Volume 1 **2004/2005**
Number 2

The International Journal of Construction Education and Research

Brian C. Moore, Ph.D., *Publisher/Editor*
D. Mark Hutchings, Ph.D., *Associate Editor*
Charles Berryman, Ph.D., *Associate Editor*

A PUBLICATION OF

THE
ASSOCIATED SCHOOLS
OF
CONSTRUCTION

ISSN 1550-3984

The *International Journal of Construction Education and Research* (ISSN 1550-3984) was begun in 2004 and is hosted by the Board of Directors of the Associated Schools of Construction (ASC). The ASC is an association currently comprised of more than 100 colleges and universities, each of which sponsors a construction education program. The *International Journal of Construction Education and Research* replaces the *Journal of Construction Education* which was founded in 1996 and was also hosted by the ASC's Board of Directors. Dr. Ken Williamson of Texas A&M University served as editor and publisher of the *Journal of Construction Education* for all but the final two issues. By replacing the *Journal of Construction Education* with the new *International Journal of Construction Education and Research*, it is the hosting organization's goal to attract not only manuscripts dealing with construction education and pedagogy, but also to publish high-quality manuscripts addressing a wider range of topics related to the construction industry. The purpose of the *International Journal of Construction Education and Research (Journal)* is to recognize scholarly work by preserving and disseminating manuscripts that contribute to the understanding of issues and topics associated with construction education and the construction industry. This issue will be the last issue published by the ASC online. Taylor and Francis will publish the first print version of the *Journal* in March/April of 2006. An associated online version of the journal will be available at that time to subscribers.

Any requests, suggestions, questions, or reports regarding this service should be directed to:

Journal Editor/Publisher
Brian C. Moore, Ph.D.
Southern Polytechnic State University
email: ascjournal@spsu.edu

Author Instructions for Submitting

Submitting an article to the *Journal* implies the manuscript is original and is not being considered nor has been published in whole or in part within another journal. Papers that have been reviewed, presented or published within ASC conference proceedings may be considered works-in-progress and may be submitted to the *Journal* if significant changes have been made to the research. Manuscripts not modified by this process will not be considered to represent an original work, and the *Journal* will not consider the manuscript publishable. Manuscripts accepted for publication will require authors to sign the Transfer of Copyright Agreement. A hard copy of this agreement must be signed mailed to the following address when the manuscript is submitted for review.

ASC Journal Editor – Dr. Brian Moore
Southern Polytechnic State University
Construction Department – Bldg. 'H'
1100 S. Marietta Parkway
Marietta, GA 30060

Until a revised style guide is available on the Taylor & Francis web site, authors should prepare manuscripts according to the *ASC's Publication Style Guide*, which conforms to the *Publication Manual of the American Psychological Association* (5th ed). All manuscripts must include an abstract, which is limited to one paragraph, containing a maximum of 200 words. Immediately following the abstract, a maximum of five key words or phrases must be included. Instructions addressing composition of manuscripts, including headings, paragraphs, text body citations, tables, figures, references, appendices, and abstracts appear in the ASC's Publication Style Guide. Every effort is made in the editorial process to eliminate discriminatory, personal, university, program and sexist language. Manuscript length should be related to the manuscript's information value.

The editors of the *Journal* consider it unethical for authors to withhold the data on which their conclusions are based from other competent professionals who seek to verify the substantive claims through reanalysis and who intend to use such data only for that purpose, provided that the confidentiality of the participants can be protected and unless the legal rights concerning proprietary data preclude their release. Authors submitting to the *Journal* are expected to have their research data available throughout the editorial review process and for at least five years after the date of publication.

Manuscripts must be submitted electronically by e-mail attachment. They are to be sent to the editor at ascjournals@spsu.edu or bmoore@spsu.edu. By submitting a manuscript for possible publication in the *Journal*, authors grant permission to the editorial board to follow the review process outlined below.

First, all manuscripts submitted to the *Journal* will first be reviewed by members of the Editorial Office for appropriate content, composition, etc. Second, manuscripts approved for peer review will then be submitted to three members of the *Journal's* Editorial Office who are qualified in the content area to determine whether or not the manuscript will be accepted for publication in

the *Journal*. Manuscripts that are not approved for peer review will be notified and suggestions for improvement provided. Manuscripts will be transmitted to reviewers electronically, and any correspondence between authors and editors will also be processed in this manner.

Author(s) should carefully review the following submission instructions:

- Copyright and Permissions
- IJCE&R's Publication Style Guide
- Formatting Instructions
- The Review Process.

Manuscripts submitted to the *Journal* should be finished products and will be accepted or rejected for publication in the *Journal* based on a majority decision of peer reviewers. Discussion between reviewers and authors may be appropriate at the ASC Proceedings level; however, comments to authors submitting to the *Journal* will be summarized only after a final decision is made by reviewers. Articles submitted to the Journal should not be considered "works-in-process."

If you have any questions, please contact the editor at ascjournal@spsu.edu, at bmoore@spsu.edu, or by telephone at 678-915-3715. Or you may contact any member of the editorial office.

International Journal of Construction Education and Research

2004/2005
Volume 1, No. 2
pp. 63-130

International Journal of Construction Education and Research
2004/2005, Vol. 1, No. 2, pp 63 - 130

1550-3984/Editorial

Changes Abound – An Editorial

Brian C. Moore, Ph.D. - Editor
Southern Polytechnic State University
Marietta, GA

The arrival of Fall brought with it cooler weather and significant changes to the ASC's *International Journal of Construction Education and Research*. I was asked to serve as the *Journal's* interim editor in late July. On August 1, 2005, I was very graciously hosted by Drs. Mark Hutchings and Jay Christofferson at Brigham Young University, where we quickly began to effect an editorial transition. At my request, Mark consented to stay on as an Associate Editor. I also invited Dr. Chuck Berryman to join the Editorial Office as an Associate Editor. Both Mark and Chuck bring terrific experience, education and commitment to bear on their editorial responsibilities. In addition, I have established a *Journal* Advisory and Mentoring Council, chaired by Dr. John Schaufelberger. John has agreed to assist the ASC and specifically the *Journal* by providing strategic input on the direction of the *Journal*. I have also asked John to organize an annual Journal publishing workshop, in concert with the Annual ASC Conference, to assist attendees with their publishing skills. In November my temporary appointment as the *Journal's* "interim editor" changed when I was elected to the position of editor by the ASC's Board of Directors.

In mid-August, ASC also finalized an agreement with Taylor & Francis (T&F), a two-hundred year old publishing company. T&F will begin publishing the *Journal* in 2006. The issue is expected to be available in April 2006 – just in time for the ASC National Conference in Fort Collins, CO. The Editorial Office is working hard with our new publisher to prepare the first ever print copy of the *Journal*. In recent months, the excellent submissions to the *Journal* promise to make the first print issue informative and interesting.

As we prepare for the upcoming *Journal* issues to be published by T&F, I strongly encourage all authors to submit your works to the *Journal*. We are, after all, striving to improve construction education and research. How do we accomplish this? I believe that we must share research, share opinions, push each other to improve and, ultimately, question the foundation concepts of our industry. We can be responsible for leading the changes or sitting by as changes occur around us. Can we afford to accept only incremental improvements? Can we expect a world without competition? From high performance buildings and green construction to skilled and unskilled worker shortages, the reality is that throughout the world changes are afoot in the construction industry that will change the lives of individuals and the business practices of corporations. We must strive to be a part of that transition or find our students and ourselves ill-prepared to compete in an increasingly global marketplace. While the Journal will continue to publish excellent manuscripts, we will also find ways to allow for discussion and disagreement and the resulting benefits that can come from such interaction.

In the meantime, the Editorial Office has scoured the ASC *National Conference Proceedings* for the years 2001, 2002, and 2003 and selected notable manuscripts to include in this the last issue of the ASC-published online *Journal*. We hope that you enjoy these works.

This, the second issue of the *International Journal of Construction Education and Research*, is hosted by the Board of Directors of the Associated Schools of Construction (ASC). The ASC is an association currently comprised of more than 100 colleges and universities, each of which sponsors a construction education program. The *International Journal of Construction Education and Research* replaces the *Journal of Construction Education* which was founded in 1996 and was also hosted by the ASC's Board of Directors.

Abstracts of Research Manuscripts for the *International Journal of Construction Education and Research*
Volume 1, Number 2, 2004/2005

Design-Build Education at Associated Schools of Construction Undergraduate Programs

Barbara J. Jackson
California Polytechnic State University
San Luis Obispo, California

This study discusses the results of a survey conducted in 2001-2002 designed to determine the extent to which design-build project delivery is taught at four year construction programs within the membership schools of the Associated Schools of Construction (ASC) and to identify existing limitations and barriers to design-build education at these programs. A questionnaire was sent to all 4-year ASC construction programs. Forty four schools or fifty percent of the member schools responded. The study focused on three primary questions (1) Do you offer design-build education in your program and if you do, do you offer it as a stand alone course or as part of another course, (2) what elements of design-build are addressed in the course(s), and (3) what are the major barriers to delivering design-build education at the undergraduate level? A majority of ASC programs responding teach components of design-build project delivery at some level. Only 17% of the programs responding indicated that they taught design-build project delivery as a stand-alone course and 17% of the responding programs indicated that they do not teach design-build project delivery at all. Programs offering design-build project delivery as a stand-alone course address significantly more topic areas than do programs that teach design-build as part of another course. The top three topic areas addressed within those programs indicating that they teach design-build are (1) advantages and disadvantages of design-build, (2) owner's objectives and needs, and (3) conceptual estimating. The number one barrier or limitation to delivering design-build education at the undergraduate level is curricular restraints primarily associated with accreditation and general education requirements.

Key Words: Design-Build, Project Delivery, Curriculum, Conceptual Estimating, Integrated Project Delivery

Solving the Construction Craftperson Skill Shortage Problem Through Construction Undergraduate and Graduate Education

Dean T. Kashiwagi and Scott Massner
Performance Based Studies Research Group (PBSRG)
Arizona State University
Tempe, Arizona

This research paper identifies construction undergraduate and graduate education as the only solution to the problem of craftsperson shortage in the construction industry. The paper first identifies the craftsperson shortage problem and easily identifiable problems of low pay, no career incentives, and minimized training. It then analyzes the construction industry structure. Using Information Measurement Theory, it identifies the environment required to increase the number of skilled craftspeople. The analysis identifies the real source of the craftsperson skill shortage in the construction industry as the industry structure, the low-bid procurement system, and the lack of performance information. The current industry structure and procurement systems identify craftsperson skill as a need and not a requirement. It identifies the construction education system as the only way to change the craftsperson skill shortage problem. It proposes that certain topics (industry structure, change mechanisms, performance information, business processes, organizational optimization) must be introduced in construction education and given to facility owner representatives, designers, and construction management to change the industry structure from within and without.

Key Words: Craftperson shortage, industry structure, low-bid procurement, performance information

Factors Leading to Construction Company Success: Perceptions of Small-Volume Residential Contractors

Mark Hutchings and Jay Christofferson
Brigham Young University
Provo, Utah

The majority of home building companies in the United States produce fewer than 25 homes per year. In an effort to identify and report on what the perceptions of owners and managers were regarding the reasons for the success of their own small-volume residential construction companies, a nationwide survey was conducted by randomly mailing written questionnaires to owners and managers of 1,114 companies who were members of the National Association of Home Builders. This research report summarizes the responses to an open-ended question to prioritize the five things that contributed most to the success of residential construction companies. Many of the most important factors that were identified as contributing to the success of construction companies were not those listed as important factors for success in the review of literature. Among the factors of success that did rank high were quality workmanship, honesty, having good subcontractors, customer communications, reputation, having good employees, and completing projects on time.

Key Words: Management Practices, Residential Construction, Home Builder, Company Success

The Perceptions of Experienced Construction Practitioners Regarding Ethical Transgressions in the Construction Industry

Barbara Jackson

California Polytechnic State University
San Luis Obispo, California

This study discusses the results of a national survey, conducted in 1999, designed to assess the perceptions of experienced construction practitioners regarding the "frequency" and "seriousness" of ethical transgressions within the construction industry. A questionnaire was sent to 1,450 systematically selected members of the Associated General Contractors. A total of 321 useable questionnaires were returned, or 22 percent. These construction practitioners were asked to consider 15 issues that may typically arise for those working in the construction industry in the normal course of operations. Contractors were asked how often they thought each of the issues occurred and, when they did occur, how serious did they consider them to be. In addition, the relationship between construction practitioners' perceptions of ethical behavior and several demographic variables were analyzed. The results indicate that the four most frequently occurring ethical transgressions were Improper or Questionable Bidding Practices, Misrepresentation of Completed Work or Value of Work, Poor Quality Control or Quality of Work, and Technical Incompetence or Misrepresentation of Competence. The four most serious ethical transgressions were Alcohol or Drug Abuse; Improper or Questionable Bidding Practices; Failure to Protect Public Health, Safety, or Welfare; and Poor Quality Control or Quality of Work. Although several of the demographic variables analyzed were related to several of the individual ethical issues, only three - gender, region of country, and experience - were found to be significant when it came to the summated scores for perceived frequency and/or seriousness of ethical transgressions.

Key Words: Ethics, Construction Ethics, Ethical Transgressions, Bid Shopping

Notes to Published Research Manuscripts

Volume 1, Number 2, 2004/2005

All of the manuscripts published in this issue of the *International Journal of Construction Education and Research* (*Journal*) appeared in ASC Annual Proceedings between 2001 and 2003. This issue of the Journal begins with two papers regarding construction education and concludes with two papers more focused on industry issues. The first manuscript, entitled *Design-Build Education at Associated Schools of Construction Undergraduate Programs,* was presented at the April 2003 ASC Conference. This manuscript offers the reader insight into design-build as it is taught in undergraduate programs in the US. The second manuscript, entitled *Solving the Construction Craftperson Skill Shortage Problem Through Construction Undergraduate and Graduate Education,* was presented at the April 2002 ASC Conference. In the latter manuscript, Kashiwagi addresses the shortages being experienced throughout the US construction industry.

Mark Hutchings and Jay Christofferson's *Factors Leading to Construction Company Success: Perceptions of Small-Volume Residential Contractors* summarizes surveys of residential construction companies about the factors that were perceived as having the greatest impact on company success. Barbara Jackson's *The Perceptions of Experienced Construction Practitioners Regarding Ethical Transgressions in the Construction Industry* addresses a topic that, in light of recent ethical lapses discovered in large corporations, is increasingly emphasized by construction professionals. These last two papers were presented at the April 2001ASC National Conference.

Design-Build Education at Associated Schools of Construction Undergraduate Programs

Barbara J. Jackson
California Polytechnic State University
San Luis Obispo, California

This study discusses the results of a survey conducted in 2001-2002 designed to determine the extent to which design-build project delivery is taught at four year construction programs within the membership schools of the Associated Schools of Construction (ASC) and to identify existing limitations and barriers to design-build education at these programs. A questionnaire was sent to all 4-year ASC construction programs. Forty four schools or fifty percent of the member schools responded. The study focused on three primary questions (1) Do you offer design-build education in your program and if you do, do you offer it as a stand alone course or as part of another course, (2) what elements of design-build are addressed in the course(s), and (3) what are the major barriers to delivering design-build education at the undergraduate level? A majority of ASC programs responding teach components of design-build project delivery at some level. Only 17% of the programs responding indicated that they taught design-build project delivery as a stand-alone course and 17% of the responding programs indicated that they do not teach design-build project delivery at all. Programs offering design-build project delivery as a stand-alone course address significantly more topic areas than do programs that teach design-build as part of another course. The top three topic areas addressed within those programs indicating that they teach design-build are (1) advantages and disadvantages of design-build, (2) owner's objectives and needs, and (3) conceptual estimating. The number one barrier or limitation to delivering design-build education at the undergraduate level is curricular restraints primarily associated with accreditation and general education requirements.

