

The Critical Path

Positioning Maryland as an Innovation
Leader in the Global Construction Industry

Key Findings and Recommendations



MARYLAND CENTER *for*
CONSTRUCTION
EDUCATION & INNOVATION

About The Critical Path

Construction is a proud business that thrives on problem solving, values dedication and craftsmanship and requires vast amounts of knowledge and professionalism. Four primary factors are now challenging construction's standard business model. **Technology.** Technology is revolutionizing the way our built environment is designed, delivered and implemented. **People.** The construction industry struggles with a "this-is-how-we've-always-done-it" mindset. An aging workforce and impending "brain drain" from retirements could lead to tremendous opportunity for future practitioners and business owners. **Pathways.** Maryland has an excellent education system, but it faces immense competition from other states at the post-secondary level and pathways to potentially fulfilling careers are not apparent. **Perception.** The industry's perception among young people hinders their desire to examine construction when planning a career path.

Leaders in Maryland's construction business, education and government saw these trends emerging and formed the Maryland Center for Construction Education and Innovation (MCCEI). MCCEI engaged the construction industry on what it needs from Maryland's education system to get in front the technological and workforce changes. During MCCEI's first year, a total of 126 industry leaders were interviewed on how they saw this business changing over the next 10 years.

The Critical Path is a summary of their perceptions and the resulting 6 policy recommendations. It covers emerging technologies, building processes, business planning, and efficiencies the industry is adopting in order to remain competitive and deliver value to customers. It also covers skills gaps, educational attainment and recommendations to Maryland's education system to teach and train the workforce of the future.

This remains a proud industry where rewarding careers are perfected over a lifetime of practice, but the notion of "this is how we've always done it" may not be the formula for success anymore. It will take partnership, dedication, open dialogue and further refinement to implement, and that process starts now.

Contents

2	About The Critical Path
3	Forward
4	Survey Participants
8	Executive Summary
11	Policy Recommendations
18	Conclusion
19	Acknowledgements

Construction professionals use an action plan that incorporates thousands of items and tasks in exact detail on how a project is going to get from concept to reality. The industry calls this a "critical path."

The recommendations made in this report, *The Critical Path*, are the beginning of a plan to build a world-class education system for Maryland's construction and related built environment industries.

Forward

The entire process of producing *The Critical Path* has been an exciting and challenging endeavor. Nothing like *The Critical Path* has ever been done before for the construction industry. MCCEI interviewed 126 professionals, some of the interviews wrapped up within an hour, most went well beyond that. With the industry reeling on its heels from the Great Recession, these professionals had dozens of things they could have been doing, but took the time to sit down and tell us what they thought. There are not enough words of appreciation to express how much validation their time gives to this project.

During the interviews, some very interesting opinions and stories were shared. One story in particular stood out as a fitting metaphor for why *The Critical Path* was produced.

An interviewee stopped mid question and said “you know how the construction business is changing? Look up there and tell me what you see” pointing at the ceiling of a recently completed office. Looking up at the ceiling, I responded that I saw a light fixture. The interviewee then asked “what do you think the electrician did to get that light installed and working?” Thinking for a minute, I responded that the electrician installed the light in the bracket, ran the power from the breaker panel to the junction box to the switch to the light circuit. Confident I passed the test with flying colors and wanting to move on to the questions at hand, the interviewee calmly stated “nope, that is actually a LED panel, and all of the wiring is low voltage, controlled by light sensors, and run by a computer server. The IT guys did all of the wiring for the lighting system.” With eyebrows raised, I questioned back that an **information technology contractor** performed a job that **was** the purview of an electrician. The interviewee responded “exactly, and when I realized that I was paying an electrician simply to install panels in ceiling brackets, I complimented him on his work but told him that he would not be needed back on site tomorrow.”

Think of the magnitude of that. One has to wonder what went through that electrician’s mind when his work day ended. Did he shrug it off and think it was back to business as usual again tomorrow, or did the reality of the changing landscape hit him and he started doing internet searches for classes on computer controlled lighting systems?

There is a technological revolution occurring in the construction industry. Materials, processes, and systems of all sorts are changing and the way we teach, train and educate the workforce, and the people pushing the buttons to the people pushing the shovels must change with it. As one survey respondent stated, a significant threat to the construction industry is “obsolete technology of conventional building – we hold on to it because we don’t know any other way.”

This is why MCCEI exists. We hope you enjoy *The Critical Path*, but more so, we hope that you will roll up your sleeves and join us in making things happen.

Sincerely,



Robert M. Aydukovic, CRE
President
Maryland Center for Construction Education and Innovation



Survey Participants

The companies listed were interviewed by MCCEI from July 2011 through April of 2012. Every attempt was made to balance the list in terms of geography, discipline, and business size.

In total, these companies, divisions and departments represent a global gross volume in excess of **\$45 billion** and employ **over 100,000** craft, trade, design, and management professionals worldwide. In Maryland, these organizations represent **\$7.2 billion** in annual volume and employ **13,700** state residents.

Brian P. Andrews

Senior Project Manager
Kettler
McLean, VA

Anonymous

Baltimore, MD

Anonymous

Rockville, MD

Dwayne Austin

Vice President, Operations Manager
Eastern Shore
Joseph M. Zimmer Inc. Contractors
Salisbury, MD

Daniel Baker

Executive Vice President
Evans Builders, Inc.
Salisbury, MD

John W. Barotti, P.E., LEED AP

Senior Vice President
Skanska USA Building, Inc.
Rockville, MD

Carl O. Belt, Jr.

