or universities?
- a. Strongly agree
  - b. Agree
  - c. Not sure
  - d. Disagree
  - e. Strongly disagree
36. Would increasing the number of four year degree programs in construction related majors lead you to hire more non-trade workers educated by Maryland colleges or universities?
- a. Strongly agree
  - b. Agree
  - c. Not sure
  - d. Disagree
  - e. Strongly disagree
37. In the future, do you anticipate hiring non-trade applicants from an educational institution in Maryland?
- a. No
  - b. Maybe
  - c. Yes
  - d. Don't know
38. In the future, do you anticipate hiring non-trade applicants from an educational institution outside of Maryland?
- a. No
  - b. Maybe
  - c. Yes
  - d. Don't know

39. In the table below, please indicate the number of hires by degree type for anticipated job openings with your company over the next 3 years:

	Number of hires	Experience level	Most likely from
Associate Degree – Construction Management			
Bachelor Degree – Construction Management			
Bachelor Degree – Civil Engineering			
Bachelor Degree – Architecture			
Bachelor Degree – Architectural/Structural Engineering			
Bachelor Degree – Construction Engineering			
Bachelor Degree – Project management			
Bachelor Degree – Logistics			
Bachelor Degree – Real Estate			
Master Degree – Real Estate			
Bachelor Degree – Business/Finance			
Bachelor Degree – Economics			
Bachelor Degree – Liberal Arts			
Degrees are irrelevant			
Associate Degree – Construction Management			
Bachelor Degree – Construction Management			
Bachelor Degree – Civil Engineering			
Bachelor Degree – Architecture			
Bachelor Degree – Architectural/Structural Engineering			
Bachelor Degree – Construction Engineering			
Bachelor Degree – Project management			
Bachelor Degree - Logistics			
Bachelor Degree – Real Estate			
Master Degree – Real Estate			
Bachelor Degree – Business/Finance			
Bachelor Degree – Economics			
Bachelor Degree – Liberal Arts			
Degrees are irrelevant			

40. Is there anything else that you would like to share with us about Maryland’s higher education construction programs? :

**Part F: Other**

41. Please provide the information below if you would like to sign up and participate in a brief interview to be used in the MCCEI report.

Name:

\_\_\_\_\_

Phone Number:

\_\_\_\_\_

Email:

\_\_\_\_\_

**B.2 Construction Industry Interview Questions**

To be completed before the interview:

Participant name: \_\_\_\_\_

Company interviewed: \_\_\_\_\_

Date interviewed: \_\_\_\_\_

Headquartered in: \_\_\_\_\_

Annual volume (\$): \_\_\_\_\_

Annual volume in MD (\$): \_\_\_\_\_

Number of employees: \_\_\_\_\_

Number of employees in MD: \_\_\_\_\_

\_\_\_ Union \_\_\_ Merit \_\_\_ Both \_\_\_ Neither

\_\_\_ MBE \_\_\_ WBE \_\_\_ DBE \_\_\_ None

\_\_\_ GC/CM \_\_\_ Sub Contractor \_\_\_\_\_ Type/Segment

\_\_\_ Developer/Owner \_\_\_ Heavy Civil \_\_\_ Institutional \_\_\_ Owner's Rep

**Part I: Determining Industry Values and Demand for College-Educated Workers**

1. What college degrees do you feel are most relevant to your business model at the current time?
2. What role, if any, do 2+2 program combinations (associate degree's + bachelor's degrees) play in your business model at the current time?
3. What college degrees do you feel will be the most relevant to your business model over the next five years?
4. What role, if any, will 2+2 program combinations (associate's degrees + bachelor's degrees) play in your business model over the next five years?
5. Over the next five years, what are the top 3 majors or areas of study do you intend to recruit new employees?

6. Approximately how many applicants with college degrees (including 2+2) do you intend to hire per year over the next five years?
  - a. Of this number, what percentage of these intended hires will need to have civil engineering and construction management degrees?
7. Do you find yourself hiring individuals from disciplines not related to the built environment?
  - a. If so, how often?
  - b. If so, which disciplines?
8. In your opinion, at which point in a person's career do experience and track record surpass academic credentials as criteria for extending a job offer?