Key Words: Design-Build, Project Delivery, Curriculum, Conceptual Estimating, Integrated Project Delivery

Introduction

Design-Build is a method of project delivery in which one entity, the design-builder, forges a single contract with the owner to provide for architectural or engineering design and construction services. Independent research on project performance has shown that design-build, when compared with traditional design and low-bid contracting, is 33% faster, 6% less in unit cost, superior in product quality, and generates less than half the claims and litigation (Beard, Loulakis, & Wundram, 2001).

In the United States, the private sector's use of design-build has been increasing during the past thirty years, and is found in a wide array of commercial, institutional, and industrial applications. In the U.S. public sector, the federal government, as well as many states and local governments, employ Design-Build contracting for a significant percentage of their building programs. According to the Design Build Institute of America, overall, the use of design-build has grown from 5% of U.S. construction in 1985 to 33% in 1999, and is projected to surpass low-bid construction in 2005.

Although the actual use of Design-Build project delivery has increased dramatically since 1985, traditional low-bid project delivery remains the educational focus of undergraduate construction programs across the country. If construction education is to address future market expectations as expressed by the increased use of design-build, than an educational emphasis on design-build must occur at some level. The primary purpose of this study was to try to determine the extent to which design-build project delivery is currently being taught in construction management programs at ASC member schools.

Methodology

Participants

The membership list published on the Associated Schools of Construction website was used as the sample source for this study. The study's focus was colleges and universities that offer a four year construction program. It was determined that there were 88 four-year schools listed as members of the ASC at the time of the survey. The programs are identified as either Construction Management, Construction Engineering, Engineering Technology, Building Science, or Construction Science programs. Each of the programs is affiliated with a college or school of Engineering, Architecture, Technology, or other.

The methodology adopted for this study was the questionnaire survey. A questionnaire was sent via regular mail to each of the member schools. The questionnaire was addressed to the department head of each program asking that the questionnaire be forwarded to an individual faculty member that could best respond to the survey. A second mailing via email and fax was conducted approximately 3 months after the first collection attempt.

Instrument

The questionnaire utilized in this study initially contained 3 parts. Part 1 contained demographic questions regarding school name, program name, and college/school affiliation. Part 1 also contained qualitative questions such as those listed below:

1. In your opinion, is the design-build education being offered at the undergraduate level adequate?
2. What do you perceive to be the main barriers to providing design-build education at the undergraduate level?
3. Do you think the use of design-build project delivery will increase, decrease, or stay approximately the same over the next 10 years?

Part 2 of the questionnaire dealt with design-build curriculum offerings within the program. The fundamental questions for Part 2 were:

1. Do you teach specific "stand alone" courses in design-build project delivery in your undergraduate program? Yes___ No ___

2. Do you teach design-build project delivery as part of another course or courses in your undergraduate program? Yes___ No ___

For the purposes of this study a "stand alone" course meant that there was a specific design-build course being offered in the curriculum.

Participants who responded in the affirmative to either question listed above were then asked to identify what elements of design-build project delivery they addressed in their courses. A list of design-build educational elements was taken from the Educational Needs Assessment for Design-Build Project Delivery research project conducted by the University of Colorado and the Design-Build Institute of America in 2001(Molenaar, 2001). This research was initiated to determine the most critical needs of design-build continuing education as viewed by industry professionals. The study resulted in a Design-Build Lifecycle model that divides the process into six main phases or categories—Project Initiation, Risk Allocation, Performance Specifications, Project Planning, Construction Administration, and Project Closeout (See Figure 1)

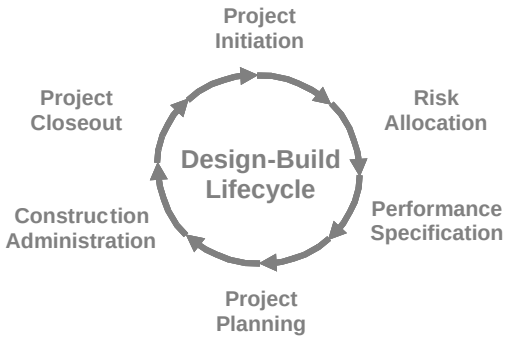

Figure 1: Design-Build Life Cycle Model

Under each phase or category, several educational elements were identified. The list of categories and elements can be seen in Figure 2. According to the study, these categories identify the most critical areas of the process. Participants were asked to mark all that applied.

PROJECT INITIATION
___ Owner's Objectives & Project Needs
___ Advantages and Disadvantages
___ Project Program and Feasibility
___ Fast Tracking (Project Timeline)
___ Early Budgeting and Contingency
___ Project Financing

PERFORMANCE SPECIFICATION
___ RFQ and RFP Definitions
___ RFQ and RFP Preparation
___ Performance Specifications
___ Preparing the Proposal Response
___ Proposal Preparation Costs
___ Design-Builder Selection and Evaluation

PROJECT ADMINISTRATION
___ Design-Build Contract Award Process
___ Progress payment Techniques
___ QA and QC for Design-Build
___ Design-Build Cost & Schedule Control
___ Change Order Management and Trending

RISK ALLOCATION
___ Laws and Licensing
___ D/B Contract Fundamentals
___ Teaming Agreements
___ Design-Build Insurance Considerations
___ Bonding for Design-Build

PROJECT PLANNING
___ Conceptual Design
___ Conceptual Estimating
___ Design and Build Scheduling
___ Life Cycle Costing
___ Value Engineering

PROJECT CLOSEOUT
___ Warranties in Design-Build
___ Facilities Commissioning Process
___ Facilities Maintenance
___ Facilities Management
___ Operations Planning

Figure 2:– Elements of Design-Build Education

Part 3 of the original questionnaire attempted to identify elements of design-build education that may not actually be recognized as such within an undergraduate construction program. The data from this part of the questionnaire was determined to be inconsistent and unreliable and therefore not utilized in the study.

Data Analysis

Data collected was analyzed using the Statistical Package for Social Sciences (SPSS). The data were analyzed using descriptive statistics only. No comparative or inferential statistics were required. Frequency and means provided sufficient measurement to fulfill the purpose of the study.

Results

Response Rate and Sample Profile

Questionnaires were returned from each of the seven regions of the ASC. Of the 88 questionnaires sent out, a total of 44 or 50 percent were returned. Of the 44 programs that responded, 53 percent were affiliated with an Engineering college or school equaling 55 percent of all Engineering affiliated construction programs, 20 percent were affiliated with an Architecture college or school equaling 73 percent of all Architecture affiliated construction programs, 20 percent were affiliated with a college or school of Technology equaling 55 percent of all Technology affiliated construction programs, and 7 percent were affiliated with a college

or school noted as other, equaling 18 percent of all "other" college affiliated construction programs.

Design-Build Curriculum

A majority of the schools that responded offer design-build education at some level. Seventeen percent indicated that they teach design-build as a stand alone course. Sixty-six percent of the respondents stated that design-build is taught as part of another course, and 17 percent indicated that they do not teach design-build at all.

Design-Build Elements Taught

The Molenaar study (2001) identified the specific aspects of design-build that are the most crucial for the continuing education of professional practitioners within the industry. The study integrated the experiences of professionals from all sides of a construction project. In determining these crucial aspects, information was gathered from seven different sectors of industry, including builders, designers, integrated design-builders, public and private owners, lawyers and sureties. For the purposes of this study, this same model was used to evaluate the extent to which design-build education is being addressed at undergraduate construction management programs. Note that the number in parentheses next to each element represents its Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study (2003). Each category is considered separately.

Project Initiation Elements

Table 1 indicates the percent of programs responding that teach project initiation elements of design-build. Project Initiation elements as a group received the highest percentages across all three categories of evaluation (All Programs, Part of Another Course, and Stand Alone Course). The elements Owner's Objectives & Needs and Design-Build Advantages & Disadvantages received high indicators across all three categories, ranging from 63 percent to 86 percent for Owner's Objectives & Needs and from 68 percent to 86 percent for Advantages & Disadvantages. Eighty-six percent of the programs that teach design-build as a stand alone course address Project Program & Feasibility—this is more than double the coverage percentage by programs that teach design-build as part of another course. This is important to note in that this particular element represents a service often required by Owner's seeking design-build services. On the other hand, it is also noteworthy to recognize that the element Project Financing, a service increasingly in demand by procurers of design-build, was addressed by fewer programs offering design-build as a stand alone course than by those that teach design-build as part of another course.

Table 1

Project Initiation

	All Programs	Part of Other Course	Stand Alone Course
Owner's Objectives & Needs (3)	63	73	86
Advantages & Disadvantages (1)	68	81	86
Project Program & Feasibility (16)	35	31	86
Fast Tracking – Project Timeline (5)	50	58	71
Early Budget/Contingency (2)	43	46	71
Project Financing (29)	35	46	29

*Number in parentheses represents the Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study.

Performance Specifications

The Performance Specifications category includes the most distinctive educational elements of design-build versus traditional project delivery. These elements deal with how the design-builder gets their work—via the RFQ / RFP process, how RFP's are written and evaluated using performance criteria, how to prepare a response to an RFP, and how a design-builder is selected and evaluated in the marketplace. Table 2 indicates the percent of programs responding that teach Performance Specifications elements of design-build. The data clearly indicates that these critical and distinctive elements of design-build are best served by programs providing design-build education as a stand alone course. For almost all of the elements listed under the category Performance Specifications, stand alone courses provide coverage two or three times more often than did design-build education offered as part of another course.

Table 2

Performance Specifications

	All Programs	Part of Other Course	Stand Alone Course
RFQ/RFP Definitions (17)	33	27	86
RFQ/RFP Preparation (22)	23	12	86
Performance Specifications (8)	50	54	86
Proposal Response Preparation (12)	35	27	100
Proposal Preparation Costs (19)	20	15	67
DB Selection & Evaluation (10)	48	50	86

*Number in parentheses represents the Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study.

Project Administration

Table 3 reveals the percentage of programs responding that teach design-build Project Administration elements in their undergraduate construction programs. For three of the elements, DB Contract Award, DB Progress Payments, and DB Cost & Schedule Control, those programs teaching this content in stand alone courses address these elements by a ratio greater than two to one. There appears to be little difference between the emphasis on QA / QC for Design-Build, and DB Change Order Management between the two methods of providing design-build curriculum.

Table 3

Project Administration

	All Programs	Part of Other Course	Stand Alone Course
DB Contract Award (21)	33	31	71
Progress Payments in DB (31)	30	27	71
QA and QC for Design/Build (15)	25	31	29
DB Cost & Schedule Control (6)	33	31	71
DB Change Order Management (11)	38	42	57

*Number in parentheses represents the Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study.

Risk Allocation

The Risk Allocation elements also represent distinctive components of design-build project delivery. Table 4 indicates the percentage of programs responding that teach design-build Risk Allocation elements in their undergraduate construction programs. In this case the data reveals that many of these elements are similarly addressed regardless of the mode of delivery. However, it is interesting to note that when it comes to design-build insurance and bonding that programs teaching design-build as part of another course address these elements at a ratio of slightly more than two to one over stand alone courses. It should also be noted that neither methodology offers a high likelihood of inclusion. One would also think that design-build contract fundamentals would be addressed by 100 percent of the programs providing design-build education. But the data reveals that this is not the case.

Table 4

Risk Allocation

	All Programs	Part of Other Course	Stand Alone Course
DB Laws & Licensing (26)	28	35	29
DB Contract Fundamentals (9)	53	62	71
Teaming Arrangements (18)	35	42	43
DB Insurance Considerations (24)	23	31	14
Bonding for Design-Build (28)	25	35	14

*Number in parentheses represents the Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study.

Project Planning

The elements listed under Project Planning once again represent distinctive components of design-build project delivery. Table 4 indicates the percentage of programs responding that teach design-build Project Planning elements in their undergraduate construction programs. Conceptual estimating, conceptual design, life cycle costing, and value engineering are all fundamental requirements in design-build project delivery. However, they are also recognized tools that can be applied to any project. This may explain why the variance between the percentages for Part of Another Course and Stand Alone Course is relatively unremarkable for all elements within the category. It should also be noted that conceptual estimating received the highest single percentage of offering by all programs at 69 percent.

Table 5

Project Planning

	All Programs	Part of Other Course	Stand Alone Course
Conceptual Design (13)	55	50	86
Conceptual Estimating (4)	69	72	100
Design & Build Scheduling (7)	40	42	71
Life Cycle Costing (20)	40	42	57
Value Engineering	60	62	86

*Number in parentheses represents the Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study.

Project Closeout

Table 4 indicates the percentage of programs responding that teach design-build Project Closeout elements in their undergraduate construction programs. It is clear from the information included in this table that these elements receive the least attention regardless of how the curriculum is offered. Given the trend toward broader services being offered to facility owners by design-builders such as design-build-operate-maintain and design-build-operate-transfer, this data suggests a possible gap in design-build education.

Content Coverage per Category

Table 7 shows the mean number and percentage of elements addressed within a topic category. These are broken down for all programs responding, programs that teach design-build as part of another course, and for stand alone courses. Among all programs and programs where design-build is being taught as part of another course, Project Initiation elements received the most attention. Among programs that teach design-build as a stand alone course, Performance Specification elements were taught more often with Project Initiation elements a close second.

Overall, the top three single elements of design-build project delivery being addressed at all programs that reported teaching design-build, regardless of whether design-build was being taught as part of another course or as a stand alone course, is the advantages and disadvantages of design-build (68 percent), owner objectives and project needs (63 percent), and conceptual estimating (69 percent).

Table 6

Project Closeout

PROJECT CLOSEOUT	All Programs	Part of Other Course	Stand Alone Course
Warranties in Design-Build (25)	23	31	14
Facilities Commissioning (27)	18	19	29
Facilities Maintenance (30)	0	0	0
Facilities Management	0	0	0
Operations Planning (30)	3	0	14

*Number in parentheses represents the Educational Needs Ranking identified in the Molenaar Educational Needs Assessment study.

Table 7

Content Coverage per Category

	All Programs	Part of Another Course	Stand Alone Course
Project Initiation	3.08 / 44%	3.54 / 51%	4.43 / 63%
Performance Specification	2.10 / 30%	1.88 / 27%	5.00 / 71%
Project Administration	1.58 / 32%	1.62 / 32%	3.00 / 60%
Risk Allocation	1.65 / 28%	2.04 / 34%	1.86 / 31%
Project Planning	2.58 / 43%	2.65 / 44%	3.71 / 62%
Project Closeout	0.43 / 9%	0.50 / 10%	0.57 / 11%

Adequacy of Undergraduate Design-Build Education and Projected Use of Design-Build Project Delivery

As can be seen in Figure 3 more than half of the participants responding indicated that the current level of design build education is inadequate or barely adequate. This information taken together with the information depicted in Figure 4 indicating that 79 percent of the participants of this study believe that the use of design-build project delivery in the marketplace will increase over the next 10 years are strong indicators for further consideration of design-build curriculum at the undergraduate level.