President
The Belt Group, Inc.
Cumberland, MD

William L. Bowen, II

Area Manager
IA Construction Corporation
Cumberland, MD

Jerry L. Bowman

Executive Vice President
Morgan-Keller, Inc.
Frederick, MD

Robert S. Boyd

President
Regional Builders, Inc.
Seaford, DE

David C. Bramble

President
David A. Bramble, Inc.
Chestertown, MD

Charles T. Breeding

General Superintendent
David A. Bramble, Inc.
Chestertown, MD

Eric C. Brown, LEED AP

Senior Vice President of Operations & Principal
KBE Building Corporation
Columbia, MD

Gregory W. Brown

President
Waynesboro Construction
Frederick, MD

Carl J. Buch

President
Buch Construction
Laurel, MD

Scott D. Bulera

General Manager
Turner Construction Company
Baltimore, MD

Mike Burlas

Vice President
Miller & Long
Bethesda, MD

Patrick A. Burns, P.E.

Vice President, Group Operations
Mortenson Construction
Alexandria, VA

Nevin Camp

President
N-Tech Mechanical Services, Inc.
Frederick, MD

Timothy R. Campbell

President/CEO
Callas Contractors, Inc.
Hagerstown, MD

Stan D. Carlat

Operations Manager
Hensel Phelps Construction Company
Chantilly, VA

Jason A. Carter, LEED AP

Vice President
John J. Kirlin, LLC
Rockville, MD

Christian M. Chambers

Partner
Crimson Partners
Herndon, VA

Francis "Frank" H. Chaney, II

Chairman of the Board
Chaney Enterprises
Waldorf, MD

Bernard A. "Andy" Cheezum, Jr., CHC

Vice President
Willow Construction, LLC
Easton, MD

Paul J. Choquette, III

Vice President
Gilbane Building Company
Laurel, MD

Terry Coakley

Chief Executive Officer
Coakley Williams Construction
Gaithersburg, MD

William Cole, Jr.

Vice President
Robert W. Sheckles, Inc.
Frederick, MD

Gregory S. Colevas

Division President
Clark Construction Group, LLC
Bethesda, MD

M. Teresa Cook

Associate Vice President for Administrative Services
UMBC
Baltimore, MD

William Cox

President
Corman Construction
Annapolis Junction, MD

Chuck Crowther

Vice President Estimating
Dixie Construction Company, Inc.
Churchville, MD

Interview Company Statistics : Geographic Breakdown by Business Location

Baltimore Metro	DC Metro	Western Maryland	Eastern Shore	Outside Maryland
36%	36%	13%	9%	6%

Matthew J. Daw, P.E., LEED AP

Principal
Keast & Hood Co.
Washington, DC

John Driggs

President
John Driggs Company, Inc.
Capitol Heights, MD

Michael F. Dugan

President
AES Electrical, Inc.
Laurel, MD

Joseph A. Easley

Vice President
Archstone
Alexandria, VA

Douglas W. Eder

President
Oak Contracting, LLC
Towson, MD

Jon Eisen

Managing Principal
The Eisen Group
Washington, DC

Paul P. Elias

Senior Vice President, Construction
The JBG Companies
Chevy Chase, MD

Pierce J. Flanigan, IV

President
P. Flanigan & Sons, Inc.
Baltimore, MD

Kevin J. Foley

Chief Financial Officer
E. Allen Reeves, Inc.
Abington, PA

Robert Fraga, FCMAA, AIA

Director, Facility Portfolio Management Services
McDonough Bolyard Peck
Columbia, MD

Steven J. Frederickson, LEED AP

President
The Christman Company
Reston, VA

Arthur N. Fuccillo

Executive Vice President
Lerner Enterprises
Rockville, MD

Michael Furbish

President
Furbish Company
Brooklyn, MD

Thomas M. Gaines, LEED AP

President
Hencken and Gaines, Inc.
Cockeysville, MD

Michael J. L. Greene, LEED AP, CCM

Vice President, Construction
Hines
Washington, DC

Sharon R. Grinnell

President and Managing Partner
sGrinnell Enterprises, LLC
Owings Mills, MD

Robert Grottenthaler, P.E., LEED AP, DBIA

Vice President
Barton Malow
Baltimore, MD

Dale Gruber

President
Dale Gruber Construction
St. Cloud, MN

John Brady Harmon, Jr.

President
HDC, Inc.
Cockeysville, MD

Gregory E. Harraka, LEED AP, DBIA

Executive Vice President
Coakley Williams Construction
Gaithersburg, MD

Ben Harries

Owner
BGC/Gardiner & Gardiner Contracting
Crofton, MD

Adrian Harrison, Jr.

Office Manager/Safety Coordinator
John W. Tieder, Inc.
Cambridge, MD

Max Hernandez

Corporate Secretary
CAM Construction
Timonium, MD

Nicholas V. Hill, Sr.

Vice President
Callas Contractors, Inc.
Hagerstown, MD

Richard G. R. Hillman

Director, Asset Management & Planning
Southern Management Corporation
Vienna, VA

Brett R. Hitt

President
HITT Contracting, Inc.
Falls Church, VA

Edward M. Hord, FAIA

Principal
Hord Coplan Macht
Baltimore, MD

Jason Jacobson

Group Vice President, Mixed-Use Development
Archstone
Alexandria, VA

Stephen W. Jensen, P.G.

Vice President & Principal
ECS Mid-Atlantic, LLC
Hanover, MD

Michael S. Johnston, P.E.

Vice President
M. S. Johnston Company
Hagerstown, MD

Sharon Justice

President
Justice Construction Group, LLC
Eldersburg, MD

Gregg S. Kaderabek

Vice President/General Manager
Freestate Electrical Service Company
Laurel, MD

Davor Kapelina

President/CEO
AtSite
Washington, DC

Survey Participants

Interview Company Statistics : Breakdown by Business Type

General Contractor or Construction Manager	Sub-Contractor	Developer or Owner	Architect Engineer	Heavy Civil	Institutional Facilities
40%	19%	15%	13%	7%	6%

David E. Katz

Senior Project Manager, IOC Projects
Bechtel Canada
Montreal, QE Canada

Stephen T. Kimball

Senior Vice President
Kimball Construction Company, Inc.
Baltimore, MD

Ronald E. Knowles, P.E.

President
J. Vinton Schafer & Sons, Inc.
Abingdon, MD

Stephen W. LaRue, P.E.