Part II: Encouraging the Future Workforce

9. How aware do you think high school and incoming college students are of construction management as a professional pursuit?
10. As an employer, what would you suggest as ways to recruit/encourage high school students and incoming college students to pursue degrees in construction or related fields?

Part III: Assessing the Construction Education System

11. Which schools do you think have the best reputations for construction-related majors outside of Maryland?
  - a. Why do you think they have these reputations?
12. Which schools do you think have the best reputations for construction-related majors in Maryland?
  - a. Why do you think they have these reputations?
13. How do Maryland schools compare to the out-of-state schools in terms of reputation, quality of graduate, etc.?

Part IV: Improving Maryland's Construction Education System

14. What are the top three ways Maryland's higher education system can improve in degree programs (including 2+2 programs) related to construction and the built environment?
15. What would be the top 3 benefits to your business if you were able to hire more college graduates from Maryland institutions, instead of from out-of-state institutions?

16. From your perspective as a construction industry professional, what are the top 3 skills or knowledge sets that are missing from the current **construction management** curriculum in Maryland?
17. From your perspective as a construction industry professional, what are the top 3 skills or knowledge sets, if any, that are missing from the current **civil engineering** curriculum in Maryland?
18. Which skills or technologies do you think college graduates of construction-related programs will need to learn in order to be well-prepared for industry needs in the next five years?

Part V: Concluding Comments

19. Is there anything else you would like to add?

**B.3 In-State Interview Questions**

**Background Information - Student Enrollment:**

1. How many students are enrolled in the (construction management or civil engineering) program?
2. On average, how many incoming students enter the program annually?
3. Has this average fluctuated over the past 5 years?
  - a. If so, please explain.
4. Of these students, on average, how many declare this as their major as incoming freshman?
5. Of these students, on average, how many transfer to this major from other programs?
  - a. If any, what percentage of these students transfers from community colleges?
  - b. If any, what percentage of these students transfers from other universities?
6. Of these students, on average, how many are from Maryland?
  - a. If not 100% in-state enrollment, then: For those students enrolled in the program from out-of-state, is there a particular state that they concentrated in?
7. Are there any incentives offered to students to enter this program? (financial, credit articulations, scholarships, other?)
8. How is this program advertised and promoted to attract students?

9. Do you feel that this program is under, at, or over capacity in relation to student registration?
10. At the current time, what plans, if any, are in place by the department to increase the recruitment of students into this program?

**Background Information - Faculty Expertise:**

11. How many full-time, tenure track faculty are dedicated to teaching in this program?
12. How many full-time, non-tenure track faculty are dedicated to teaching in this program?
13. How many part-time/adjunct faculty are dedicated to teaching in this program?
14. Have these figures for full-time / part-time faculty fluctuated over the past 5 years?
  - a. If so, please explain.
15. What percentage of the total faculty in this program has industry experience?
  - a. Are those faculty members with industry experience concentrated in full-time or adjunct positions?
16. At the current time, what plans, if any, are in place by the department to add more tenure track faculty for this program?

**Program Overview:**

17. Would you consider this program to be teaching-based, research-based, or a combination of teaching and research?
  - a. Please explain with examples where possible.
18. Is this program accredited?
  - a. If so, by which accrediting organizations?
  - b. If no, are there any plans to seek accreditation for this program?
19. What types of facilities are used to enhance the student experience on this program?
  - a. Examples could include: study lounges, lecture halls, lab spaces, etc.
20. Collectively, what is the current condition of these facilities?
  - a. Examples could include: new/old/new repair/non-existent/ etc.

**Pre-Graduating Preparation**

21. What kind of coaching/guidance, if any, do students in the program receive regarding job placement?
  - a. Examples include: Resume critiques, mock interviews

- b. If so, when is this coaching/guidance provided?
  - c. If so, is it optional or mandatory for the students to attend?
22. What access to the wider industry, if any, does the university facilitate with students in this program?
- a. Review each of the following:
    - i. Career fairs
    - ii. Recruiting
    - iii. Internships/co-ops
    - iv. Guest lecturers
23. If the university sponsors events for students in this program, how are the recruitment companies involved in the career fair solicited?
24. Of the companies that recruit students of this program at university events, what percentage of the companies is from Maryland?
25. Of the companies that recruit student of this program at university events, what percentage of the companies is from other states?

