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**Construction Industry Craft Training
in the United States and Canada**

**Prepared by
Construction Industry Institute
Construction Industry Craft Training Research Team**

**Research Summary 231-1
August 2007**

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The University of Texas at Austin.

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Executive Summary

Enhanced craft training is where safety training was 15 years ago. Safety improvements garnered much attention then, and efforts to improve the skills of the industry's work force are now receiving similar attention. Improving safety resulted in large payoffs, and continuing to emphasize safety is the right thing to do. Evidence exists that craft training pays off just as well.

CII established the Construction Industry Craft Training Research Team to examine construction craft training. The team concludes that each dollar invested in craft training can yield \$1.30 to \$3.00 in benefits. The benefits accrue in the form of increased productivity and reductions in turnover, absenteeism, rework, and other areas.

Since the 1980s, the average age of craft workers has continued to climb. Currently, real wages are rising rapidly and could attract new entrants, who unfortunately may stay only briefly. Craft training will be one major way to retain these new entrants in the construction profession and make them fully productive.

A large body of evidence shows that construction craft training can be effective in a broad range of circumstances. The research presented here shows that the business case for craft training improves the longer craft workers are engaged in training.

Some owners have begun requiring craft training and certification for all craft workers. Current shortages of certified workers are driving up wages, which will attract new craft workers to enter the profession. These new workers will need training in construction basics and will benefit greatly from mentoring and formal on-the-job training programs. When new craft workers recognize that efforts on their part to obtain training pay off in higher wages, they will make the sacrifices necessary to move ahead.

This CII study received financial support from the Construction Users Round Table (CURT) and the National Center for Construction Education and Research (NCCER).

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Introduction

Over the years, the North American construction industry has not invested enough to nurture and develop an adequate construction craft work force required to sustain economic growth. Over the past couple of decades, several demographic, sociological, and economic factors have contributed to craft shortages.

According to the U.S. Bureau of Labor Statistics, the average age of craft workers was 36 in 1985. By 2003, the average age increased to 39. The average age of craft workers on CII projects is higher than the national average. According to a recent CII survey, the average craftworker's age was 42. The Construction Labor Research Council predicts that 185,000 new craft workers must be attracted, trained, and retained each year until 2016 in order to replace those leaving and to sustain growth expectations. CURT has estimated the rate to be closer to 200,000 to 250,000 new craft workers required per year.

The construction industry's unfavorable image continues to hamper recruitment of young craft workers. In the *2002 Jobs Almanac* by Krantz, construction occupations ranged from #182 (construction foreman) to #247 (ironworker) out of 250 jobs in analyses that involved high school seniors that considered salary, stress, work environment, career outlook, job security, and physical demands. In addition to craft demographics and industry image, prior research has identified declining real wages, poor work environment, and lack of stable career paths. One way to begin addressing the current shortage of skilled craft workers is through more industry training.

Problem Statement

Craft training could assure an adequate craft supply in the future, but it is not being done. Numerous factors contribute to training resistance among the construction community, including: 1) reluctance to lose a bid due to added training costs; 2) reluctance to train and then possibly lose trained craft workers to competitors; 3) reluctance to invest in

unproven training programs; 4) reluctance to address the general need for training, since craft workers can be attracted from competitors; 5) lack of employee acceptance of formal training programs; and, perhaps most importantly, 6) lack of the ability to quantify the improved productivity and other benefits that can be realized through training.

Research Scope and Objectives

The purpose of this research was to identify and quantify the business case for construction craft training. Significant debate exists in the industry regarding the value of craft training. Providing quantifiable data regarding the benefits and costs of training will identify which concerns are legitimate and also serve as a first step toward their resolution. The research identified the potential benefits of training including improved productivity, improved safety, improved quality, decreased absenteeism, and decreased turnover.

The research team considered existing data sources as well as collecting data of its own. The research was coordinated and complimentary to other ongoing research and craft training initiatives in the industry, including previous CII research, CURT, NCCER, Associated Builders and Contractors (ABC), and the Center for Construction Industry Studies (CCIS). Objectives include:

1. Research, classify the types, and quantify the costs of training for construction craft workers.
2. Identify results of types of training in terms of high and low impact and payback.
3. Evaluate tradeoffs that organizations should consider for training (e.g., technical versus leadership training and hiring costs versus training costs).

Current State of Training in North America (U.S. & Canada)

Craft training currently exists in North America both informally (on-the-job training) and formally (classroom). Not all on-the-job training is informal. Training on the job can be formalized through mentoring and through providing performance feedback to the trainee.