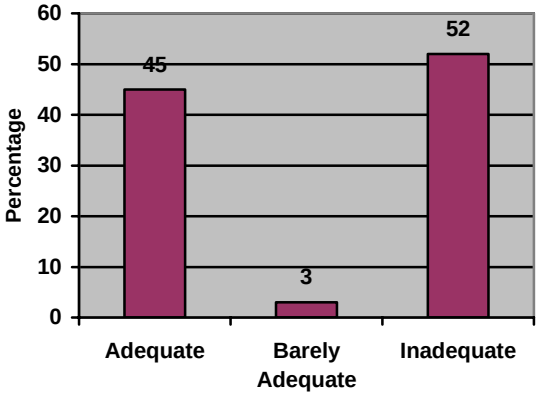

Figure 3: Adequacy of Undergraduate Design-Build Education

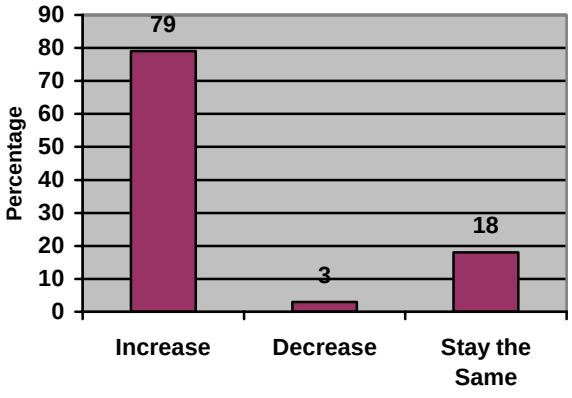

Figure 4: Projected Use Of Design-Build Education

Barriers and Limitations to Design-Build Education

Survey participants were asked to list perceived barriers and constraints to delivering design-build education at the undergraduate level. Participants were allowed to list as many barriers or constraints as they wished. Figure 5 indicates their responses. Curricular restraints are by far the barrier most often reported. Some of the specific curricular restraints mentioned were: (1) Limited number of credit hours in the curriculum, (2) Accreditation requirements dictate, (3) No room in curriculum after meeting general education and accreditation requirements, and (4) Programs have few or no electives.

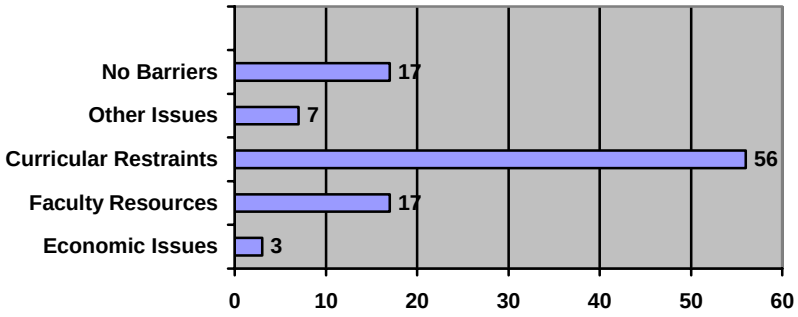

Figure 5 – Barriers and Limitations to Offering Design-Build Curriculum

Other responses that were listed were grouped under the categories of faculty resources, economic issues, and other issues. Some of the specific responses under these categories are listed below. It is also worth noting that several participants indicated that there were no barriers to delivering design-build education.

Faculty Resources-

Faculty resistance to change.

Lack of qualified/knowledgeable faculty.
Refusal to integrate across disciplines.
No time to develop new courses.
No resources to develop new courses.

Other Barriers-

1. Why develop a course around a single delivery method?
2. Students unable to understand.
3. Lack of student interest.
4. Complexity of design-build.
5. No reference materials/textbooks.
6. Design-Build is still unproven in the marketplace.

Conclusions

At first glance it may appear that Design-Build being addressed at 83% of all programs responding is a positive result. However, with further analysis and in consideration of the numerous educational elements of design-build, the picture is less encouraging. For example, when the three most important educational needs identified by industry practitioners in the Molenaar Study (2001) are considered, the analysis is as follows:

Element #1 – Advantages & Disadvantages

6 programs or 14% of all programs address this element in a stand alone course.
24 programs or 55% of all programs address this element as part of another course.
14 programs or 32% of all programs responding did not offer this element at all.

Element #2 – Budget & Contingencies

5 programs or 11% of all programs address this element in a stand alone course.
44 programs or 32% of all programs address this element as part of another course.
25 programs or 57% of all programs responding did not offer this element at all.

Element #3 – Owner's Objectives & Needs

6 programs or 14% of all programs address this element in a stand alone course.
22 programs or 50% of all programs address this element as part of another course.
16 programs or 37% of all programs responding did not offer this element at all.

Quantity versus Quality

Although an effort was made to quantify the educational elements of design-build being addressed at ASC programs in this study, it is important to recognize that the findings don't reveal anything about the quality of the design-build curriculum being offered. Even though the industry has surged forward in its use of design-build and the marketplace is a clear demand for it, there is probably limited knowledge and experience of the design-build process among construction academics. Therefore, it is likely that the quality and consistency of design-build education is suspect at best. Professional educational offerings in design-build presented by DBIA, ASCE, AGC, AIA, and others might be considered appropriate professional development avenues for those programs and individual faculty that are interested in improving design-build educational opportunities at the undergraduate level.

Discussion

One of the questions that need to be addressed by construction educators is whether the coverage of these topics is warranted in an undergraduate construction management program today—in other words, is there a need to provide specific design-build curriculum to CM students. To help answer this question the author suggests consideration of the following 4 factors:

- During the past decade, the use of and interest in design-build in the United States and Canada has greatly accelerated, making the growth of this delivery method one of the most significant trends in the design and construction industry (DBIA, 1996).

- Design-build requires a team and a new mentality—an integrated mentality. In colleges and universities around the country, the architecture, engineering, and construction disciplines are taught in programs with an inherent bias towards separation of design and construction professionals. These biases can be more deeply entrenched in a workplace where design-bid-build delivery environments exist. As the delivery process has changed in the US market, so have the educational needs of the professionals (Molenaar, 2001).

- For at least the past six years the design and construction industry itself has responded to this trend by developing specific design-build educational courses to serve practitioners who find themselves ill equipped to provide the unique design-build services that the public is a demand for.

- According to Doug Gransberg, , an instructor for the American Society of Civil Engineers (ASCE) and professor at the University of Oklahoma, the ASCE has offered an intensive 2-day course entitled "Design-Build Contracting" approximately 6 times per year since 1996. These courses have been attended by engineers, contractors, architects,

and several owners. They have also provided coast to coast design-build training to the Federal Transportation Administration, the National Park Service, the United States Navy, and several other public and private entities.

- Michael Sallas, Vice President for Education and Research at the Design-Build Institute of America reports that over 100 design-build courses, serving over 5000 practitioners and owners have been delivered across the United States in the past 6 years. Approximately 40 percent of the course attendees have been contractors, 30 percent architects and engineers, and 30 percent have been owners.

- There are many factors that clearly distinguish design-build as a unique, complex process. Design-Build project delivery is distinctly different in at least 5 significant areas.

- Traditional project delivery award is based upon low price. Design-build project award is typically based upon "best value"—a consideration of both quantitative and qualitative factors. The competitive RFQ/RFP process is very different from the competitive low bid process. Design-build teams and proposals are selected based upon any number of unique evaluation processes—weighted criteria, fixed price/best design, adjusted low bid, etc.
- Traditional project delivery depends upon 100 percent complete plans and specifications in order to provide detailed estimates and competitive bids. Design-build depends upon performance criteria spelled out in an RFP (which may or may not include drawings) to develop conceptual estimates in order to provide conceptual estimates leading to a guaranteed maximum or even lump sum price very early on in the process.

- In traditional project delivery, what constitutes the "contract" are the plans, the specifications, and the agreement form itself. In design-build what constitutes the "contract" is the RFP performance requirements, the technical proposal (design, schedule, management plan, etc.), and the price proposal. There are no completed plans and specs at the time of the signing of an agreement.

- In traditional project delivery, the owner warrants the sufficiency of the plans and specs to the contractor. The owner is responsible for any gaps between the plans and specs and the owner's requirements for performance. Under deign-build the design-builder warrants the sufficiency of the plans and spec to the owner. The design-builder is liable for any gaps between the plans and specs and the owner's expectations for performance.

- Traditional project delivery is linear in approach and restricts early contractor involvement. Design-build is an integrated, interdisciplinary team approach and permits/requires early contractor involvement.

Some construction faculty have suggested that design-build education would best be provided by graduate programs and indeed there are now 4 universities that offer a Masters degree in design-build—Georgia Tech, University of Oklahoma, Washington State, and Stanford. However, given the apparent urgent need for design-build education by practicing construction

professionals, and the unlikelihood that graduate education will fill that urgent need, one might conclude the following:

- Design-build requires unique skills and knowledge and is obviously needed to perform and compete in today's market.

- Our undergraduate construction programs are not adequately providing it, but could possibly do so, and thereby better serve the industry

Future Opportunities

There is significant evidence that design-build is not just a fringe delivery system. Design-build is here to stay. In many ways, the "best value approach" as signified by design-build could be said to be the emerging new standard for project delivery. For example, best value contracting is now being used for over 50% of federal construction projects and is applied to over 66% of federal construction dollars (Waites). Very recently the U.S. Federal Highway Administration has given the green light to widespread use of design-build project delivery for federally aided transportation jobs (ENR, 2002). According to the Mechanical Contractors Association of America Reporter (2001), after getting consistent, positive results with best value approaches, federal agencies increased their use of best value contracting by more than 500% in the 1990's, reversing a prior preference for low bid.

One could make the case that design-build could become the foundation upon which we build an entire new construction, engineering, and architecture curriculum, just as we built our current A/E/C curriculum around design-bid-build. According to experienced Design-Build practitioners, the term design-build is really inadequate to describe the level of services that are now being demanded by clients and offered by Design-Build professionals. Clients not only want a single source for design and construction but they also want the design-builder to finance the project, maintain the project, and operate the facility in some cases. And it doesn't stop there. What clients are really looking for are comprehensive facility solutions, fully integrated by the design-build team. Traditional project delivery methods and thinking can not provide that for a client. Just as practicing professionals have been forced to educate themselves in these new ways of thinking and doing business, construction educators must likewise educate themselves so that they may be responsive to the needs of their students and the futures that they will move into.

Does Design-Build Education Make a Difference?

For the past 4 years a stand alone design-build course has been required at the author's university. A recent 2001 construction management graduate employed by a major general contractor/design-builder who completed the stand alone course offered these comments when asked if a design-build education made a difference in his career:

> "Having a design-build educational background has blown open the doors of opportunity for me. I don't just see the project from the builder's perspective, I see the project from everyone's eyes—the owner, the architect, the end user. This allows me to anticipate in a

way that I couldn't do from a single discipline perspective. I can be one step ahead and contribute in a way that adds value and results in a win for everyone."

Further progress has been made with a new 30 unit undergraduate minor in Integrated Project Delivery with an emphasis on Design-Build has been approved by the department, college, and university curriculum committees. This program, offered by the Construction Management Department, will be available to various majors from across the campus including construction management, architecture, civil engineering, architectural engineering, mechanical and electrical engineering, landscape architecture, and city and regional planning starting in the fall of 2003, and will be taught in a multidiscipline environment. In addition to addressing all of the cognitive elements of a design-build education suggested in the Molenaar Report (2001) including facilities, project feasibility, and programming, the new program will also provide the critical affective components of successful design-build and the collaborative process— high performance teams, communication, and leadership.

References

Beard, J., Loulakis, M., & Wundram, E. (2001). *Design-Build: Planning Through Development*, McGraw-Hill.

Design-Build Institute of America (1996) *Design-Build Manual of Practice*, Washington, DC.

Feds Broaden Design-Build (2002, Dec. 16), *Engineering News Record*, p. 16.

Mechanical Contractors Association of America Reporter, *Best Value Contracting: A Growing Federal Trend*, July/August 2001.

Molenaar, K.R. and Saller. B.J. (2003), *Educational Needs Assessment for Design-Build Project Delivery*, Journal of Professional Issues in Engineering Education and Practice.

Waites, G.M., *Best Value Contracting Briefing Book*, O'Donoghue & O'Donoghue, Washington, D.C.

Solving the Construction Craftperson Skill Shortage Problem Through Construction Undergraduate and Graduate Education

Dean T. Kashiwagi and Scott Massner
Performance Based Studies Research Group (PBSRG)
Arizona State University
Tempe, Arizona

This research paper identifies construction undergraduate and graduate education as the only solution to the problem of craftsperson shortage in the construction industry. The paper first identifies the craftsperson shortage problem and easily identifiable problems of low pay, no career incentives, and minimized training. It then analyzes the construction industry structure. Using Information Measurement Theory, it identifies the environment required to increase the number of skilled craftspeople. The analysis identifies the real source of the craftsperson skill shortage in the construction industry as the industry structure, the low-bid procurement system, and the lack of performance information. The current industry structure and procurement systems identify craftsperson skill as a need and not a requirement. It identifies the construction education system as the only way to change the craftsperson skill shortage problem. It proposes that certain topics (industry structure, change mechanisms, performance information, business processes, organizational optimization) must be introduced in construction education and given to facility owner representatives, designers, and construction management to change the industry structure from within and without.

Key Words: Craftperson shortage, industry structure, low-bid procurement, performance information

Introduction

One of the greatest challenges currently facing the construction industry is attracting and retaining skilled craftspeople. Skill levels continue to decline while owners squeeze contractors for lower costs and faster schedules through the low-bid or design-bid-build delivery process. In response, contractors have reduced training and use less skilled craftspeople to be competitive. An aging workforce, low pay, poor image and poor career paths for skilled craftspeople have precipitated the current work shortage. Both owners and contractors must work together to address these issues. One of the methods to accomplish this is to minimize the use of the low bid process and move to a system that will provide more incentive for contractors to have highly qualified craftspeople. Contractors and owners that find a way to attract and retain quality craftspeople will be the successful companies of the future. (CII, 2001).

Skilled Craftsperson Shortage in the Construction Industry

A Construction Industry Institute study shows that 75% of contractors are experiencing labor shortages and that these shortages are costing contractors and owners time and money. The

Business Roundtables Construction Committee found that 25% of their member's projects encountered cost overruns and/or schedule delays caused by a labor shortfall. The Department of Labor estimates that the construction industry needs to attract 240,000 workers each year to replace the aging workforce who are retiring or leaving the industry. The Department of Labor also reports that the current average age of a construction worker is 47 years old and climbing. (Garrity, 1999). In a recent survey done by the Associated General Contractors and Deloitte & Touche that was released March 2nd, 2001, skilled labor shortages were identified by more than 80% of survey respondents as their most significant challenges over the next five years. (AGC, 2000). These astonishing statistics make it clear the problem that the construction industry is currently facing.

Identifiable Problems In Retaining and Attraction of New Talent

Quickly identifiable problems in the recruitment of skilled craftspeople include low wages; no clear-cut career path, a diminishing craftsperson skilled training program.

Low wages is a major reason the construction industry is having problems retaining skilled laborers. Listed below is a list of average wages of different occupations according to the Department of Labor's Survey on Compensation in 1999. (BLS, 2001)

Table 1

Relative Occupational Pay

Occupation	Hourly Rate
Plumber	$20.37
Skilled Craftsmen	$15.60
Meter Readers	$14.75
Secretary	$13.55
Bus Driver	$12.38

Considering the safety issues involved in being in the construction field, it is no wonder that many are opting to pursue other careers.

At a recent meeting for the Construction Industry Institute in San Francisco over Aug. 8-9, 2001, low wages was a major topic of discussion. "If low pay was a felony, I think most of us would be on death row today" said Franklin J. Yancey, a former senior vice-president and now a consultant at Kellogg Brown & Root. Speaking at the conference, Yancey explained that a journeyman trying to support a spouse and two children on $17 an hour ends up with $29 dollars per week in disposable income, after expenses. (Table 2) With poverty level wages, many workers leave the construction industry within two years. (Yancey, 2001.)