President
C. William Hetzer, Inc.
Hagerstown, MD

Jody L. Latimer

Director, Design and Construction
Johns Hopkins University
Baltimore, MD

Richard M. Lombardo

President & CEO
Harkins Builders
Marriottsville, MD

Christopher J. Lukawski

Vice President of Development & Construction
Crimson Partners
Herndon, VA

Jim Lutz

Senior Vice President, Development
Liberty Property Trust
Malvern, PA

Eileen B. Macario

Controller
Target Building Construction
Crum Lynne, PA

George Maloney

President
Helix Construction Services, Inc.
Millersville, MD

Amy Marks

President
XSite Modular
Clinton, NJ

Milton Matthews

Executive Vice President
Commercial Interiors, Inc.
Hanover, MD

David Mayhew, AIA, LEED AP

Director, Architecture and Engineering
Towson University
Towson, MD

Douglas McCoach, AIA, NCARB, LEED AP

Vice President
RTKL Associates, Inc.
Washington, DC

Michael McGeady

Business Development Manager
Cianbro Corporation
Baltimore, MD

Dwight Miller

President
Gillis Gilkerson, Inc.
Salisbury, MD

Tim Miller

Chief Financial Officer
AES Electrical, Inc.
Laurel, MD

Mairav R. Mintz, P.E.

Vice President, Branch Manager
McDonough Bolyard Peck
Columbia, MD

M. Marc Munafo

President
CAM Construction
Timonium, MD

Robert W. Nilsson

Senior Advisor
Turner International, LLC
Stevensville, MD

Rusty Ober

Project Manager
McDonough Bolyard Peck
Columbia, MD

Daniel F. Pallace, P.E.

Director of Construction
Merritt Construction Services
Baltimore, MD

Frank R. Palmer, IV

Senior Vice President
The Whiting-Turner Contracting Company
Towson, MD

Richard "Skip" Parks, P.E., LEED AP

Executive Associate
Heery International, Inc.
Baltimore, MD

Jeffrey A. Penza, AIA, LEED AP

Principal
Penza + Bailey Architects
Baltimore, MD

Scott Peterson

Vice President of Operations
Commercial Interiors, Inc.
Hanover, MD

Steven M. Petri, Sr.

Owner
DECA, Inc.
Baltimore, MD

Dave Pollin

President
The Buccini/Pollin Group, Inc.
Washington, DC

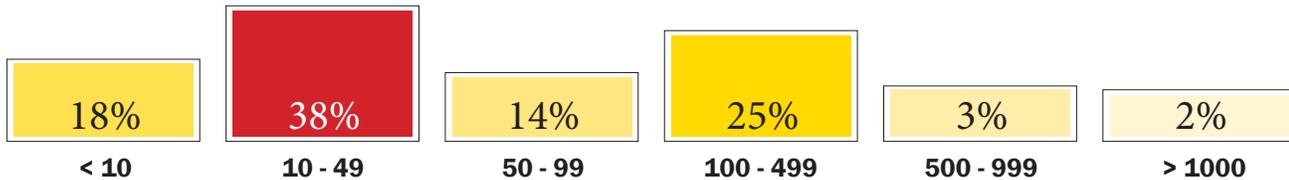
Andrei Ponomarev

Project Manager
Akridge
Washington, DC

Tonja Potter, LEED AP

Project Manager
McDonough Bolyard Peck
Columbia, MD

Interview Company Statistics : Size by Maryland Employment



Michael Proffitt, AIA

President
Proffitt & Associates
Frederick, MD

Timothy J. Regan

Executive Vice President
The Whiting Turner Contracting Company
Towson, MD

W. Blair Rinnier, CCIM, CPM

President
Rinnier Development Company
Salisbury, MD

Vernon Roberts

Estimator/Project Manager
John W. Tieder, Inc.
Cambridge, MD

Anthony Rodgers

Executive Vice President
A & R Development Corporation
Baltimore, MD

Bruce C. Rogers

Business Development
Kinsley Construction
Timonium, MD

Michael W. Ruth, CCC, LEED AP

Senior Consultant
McDonough Bolyard Peck
Columbia, MD

Enrique Salvador, P.E., LEED AP

Associate Director - Capital Projects
University of Maryland
College Park, MD

Michael A. Schlegel

President
Bozzuto Construction Company
Greenbelt, MD

Douglas Schmidt

Principal
Chesapeake Real Estate Group, LLC
Baltimore, MD

H. Wesley Schwandt

President
BPGS Construction, LLC
Wilmington, DE

Michael T. Shacklette

President
The Michael Group, Inc.
Baltimore, MD

Jay Silcox, P.E.

David A. Bramble, Inc.
Chestertown, MD

Jay Sinclair, Jr.

Controller
A&E Construction Company
Upper Darby, PA

Donald B. Smith, Jr.

President
Conewago Enterprises, Inc.
Hanover, PA

Francis X. Smyth

CEO/President
Century Engineering
Hunt Valley, MD

Adam E. Snavelly

President and CEO
The Poole & Kent Corporation
Baltimore, MD

Bill Stewart, LEED AP

Project Manager
Gables Residential
McLean, VA

Lisa G. Sullivan

Vice President and City Manger
Liberty Property Trust
Columbia, MD

Gerald N. Therrien

President
Therrien Waddell
Gaithersburg, MD

John W. Tieder, III

Vice President
John W. Tieder, Inc.
Cambridge, MD

Bruce Traggorth

Director of Estimating & Pre-Construction
Hencken and Gaines, Inc.
Cockeysville, MD

Michael E. Wagner, Sr.

Vice President- Operations
Freestate Electrical Construction Company, Inc.
Laurel, MD

Dodd Walker

Vice President – Development
Akridge
Washington, DC

David W. Wallace, P.E.

Partner
RK&K
Baltimore, MD

Craig Wess

President
Manekin Construction
Columbia, MD

Sandra V. Whipp, PHR

Director of Human Resources
RTKL Associates, Inc.
Washington, DC

David I. Wiegand, P.G.