The research team examined data from the Survey of Employer Provided Training (SEPT), which was conducted by the U.S. Bureau of Labor Statistics in 1995. SEPT involved approximately 1,000 private, nonagricultural business establishments and examined different aspects of training, including the type of training (formal or informal) provided to employees. The survey found that 76 percent of the training provided in construction was informal. Only the retail sales industry reported a higher percentage of informal training.

The research team also examined the percentage of total training hours that involve formal and informal training provided in construction and found that similar percentages of formal and informal training still exist, at least among the surveyed companies (Table 1).

Table 1. Formal versus Informal Training in Construction

Trade	Percentage of Formal Classroom Training Provided	Percentage of Informal (OJT) Training Provided
Civil	19%	78%
Electrical	23%	70%
Piping	22%	71%
Other Mechanical	23%	70%
Equipment Operator and Maintenance	20%	74%

(Data source: CII RT 231 Survey)

Note: formal training includes classroom training as well as computer based and home curriculum self-study.

Both union and open-shop construction arenas have formal training programs. In the union sector, formal apprenticeships and other training programs are established jointly by unions and employers. The national unions strive to make the content of the training programs consistent through standards adopted by national Joint Apprenticeship and Training Committees (JATCs). Union-sector training is funded through contributions to training funds based on each hour of work, as mandated through collective bargaining agreements.

In some areas, open shop formal training programs are funded through cents-per-hour voluntary contributions from owners and contractors into a local training fund, although this rarely happens as frequently compared to the union sector. Open-shop apprentices often pay for all or a portion of training. NCCER, a non-profit education foundation affiliated with the University of Florida, has developed standardized curricula, instructional materials, assessments, and certifications that have become a standard in the open-shop sector.

The classroom portion of training varies by trade. In electrical, mechanical, and hard metal trades, a significantly higher percentage of classroom training time is required due to the technical content of the trades. Civil trades have a lower percentage of time in formal classroom training.

The survey by the research team examined the barriers that organizations experience in conducting a formal training program. The barriers identified are listed in order from the greatest to the least important:

1. Lack of new craft workers interested in training programs
2. Training schedule conflicts with work schedule
3. Training takes too much time to complete
4. Lack of financial resources
5. Lack of adequate instructors
6. Once trained, employees leave the training organization

7. Lack of support from job-site supervisors
8. Inadequate completion rates of existing training programs
9. Language barriers
10. Training location is not accessible to employees
11. Lack of adequate training facilities and
12. Lack of adequate instructional material

Currently, craft training is insufficient to keep pace with the demand for qualified craft workers. This situation is aggravated by an aging work force and high retirement rates of experienced craft workers. Shortages of craft workers and the barriers to formal training are intertwined. Indeed, geographic regions in North America that are experiencing the most significant craft shortages are also experiencing significant increases in craft real wages. In time, higher real wages will attract more craft workers to construction, but it is uncertain whether this will balance out. It is not economically efficient for wages and training capacity to swing wildly. Spikes in wage levels due to temporary shortages distort expectations of new craft entrants and result in excessive turnover.

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Means and Best Practices of Training

Although it is possible, most organizations do not measure the effectiveness of craft training. Contractors typically keep general records of the costs associated with training, but few maintain records of the benefits of training. The effectiveness and benefits of training can be seen in data that is commonly collected by contractors, which include:

- Absenteeism rate: the rate of occurrence of absence from work or duty
- Turnover rate: the rate of the number of craft workers hired by a company/project to replace those who have left voluntarily in a given period of time
- OSHA recordable rate: The rate, per 100 craft workers, of the number of times per year a craft worker received treatment beyond basic first aid for an occupational injury or illness
- Rework rate: the amount of rework, wastage and off-quality product produced during a project or within a company during a given period of time
- Labor productivity rate: the amount of craft hours used to complete a given quantity of work.

By tracking and evaluating the changes in value of these key data indicators, a contractor can determine the effectiveness and benefits of training at a project, division, or overall company level.

Various kinds and numerous providers of craft training can be found. The current training infrastructure in construction consists of apprenticeship training, craft and task training programs that may include craft progression programs, high school, community colleges, trade schools, school-to-career programs, cooperative training efforts, vendor training, government-based training such as job corps and prison-based programs, military construction force training, and various forms of structured or unstructured on-the-job training (OJT).