Table 2

Expenses/Income of Construction Craftsperson

Expenses for Typical Craftsperson			Total Income for Typical Craftsperson	
Expense	Month	Year	Income	
Rent/Mortgage	$500	$6,000	Gross Annual Pay (2080 hrs X $17)	$35,360
Utilities	$300	$3,600	Less Taxes	
Vehicle	$250	$3,000	Federal	-$2,964
Vehicle Ins.	$125	$1,500	Social Security	-$1,971
Fuel, Oil, Gas	$200	$2,400	Medicare	-$460
Charge Cards	$100	$1,200	Net Annual Pay	$29,965
Grocery/Dining	$600	$7,200	Total Expenses	$28,476
Health Care Ins.	$298	$3,576	Net Disposable Income	$1,489
Total Expenses		$28,476		

There seems to be a lack of image and well defined career path in the construction industry. In a recent survey of high school students by the National Business Employment Weekly, 'Construction Worker' came in #247 out of a possible 250 as an attractive career option. (Table 3) (Kantz, 2001) Young people see construction work as uninteresting work done in harsh conditions by not very talented people. The industry has not been successful in laying out the opportunities and career paths available in construction.

Table 3

Jobs Rated Almanac (National Business Employment Weekly

No.	Job Title
245.	Dancer
246.	Cowboy
247.	Construction Worker
248.	Fisherman
249.	Lumberjack
250.	Oil Field Laborer

There has also been a decrease in training by the unions. The unions have moved their effort from improving their training programs and identifying the difference in performance to having owners specify labor agreements where craftspeople used by contractors are union trained. Job training has been traditionally handled by the trade unions in the construction industry. Apprenticeship programs played a central role in this training to ensure that workers had received the proper training in their field. In the early 1980s as union power faded, many contractors began to pursue open shop agreements. (Kadlub, 1998) According to the Bureau of labor, Union membership went from 40% of the total workforce in the 1970s to only 18.3% in 2000. (ABC, 2001) When this happened, the impact of successful job training programs of the unions went to the wayside. The new open shop agreements did not have provisions for on going training and apprenticeships. Although, some open shop environments tried to include

training, they did not have the job placement abilities that the unions had and subsequently lost trainees.

Industry Structure and Information Measurement Theory (IMT)

The construction industry can be graphed using two major components: competition and performance (Figure 1). The industry is divided into four quadrants:

1. Quadrant I. High competition and low performance. This is where the award is based on price. A minimum performance (low performance) is required. The contractors force the owner to identify when the performance does not meet minimum standards. The award is based on price. The lowest price is usually awarded the contract. In many instances the low bid may also go to contractors who forget to include activities, force subcontractors and manufacturers to lower their price, and employ the least expensive management and craftspeople.

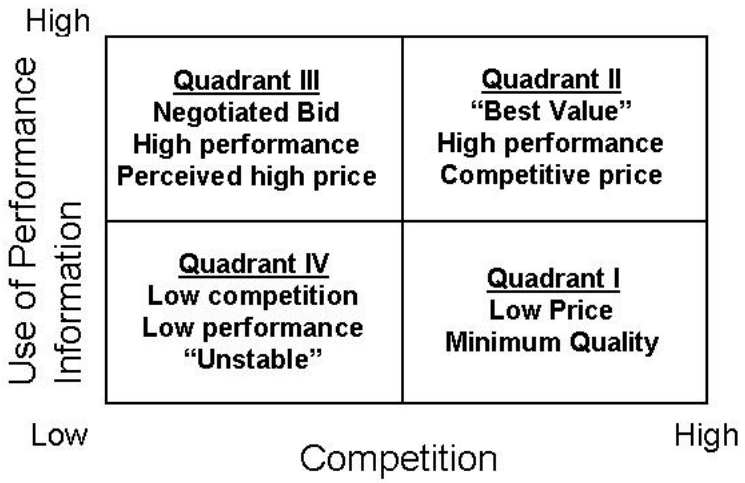

Figure 1: Construction Industry Structure

2. Quadrant II. High competition, high performance. This is the best value quadrant. Users consider both performance and price. It differs from both Quadrants I and III in that it requires performance information that minimizes risk (not being on-time, on-budget, and meeting quality expectations).

3. Quadrant III. High performance and low competition. This is the negotiated contract. Users usually pre-qualify contractors, and subjectively select the best value. There is no way to identify the value of construction unless more than one contractor is employed.

4. Quadrant IV. Low competition and low performance. This quadrant is unstable and cannot maintain itself. If a contractor has no competition, and cannot perform, they will not remain in business for a prolonged period of time. When a performer appears, the

nonperformers will disappear. If competition appears, the noncompetitive will disappear. An industry requires performance, competition, or both to maintain itself.

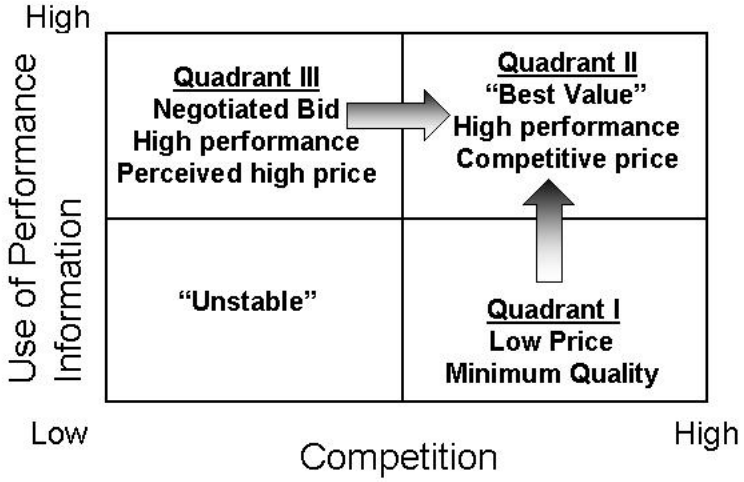

Figure 2: Movement Due to Poor Performance and Worldwide Competitive Price Pressure

Movement over time will include the following (Figure 2):

Quadrant I to II. The low performance of contractors will force facility owners to seek a performance-based process. This is evident over the last five years as facility owners have gone to alternate delivery processes and the Federal government has mandated the use of performance contracts to do construction renovation. Quadrant I also is the location of the following:

1. Construction workers are being asked to do work faster for the same pay.
2. Construction workers skill levels are decreasing due to a lack of training programs and the retirement of the more experienced.
3. The construction industry is having a difficult time recruiting talented individuals.
4. Construction now requires more management for each construction craftsperson.

Quadrant III to II. This movement is caused by the worldwide competitive marketplace and the resulting price pressure. It is also exacerbated by the lack of performance and life cycle performance information, which can justify long-term partnerships and relationships independent of price pressure. The price pressure will force owners to direct construction and facility managers to get more competition with the assumption that performance can be maintained and competition will bring a lower price.

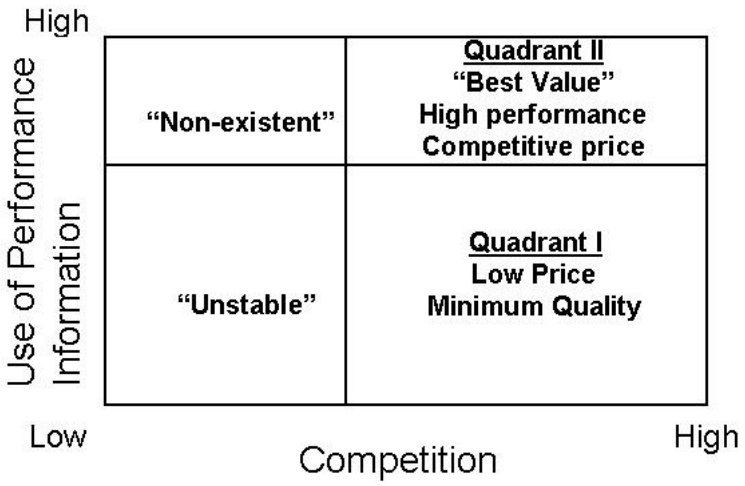

Figure3: Future Structure of the Construction Industry Without Performance Information

Quadrant III to I. As a result of the price pressure, if the construction industry does not use performance information which differentiates value (performance and price), the movement will go to Quadrant I which will further erode the characteristics that are associated with performance: training, quality, quality control, value, lower life cycle costs, and customer satisfaction. The result of these movements will leave the industry to Quadrants I and II and the other Quadrants being unstable or nonexistent (Figure 3). The industry is finding itself defined by Quadrant I. To move to Quadrant II the industry needs performance information. This is a concept that has been misunderstood by union groups, end users, and designers who have tried to make the move using minimum training standards or proprietary specifications.

Information Measurement Theory (IMT) was developed at Arizona State University in 1994 (Kashiwagi, 2001). It is used to show relationships between factors when there is insufficient data to use statistical analysis techniques. IMT has the following theoretical foundation:

1. Everything is cause and effect.
2. All factors are related and relative.
3. Information predicts the future outcome.
4. Information, or laws that predict the future state, always exist, but must be perceived.
5. The more perceptive an entity is, the faster the rate of change. The rate of change becomes exponential over time.
6. Statistical analysis requires a relative random sample.
7. Some information is better than no information.

The above deductive theories result in Figure 4. Figure 4 includes a representation of the relationship between perception of information over time or change. Figure 4 also includes two-way Kashiwagi Solution Models (KSM). By definition of the vertical axis, 'Level of Use of Information', entity 'A' has much more perception of information than entity 'C'. A decision is defined by the authors is when an entity perceives that there are two future states for one current state or exists when there is uncertainty. Entity 'A' makes far fewer decisions than entity 'C'.

Decisions are caused by the lack of information, or the use of one's biases to compensate for the lack of information.

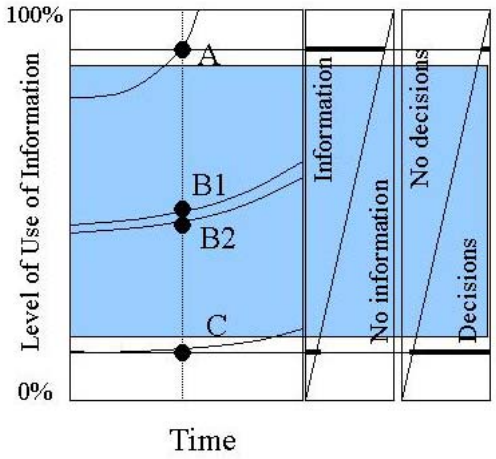

Figure 4: Use of Information/Change Rate

KSMs also make the following assumptions:

1. To differentiate between B1 and B2 requires too much data, data that cannot be collected. Therefore the shaded areas are where statistical analysis is required to differentiate. These areas are not considered.
2. The slope of the line dividing the opposite sides is not important due to the fact that the shaded areas are not being considered.
3. The only important objective is to locate the two sides of the KSM accurately. This must be done by deduction, and supported by documentation of the construction industry.

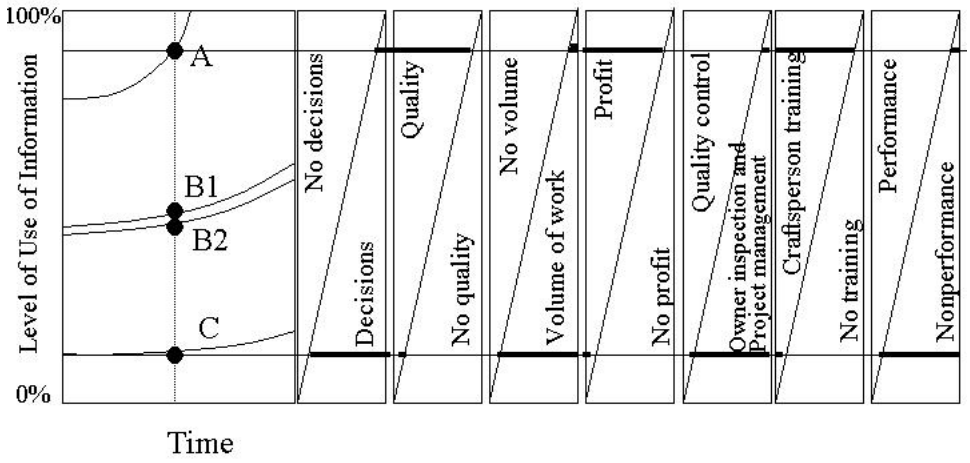

Figure 5: Use of Information/Change Rate &Accompanying Information Related Performance Factors

The KSMs for decisions, quality, volume of work, profit, quality control, craftsperson training, and external control (external management and inspection) are shown in Figure 5. These graphs were validated by a recent research thesis where 2,312 contractors located in Arizona, California, Florida, Michigan, New York, and Texas were asked to verify the relationship of criteria. Response rate was 14% (313 responded) (Erdmann, 2001). The explanation and documentation is shown below:

1. Decisions. Decisions are made due to a lack of performance information. The low-bid process forces the managers to make a decision that all the contractors are the same. If performance information was made available, it becomes obvious that some of the previously acceptable contractors may not be able to perform (time, cost, and quality). This is the motivation to move away form low-bid or Quadrant 1.

2. Quality. Performance information identifies quality. More performance information will identify the higher quality.

3. Volume of work. Higher volume of work requires contractors to do lower quality of work. With a shortage of quality craftspeople, more volume leads to lower quality. Higher volume of work requires more craftspeople. However, contractors are leveraging volume, therefore they get more work by offering it for a lower price per unit. This is commonplace in the manufacturing sector where automation and predictability have been implemented.

4. Profit. Profit margins are lower when contractors do more work for a lower unit price. Difficulty in closing out projects also forces contractors to 'rob Peter to pay Paul'. Business failures are the primary cause of contractor bankruptcy. (Schleifer, 1994)

5. Quality control. Contractors who quality control their own work do not need inspectors inspecting their quality. High quality contractors do less work, quality control their own work, and minimize the need for inspection.

6. Craftsperson training. Craftsperson training is driven by the requirement for trained craftspeople who will be rewarded for their high level of skill. Training cannot be sustained in a Quadrant I environment overtime. This is verified by the tremendous need for trained craftspeople.

7. Inspection and construction management. Inspection and management is required less for quality contractors and craftspeople. The less craftperson skill, quality control, and pay, the more inspection and management are required.

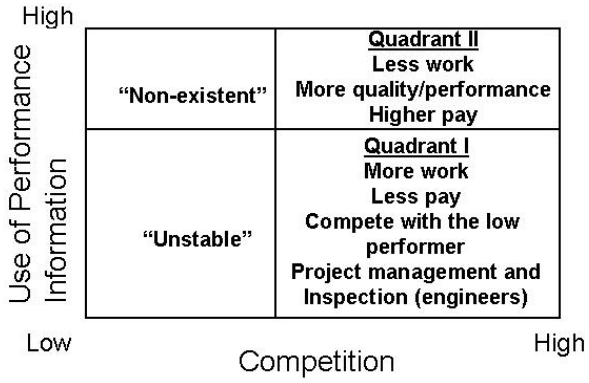

Figure 6: Work/Quality/Pay Issues

Based on Figure 5, the current movement to project management and alternate delivery methods identifies that the construction industry is in Quadrant 1. Figure 6 shows that Quadrant I requires people to work more for less pay. Quadrant I also contains the characteristics of decisions and inspection and construction management (engineering positions), and minimized profit, pay, quality control, and training. These are factors that attract low performing craftspeople. However, this quadrant offers more design/engineering/project management opportunities. Therefore, it may be in the best interest of the design/project management/engineering communities to remain in Quadrant I. To attract a higher quality of craftspeople, to stimulate training, and to give the construction industry the sustainability over time, requires both education of users (users must dictate moving from I to II) and the construction industry to respond to the movement by keeping track of their quality (training), production (selecting quality subcontractors), and contractor's ability to manage their own construction (coordination of construction).