Principal
Specialized Engineering, Inc.
Frederick, MD

George E. Wirth, P.E.

Principal
Schnabel Engineering
Baltimore, MD

Tiffani Worthy

Director of Learning and Development
M. C. Dean
Dulles, VA

Dirk Yoder

President
Daystar Builders, Inc.
Grantsville, MD

“ This was an interesting process, it really made you think in different ways. ”
~ MCCEI Survey Participant

Executive Summary

Amidst a sea of economic tumult, skills shortages in

construction have hardly been a significant source of preoccupation for social scientists and other stakeholders in recent years. Skills shortages are typically associated with rapidly expanding industries and since the onset of the recession, no major U.S. industry suffered as much proportionate job loss than construction.

Since December 2007, the U.S. construction industry has shed nearly 2 million jobs, 47 percent in nonresidential construction and the balance in residential construction. At its cyclical peak achieved in February 2012, construction unemployment reached 27.1 percent. By mid-2012, that rate had fallen to 12.8 percent, still well above historic norms and U.S. economic averages, but sharply in decline. Much of this decline occurred as former construction workers secured employment in other economic segments, including manufacturing, distribution and retail. The implication is that the market has pushed many highly talented professionals into other industries, leaving voids in the construction labor force.

At the same time, pent-up demand for construction has been building, particularly in the category of infrastructure. The nation's bridges, highways, water systems, sewer systems, storm water management systems, dams and levees continue to falter, negatively impacting productivity and generating enormous one-time expenditures for governments at all levels.

The impact of technology is contributing to pent-up demand for construction as well as office buildings, hotels, and other structures increasingly needing to be retro-fitted to improve performance along various dimensions, including in terms of energy efficiency. Presumably, capital markets will eventually heal, job creation will accelerate and the down cycle in construction will be reversed. Already, progress is observed in the housing market, with starts up substantially. As one respondent eloquently stated “I think we will be fighting for people before too long as the market improves.”

A First-of-its-Kind Survey

The Maryland Center for Construction Education and Innovation (MCCEI), in conjunction with Sage Policy Group, Inc. and Regional Economic Studies Institute, (RESI) of Towson University, developed this report to provide stakeholders with an understanding of how Maryland's educational institutions can help bridge current and future gaps between construction skills demand and supply. Increasingly, construction services are being exported to other regions and other nations. If Maryland is able to provide a highly competitive workforce, its construction companies and industries will be positioned to provide services to other parts of the world, bringing income back home with them.

Moreover, given daily alerts regarding exploding pipes, buckling roads and crumbling schools, a ready construction workforce is necessary for the maintenance of the state's historically high quality of life and broadly shared prosperity. The State of Maryland and many local governments have focused on a number of issues related to construction and real estate, including septic systems, storm water management, wastewater treatment, green construction, building safety, historic preservation and architectural design.

This report provides primary and secondary data indicating that the skill sets needed to address these issues are simply not in existence. The analysis is based on a first-of-a-kind, in-depth survey of U.S. construction leaders, many of whom are primarily based in Maryland. The survey asks many questions, including questions regarding what educators can and should do to support the industry, accelerate the diffusion of technology, reduce costs and enhance project safety.

Core Analytical Findings

The survey, in conjunction with a review of relevant literature, indicates that Maryland has an important opportunity to provide a comparative advantage to the state’s workforce and construction firms by providing more and better programing in the areas of construction management, industry software and skilled craftsmanship (electricians, carpenters, masons, etc.). Emphasis should be upon new 4-year programs in the area of construction management, specialized training in specific software including BIM, training in green construction and modularization, and combined academic/apprenticeship programs for skilled craftspeople.

Brain-Drain

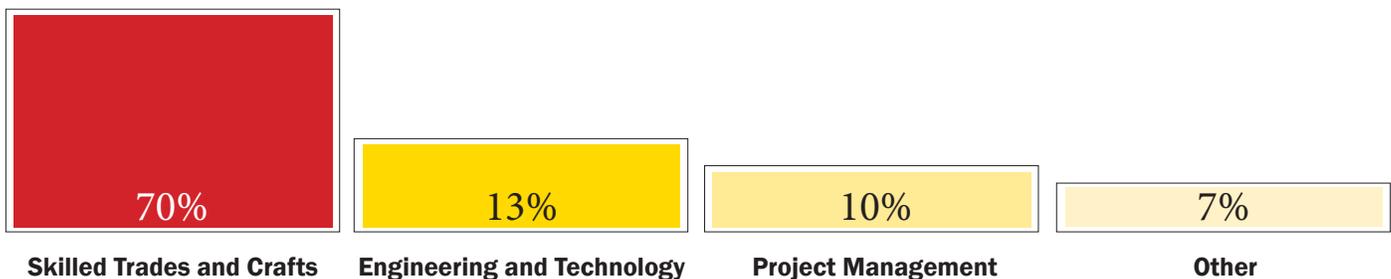
Survey respondents also indicated that a shortage of skilled craftsmen and construction supervisors emerged during the past 5 years. This is simply remarkable given that over this period, residential construction activity slipped by nearly two-thirds and nonresidential construction declined by roughly a quarter. In spite of the decline in activity, shortages can be attributable to inadequate educational programming opportunities, apathy among the young regarding industry prospects, and significant labor force departures due to rapid retirement. With retirement expected to be even more elevated going forward, skills shortages could become debilitating. One survey participant summed it best by stating “if senior owners are not petrified by continuity, they should be.” This is true not only for demographic reasons, but also for reasons of technology and process. Many survey respondents also emphasize the need for ongoing training of their existing workforces, particularly in the areas of management/leadership, communications, BIM, and LEED certification.