Training can also be categorized as either short term or long term. Short-term training is specific and has a limited number of hours offered. Short-term training is generally referred to as task specific or journeymen upgrade training. Examples of short-term training are a 30-hour blueprint class or a 24-hour motor controls class. Long-term training is craft training and generally takes several years to complete.

Apprenticeships cover a wide range of skills over a specified number of years and produce a full craft professional. Task training can be structured as a part of long-term training. For example, a helper takes only the first year of an electrical program using NCCER Electrical Level I curriculum. Apprentices and other craft trainees can take training simultaneously in the same classroom. The differences in these two types of training will be discussed in more detail below.

New instructional methodologies emerge as needs and demands change in the industry. Notable new methodologies include technology-based instruction and accelerated craft training models. Technology-based instruction includes computer-based, web-based, and simulation methods. Due to the pressing needs for skilled craft workers in the construction industry, accelerated craft training models are being tested and implemented.

Accelerated models are based on compressing long-term craft training instruction into dramatically shorter periods of classroom instruction. Three- and four-year training programs have been compressed into blocks of 6 to 24 months. Significant benefits and notable challenges to technology-based and accelerated models can be found. The primary benefit is faster preparation of crafts to meet the pressing work force demands. The primary challenge is in meeting the hands-on skills development requirements of craft training under these models.

While technology-based and accelerated models enhance or facilitate classroom delivery, hands-on skills development is still essential to the overall training needs of a craft worker. Hands-on skills development takes time, is difficult to simulate or accelerate, and must not be overlooked in developing a craft professional. Historically, government regulators have

been slow to adapt. The following sections provide an overview of the various types of training that are in use in the industry today.

Apprenticeship Training

Apprenticeship training is a combination of school and work under a formal contract between the apprentice and the sponsor, often referred to as an “indenture.” Some states have changed the name of the indenture to the “apprentice contract.” Formal apprenticeship programs are recognized and governed by either the state apprenticeship agency or the Federal Office of Apprenticeship in the U.S. Department of Labor. Apprenticeship training is long-term, lasting three to five years depending on the craft. Formal apprenticeship training is a time-honored, nationwide system that is considered the equivalent of a college degree in the construction industry. An apprenticeship completion certificate is valuable both to the completing apprentice and to the employer.

One advantage of operating a formal apprenticeship program for construction firms that do government work is that state and federal governments recognize it for purposes of the Davis-Bacon Act and other “prevailing wage” legislation. Prevailing wage and Davis-Bacon laws require that a specific skilled worker wage rate and benefits package be paid to anyone working on a project where state or federal money is involved. Only registered apprentices can be paid less than the full skilled worker rate, in accordance with the percentages outlined in the apprentice wage schedule. This can offer the contractor who trains registered apprentices a significant advantage in bidding work. Non-apprentice trainees or helpers must be paid the full skilled craft rate determined by the state or federal agency. In addition to defining the wage rates, the apprenticeship contract defines the term of the apprenticeship program, including required hours of related instruction and specific work processes to be learned in OJT. Industry experts are available to assist programs in developing their specific work processes.

Since apprenticeship is a formal training program, several requirements are imposed, such as stringent recordkeeping, maintaining a specified ratio

of apprentices to skilled workers, and compliance with equal opportunity selection procedures specified in state and federal regulations. These requirements, often considered a disadvantage, help ensure a level of quality that may not be achieved through other types of training.

Apprenticeship training combines classroom instruction and work experiences to produce a skilled craft with broad-based knowledge. The school or classroom portion of the training is often called “related instruction.” Typically, related instruction is approximately 10 percent of an apprenticeship program, at a minimum. The research team survey showed this to be higher in many instances. OJT or work experience accounts for the remaining 90 percent.

Craft Training

Many organizations operate long-term craft training programs in addition to formal apprenticeship training. Depending on the craft, training programs can run from one to five years in length, which is equivalent to an approved apprenticeship. In some states and programs, registered apprentices and craft trainees can be in the same class at the same time, although some state laws prohibit mixing types of students. Many organizations operate craft training programs instead of formal apprenticeship training because they perform little or no public work affected by the Davis-Bacon Act or other prevailing wage requirements.

Until the creation of the NCCER, the construction industry as a whole did not recognize craft training outside of apprenticeship as being of the same quality as apprenticeship training. Today both the construction industry and government entities alike are recognizing NCCER Accredited Training Sponsors as providing quality training. In 2004, the Texas Skill Standards Board and owner firms (e.g., ExxonMobil) formally recognized NCCER Accredited Training Programs as equivalent to approved apprenticeship programs.