Current industry environment, industry structure analysis, and IMT identify the major causes of the shortage of skilled craftspeople in the construction industry:

1. Low-bid delivery system.
2. Lack of performance information.
3. Emphasis on project management and inspection instead of optimized business and delivery processes and contractor performance.
4.

Solution to Craftperson Shortage in the Construction Industry

The following proposals are given to solve the problem of craftsperson shortage in the construction industry:

1. Educate owners, contractors, and related industry personnel that the competitive low-bid process is an ineffective procurement process that is detrimental to the users and contractors.
2. Promote the use of performance information. Use performance information not to pre-qualify, but to impact the selection of the contractor using information systems, which minimize subjective decision-making.
3. Promote the concept of paying more for proven performance.
4. Change the emphasis from project manager to performing contractor in construction education.
5. Change the paradigm from the owner hiring the project manager to the contractor having their own project manager.

These solutions can only be implemented in construction education. Contractors who have made their living in Quadrant I are running the construction industry. General contractors have leverage in Quadrant I over subcontractors. In both Utah and Hawaii where prototype best value projects have been run, general contractors perceive that their control and leverage is threatened by moving to Quadrant II. In both states, the general contractors have proposed to the state that the performance of the subcontractors can be controlled by the general contractors and therefore making subcontractor performance lines unnecessary. This will result in the general contractors bidding the subcontractors, seeking the lowest price, and using low price as leverage. This is the same low bid system that the user or owners are using to hire the general contractor. The construction industry contains the following obstacles to moving from a low-bid to a performance-based process:

1. Large contractors who leverage price for volume, who currently have a large industry share, will have to compete with smaller contractors who have high performance.
2. No large amounts of performance information or direct process to use the performance information to award contracts.
3. Current process of low-bid (Quadrant I) is advantageous to large, long time contractors.
4. Quadrant I is designer and engineer controlled. Quadrant II is contractor controlled with minimized construction management or inspection role for designers and engineers in the construction phase. If the move was made to a performance based environment, the change from a user's construction management function to a contractor's construction management function would occur automatically. In the process, the management would also improve in efficiency.
5. Quadrant I is governed by minimum standards. These are used as minimum acceptable levels. Standards ensure that contractors and manufacturers meet the minimum or lowest level of acceptability. This gives the owner more risk than if the contractors provided products and services at a higher level of quality and performance. In Quadrant II, the best value is the highest level of performance that the owner can afford. The liability moves to the contractor who now has to ensure that the high level of performance is met. Many contractors used to doing work in the environment of Quadrant I, are hesitant on taking on the risks of performance due to inexperience with performance contracting.

Even in construction education (undergraduate and graduate programs) the task will not be easy. Construction educators are usually long time participants in the industry or engineers. The

industry is the way it is, because of its participants. Construction education programs proliferate the 'status quo' of management (engineer and designer controlled, using specifications with means and methods, and award on price) over craftperson skill. The industry must adopt the proven concepts of Deming's continuous improvement from the manufacturing sector.

Construction undergraduate and graduate education must include the following Deming principles in their curriculum (Deming, 1985):

1. Use of contractor performance information (on-time, on-budget, meeting quality expectation).
2. The study of construction industry structure and the relationship of factors of performance.
3. The study of performance based selection where the selection of contractors is based on performance information.
4. Changing the construction system to get better performance.
5. Increase performance by forming relationship between designers, contractors, and owners based on performance information and not on personal relationships.

A study of construction undergraduate and graduate education programs will find very few courses, which focus on the above. A literature review of the Associated School of Construction journal shows only two documented studies of continuous improvement of a construction environment using performance information when using the following keywords: performance information, best value procurement, performance-based procurement and construction industry structure. There is only one research group doing research on contractor performance information.

Locations of construction programs are usually in civil engineering departments or in architectural schools. The authors propose that Industrial engineering ties would be more beneficial to the construction industry based on the expertise of Industrial engineers to optimize processes, use information systems, and their performance objective orientation of not having bias toward a specific function in the process.

Conclusion

The major reasons for the shortfall of construction skilled craftspeople is the users' low-bid procurement system and the Quadrant I dominated structure of the construction industry which emphasizes management and control by engineers instead of skilled contractors and craftspeople. The analysis proposes that instead of project managers being hired by the owner to regulate the contractor, contractors should regulate themselves resulting in higher performance. Also, instead of using price as the sole determinate, owners should use value (performance and price) as the determinate. The resulting environment of performance will bring high quality constructors and craftspeople, create a demand for more quality craftspeople at a higher pay, and create an environment of higher profit, higher performance, and user satisfaction. The current concept of project management by the owner may not be optimal. Designers and engineers know design. Contractors know construction. Some designers and engineers may know more than poor

performing contractors, but high performance contractors know construction the better. This direction has led to the acceptability of less performing contractors doing more work for less profit and a lessening demand for skilled craftspeople. This has led to a severe shortfall of construction craftspeople. A major change in construction education programs, which change the thinking of the industry, must be accomplished to reverse this trend. This includes education on industry structure and stability, contractor performance and performance information, and performance based procurement.

References:

Association of Builders and Contractors (2001) *Bureau of Labor Statistics,* www.abc.org/page.cfmkeypageID=3054

Association of General Contractors (2001) *Year 2000 Insights in Construction Survey*, URL www.agc.org)

Bureau of Labor Statistics (2001) *National Compensation Survey.* URL www.bls.gov/data

Construction Industry Institute (2001) *Attracting and Maintaining a Skilled Construction Work Force.* URL construction-institute.org/services/catalog/products/more/137_1_more.htm

Deming, W. Edwards, (1986) *Out of the Crisis.* Cambridge: Massachusetts Institute of Technology.

Erdmann, Rudy (2001) *The Relationship Between the Design-Bid-Build System and Construction Nonperformance*. Unpublished Masters Thesis, Arizona State University, Tempe.

Garrity, Kathleen (1999, March)No easy Solutions to Construction Labor Shortage, Seattle Daily Journal of Commerce. [On-line Edition] URL www.djc.com/special/construct99/10050580.htm

Kadlub, Luanne (1998, September 4) Northern Colorado Business Report, *Shortage of workers slams area contractors*. URL www.nvbr.com/dec97/constr.shortage.htm

Kantz, Frank (2001) National Business Employment Weekly, *Jobs Rated Almanac.* URL www.uiuc.edu/ro/iie/topjobs.html

Kashiwagi, D. T. (2001) *Information Measurement Theory, 4th Edition.* Tempe: PBSRG.

Kashiwagi, D. T. & Byfield, R. (2002) Minimization of 'Subjectivity' in Best Value Procurement by Using Artificial Intelligence Systems, *ASCE Journal of Construction Engineering and Management.* Approved unpublished article.

Kashiwagi, Dean T. & Mayo, Richard E. (2001, April) State of Hawaii Selects 'Best Value' by Artificial Intelligence" *Cost Engineering*, 43, (4), 38-44.

Schleifer, Thomas C. (1994) *Indicators of Construction Business Financial Risk in the Closely Held Construction Company Operating in the United States of America.* Published Doctorial Dissertation, Heriot-Watt University, Edinburgh, Scotland.

Yancey, Frank (2001, August 8) Annual Construction Industry Institute Conference – San Francisco, *Safe, Skilled, Trained, Viable, Participation Citizen Workforce*Yancey's [power point presentation location]. URL www.construction-institue.org

Factors Leading to Construction Company Success: Perceptions of Small-Volume Residential Contractors

Mark Hutchings and Jay Christofferson
Brigham Young University
Provo, Utah

The majority of home building companies in the United States produce fewer than 25 homes per year. In an effort to identify and report on what the perceptions of owners and managers were regarding the reasons for the success of their own small-volume residential construction companies, a nationwide survey was conducted by randomly mailing written questionnaires to owners and managers of 1,114 companies who were members of the National Association of Home Builders. This research report summarizes the responses to an open-ended question to prioritize the five things that contributed most to the success of residential construction companies. Many of the most important factors that were identified as contributing to the success of construction companies were not those listed as important factors for success in the review of literature. Among the factors of success that did rank high were quality workmanship, honesty, having good subcontractors, customer communications, reputation, having good employees, and completing projects on time.

Key Words: Management Practices, Residential Construction, Home Builder, Company Success

Introduction and Review of Literature

In 1999, annual revenues of $208 billion generated from the building of single-family housing units within the United States dwarfed all other categories of construction (King, 1999). Of the residential builders performing this huge amount of work, companies producing twenty-five or fewer homes per year currently make up the majority of home building firms in the United States (Carliner, 1999).

It has been argued that some of the most influential factors contributing to the ongoing success of a construction firm are its management systems, procedures and practices (Adrian, 1976; Lussier, 1995; Strischek, 1998). In fact, small business failures, including those of home building companies, typically seem to be characterized by a lack of management skill and experience (Flahvin, 1985; Gaskill & Van Auken, et al, 1993).

A thorough review of the literature has revealed no significant studies addressing management's perception of factors leading to the success of construction companies. In a study using nonfinancial predictors, the analysis of the data indicated that careful planning and the use of professional advisors were two factors directly linked to successful businesses. Seeking outside help from professional advisors, including accountants and management consultants can be a wise business strategy (Gaskill & Van Auken, et al, 1993; Lussier, 1995). Of all the management practices addressed in the literature, one of the most universal was planning. Not surprisingly, many indications point to strategic planning as one of the most important tools used by successful businesses (Bryson, 1995; Constance, 1997; Strischek, 1998).

Other factors perceived to be important in construction companies include implementation of accounting systems and regular review of financial statements (Adrian, 1976; Gerstel, 1991; Schleifer, 1990), change order procedures (Adrian, 1976; Gerstel, 1991; Strischek, 1998), the creation of quality performance standards for subcontractors (Gill, 1968; Shinn, 1995), estimating and scheduling procedures (Shinn, 1995; Strischek, 1998), implementation of strict purchase order systems (Gill, 1968; Shinn, 1995), control of job-site safety (Gordon, 1997), ongoing training and education (Bednarz, 1997), and the use of checklists for quality control (Gerstel, 1991).

Research Purpose

The purpose of this research was to identify and report on what perceptions owners and managers of small-volume home building companies had regarding the reasons contributing to the success of their own construction companies.

Limitations

This study was limited to companies that reportedly produced eleven to twenty-five new homes per year. Only data from companies whose main source of revenue was from the construction and sale of new homes was used.

The Data and the Treatment of the Data

In an effort to identify and report on what the perceptions of owners and managers were regarding the reasons for the success of their own small-volume residential construction companies, a nationwide survey was conducted by mailing written questionnaires to owners and managers of 1,114 companies. These companies were randomly selected from the population of builder members of the National Association of Home Builders who reported building eleven to twenty-five homes per year.

According to the information available at the time of this study, there were approximately 62,450 builder members of the NAHB nationwide, including home builders, remodelers, and developers. Of these, some 40,984 firms reported that they started at least one new home during the year. Companies producing between 11 and 25 new residential units for the year numbered 20,979 and represented more than half of the reporting firms. The remainder of the population was divided into four other segments. There were 6,563 companies producing between 1 and 10 units per year, 7,079 companies building between 26 and 100 units per year, 4,426 companies constructing between 101 and 500 units per year, and 1,937 companies producing more than 500 units per year (Evans, 2000).

Rather than compiling a list of management practices suggested by the review of literature and then asking builders to determine which were the most important in their business, owners and

managers were asked to prioritize the five things that contributed most to the success of their companies.

Research Design

The population of interest in this study was quite large, consisting of almost 21,000 companies nationwide. In order to obtain results that would provide a 95 percent level of confidence, with a plus or minus 5 percent margin of error, it was necessary to obtain data from approximately 400 firms (Hill & Roth, et al., 1962; Weisberg & Bowen, 1977). In a similar study, fewer than 2 percent of the surveys were returned to the researchers by the post office because of incorrect addresses (Hutchings & Christofferson, 2000). By predicting a 40 percent response rate of those sampled, and by applying this 98 percent contact rate, a minimum sample size of 1,020 companies was required. The formula used was Sample Size = 400 / (.40 x .98).

Description of Companies Responding to the Survey

A number of interesting factors surfaced from the information provided by the companies that responded to the survey. For example, it was discovered that the average company had been in business for 16.22 years. In addition, 42 percent were doing business as S-corporations, 26.35 percent were sole proprietorships, 19.53 percent were C-corporations, 8.71 percent were limited liability companies, and 3.29 percent were general partnerships.

Seventy-five percent of the homes that were marketed were sold for more than $150,000 each. More than half (52.5 percent) of the new homes built were sold for more than $200,000, while 29 percent were sold for more than $300,000. More than one-tenth of all homes produced by these companies, some 11 percent, were priced at over $500,000 each. Pre-sold homes represented 50.92 percent of all sales, while 28.16 percent were sold on speculation. The balance of operational revenues consisted of residential remodel work (12.95 percent), commercial jobs (6.34 percent), and other income, including finished lot sales (1.63 percent).

Analysis of the Data

Of the 478 questionnaires that were returned, 410 were responsive to the research question. Almost all the respondents listed five things that contributed to the success of their companies. A very small percentage of those who answered gave fewer than five responses. Because the answers were given in priority order, listed one through five, a scoring system was devised to compile the results. The first answer was assigned five points, the second was given four points and so forth, with the fifth answer receiving a single point. In the case of those who gave fewer than five answers, the same point system was followed for the responses given, with the first response receiving five points, etc.

A grid was developed in order to categorize and score the responses. Seventy-eight unique responses were identified along one axis of the grid. The other axis contained a list of the valid

questionnaires. All responses were entered into the spreadsheet, and individual scores were recorded. The scores were then totaled and ranked from highest to lowest (Figure 1).

It was interesting to note that builders' perceptions did not necessarily agree with the literature. For example, strategic planning, considered to be one of the most important factors to the success of a business was considered important to the success of a company by only a handful of the respondents. In fact, it ranked only twenty-first out of the seventy-eight different responses. Additionally, not one builder reported seeking outside help from professional advisors. In fact, of the management practices addressed in the literature, few were considered important by company owners.

By far, home builders considered quality of workmanship and products to be the most important factor to the success of their companies. Many factors that are difficult to quantify, such as honesty, integrity, communication skills, reputation, teamwork, work ethic, commitment and attitude, were also considered to be highly important factors contributing to company success. Other important factors included good subcontractors, employees and suppliers. Scheduling and completing projects on time, in addition to good management, were two other high-ranking factors.