“ We need to do things to inspire kids to go into this field. The best and brightest were in engineering, it then shifted to Wall Street, now the interest is in Information Technology. ”

Anticipated Percentage of Total Workforce Retirements for Interviewed Companies Through 2020



Anticipated Labor Shortages Through 2020



Executive Summary

Technology

According to 55 percent of survey respondents, advancements in technology, BIM, and retrofitting collectively represent the most dramatic sources of change in the way construction will be delivered over the next ten years. Technologies expected to be the most broadly diffused over the next decade include BIM, mobile computing, GPS, and newly emerging construction-related software. Part of this shift toward greater capital intensity and technology is the ongoing shortage of construction talent, which has led construction firms to scramble to find alternative production methods.

BIM and other technologies are expected to become everyday tools in the near future, but survey respondents reported a concern that very few workers are presently skilled in these programs. This represents an important source of opportunity for local high schools, colleges and universities and a potential source of competitive advantage for both individual workers and local companies in Maryland alike.

Education

A number of construction industry leaders indicated that many of their recent recruits do not come from Maryland. Many come from universities in neighboring states such as the Pennsylvania State University and Virginia Tech. This represents another indication that Maryland's educational infrastructure has not served the local construction industry well in recent times. Thanks to the MCCEI survey, there is now concrete information telling educators just how they can change with the industry going forward.

“ It is going to be a computer driven industry in five years.”

Survey Participant's Views on Top Emerging Technologies

- 55%** BIM/VDC/GPS/Other Software
- 12%** Wireless Communications/Components
- 11%** Prefab and Modular Components
- 10%** Alternate Delivery Models
- 8%** Renewable Energy/Energy Efficient Components
- 5%** Better Equipment and Safety Measures

“ In 20 plus years in this business, I have never hired anyone out of a Maryland based program.”

Maryland Construction Industry College Graduate Recruitment

30% - Maryland Based Schools ~ 70% - Out-Of-State Schools

Policy Recommendations

The study team combined the primary information gathered from the survey with the findings from the literature review to produce a set of strategies for Maryland construction stakeholders, including industry business owners, state policymakers, the Maryland State Department of Education, and state colleges and universities. These strategies correspond with a list of action items that are outlined on the following pages.

- #1 Create or expand construction education programs** at Maryland four-year institutions to meet the demands of Maryland construction companies;
- #2 Better align K-12, high school Career and Technical Education (CTE), community college, and apprenticeship programs** with new construction skill requirements;
- #3 Create or strengthen articulations between high schools, CTE programs, apprenticeships, community colleges, and universities** to define educational pathways for a career in construction;
- #4 Create a public image campaign** to convey attractive construction-related career options;
- #5 Create a strategy to include demographic groups** that have not historically participated in the industry's workforce; and,
- #6 Recognize and adapt to the substantial technological changes** in the construction environment necessary to keep the industry competitive.

“ In Maryland, if something can be done, it will get done. There is the will, size and forethought to make this happen. ”

Policy Recommendation #1

Create or expand construction education programs at Maryland four-year institutions to meet the demands of Maryland construction companies.

Maryland has two institutions that have bachelor's degree programs in construction management: the University of Maryland Eastern Shore (UMES) and Morgan State University. In addition, the University of Maryland College Park has a bachelor's degree program in civil engineering with construction management emphasis. However, the output of students with construction-related degrees from these institutions is insufficient to meet the demand of the state's industry. Moreover, there are no four-year construction education programs in Western Maryland.

A significant trend in survey participant responses is that ideal university programs should offer significant work-study components. The ultimate objective is to provide practical, onsite field experience that emphasizes technical, communications, business, and leadership skills. Industry leaders indicate that there is a need to:

- Convene a special purpose task force comprising industry, postsecondary education, the Governor's Workforce Investment Board, and Maryland Higher Education Commission representatives to formulate what an ideal university-level program should encompass;
- Quantify the annual demand for construction related degreed students from Maryland's construction industry through further research and analysis;
- Work with UMES and Morgan State and select other appropriate institutions to expand or develop in-state programs to meet industry demand. Ideally, the chosen institution(s) should offer undergraduate degrees in engineering, design, business, computer sciences, environmental studies, and/or geoscience. It may be the case that only a much larger university is able to fully supply the technology and faculty necessary to produce the next generation of construction leaders;
- Benchmark other university programs for optimal program structure and consider adding other programs such as a bachelor's degree in building technology or industry group accredited programs; and,
- Provide bachelor's degree programs that fully accept relevant associate degree programs from community colleges.

“ We don't compete with the Penn States of the world. Maryland does not have the programs. Without more programs, the industry will fall behind. ”

“ I would like to see a 4 year degree with a work-study component. Grads from college with two years relevant experience are vastly important. ”

36% of survey participants were unaware that Maryland has existing bachelor's degree programs in construction management.

Does Maryland Need Another 4-Year Degree Program in Construction Management?

Yes - 65%

No - 34%

1%

Policy Recommendation #2

Better align K-12, high school CTE, community college, and apprenticeship programs with new construction skill requirements.

High school remains the basic foundation for career readiness and critical thinking, but the career readiness currently provided by a high school diploma does not meet the needs of the construction industry. Ongoing changes in the industry necessitate continued investment in training at all educational levels, with community colleges and apprenticeship programs serving as vital elements. This investment will mitigate the skills shortages that are already apparent and provide immediate employment and skills-generating opportunities to high school and college graduates. Industry leaders suggest the following:

- Increase engagement of construction professionals with school program advisory boards and the education community;
- High school Career and Technical Education (CTE) programs and community college advisory boards are encouraged to use MCCEI and its industry partners as a resource for technology and workforce trends;
- Identification of promising and engaged students for internships and mentorships;
- Emphasis on CTE program elements including hands-on field and jobsite experience, mentorships and internships, articulations with apprenticeship programs, community colleges, and universities, Building Information Modeling (BIM), Integrated Project Delivery (IPD), and communication and interpersonal skills;
- Enhance and expand Technology Education classes in Maryland's middle schools. Include a focus on three-dimensional modeling, analytical thought, processes and scheduling, and hands-on experience with tools and software;
- Enhance and expand community college level education and training opportunities through additional support and investment both directly and through organizations like the Construction and Energy Technologies Education Consortium (CETEC);
- Develop a universally accepted apprenticeship format with standardized criteria that will be recognized by employers in both union and merit shops; and,
- Establish the BIM Institute of Maryland to bridge the widening gap between advances in building technology and industry participants.