Most craft training programs cover core skills, such as basic math, blueprints, tools, safety, and communication. The research team survey asked industry experts to rank eight core topics regarding their importance

in the training of new construction craft workers. The resulting priorities are shown below:

1. Basic Safety
2. Introduction to Power Tools
3. Construction Math
4. Basic Employability Skills
5. Introduction to Hand Tools
6. Communication Skills
7. Basic Rigging
8. Introduction to Blueprints

Task Training

Task training is typically classified as short-term training that takes less than one year to complete. Short-term training, by definition, is not apprenticeship training. These programs are often known as task specific, skill upgrade training, or continuing education. Many contractors use task training to prepare craft workers for specific tasks. Skill upgrade training is typically used to help experienced craft prepare for licensing or certification exams.

Many contractors also will use task training to help create a multi-skilled worker. Vendor-based and specialized technical training are typically offered as task training.

With the introduction of NCCER's National Craft Assessment and Certification Program, many organizations use the assessments to help them determine "targeted," task-specific training needs and then offer specific module-based task training.

Financing Training

One of the greatest obstacles to implementing a quality training program for any organization is lack of funding. Traditional funding methods include employer-paid training allocated from general overhead accounts, tuition-based funding, cents-per-worker hour assessments, work force investment act funds, and local, state, and federal grants.

Most training programs are funded either by charging students tuition or by collecting contributions from employers on the basis of hours worked. A few programs may be funded by a combination of both. Most training programs in the unionized section of the industry are

funded through cents-per-hour contributions established in a collective bargaining agreement.

Suppliers are often overlooked resources in developing and running a training program. They frequently have personnel who can offer specific training, and can provide needed tools, equipment, materials, and other resources at a reduced price or even as a contribution to the training program.

Roles of Owners in Requiring and Financing Training

Traditionally, cents-per-hour funding in the open shop is based on a job costing model. Typically costs associated with the construction or maintenance of a facility are passed on from the sub-contractor to the prime or general contractor and ultimately the client or owner. Training costs should be no different. The costs borne by contractors to train employees should be passed on to owner clients, whether training is conducted in-house or through a third-party provider.

The Business Roundtable report, *Confronting the Skilled Construction Work Force Shortage—A Blueprint for the Future*, recommended in 1997 that “Owners should only do business with contractors who invest in training and maintain the skills of their work force.” In 2004, CURT made a stronger and more specific recommendation to owners: “As they did with safety, owners should require contractors to invest in training and maintain the skills of their work force as a condition of employment.”

Today it is virtually impossible for a contractor to do business with an owner without a proven record of safety performance. Like safety, significant improvements in craft work force training will only occur when owners broadly support and fund such efforts. Cents-per-hour funding through collective bargaining agreements has been the backbone of union training for many years. Through owner-supported training in a number of industrial communities and NCCER’s National Training Services Agreement, cents-per-hour funding for open shop training has become a viable funding mechanism. These programs provide verifiable processes for managing cents-per-hour funds, but only the most progressive contractors and owners participate.

Summary of the Business Case for Training

A preponderance of evidence demonstrates that training pays off, as indicated not only in the analysis from this study but others as well. The research team analyzed the benefits from craft training from three perspectives: employer, project, and craft worker. Craft training can benefit both the individual worker and the employer.

Employer/Project Level

The research team administrated a survey to collect information about training benefits at the employer/project level. The survey asked respondents to estimate the impact of investing one percent of the total project budget for wages/labor on training under two types of scenarios (the average for U.S. corporations in general is 1.25 percent):

- On a typical 24-month capital project
- On a typical ongoing maintenance/small capital contract

Specifically requested were the estimated effects on productivity, turnover, absenteeism, injuries, and rework. The results of the survey are shown in Table 2, based on responses in the 93 completed surveys. The respondents estimated improvements in all categories.

The survey also revealed that on average, 47 percent of the craft workers who received training on one project would be rehired on another project by the same company. Once a company invests in craft workers' skills and capabilities, it is likely to retain them. Currently, hiring costs on many projects approach \$2,400 per person, so training can increase the craft-rehiring rate and cut hiring costs significantly for construction companies.