Rank	Factors	Total	Percentage
1	Quality Workmanship & Products	757	13.84%
2	Honesty & Integrity	333	6.09%
3	Good Subcontractors / Subcontractor Relations	279	5.10%
4	Customer Communications & Relations	271	4.95%
5	Reputation / Name	238	4.35%
6	Good Employees / Teamwork	220	4.02%
7	Scheduling -- Timeliness -- Cycle Time	202	3.69%
8	Work Ethic / Commitment / Attitude	184	3.36%
9	Focus on Product Design	176	3.22%
10	Effective Sales and Marketing	174	3.18%
11	Competitive Pricing / Product Affordability	156	2.85%
12	Good Management	151	2.76%
13	Customer Service / Prompt	146	2.67%
14	Owner Knowledge of and Experience in Construction Industry	140	2.56%
15	Location of Building Lots	131	2.39%
16	Referrals / Repeat Business	123	2.25%
17	Attention to Detail / Personal Pride	106	1.94%
18	Fair Pricing / Value	103	1.88%
19	Reliability / Dependability	99	1.81%
20	Good Economy / Good Market	95	1.74%
21	Strategic Planning and Goal Setting / Careful Organizing	85	1.55%
22	Customer Satisfaction	76	1.39%
23	General Communications / People Skills	76	1.39%
24	Careful Supervision of Jobs	72	1.32%

Rank	Factors	Total	Percentage
25	Owner Involvement on Job Site	70	1.28%
26	Warranty Work	69	1.26%
27	Good Suppliers / Product Availability	56	1.02%
28	Flexibility	55	1.01%
29	Low Overhead	44	0.80%
30	Job Cost Control	42	0.77%
31	Time in Business / Longevity	42	0.77%
32	Personality / Friendliness	39	0.71%
33	Estimating / Detailed Bidding	38	0.69%
34	Budgeting and Cash Flows	34	0.62%
35	Lot availability / Company Develops Lots	32	0.58%
36	Use of New Products / Use of Computers	30	0.55%
37	Size of Business is Small	30	0.55%
38	Community / Professional Involvement	28	0.51%
39	Site Cleanliness / Neatness	28	0.51%
40	Capitalization / Financial Strength	26	0.48%
41	Owner On-the-Job Experience	26	0.48%
42	Ability to Obtain Financing	24	0.44%
43	Professionalism	23	0.42%
44	Education of Owners	21	0.38%
45	Employee Relations / Compensation / Longevity	20	0.37%
46	Other Sources of Income	20	0.37%
47	Financial Management	18	0.33%
48	Timely Payment of Bills	17	0.31%
49	Good Accounting Practices	16	0.29%
50	Updated Products / Variety of Products	16	0.29%
51	Family Involvement in Company	15	0.27%
52	Problem Solving Ability / Ingenuity	14	0.26%
53	Husband and Wife Teamwork	14	0.26%
54	Networking / Political Connections	13	0.24%
55	Control of Change Orders	12	0.22%
56	Self-Performed Work / Work not Subcontracted	12	0.22%
57	Desire / Ambition	12	0.22%
58	Interest Rates / Low Cost of Money	11	0.20%
59	Prayer / God	11	0.20%
60	Use of Website	10	0.18%
61	Love of Work	10	0.18%
62	Leadership	10	0.18%
63	Focus on Profit	9	0.16%
64	School Systems in Community	9	0.16%
65	Job Selection	8	0.15%
66	Luck	6	0.11%
67	Government Regulations	5	0.09%
68	Woman's Input	5	0.09%

Rank	Factors	Total	Percentage
69	Paper Contractor / Work is Subcontracted	4	0.07%
70	Client Selection	4	0.07%
71	Favorable Weather	4	0.07%
72	Safety	3	0.05%
73	In-House Mortgage Company	3	0.05%
74	Diplomacy and Manners	3	0.05%
75	Parade of Homes Involvement	2	0.04%
76	Lack of Competition	2	0.04%
77	Good-looking owner	2	0.04%
78	Non-Pressure Atmosphere	1	0.02%
	Total	5471	100.00%

Figure 1: Prioritized list of factors leading to success of small-volume residential companies.

After listing the responses in rank order, similar responses were categorized. The categories included business and management practices; technology; business profile; planning; marketing; external factors; quality, service and warranty work; and personal attributes. Responses in each category were then totaled. Personal attributes were perceived to be the most important by those responding to the survey. Quality of construction, customer service and warranty work were also considered important. Builders also perceived the importance of marketing, product design, and pricing strategies.

Business and Management Practices	Points	Percentage
Scheduling -- Timeliness -- Cycle Time	202	
Good Management	151	
Careful Supervision of Jobs	72	
Owner Involvement on Job Site	70	
Low Overhead	44	
Job Cost Control	42	
Estimating / Detailed Bidding	38	
Budgeting and Cash Flows	34	
Ability to Obtain Financing	24	
Professionalism	23	
Financial Management	18	
Timely Payment of Bills	17	
Good Accounting Practices	16	
Control of Change Orders	12	
Focus on Profit	9	
Safety	3	
Total	**775**	**14.17%**

Technology		
Use of New Products / Use of Computers	30	
Use of Website	10	
Total	**40**	**0.73%**
Business Profile		
Good Subcontractors / Subcontractor Relations	279	
Good Employees / Teamwork	220	
Business Profile (Continued)	**Points**	**Percentage**
Good Suppliers / Product Availability	56	
Time in Business / Longevity	42	
Size of Business is Small	30	
Capitalization / Financial Strength	26	
Employee Relations / Compensation / Longevity	20	
Family Involvement in Company	15	
Self-Performed Work / Work not Subcontracted	12	
Paper Contractor / Work is Subcontracted	4	
In-House Mortgage Company	3	
Total	**707**	**12.92%**
Planning		
Strategic Planning and Goal Setting / Careful Organizing	85	
Community / Professional Involvement	28	
Networking / Political Connections	13	
Total	**126**	**2.30%**
Marketing		
Focus on Product Design	176	
Effective Sales and Marketing	174	
Competitive Pricing / Product Affordability	156	
Location of Building Lots	131	
Referrals / Repeat Business	123	
Fair Pricing / Value	103	
Lot availability / Company Develops Lots	32	
Other Sources of Income	20	
Updated Products / Variety of Products	16	
School Systems in Community	9	
Job Selection	8	
Client Selection	4	
Parade of Homes Involvement	2	
Total	**954**	**17.44%**
External Factors		
Good Economy / Good Market	95	
Interest Rates / Low Cost of Money	11	
Luck	6	
Government Regulations	5	
Favorable Weather	4	

External Factors (Continued)		
Lack of Competition	2	
Total	**123**	**2.25%**
Quality, Service, Warranty Work		
Quality Workmanship & Products	757	
Customer Service / Prompt	146	
Attention to Detail / Personal Pride	106	
Customer Satisfaction	76	
Quality, Service, Warranty Work (Continued)		
Warranty Work	69	
Site Cleanliness / Neatness	28	
Total	**1182**	**21.60%**
Personal Attributes		
Honesty & Integrity	333	
Customer Communications & Relations	271	
Reputation / Name	238	
Work Ethic / Commitment / Attitude	184	
Owner Knowledge of and Experience in Construction Industry	140	
Personal Attributes (Continued)	**Points**	**Percentage**
Reliability / Dependability	99	
General Communications / People Skills	76	
Flexibility	55	
Personality / Friendliness	39	
Owner On-the-Job Experience	26	
Education of Owners	21	
Problem Solving Ability / Ingenuity	14	
Husband and Wife Teamwork	14	
Desire / Ambition	12	
Prayer / God	11	
Love of Work	10	
Leadership	10	
Woman's Input	5	
Diplomacy and Manners	3	
Good-looking owner	2	
Total	**1563**	**28.59%**

Figure 2: Categorized list of factors leading to the success of small-volume residential companies.

Conclusions and Recommendations

This study provides insights into the perception of small-volume homebuilders regarding the success of their companies. According to the literature review, one would expect various

management systems, procedures and practices to be among the most important factors contributing to success. However, the results of this research indicated that owners and managers of small-volume home building companies believed that the most important factors contributing to the success of their companies were quality workmanship and products, honesty and integrity, good subcontractors, customer communication and relationships, retaining good employees and completing projects in a timely manner.

Recommendations for further study would be to correlate owners' perceptions of factors affecting their success with actual practices within their companies. Another line of study would be to determine whether these factors are predictors of company success. Further research is also needed to determine measures of some of the important qualitative factors that determine builder success.

References

Adrian, J. J. (1976). *Business Practices for Construction Management*. New York, NY: American Elsevier Publishing Company, Inc.

Bednarz, T. F. (1997). Winning Strategy; the Nine Laws of Business Success. *Air Conditioning, Heating & Refrigeration News*, 32-33.

Bryson, J. M. (1995). *Strategic Planning for Public and Nonprofit Organizations*. San Francisco: Jossey-Bass Publishers.

Carliner, M., Staff Vice-President of NAHB Economics Department. (phone call, July 28, 1999). Washington, D.C.

Constance, J. C. (1997). Why Contractors Fail, Part I. *CPA Construction Niche Builder* 1997, vol. 6 & 7. (1-6).

Evans, D. (2000, February 2, 2000). [Telephone interview with Don Evans, Director of Operations and Records Management, NAHB] (by Mark Hutchings, Ed.). NAHB.

Flahvin, A. (October 1985). Why Small Businesses Fail. *The Australian Accountant*, 17-20.

Gaskill, L. R., Van Auken H. E., and Manning R. A. (October 1993). A Factor Analytic Study of the Perceived Causes of Small Business Failure. *Jrnl. of Small Business Management*, 18-31.

Gerstel, D. (1991). *The Builder's Guide to Running a Successful Construction Company*. Newton, CT: The Taunton Press.

Gill, P. G. (1968). *Systems Management Techniques for Builders and Contractors*. New York, NY: McGraw-Hill, Inc.

Gordon, M. (October 1997). Safety Saves Money. *Contract Journal*, 19 (3).

Hill, H. P., C.P.A., Roth, J. L., C.P.A., & Arkin, H., Ph.D. (1962). Sampling in auditing. New York, NY: The Ronald Press Company.

Hutchings, D.M., and Christofferson, J.P. (2000). A Study of Management Practices in Small-Volume Home Building Companies. *Proceedings of the 36th Annual Conference, Associated Schools of Construction*, 325-332.

King, S. (Ed.). (1999) *1999-2000 U.S. Markets Construction Update* FMI. Raleigh, NC: Author. p. 14.

Lussier, R. N. (January 1995). A Nonfinancial Business Success Versus Failure Prediction Model for Young Firms. *Journal of Small Business Management*, 8-20.

Schleifer, T. C. (1990). *Construction Contractors' Survival Guide*. New York: John Wiley & Sons.

Shinn, C. C., Jr. (May, June, July 1995). Where Did My Profits Go? How Do I Get Them Back? Part I. *The Builder's Management Journal* 9, (1), 1-4.

Shinn, C. C., Jr. (August, September, October 1995). Where Did My Profits Go? How Do I Get Them Back? Part II. *The Builder's Management Journal* 9, (2), 1-4.

Shinn, C. C., Jr. (November, December 1995). Where Did My Profits Go? How Do I Get Them Back? Part III. *The Builder's Management Journal* 9, (3), 1-3.

Strischek, D. (July 1998). Red Warning Flags of Contractor Failure. *Journal of Lending & Credit Risk Management* 80, (11), 40-47.

Weisberg, H. F., & Bowen, B. D. (1977). An introduction to survey research and data analysis. San Francisco, CA: W. H. Freeman and Company.

The Perceptions of Experienced Construction Practitioners Regarding Ethical Transgressions in the Construction Industry

Barbara Jackson
California Polytechnic State University
San Luis Obispo, California

This study discusses the results of a national survey, conducted in 1999, designed to assess the perceptions of experienced construction practitioners regarding the "frequency" and "seriousness" of ethical transgressions within the construction industry. A questionnaire was sent to 1,450 systematically selected members of the Associated General Contractors. A total of 321 useable questionnaires were returned, or 22 percent. These construction practitioners were asked to consider 15 issues that may typically arise for those working in the construction industry in the normal course of operations. Contractors were asked how often they thought each of the issues occurred and, when they did occur, how serious did they consider them to be. In addition, the relationship between construction practitioners' perceptions of ethical behavior and several demographic variables were analyzed. The results indicate that the four most frequently occurring ethical transgressions were Improper or Questionable Bidding Practices, Misrepresentation of Completed Work or Value of Work, Poor Quality Control or Quality of Work, and Technical Incompetence or Misrepresentation of Competence. The four most serious ethical transgressions were Alcohol or Drug Abuse; Improper or Questionable Bidding Practices; Failure to Protect Public Health, Safety, or Welfare; and Poor Quality Control or Quality of Work. Although several of the demographic variables analyzed were related to several of the individual ethical issues, only three - gender, region of country, and experience - were found to be significant when it came to the summated scores for perceived frequency and/or seriousness of ethical transgressions.

Key Words: Ethics, Construction Ethics, Ethical Transgressions, Bid Shopping

Introduction

Ethics are becoming the defining business issue of our time, affecting corporate profits and credibility, as well as personal security and the sustainability of a global economy. From price-fixing to bribery to toxic waste dumping, companies around the world are engaging in unethical practices and chalking them up to the cost of doing business (Dalla Costa, 1998).

The purpose of this study was to assess the perceptions held by experienced construction practitioners across various regions of the United States regarding the frequency and seriousness of ethical transgressions in the construction industry. The research study looked for relationships between "frequency" and "seriousness" of ethical transgressions and the following variables: gender, age, education, position in company, experience, contractor classification, primary market focus, size of company, union affiliation, region of country, and company code of ethics.

Dan Nabholz, the CEO of Nabholz Construction Corporation, suggests that there have always been and always will be unethical general contractors (Nabholz, 1995). He asserts that construction is a people business and attracts a full spectrum of personality types. However, he

sees ethical standards on a downward trend. He suggests that society and industry are changing and attributes some of the downturn in ethical conduct to the following:

--Today's constructors represent a different generation. The values they learned are different.
--The industry is seeing more and more absentee owners of construction operations.
--Construction managers appear to have more of a short-term perspective, one tied to bonus compensation. You're paid for bottom line performance, not your code of ethics.
--Purchasing decisions are more likely made in a high-rise office building, far removed from the job site, by people you never see or touch.

Nabholz (1995) asserts that construction managers should be responsible for knowing the ethics being practiced by the people who report to them. He argued that contractors should not accept a slow deterioration of ethics in construction as being inevitable. He stated that construction trade groups and industry publications should give ethics more attention and coverage, and that ethics should be an important part of the curriculum at construction schools across the country.

The media is filled with bad press regarding lapses in ethical behavior by those in the construction industry. With so much of the public perception coming from the media's coverage of the construction industry, it is not surprising that the American public is cynical--and the media finds no shortage of unethical behavior to publicize. For example:

--Five construction firms pleaded guilty to bid-rigging and kickbacks in the interiors market in New York City (Tulacz, 1998).
--Defiant engineer loses $62,000-a-year city engineering job for refusing to stamp plans for road repairs prepared by others in a way he believed would violate laws and engineering ethics (Korman, 1998).
--North Carolina Governor James Hunt is overhauling the Department of Transportation after months of scandal tarnished the panel of political appointees that oversees the agency's $2-billion construction fund (Buckner-Powers, 1998).

Public attention regarding bid rigging schemes, elaborate kick back operations, fly by night contractor rip-offs, and horror stories about price gouging all add to the concerns regarding ethics in construction. Add on top of these an increased public interest in issues of environmental impact and safety, as well as an increase in stringent regulations imposed by the government, and one can see why construction companies might be interested in focusing their attention on the ethical aspects of both their policies and their personnel.

Methodology

Subjects

The sample of experienced construction practitioners for this study was obtained from the national membership directory of the Associated General Contractors (AGC) trade association. For the purposes of this study, an experienced construction practitioner was an individual with at least five years of construction experience in either a management or field position. Although the AGC membership includes general contractors, subcontractors, venders, suppliers, and associates, only *general contractor* and *subcontractor* members were selected for this sample. Each participant was identified as coming from one of the following four regions of the United States:

1. Northeast Region - Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, Delaware, Maryland, and West Virginia.
2. Southern Region - Virginia, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Texas, Oklahoma, Arkansas, and Louisiana.
3. Midwest Region - Michigan, Wisconsin, Illinois, Indiana, Ohio, Minnesota, Kentucky, Kansas, Nebraska, Missouri, Iowa, South Dakota, and North Dakota
4. Western Region - Arizona, New Mexico, Colorado, Wyoming, Montana, Utah, Idaho, Nevada, California, Oregon, and Washington.

Procedure

The membership list included the names, addresses, and phone numbers of approximately 7,260 company members from coast to coast. The officers for each company also were listed in the directory. Systematic sampling with a random start was used to generate the list of subjects. This sampling method allowed for all members on the list of 7,260 companies an equal chance of being selected.