“ When everyone has to go to college, all that means is that everyone on a roofing crew has a BA degree. ”

A Great Start: MSDE’s Construction Design and Management Program

MCCEI and the Maryland State Department of Education (MSDE) have started addressing the alignment between industry demand and Career and Technical Education (CTE). Through partnership with MSDE and industry representatives, a new CTE program is being developed called the Construction Design and Management program. This is a 4 course program where high school students will learn about the design and construction process through project based learning. The courses are:

1. Introduction to Construction Design and Management
2. Principles of Construction Design
3. Advanced Design and 3-D Modeling
4. Advanced Construction Management

Top Areas for Investment and Promotion to Best Serve the Construction Industry

- 30%** College Level Construction Management/Engineering
- 27%** High School CTE
- 18%** Better Marketing of Programs/Career Options
- 14%** Trade Schools and Apprenticeships
- 5%** More Industry Involvement

Top Recommended Concentrations for Maryland’s Education System to Best Serve the Construction Industry

BIM, Design, Computer Technology	Field Experience	Math/STEM	Communications, Interpersonal Skills	11% Career Readiness; 8% Other Education; 7% Business Management		
22%	19%	17%	17%	11%	8%	7%

Policy Recommendation #3

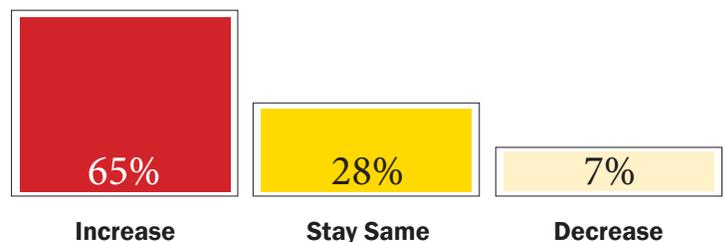
Create or strengthen articulations between high schools, CTE programs, apprenticeships, community colleges, and universities to define educational pathways for a career in construction.

Education pathways for careers in construction are needed to develop the necessary industry skills and attract talent. While articulation between CTE programs, community colleges, apprenticeships, and four-year institutions in Maryland exist, there is little apparent public knowledge beyond guidance counselors and program administrators. Without that transparency and connectivity, students will continue to lack interest in construction career pathways. To create pathways, the following steps should be taken:

- Establish formal articulation agreements where and when feasible;
- Benchmark neighboring states and establish a best practices model for Maryland that allows for maximum flexibility and credit for high school and CTE achievement to count toward associate's degrees and apprenticeships;
- Create a statewide database and user tool for articulation like Artsys for all education sources;
- Provide wage, income, and benefits information to potential workforce entrants;
- Articulate high school CTE programs and apprenticeships with community colleges;
- Offer "two plus two" programs with four-year universities.
- Reduce redundancy between classroom and apprenticeship training as appropriate—for example, more apprenticeship programs could accept CTE credits; and,
- Align apprenticeship programs with community college or four-year university programs.

- “ Improve articulation agreements and reach the parents - show a clear pathway to college credits. ”
- “ Technical vs. management vs. theoretical, create and define the pathways. Many people have no clue about the career opportunities. ”

Industry Opinion on General Education Levels Necessary for Relevance Over the Next 5 Years



Education Levels and Trends for Construction Professionals

Job Category	Preferred Education Attainment	10 Year Trend
Managerial	Bachelor's Degree	Shifting slightly towards master's degree
Site Superintendent	Apprenticeship	Shifting rapidly towards bachelor's degree
Skilled Trades	Apprenticeship	Shifting rapidly towards apprenticeship plus associate's degree
General Labor	High School Diploma	Shifting moderately towards apprenticeship

Policy Recommendation #4

Create a public image campaign to convey attractive construction-related career options.

Construction's traditional image limits the industry's ability to recruit exceptional candidates. A public campaign that conveys the exciting, attractive opportunities and broad experiences of a career in construction would improve the image of the industry and encourage recruitment of highly skilled individuals. While construction executives are aware of some career pathways and opportunities that exist, parents, guidance counselors and potential career seekers may not. The public image campaign should:

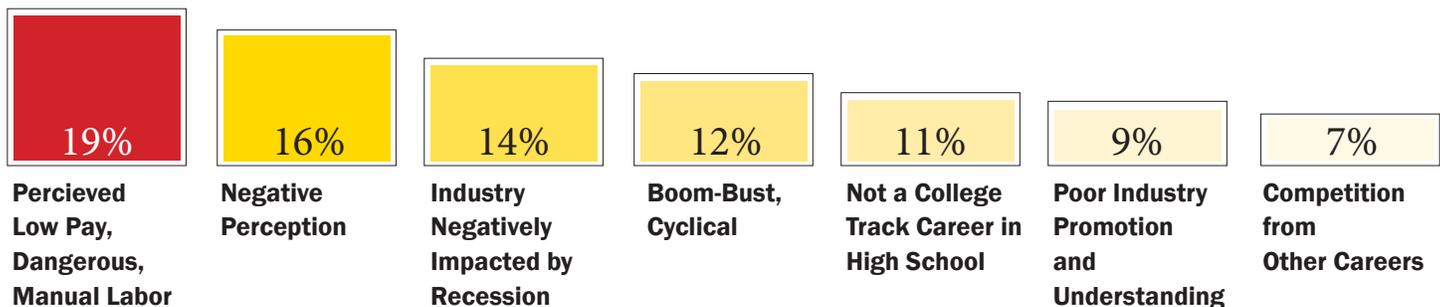
- Mimic other successful recruitment campaigns, such as those developed by branches of the U.S. military;
- Focus on the occupational categories that require a postsecondary degree, including engineering, architectural, and managerial categories;
- Encourage construction stakeholders to reach out to parents, career counselors, and students, to help them learn about the potential salaries, careers, and career pathways;
- Make a concentrated effort for promotion of continuing education opportunities for the existing construction workforce through Maryland's community college network;
- Emphasize that specialized training and education beyond high school is needed to be competitive;
- Present construction as a high-tech industry, with emphasis on digitization, modularization/manufacturing, environmental science, and materials science; and,
- Emphasize the merits of production, the technical character of the industry, opportunities for high wages, and the growing demand for construction skills;