Table 2. Summary of Expected Training Benefits Identified through CII RT 231 Survey

Expected Training Benefit	Capital Project			Maintenance Project		
	Average	95% Confidence Interval		Average	95% Confidence Interval	
		Lower Bound	Upper Bound		Lower Bound	Upper Bound
Productivity Improvement	11%	6.8%	14%	10%	7.7%	12%
Turnover Decrease	14%	10%	18%	14%	8.0%	19%
Absenteeism Decrease	15%	10%	19%	15%	8.3%	21%
Injury Decrease	26%	18%	33%	27%	18%	37%
Rework Decrease	23%	17%	29%	26%	18%	35%

The research team also analyzed data from case studies of craft training in two CII member companies. Both are heavy industrial construction firms engaged in work throughout North America. Company A monitored the absenteeism and turnover rates on four projects over a 15-month period among three groups of craft workers: individuals who had completed their respective training program and obtained certification, individuals engaged in training but who had not yet achieved certification, and individuals who had not engaged in craft training. Based on Company A's data, the study found that craft training had a rather immediate impact on both craft turnover and absenteeism (Table 3).

Table 3. Company A Turnover and Absenteeism Rates for Workers

	Workers with No Training	Workers Receiving Training	Company-Certified Workers
Voluntary Turnover Rate	6.5%	0.6%	3.4%
Absenteeism Rate	7.3%	2.5%	0.3%

Source: Internal CII member company data

Company B was engaged in a construction maintenance project in which the owner actively promoted certification of all craft workers employed on the project. Craft workers were required by the owner to be certified in accordance with the NCCER “certified-plus” designation, which included passing both written and performance assessments. Over a 12-month time period on one construction maintenance project, Company B measured the percentage of its craft workers that had achieved certified plus and the corresponding productivity performance factor. In this case, the productivity performance factor was defined as the expected productivity divided by the actual productivity; thus, a productivity performance factor of less than one indicates better than expected productivity performance. Although the case study involved a limited sample size, a statistically significant relationship was found as shown in Figure 1, indicating that as the percentage of certified plus in the project’s craft workers increased, the project’s productivity performance factor improved.

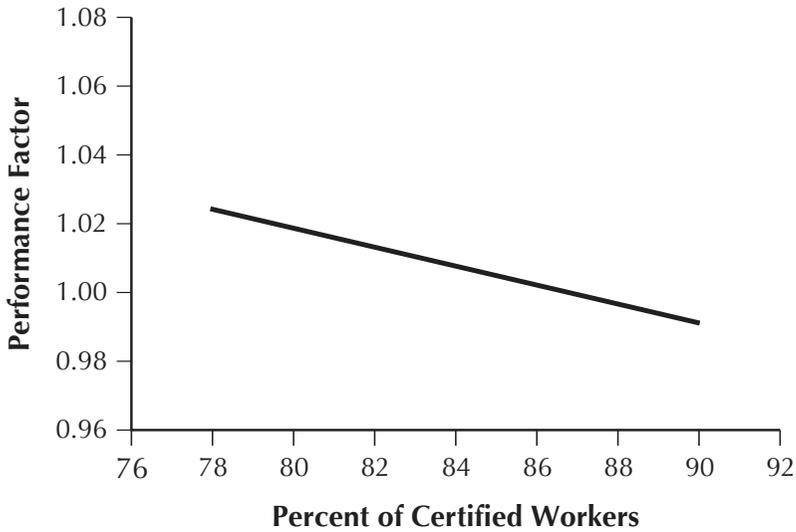


Figure 1. Company B Productivity Performance Factor versus Percentage of Certified-Plus Craft Workers

The Business Case for Craft Training: A Project and Company Perspective

To formulate the business case for craft training from a project and company perspective, the research team utilized a benefit-cost (B/C) ratio analysis. The B/C ratio is greater than or equal to one when an investment is economically acceptable and less than one when an investment is not economically acceptable.

The study assumed a hypothetical craft training program was implemented on a typical industrial construction project based on the characteristics of the CII Model Plant project. By applying the estimated training benefits based on the experience of industry experts (Table 2) and actual project data (Table 3 and Figure 1), the research team established the benefit-cost ratio estimates for craft training.

The Model Plant was initially developed by CII in 1985 to represent a generic petrochemical facility and has been modified through a series of related efforts since then. Its mock scope of work includes a full range of construction activities including civil, structural, electrical, mechanical, and architectural finishes. Since its development, the Model Plant data have been used to benchmark industry productivity, analyze the impact of multifunctional equipment, examine the schedule and manning impacts of utilizing a multi-skilled work force, and examine the impact of alternative training strategies for a project's work force. Since its conception, a number of significant revisions have been made. For example, the research team adjusted the original cost estimates for inflation. The 2006 costs for the CII Model Plant are estimated to range from \$134.6 to \$152.5 million with a construction duration of 78 weeks.