Questionnaires were sent to 1,450 company members of the Associated General Contractors. A cover letter accompanied the questionnaires explaining the purpose of the study and assuring the recipients of anonymity. A self addressed, postage paid envelope was supplied with each questionnaire. The questionnaires were mailed to the president, vice-president, general manager, or estimating manager for each company. Recipients of the letters were asked to complete the questionnaire themselves or to pass it onto someone else in their companies qualified to respond.

Instrument

The instrument (See Appendix) used in this study was adapted from a questionnaire utilized in several studies done by the Murdough Center for Engineering Professionalism at Texas Tech University in Lubbock, Texas. Dr. W. Pennington Vann of Texas Tech University and Dr. P. Aarne Vesilind of Duke University developed the questionnaire. The original instrument consisted of 12 ethical issues. Three additional items were added to the instrument--Improper or Questionable Bidding / Estimating Practices, Misrepresentation of Completed Work or Value of Work, and Misrepresentation of Financial Records or Status. The questionnaire consisted of 15

ethical issues that may be encountered by experienced construction practitioners in a typical construction business environment.

The participants were asked to rate each issue according to how frequently they think it occurs in the industry, and how serious they think it is when it does occur. Participants were not asked whether they themselves engage in such activities. Participants were asked to base their responses on their experience as a construction practitioner. Responses to each of the 15 items were rated using a Likert scale. Values of 1 to 5 was assigned to the responses for "frequency," where 1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *very frequently*. Values of 1 to 5 was assigned to the responses for "seriousness" with 1 being "*not serious at all"* and 5 being *"extremely serious."* The higher the response is to the item, the higher the frequency, or greater the seriousness.

Each questionnaire included a demographic information section in addition to the measurement scale. The demographic information collected on each participant included gender, age, education, position in company, number of years employed in the construction industry, contractor classification , primary market focus, company size, trade association affiliation, union affiliation, region of country, and whether the company had a written code of ethics or ethics policy in place.

Data Analysis

Data collected from the questionnaires were analyzed using the Statistical Package for Social Sciences (SPSS). The data were first analyzed (frequency distributions) to check the normal distribution assumption. The dependent variables were approximately normally distributed and, given the Likert scale is approximately interval, parametric tests were used.

Descriptive statistics were used to describe and summarize the data. Difference inferential statistics were used to analyze and compare groups or levels of the independent variable on their scores on the dependent variable. Differences between groups were tested at the .05 level of significance.

The statistic that was used to analyze the independent variables of *market focus, contractor classification*, *gender*, *union affiliation*, and *company code of ethics* the was the independent samples t-test. Levene's test for equality of variances was checked in each case. Where Levene's test was statistically significant, the *t* was adjusted to indicate that "equal variances were not assumed."

The statistic that was used for the independent variables of *age, education, position in company, experience, company size*, and *region of country* was a one-way ANOVA. This statistic was chosen because each variable represents one independent variable with 3 or more levels and the dependent variable is approximately interval. If the one-way ANOVA indicated significant differences between groups of the independent variable, then the post hoc Tukey HSD test was used as the follow up to determine between which groups a significant difference existed.

Results

Response Rates

A total of 1450 questionnaires were sent to individual members of the Associated General Contractors. Of the questionnaires sent out, a total of 321 useable questionnaires were returned, or 22 percent.

Contractor Profile

Of the 321 contractor respondents the ratio of male to female contractors was almost 10 to 1. The majority of the contractors were between the ages of 36 and 50. More than two thirds of all respondents self reported having a bachelor's degree or higher.

Of the 321 contractors surveyed, more than two thirds of the respondents were professionally positioned at the executive level. The number of years the participants were employed in the construction field ranged from 5 to 55, with the average being almost 26 years. Over 50 percent reported having between 21 and 40 years of experience. More than 50 percent of the participants were currently associated with companies with annual revenues between 5 and 50 million dollars.

Over 80 percent of the participants were classified as general contractors with the remaining being classified as specialty contractors. Almost all of the participants operated in the commercial market. Less than 5 percent of the respondents were involved in the residential market. Of the 321 respondents, over two thirds worked for companies who did not have a written "Company Code of Ethics" or "Ethics Policy."

The contractor respondents were primarily from non-union affiliated companies. The ratio of companies whose labor force is primarily non-union companies to companies whose labor force is primarily union affiliated was almost 2 to 1.

All four regions of the United States were represented in this study. The Northeast region produced the fewest number of responses, comprising only 12.5 percent of the sample, with the Southern region producing the greatest number of responses at 33 percent. The Midwest and Western regions were approximately equal in their participation.

Contractor Perceptions of Frequency and Seriousness of Ethical Transgressions

Each questionnaire listed 15 issues that may arise for those working in the construction industry. For the purposes of this study, each issue was viewed as an ethical transgression. Each participant was asked to rate each issue according to how frequently they thought the issue occurred in the industry and than, how serious they thought the issue was when it did occur. A mean of 1.0 for frequency represents the transgression never happening, and a mean of 5.0 represents the transgression happening very often. A mean of 1.0 for seriousness represents the transgression being perceived as not serious at all, and a mean of 5.0 represents the transgression being perceived as extremely serious. The mean scores of the 15 issues or ethical transgressions

are ranked from most frequently occurring to least frequently occurring, and most serious to the least serious in Table 1. Of the 15 issues surveyed, the four most frequently occurring ethical transgressions according to those contractors who responded are:

1. Improper or Questionable Bidding Practices
2. Misrepresentation of Completed Work or Value of Work
3. Poor Quality Control or Poor Quality of Work
4. Technical Incompetence or Misrepresentation of Competence.

Table 1

Contractor Perceptions of Frequency and Seriousness of Ethical Transgressions

	Frequency Issue	**Mean**	**Seriousness Issue**	**Mean**
1.	Improper or Questionable Bidding	3.3178	Alcohol and Drug Abuse	4.0870
2.	Misrepresentation of Completed Work or Value of Work	3.3031	Improper or Questionable Bidding	3.9437
3.	Poor Quality Control or Quality of Work	3.1063	Failure to Protect Public Health, Safety, or Welfare	3.8750
4.	Technical Incompetence or Misrepresentation of Competence	3.0063	Poor Quality Control or Quality of Work	3.8213
5.	Abuse of Company Resources	2.9969	Abuse of Client Resources	3.6677
6.	Alcohol and Drug Abuse	2.7262	Improper Relations with Clients, Contractors, etc.	3.6270
7.	Failure to Reconcile Employee or Subcontractor Concerns	2.7081	Conflicts of Interest, Improper Political/Community Involvement	3.5696
8.	Abuse of Client Resources	2.6563	Misrepresentation of Financial Status or Records	3.5688
9.	Conflicts of Interest, Improper Political/Community Involvement	2.6375	Technical Competence or Misrepresentation of Competence	3.5643
10.	Mishandling Sensitive Information	2.4769	Failure to Protect the Environment	3.5497
11.	Failure to Protect Public Health, Safety, or Welfare	2.4594	Failure to Reconcile Employee or Subcontractor Concerns	3.4563
12.	Discrimination, Favoritism, or Harassment	2.4206	Mishandling Sensitive Information	3.4517
13.	Misrepresentation of Financial Status or Records	2.4149	Discrimination, Favoritism, or Harassment	3.4222

Table 1 Continued

14.	Failure to Protect the Environment	2.3673	Abuse Company Resources	3.3836
15.	Improper Relations with Clients, Contractors, etc.	2.3187	Misrepresentation of Completed Work or Value of Work	3.0503
	Average Mean	**2.7277**		**3.6025**

Note: A mean of 1.0 for frequency represents the transgression never happening, and a mean of 5.0 represents the transgression happening very often. A mean of 1.0 for seriousness represents the transgression being perceived as not serious at all, and a mean of 5.0 represents the transgression being perceived as extremely serious.

Of the 15 issues surveyed, the four <u>least frequently occurring</u> ethical transgressions according to those contractors responding are:

1. Discrimination, Favoritism, or Harassment
2. Misrepresentation of Financial Status or Records
3. Failure to Protect the Environment
4. Improper Relations with Clients, Contractors, etc.

Of the 15 issues surveyed, the four <u>most serious</u> ethical transgressions according to those contractors who responded are:

1. Alcohol or Drug Abuse
2. Improper or Questionable Bidding Practices
3. Failure to Protect Public Health, Safety, or Welfare
4. Poor Quality Control or Poor Quality of Work

Of the 15 issues surveyed, the four <u>least serious</u> ethical transgressions according to those contractors responding are:

1. Mishandling Sensitive Information
2. Discrimination, Favoritism, or Harassment
3. Abuse of Company Resources
4. Misrepresentation of Completed Work or Value of Work

Pearson Correlations were performed on all 15 issues relative to frequency and seriousness. All issues indicated a significant positive correlation (at the 0.01 level, 2-tailed) between frequency of occurrence and seriousness of occurrence with the exception of one, Misrepresentation of Completed Work or Value of Work. These positive correlations simply indicate that contractors who view an issue as occurring relatively frequently also tend to view it as serious. However, this is not the case for Misrepresentation of Completed Work. Referencing Table 2, the issue of Misrepresentation of Completed Work or Value of Work is almost at opposite ends of the ranking spectrum of occurrence and seriousness. According to the contractors responding to the survey, "Misrepresentation of Completed Work or Value of Work" occurs second most often, and is perceived as the least serious offense.

Perception of Overall Ethical Behavior of the Construction Industry

The demographic portion of the questionnaire asked each participant to rate their perception of the overall ethical behavior of the construction industry (self-view) and also to rate how they thought the general public perceived the overall ethical behavior of the construction industry (public view). A Likert scale with values from 1 to 7 was used, where 1 equals highly "unethical" behavior and 7 equals highly "ethical" behavior. The higher the mean is, the higher the perceived ethical behavior of the industry. With 320 of the 321 contractor participants responding, the mean for the perceived self-view of ethical behavior of the industry was 4.78. The mean for the perceived general public view of the industry's ethical behavior was 3.31. There was a significant difference ($t = 19.45$, $df = 319$, $p < .001$) between the perceived self-view and the perceived public view of the overall ethical behavior of the construction industry.

Two of the 12 demographic factors, gender and experience, were related to the perceived view of the overall ethical behavior of the construction industry. Females scored the public view significantly higher ($t = -2.16$, $df = 317$, $p = .031$) than that of males. Participants with the least experience (under 10 years) scored the public view significantly higher ($F = 4.00$, $df = 3$, $p = .008$), than 2 of the other 3 experience levels (10-20 years and 21-40 years). None of the other comparisons of experience groups were significantly different.

Ten of the 11 demographic factors were tested for significant differences among groups. Primary market focus was not measured due to an insufficient response rate from residential contractors. Among contractor demographics, all factors measured had a significant relationship to contractor responses in terms of the 15 ethical transgression issues listed in the questionnaire. Table 2 summarizes the significant demographic variables.

Table 2

Summary of Significant Demographics

Variable	Responses to the Frequency of Issues	Responses to the Seriousness of Issues
Gender	Makes scored higher on question 4.	Females scored higher on questions 2, 3, 4, 5, 6, and 11.
Age	Younger contractors scored higher on questions 2 and 14.	Younger contractors scored higher on questions 5, 9, and 13.
Education	Contractors with some college scored lower on question 4. Contractors with the least education scored higher on question 13.	Contractors with the least education scored higher on questions 1, 4, and 7.
Position	Contractors at the executive level scored higher on question 4. Contractors at the management level scored higher on questions 10 and 13.	No differences.

Table 2 Continued

Experience	Contractors with over 40 years of experience scored lower on questions 1, 2, and 8. Contractors with less than 10 years of experience scored higher on question 14.	Contractors with over 40 years of experience scored lower on questions 2, 3, 5, 8, 9, and 13.
Contractor Class	Specialty contractors scored higher than general contractors on question 6.	General contractors scored higher than specialty contractors on question 5.
Market Focus	Not evaluated.	Not evaluated.
Company Size	Contractors who work for companies with revenues under $5 million scored lower on question 4.	No differences.
Union Affiliation	No differences.	Contractors who work for companies that are primarily union affiliated scored higher on questions 8 and 9.
Region of Country	No differences.	The Northeast scored higher on question 1. The West scored higher on questions 2, 13, and 14. The Northeast and the West scored higher on questions 8 and 9.
Code of Ethics	Contractors who worked for companies that did not have a written code of ethics scored higher on question 4.	No differences.

Note: The higher the score the more frequently the transgression occurs and the more serious it is when it does occur. Specific differences between groups are detailed in the text.

Summated frequency scores and summated seriousness scores were calculated by computing the average frequency and average seriousness scores for all 15 ethical transgression issues listed in the questionnaire. The internal consistency reliability of these scales was tested using Cronbach's coefficient alpha. The alpha for the frequency scale was .78 indicating that the summated scale is internally consistent in measuring the concept of frequency (Gliner & Morgan, 2000). The alpha for the seriousness scale was .93, indicating that the items in the scale are somewhat repetitious or that there are more items in the scale than are really needed for a reliable measure of the concept (Morgan & Griego, 1998). In either case, there is good internal consistency reliability for both scales. The average summated score for the frequency of issues was 2.73. The average summated score for the seriousness of issues was 3.60.

Although several individual ethical issues were related to several individual demographic factors, only three demographic factors were found to be significant when it came to the summated scales for perceived frequency of ethical transgressions and summated scales for perceived seriousness of ethical transgressions: experience, gender, and region of country. Contractor experience was found to be related to both frequency and seriousness of summated scores for the 15 ethical transgressions. Generally, contractors with the most experience perceived the occurrence of ethical transgressions to be least frequent and, when they did occur, they perceived

them to be less serious than contractors with less experience. Gender and Region of Country were only related to the seriousness of ethical transgressions on the summated scale. Females perceived ethical transgressions to be more serious than did males. Contractors from the West perceived ethical transgressions to be more serious than contractors from the South or the Midwest.

Discussion

The primary objective of this study was to ascertain the perceptions of construction practitioners regarding the extent to which ethical transgressions occur in the construction industry. The assumption was that those persons actually working in the industry know better than anyone else does when it comes to issues like poor quality, improper bidding practices, discrimination, abuse of client resources, and alcohol or drug abuse, just to name a few. Participants were asked to base their responses on their personal experience working in the industry, and they were assured of anonymity. According to the construction practitioners who responded to the survey, the frequency of the kinds of ethical transgressions presented in the questionnaire is rare. As a matter of fact, the participants of this study view the behavior of the construction industry to be quite ethical. However, they do perceive that the general public does not hold their industry in the same positive light.

Another primary objective of the study was to ascertain the perceived seriousness of ethical transgressions when they do occur in the industry. Clearly, those construction practitioners who responded to the survey think ethical transgressions are a serious matter. Some of the ethical issues, like alcohol or drug abuse, improper bidding practices, and failure to protect public health, safety, or welfare, are close to being perceived as extremely serious. There have been serious efforts made to address some of these issues. For example, drug testing is mandatory for union workers but not for non-union workers, although many companies now require drug testing at least at the time of hiring. Bid listing legislation has been adopted in more than two dozen states, and most trade associations have condemned the practice of bid shopping; however, the Federal Trade Commission warns trade associations to step lightly in this area to avoid anti-trust violations themselves.

Not all ethical issues are considered serious even when they occur more frequently (for example, Misrepresentation of Completed Work or Value of Work). It is questionable whether some items listed in the questionnaire represent ethical transgressions at all, as far as the industry is concerned.