“ Kids want to be in high tech. A hammer is not a high tech instrument. ”

“ In construction, you have a huge sense of accomplishment at end of the day. You can see a positive impact on the community by what you build. ”

- Utilize social media platforms for branding and promotion to increase awareness of the campaign and the industry's evolving image;
- Promote technical construction careers as part of the pathway to business ownership;
- Support CETEC's efforts to build employer awareness of the existing and extensive inventory of construction and skilled trades programming in MD's community colleges;
- Emphasize sustainability to underscore the proper balance between economics and the environment; and
- Consider possible partnerships between the industry and the community through charitable activities to attract new and diverse workforce entrants.

Top Responses on Obstacles to Recruiting People to the Construction Industry



Policy Recommendation #5

Create a strategy to include demographic groups that have not historically participated in the industry’s workforce.

Given the changing needs of construction, the industry will need access to the entire labor pool across all races, ethnicities, genders, and ages, to attract ideal candidates. Diverse labor is vitally important to the construction industry and should be encouraged, mentored, and nurtured for expanding roles in the industry. To attract a more diverse workforce, the industry should:

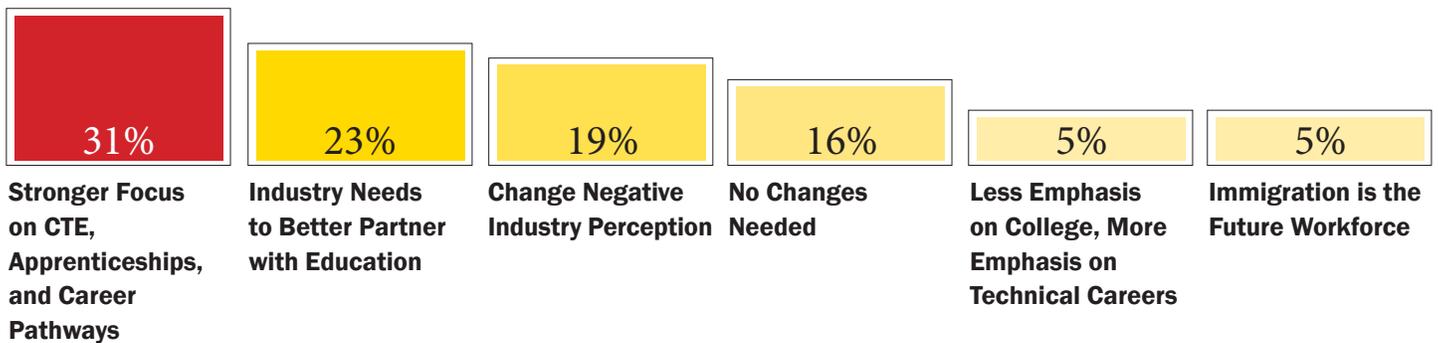
- Structure the public image campaign to be inclusive of nontraditional and diverse participants;
- Create or expand mentorship opportunities between industry practitioners and students using the ACE Mentorship Program as a benchmark;
- Assemble a special focus task force to target opportunities for diversity with an emphasis on:
 - High school/GED attainment,
 - “Career pathway” programs using contextual accelerated learning strategies to advance worker skills (Department of Labor, Licensing and Regulation; community colleges; workforce investment boards; and CBOs),
 - Three-dimensional modeling,
 - General business knowledge and training,
 - Related apprenticeship and community college offerings, and
 - English as Second Language (ESOL) programs in high schools; and,
- Adopt social media platforms for job searches to reach a more diverse labor pool.

“ A diverse workforce has a massive impact to the good. Forces people to improve. ”

“ Construction will always need labor - someone HAS to do it. This is how companies start. ”

71% of survey participants did not think either the Maryland education system or the industry itself is doing enough to create a future construction workforce pipeline.

Top Opinions from Interview Companies on Future Workforce Pipeline Development



Policy Recommendation #6

Recognize and adapt to the substantial technological changes in the construction environment necessary to keep the industry competitive.

Technology is revolutionizing the construction industry in terms of process, materials, logistics, waste reduction, and increased efficiency. Opportunity exists for the Maryland construction industry to become an export leader by focusing on modular construction and related training as well as advanced engineering and design that improve safety and efficiency. These growth areas need to be recognized and related education and training need to be developed to keep companies competitive in world markets. To enhance competitiveness, the industry should:

- Adopt BIM and IPD to increase efficiency and reduce waste— institutional and governmental users have already shifted over to these technologies;
- Adapt to modular and prefabricated construction to increase efficiency, improve quality, and reduce price;
- Adopt new contracting and delivery models (such as design-build, design-assist, Guaranteed Maximum Price [GMP], or hybrid contract models) to mitigate risks, accelerate schedules, and reduce budgets;
- Embrace new deal structures including public-private partnerships (P3s), equity investments, and builder-developer teams; and,
- Diligently pursue modular building and prefabrication component operations for expansion or relocation to Maryland through economic development activities and initiatives, leveraging the state's transportation networks and export capacities.

On BIM, Modular and Prefab

- “ It is game changing. We are on the precipice on how buildings are built.”
- “ People don't know what modular and prefab really is. Need to educate on 3D and up, it's the way to go.”