### **Graduate Experience**

26. On average, how many students graduate from the program annually?
27. Has this average fluctuated over the past 5 years?
- a. If so, please explain.
28. From your existing records, what percentage of graduates from this program, on average, is placed in jobs related to their major?
29. For those graduates from this program employed in the industry, what percentage is employed directly after graduation?
- a. Does this employment percentage increase over the year after graduation?
    - i. If so, please explain.
    - ii. If no, why not?
30. For those graduates from the program that are employed in the industry up to a year after graduation, what percentage is hired by Maryland firms?
31. For those graduates from the program that are employed in the industry up to a year after graduation, what is their median annual salary?

32. What, if anything, do you think could be improved upon for this program?

#### B.4 Out-of-State Visit Themes

Student Enrollment:

- # of total students enrolled in the program
- Average # of graduates annually, with 5 years historical data
- Average # of incoming students annually with 5 years historic data
- Any sense on how many students enrolled are from Maryland.
- Anecdotal or actual evidence on how students find the program/major. For example, XX% of students declare this as their major (intended major) as incoming freshmen versus YY% that transfer in from other programs at junior status.

Faculty: (Some of this may be readily available from on-line faculty bios)

- Numbers of FT tenure track faculty
- Number of FT Non-tenure track faculty
- Numbers of PT/Adjunct faculty
- Average tenure of faculty
- Faculty with industry experience
- Does the program have a mission to add tenure track faculty

Program Focus:

- Is this a teaching based program, research based program or some combination of both?
- Accreditations

Industry Connections:

- How does the program engage with the industry/employers?
- Career fairs
- Recruiting
- Internships/co-ops
- Guest lecturers

Facilities:

- General gauge of the type and condition of the facilities and amenities (student lounges, etc.). Such as, new building, well kept, modern technologies, classroom size.
- Lab Spaces

Articulations:

- Get a sense for the number and effectiveness of the articulations with community colleges and high schools.

Placements/Placement services

- Numbers and stats of job placements (100% employed within X months of graduation at \$Y median salary)
- How do they solicit companies to come in and recruit students (resume books, on line, reputation only, etc.)?
- Of the companies that recruit there, X% of companies are from Maryland, Y% from home state, Z% from other states
- What kind of coaching/guidance do they do with the students? Resume critiques, mock interviews

## Appendix C—REMI PI+ Methodology and Analysis

Appendix C will provide an overview of the REMI PI+ model, and the use of the model for analysis within this report. This appendix will discuss the REMI PI+ model overview, REMI PI+ model mined data, and the analysis of stagers, scholars, returners, and careerists on Maryland's economy. The first section will outline what the REMI PI+ model is and how RESI uses the model with regard to gap analyses.

### C.1 REMI PI+ Model Overview

To quantify the economic impacts of a specific economic event or events, RESI uses the Regional Economic Models, Inc. (REMI) PI+ model version 1.6.7. The REMI PI+ model is a high-end dynamic modeling tool used by various federal and state government agencies in economic policy analysis. Utilization of REMI PI+ helps RESI to build a sophisticated model that is calibrated to the specific demographic features of the study area. This model enumerates the economic and fiscal impacts of each dollar earned and spent by the following: employees relating to the economic events, other supporting vendors (business services, retail, etc.), each dollar spent by these vendors on other firms, and each dollar spent by the households of the event's employees, other vendors' employees, and other businesses' employees.

REMI PI+ features the ability to capture price effects, wage changes, and behavioral effects through time. Another benefit of the model compared to traditional static models, such as IMPLAN, is the regional constraint is built in to account for limited resources over time. A situation like this is built into the model using current industry data and employment information from Bureau of Economic Analysis (BEA) data. The REMI PI+ model also allows RESI to capture the effects occurring between industries and minimize the potential for double-counting in employment, output, and wages. The ability to capture effects throughout a span of time provides a detailed representative of an economic event over time and its effects on the study area.