The results of this study indicate that female construction practitioners perceive ethical transgressions to be more serious than do male construction practitioners. In a previous study conducted by the researcher, Jackson, 1998) a similar result was found when comparing the ethical perceptions of female construction students and male construction students. However, at that time, the researcher concluded that it seemed unlikely that this would have much impact on the industry as a whole given the small number of women who were actually employed in the industry. However, there are current reports that suggest a different outlook. The National Foundation for Women Business Owners reported in 1997 that between 1987 and 1996 construction was the *fastest-growth* area for women business owners (Touby, 1997).

Additionally, the number of women starting construction businesses was significant. In 1997, over 320,000 female contractors employed more than a million people and took in $130.4 billion in revenue, representing an increase of 170 percent in nine years (Touby, 1997).

Furthermore, the nature of the business itself is changing. Touby (1997) may have said it best. "More and more construction companies are being run by MBAs than craftsmen. Bidding on and completing a project requires a whole new constellation of professional skills. What this means is that the straw boss mentality is giving way to a new, more sophisticated business style, and female contractors are perfectly poised to prosper (p. 40)." And, given the evidence suggesting that women may be more sensitive to ethical issues (Cole, 1993, Dawson, 1997, and Jackson, 1998), one might expect to see real changes in the ethical culture of the industry.

On the other hand, one must not overlook several theories also presented by Dawson (1997). He suggested that the opposite could occur--while women may enter business careers with values different from men, they will respond similarly to the same training and occupational environment and become more like men in their actions and perceptions.

There appears to be an association between the perceived "frequency" and "seriousness" of ethical transgressions and "experience" of the construction practitioners. Analysis of the summated scores revealed that contractors with over 40 years of experience perceive ethical transgressions overall to occur less frequently than do less experienced constructors. Furthermore, contractors with over 40 years of experience perceive ethical transgressions to be less serious overall than do contractors with less experience. There was very little research found by the investigator to corroborate these findings and the researcher questions the validity of them. Construction practitioners with over 40 years of experience are likely to be over age 60 and may not be as close to the day to day construction operations as they once were. Thirty-five participants were listed as having over 40 years of experience, and 37 participants were over age 65. Therefore, they may be out of touch and unable to access the real ethical behavior of the industry.

There appears to be no differences across regions of the United States in regard to the frequency of ethical transgressions. This came as a surprise to the researcher. Most contractors that were interviewed prior to the start of this study expected regional differences. It was thought that the frequency of transgressions would be higher in the Northeast by most of the contractors interviewed. No differences were found between respondents from union affiliated firms and respondents from non-union affiliated firms when it came to frequency of transgressions either. And, although the lowest number of respondents to the study came from the Northeast, the number was still sufficient to make reliable comparisons.

However, there was an association between the perceived "seriousness" of ethical transgressions and "region of country." The Western Region of the United States perceived ethical transgressions overall to be significantly more serious than did construction practitioners from the Midwest or Southern Regions. The investigator found no research to corroborate this finding.

Conclusion

This study was a look into a very important topic seldom addressed in construction. The possibility for further research in this area is immense. Ethics has never been a clear-cut issue in the business world, and is definitely not a simple issue in the complex construction industry. There are no easy answers. The true ethical culture that exists within the industry is yet to be determined. However, with continued research in the area of ethics in construction, a more accurate picture may be drawn. Once we are actually aware of that "ethical culture," we may have the opportunity to influence it, if we so choose. Hopefully, this study brings us one step closer to that awareness.

The researcher believes that the vast majority of contractors conduct their businesses in an ethical fashion. However, it is disturbing that the behavior of those who do not, goes undeterred and therefore is interpreted as being acceptable. Unfortunately, such questionable behavior tarnishes the reputation of those who conduct themselves ethically, and jeopardizes the industry as a whole.

References

Buckner-Powers, M., (1998). North Carolina controversy raises board patronage issue, ENR: Engineering News Record, 17.

Cole, B.C. (1993). Perceptions of college business students and of experienced business practitioners regarding the ethics of business people. Unpublished doctoral dissertation, Memphis State University, Tennessee.

Dalla Costa, J. (1998). The Ethical Imperative: Why Moral Leadership is Good Business. Reading, Massachusetts: Addison-Wesley

Dawson, L.M., (1997). Ethical differences between men and women in the sales profession. Journal of Business Ethics, 16, 1143-1152.

Gliner, J.A., & Morgan, G.A. (2000). Research methods in applied settings: An integrated approach to design and analysis. Mahwah, New Jersey, Lawrence Erlbaum Associates.

Jackson, B.J., (1998). Perceptions of college construction students regarding the ethics of the construction industry. Unpublished master's thesis, Colorado State University, Fort Collins, Colorado.

Korman, R., (1998). Defiant engineer draws praise. ENR: Engineering News Record, 10.

Morgan, G.A. & Griego, O.V., (1998). Easy use and interpretation of SPSS for windows: Answering research questions with statistics. Mahwah, New Jersey, Lawrence Erlbaum Associates.

Nabholz, D.F., (1995). Your ethics, my money. The Contractors Management Journal, 15-22.

Touby, L. (1997, January). Contracting. Working Woman, 39-41, 70-72.

Tulacz, G.J., (1998), NYC interiors firms plead guilty. ENR, 10-11.

Appendix

Opinion Survey on Ethics in Construction

Below are 15 issues that may arise for those working in the construction industry. Listed under each category are examples that might be representative of each issue.

Remember, your responses are not a reflection of your personal behavior, but rather are to be based on your personal experience working in the construction industry.

Please rate each issue according to:

1. **How frequently you think it occurs in the industry.**
   1 = never **2** = rarely **3** = sometimes **4** = often **5** = very often

2. **How serious you think it is when it does occur.**
   1 (not serious at all) **2** **3** **4** **5** (extremely serious)

Circle your responses: Higher numbers indicate higher frequency or greater seriousness.

Issue 1- Technical Incompetence or Misrepresentation of Competence
(Examples of this issue might be- Operating outside one's area of experience or expertise, operating without a license, misleading advertising or claims for performance or products, misleading schedules, misleading information on resumes or pre-qualification statements, etc.)

Frequency 1 2 3 4 5 **Seriousness 1 2 3 4 5**

Issue 2- Poor Quality Control or Poor Quality of Work
(Examples of this issue might be- Cutting corners in the face of budget or time pressures, not satisfying specifications, hedging on standards, not performing in a workmanlike manner, etc.)

Frequency 1 2 3 4 5 **Seriousness 1 2 3 4 5**

Issue 3- Improper or Questionable Bidding / Estimating Practices
(Examples of this issue might be- Bid-shopping, bid peddling, bid rigging, etc.)

Frequency 1 2 3 4 5 **Seriousness 1 2 3 4 5**

Issue 4- Misrepresentation of Completed Work or Value of Work
(Examples of this issue might be- Inflating completed work percentages, adjusting schedules of value, front-end loading schedules of value, etc.)

Frequency 1 2 3 4 5 **Seriousness 1 2 3 4 5**

Issue 5- Conflicts of Interest, Improper Political or Community Involvement
(Examples of this issue might be- Political contributions or activity for personal or company gain, undue influence, fraud, conflicts of commitment, financial, personal, political, or other interest in people or organizations that one performs construction services for, etc.)
Frequency 1 2 3 4 5 **Seriousness 1 2 3 4 5**

Issue 6- Discrimination, Favoritism, or Harassment
(Examples of this issue might be- Unfair treatment on the basis of race, sex, etc, in business, or relative to evaluations, promotions, or recommendations, supervisory harassment of subordinates, sexual harassment, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 7- Abuse of Company Resources
(Examples of this issue might be- Abuse of travel allowance, fudging on time cards, personal use of company supplies, equipment, telephone, or facilities, using company employees for personal projects or benefit, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 8- Abuse of Client Resources
(Examples of this issue might be- Over billing for time and material, excessive change orders and charges, inflating hours, wasting public funds, etc)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 9- Failure to Protect Public Health, Safety or Welfare
(Examples of this issue might be- Poor safety or risk analysis or assessment, neglect in regard to worker safety, hazardous materials, natural hazards, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 10- Improper Relations with Clients, Contractors, etc.
(Examples of this issue might be- Excessive gifts, entertainment, or gratuities, undue influence, inside information, failure to maintain independent judgment; kickbacks, bribery or blackmail, fraud, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 11- Mishandling Sensitive Information
(Examples of this issue might be- Revealing or obtaining proprietary or confidential information, revealing or discussing confidential bids and prices, misrepresentation of data, lack of informed consent, violation of privacy, gossip, insider trading, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 12- Failure to Reconcile Employee or Subcontractor Concerns
(Examples of this issue might be- Falsely blaming others for poor performance or schedule delays, company disloyalty, technical dissent, company communication, reporting, and grievance procedures, public exposure of misconduct or technical conflict, improper punishment or retaliation against an employee, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 13- Alcohol or Drug Abuse
(Examples of this issue might be- Use of alcohol or drugs while on the job, excessive use of alcohol or drugs while off the job, effects of substance abuse on performance and decision-making)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 14- Failure to Protect the Environment
(Examples of this issue might be- Conduct contributing to pollution, deterioration or destruction of air, water, or nature, resource depletion, poor resource allocation, etc.)

Frequency 1 2 3 4 5 Seriousness 1 2 3 4 5

Issue 15- Misrepresentation of Financial Status or Records

(Examples of this issue might be- Misinforming or misleading the IRS, lending institutions, banks, clients, bonding agencies, etc.)

Frequency 1 2 3 4 5 **Seriousness 1 2 3 4 5**

COMMENTS

This survey is an adaptation of the Murdough Center for Engineering Ethics Survey, Texas Tech University, (Vann & Vesilind, 1991)

Ethics Survey - Demographic Information

1. Gender: _____ Male _____ Female

2. Age: _____ Under 20 _____ 20-35 _____ 36-50 _____ 51-65 _____ Over 65

3. Education: _____ High School or Less _____ Some College/Business School/Vocational Training

   _____ Bachelor's Degree _____ Master's or Doctorate Degree

4. Position in Company (Please select the one that best describes your position or type of work)

   _____ Executive _____ Management _____ Design/Engineering

   _____ Estimating _____ Supervision _____ Other:_____

5. Number of years employed in the construction industry: _____ (round up or down to nearest whole number)

6. Contractor Classification: _____ General Contractor _____ Subcontractor _____ Associate (Supplier, etc.)

7. Primary Market Focus: _____ Residential _____ Commercial (Includes Industrial & Heavy Highway)
   (Please select only one)

8. Company Size: _____ Under $1 million _____ $5 to $50 million _____ Over #250 million

   _____ $1 - $5 million _____ $50 to $250 million

9. Trade Association Affiliation: (Please circle all that apply)

   AGC ABC NAHB NAWIC ASA WCOE Other: _____

10. Union Affiliation: _____ Primarily Union _____ Primarily Non-Union

11. Region of Country:

    _____ Northeast (Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, Pennsylvania, New Jersey, Delaware, Maryland, West Virginia, Minnesota)

    _____ Southern (Virginia, North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Texas, Oklahoma, Arkansas, Louisiana)

    _____ Midwest (Michigan, Wisconsin, Illinois, Indiana, Ohio, Kentucky, Kansas, Nebraska, Iowa, Missouri, South Dakota, North Dakota)

    _____ Western (Arizona, New Mexico, Colorado, Wyoming, Montana, Utah, Idaho, Nevada, California, Oregon, Washington)

12. Does Your Company Currently Have a Written Code of Ethics or Ethics Policy? _____ Yes _____ No

13. On a scale of 1 to 7, how do <u>you</u> perceive the overall ethical behavior of the construction industry?

    Highly Unethical 1 2 3 4 5 6 7 Highly Ethical

14. On a scale of 1 to 7, how do you think the <u>general public</u> perceives the overall ethical behavior of the construction industry?

    Highly Unethical 1 2 3 4 5 6 7 Highly Ethical

Editorial Board / Acknowledgements

Special thanks go to those reviewers that have served the ASC-published journal over the years. Without your dedication and professionalism, the *Journal* could not have been as successful as it has been.

With the advent of the print version of the *Journal*, to be published by Taylor & Francis in March of 2006, we are reconstituting the Editorial Board (EB), previously referred to as the "Editorial Review Board." Shortly we will be posting the manner in which interested and qualified persons may serve with this distinguished group, comprised of not more than twenty-five reviewers. While we hope to have many reviewers from ASC member institutions, we also welcome qualified others from the USA and abroad to make us aware of your interest in serving. We intend to carefully evaluate submitted credentials to ensure that we have a balanced and capable EB. Please check our web site for reviewer sign-up instructions.

Membership Applications

Inquiries should be sent to: Associated Schools of Construction • **Dr. Mostafa M. Khattab,** ASC President, Colorado State University, Tel: 970.491.6808, E-Mail: mostafa.khattab@cahs.colostate.edu

Organizations eligible for membership may fill out one of the following application forms: (http://ascweb.org/). Please read the following membership grouping information, pick or enter the hyperlink into your web browser for the type of membership that fits your organization and submit the completed form.

Institutional Members: shall be those institutions having at least one baccalaureate or higher degree construction program. Annual member dues are $400.00.

Associate Members: shall be institutions of higher education, including junior and community colleges, not meeting institutional member requirements (two year programs). Annual member dues are $250.00.

Industrial Members: shall be industrial organizations demonstrating a constructive interest in construction education. Annual member dues are $400.00 base membership or $650, which includes $250 for advertising industry positions on the ASC website. This service includes full-time, part-time, summer internship, and co-op program listings.

National Office Staff

Webmaster
Dr. Kevin R. Miller
Brigham Young University
Tel: 801.422.8728
E-mail:ascweb@byu.edu
kmiller@byu.edu

Journals Editor/Publisher
Dr. Brian C. Moore
Southern Polytechnic State University
Tel: 678.915.3715
E-mail:ascjournal@spsu.edu
bmoore@spsu.edu

Proceedings Editor/Publisher
Dr. Tulio A. Sulbaran
University of Southern Mississippi
Tel: 601.266.6419
E-mail: tulio.sulbaran@usm.edu
ascproceedings@unlinfo.unl.edu

Officers 2004-2005

President
Dr. Mostafa M. Khattab
Colorado State University
Tel: 970.491.6808
E-mail:
mostafa.khattab@cahs.colostate.edu

First Vice-President
Dr. David F. Rogge
Oregon State University
Tel: 541.737.4351
E-mail: david.rogge@orst.edu

Second Vice-President
Mr. Charles R. Gains
Boise State University
Tel: 280.426.1829
E-mail: cgains@boisestate.edu

Secretary
Dr. Jay P. Christofferson
Brigham Young University
Tel: 801.422.6302
E-mail: jay_christofferson@byu.edu

Treasurer
Dr. Larry Grosse
Colorado State University
Tel: 970.491.7958
E-mail:
drfire107@mindspring.com

Directors 2003-2004

Northeast Director
Dr. Ronald J. Miers
Roger Williams University
Tel: 401.254.3418
E-mail: rmiers@rwu.edu

Southeast Director
Dr. Brian C. Moore
Southern Polytechnic State University
Tel: 678.915.3715
E-mail: bmoore@spsu.edu

Great Lakes Director
Dr. Richard A. Boser
Illinois State University
Tel: 309.438.2609
E-mail: raboser@ilstu.edu

North Central Director
Dr. Charles W. Berryman
University of Nebraska – Lincoln
Tel: 402.472.0098
E-mail: cberryman1@unl.edu

South Central Director
Mr. Richard C. Ryan
University of Oklahoma
Tel: 405.325.3976
E-mail: rryan@ou.edu

Rocky Mountain Director
Dr. Kraig Knutson
Arizona State University
Tel: 480.965.1402
E-mail: kraig.knutson@asu.edu

Far West Director
Mr. Mike Borzage
Oregon State University
Tel: 530.898.4505
E-mail: mborzage@csuchico.edu