Interview Participant Opinions on Changes to Construction Processes through 2020

34% Increase in BIM/IPD/GPS/Communications

18% Will Require a Different Business Approach

15% Increase in Prefab/Modular/Materials

10% New Contracting/Procurement Methods

5% Constriction in Labor Supply

4% Cutthroat Environment/Industry Consolidation

3% Green Building

1% Renovations/Retrofits

10% Other

Conclusion

This study has determined that Maryland's construction workforce is simply not prepared for the industry's future. Correspondingly, Maryland will remain dependent on other states to provide higher quality workers. This will result in lost opportunities for local colleges and universities and higher costs for local employers.

The study provides six recommendations that, if implemented with fidelity, can make Maryland a global leader in construction. Since construction is increasingly becoming a global industry given modularization and prefabrication, there is an opportunity to increase Maryland's construction service exports, not only to other states, but also to other nations.

The most important priority is to expand or create construction management programs at the bachelor's degree level at colleges/universities in Central Maryland. These are where the major construction firms operate, and there is presently no contemporary programming available to support these and other firms.

There is also a need for better articulation between high schools (e.g. CTE programs), community colleges, four-year colleges, apprenticeship programs, and on-the-job training programs offered by employers. Better articulation will not only help create a higher quality workforce but will also do so efficiently.

MCCEI Board of Trustees

Officers

Martin G. Knott, Jr.
Chairman, MCCEI
President
Knott Mechanical
Hunt Valley, Maryland

Dyan Brasington
Secretary/Treasurer, MCCEI
Vice President
Towson University
Towson, Maryland

Gino Gemignani
Vice Chair, MCCEI
Senior Vice President
The Whiting-Turner Contracting Company
Baltimore, Maryland

Michael Henderson
Officer, MCCEI
President
ABC Baltimore Metro Chapter
Towson, Maryland

Members

Vance Ayres
Secretary
DC Building Trades Council
Camp Springs, Maryland

Francis "Frank" H. Chaney, II
Chairman
Chaney Enterprises
Waldorf, Maryland

Bernard A. "Andy" Cheezum
Vice President and Principal
Willow Construction
Easton, Maryland

William Cox
President and Owner
Corman Construction
Annapolis Junction, Maryland

Ronald DeJuliis
Commissioner, Division of Labor and Industry
Department of Labor, Licensing and Regulation (DLLR),
Baltimore, Maryland

Katharine Oliver
Deputy Superintendent
Maryland State Department of Education
Baltimore, Maryland

Lynn Reed
Executive Director
Governor's Workforce Investment Board (GWIB)
Baltimore, Maryland

Bernard J. Sadusky, Ed.D.
Executive Director
Maryland Association of Community Colleges
Annapolis, Maryland

Eric Seleznow
State Policy Director
National Skills Coalition
Washington, DC

Adam E. Snavely
President and CEO
Poole & Kent
Baltimore, Maryland

Designees

Jean Henry
Director
Construction and Energy Technologies
Education Consortium (CETEC)
Catonsville, Maryland

Pat Mikos
Program Manager, Division of Career and
College Readiness
Maryland State Department of Education
Baltimore, Maryland

Mary O'Connor
Program Manager
Governor's Workforce Investment Board
(GWIB)
Baltimore, Maryland

C. Edward Poarch, II
Director, Maryland Apprenticeship and Training
Department of Labor, Licensing & Regulation
Baltimore, Maryland

Acknowledgements

The Critical Path was produced by MCCEI and a consultant team of Sage Policy Group, Inc. and the Regional Economic Studies Institute (RESI) of Towson University. Charts and graphs are the product of MCCEI unless otherwise noted.

This report would not have been possible without the support and cooperation of our partner organizations and dedicated Board of Trustees. We cannot thank you enough.

Special thanks to:

- All of the interviewees that took the time to meet with and talk to MCCEI staff and consultants to share their views on the future of the construction industry.
- The Governors Workforce Investment Board.
- The Department of Labor, Licensing and Regulation, state of Maryland.
- The Maryland Economic Development Corporation.
- Towson University, Division of Innovation and Applied Research.

About MCCEI

MCCEI is an independent 501-c-3 corporation that was formed through the Governor's Workforce Investment Board. The primary missions of the MCCEI are to work in partnership with business and government to build a world-class education system for Maryland's construction industry, promote construction as a career of choice and to serve as an information marketplace for the industry and potential career seekers.



MARYLAND CENTER *for*
CONSTRUCTION
EDUCATION & INNOVATION

About Sage Policy Group

Sage Policy Group, Inc. is an economic and policy consulting firm specializing in economic, fiscal and legislative analysis, program evaluation, and organizational and strategic development. The firm's clients include public agencies at every level of government, multinationals, law firms, developers, money managers and an array of nonprofit organizations operating in a variety of segments.



About The Regional Economic Studies Institute

Towson University's Regional Economic Studies Institute (RESI) is a leading expert on Maryland's economy. RESI provides a vast array of services include economic forecasting, economic and fiscal impact analysis, market studies, workforce and commuter analysis, and human services analysis. RESI dedicates itself to providing the highest level of services to decision-makers in the private, public, and nonprofit sectors while emphasizing an interdisciplinary approach that combines knowledge with technology.

Regional Economic Studies Institute



Production

MCCEI Staff Contributors

Robert M. Aydukovic, CRE
Lauren C. Mari

MCCEI Interns

Charles P. Kerrigan
Simeon T. E. Williams

Contributing Consultants

Anirban Basu
Chairman and CEO
Sage Policy Group, Inc.

Carl DeLorenzo
Chief Operating Officer
Sage Policy Group, Inc.

Rebecca Ebersole
Research Associate, RESI
Towson University

Sharyn K. Grove
Design Manager
Towson University

Milton Hunt
President
Hunt International

Daraius Irani, Ph. D.
Executive Director, RESI
Towson University

Bobbie K. Laur
Director, External Affairs
Towson University

Lauren Moore
Research Associate
Sage Policy Group, Inc.

Printing

Schmitz Press
Sparks, Maryland



MARYLAND CENTER *for*
CONSTRUCTION
EDUCATION & INNOVATION

7400 York Road, Suite 302
Towson, MD 21204
410-704-5981 office 410-704-3684 fax
www.mccei.org