### C.2 REMI PI+ Model Inputs

RESI analyzed REMI PI+ forecast for Maryland from 2015 through 2020 for the construction industry. The data associated with the construction industry was mined from the model at the occupational level to determine the demand for the industry for Bachelor's degree employees by 2020. The occupational groupings used in this analysis can be found in Figure 60 below.

**Figure 60: REMI PI+ Occupational Groupings Associated to the Construction Industry**

Occupational Group
Supervisors of construction and extraction workers
Architects, surveyors, and cartographers
Drafters, engineering technicians, and mapping technicians
Engineers

Source: REMI PI+

As noted in Figure 60, these occupational groups are those that require at least a Bachelor’s degree for employment within the industry. RESI reviewed each group’s forecast from 2015 to 2020 within the model to determine the level of demand that would exist each year. Assuming that Maryland schools will continue to produce only 170 new graduates a year for Bachelor’s degrees in construction management and civil engineering, RESI subtracted the demand from the current in-state labor supply to estimate the potential gap needing to be filled by out-of-state graduates. RESI then used the number of direct graduates for each trajectory as defined in Section 4.1 in a secondary analysis to assess their economic contribution to Maryland. This analysis is detailed in Appendix C.3.

### **C.3 Analysis of Staters, Scholars, Returners, and Careerists**

To analyze the impacts associated with each trajectory within the report, RESI first estimate the potential number of individuals filling the direct employment within the construction industry by trajectory. Under the assumption that Maryland four-year institutions will continue to graduate a total of 170 new graduates a year, RESI assumed the potential distribution of those graduates as 20 percent out of state and 80 percent in state. For each year, RESI analyzed the impact of 136 new staters and 34 new scholars entering the construction labor force. Furthermore, since the students attended school prior to taking a position within the industry in Maryland, RESI analyzed the total number of college students for each category attending Maryland’s four-year institutions during that time.

RESI used spending pattern data from the Bureau of Labor Statistics Consumer Expenditure Survey for the 18 to 25 age group to assess how much students spend annually. Figure 61 shows the categories assessed and totals for a single year by category for each trajectory.

**Figure 61: Annual Consumer Expenditures by Trajectory**

Trajectory	Entertainment	Clothing	Transportation <sup>76</sup>	Laundry	Total
Staters	\$169,048	\$205,768	\$300,288	\$12,648	\$687,752
Scholars	\$28,175	\$34,295	\$50,048	\$2,108	\$114,626
Returners	\$300,254	\$365,474	\$533,355	\$22,465	\$1,221,548
Careerists	\$0	\$0	\$0	\$0	\$0

Sources: BLS Consumer Expenditure Survey 2013, RESI

Using Figure 61, RESI estimated students' annual personal expenditures while attending university in Maryland. RESI used this information, along with tuition and total jobs acquired by each trajectory, to determine the full economic impact for Maryland. Assuming that there will always be 170 total graduates a year, starting in 2015, RESI assumed there were approximately 580 students currently in programs across Maryland with 170 graduating each subsequent year.

Figure 62 details the level of economic activity associated with each trajectory.

**Figure 62: REMI PI+ Input by Trajectory, 2020**

Trajectory	Tuition Total	Personal Expenditure Spending	Jobs Acquired by Group in MD
Staters	\$24,063,803	\$4,126,512	816
Scholars	\$7,938,345	\$687,756	204
Returners	\$0	\$7,329,288	4,348
Careerists	\$0	\$0	4,348

Sources: BLS Consumer Expenditure Survey, RESI

Using the information above, RESI found that staters will spend the most money within Maryland over their career lifetime. However, since scholars pay a higher rate of tuition, and there are only 34 per year admitted into Maryland institutions under this analysis, scholars have the highest per person economic impact on Maryland's economy. Finally, returners and careerists have the third and fourth greatest impacts on Maryland's economy as they spend the least amount of time within the state.

**END OF DOCUMENT**

<sup>76</sup> RESI includes gas and car insurance payments made as one category, "Transportation," in this analysis.