The Project's Baseline Cost

The research team first determined the baseline cost of the CII Model Plant when no training program was implemented. It was anticipated that the craft training program would impact the following costs: labor productivity; turnover; absenteeism; injury rates, and rework.

These costs were determined by using past CII Model Plant research as well as other construction industry data and previous research findings. Table 4 details how the baseline cost rate for each cost component was derived.

Table 4. CII Model Plant Baseline Cost Rates

Cost Component	Baseline Rate	Source	Unit Cost Rate	Source
Labor	527,457 work-hours	CII Model Plant Research, 1986	Varied by different trade and included fringes and worker's compensation insurance	RS Means, 2006
Turnover	15.53% of total project work force	RT 231 Survey	\$2,000 per hire	CII member company
Absenteeism	7.20% of daily work force	RT 231 Survey	\$110 per absence	Pappas, 2004
Injury	6.4 per 100 full-time workers per year	U.S. Bureau of Labor Statistics, 2004	Varied by different types of incidents	CII Research "Indirect Cost of Construction Accident"
Rework	—	—	4.4% of Labor Cost	CII Research, "An Investigation of Field Rework in Industrial Construction"

Given these rates, the estimated total baseline costs for the CII Model Plant are shown in Table 5.

Table 5. Baseline Cost Summary (2006\$)

Cost	Amount (\$)	Percent of Total
Labor Cost	\$23,029,633	92.7%
Turnover Cost	\$231,458	0.9%
Absenteeism Cost	\$514,930	2.0%
Injury Cost	\$262,100	1.1%
Rework Cost	\$807,030	3.3%
Total	\$24,845,150	

B/C Ratio of Craft Training Using Survey Data

The research team determined the cost savings after implementing craft training by applying the estimated benefits of craft training on productivity, turnover, absenteeism, injury, and rework listed in Table 2. The team also examined the B/C ratio based on the 95 percent confidence interval of the survey data for statistical validity. Assuming a single project training estimate, the expected cost savings and B/C ratios are listed in Table 6.

The craft workers' duration on the project is a critical element of the B/C estimates and was examined in further estimates. Increasing the craft workers' average duration on the project increased the B/C estimates (Figure 2). The research did assume that increasing the craft workers' duration time on the job would decrease the total number of workers hired by the project. As a result, the estimated turnover and injury baseline costs decreased along with the estimated benefits. In addition, the increases in the craft workers' time on the job significantly improve the estimated productivity and reduction in rework, since the increased exposure to the project's training increased their skill level.

Table 6. B/C Ratios under Model Plant Training Estimate (2006\$)

	Single Project Training Model		
	Average	95% Confidence Interval	
		Lower Bound	Upper Bound
Estimated Productivity Improvement	\$322,257	\$207,564	\$436,951
Estimated Turnover Reduction	\$32,150	\$23,790	\$40,509
Estimated Absenteeism Reduction	\$74,871	\$51,592	\$98,150
Estimated Injury Reduction	\$66,940	\$47,452	\$86,428
Estimated Rework Reduction	\$25,774	\$18,876	\$31,933
Total Cost Saving	\$521,992	\$349,252	\$693,938
Training Cost (1% Labor Cost)	\$230,296	\$230,296	\$230,296
Benefit Cost (B/C) Ratio	2.3	1.5	3.0

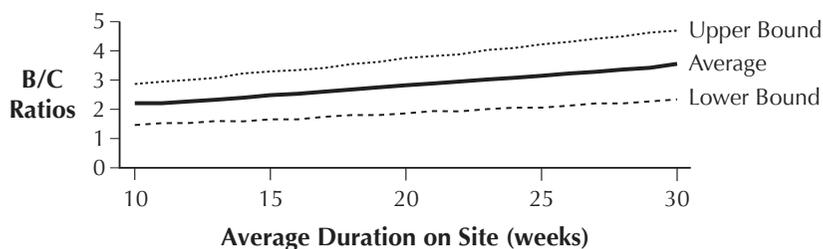


Figure 2. Changes of B/C Ratios with Average Duration on Site

B/C Ratio of Craft Training Using Company and Project Data

Based on already presented company data (Table 3), B/C ratios were also estimated using the CII Model Plant. The benefits were restricted to improved turnover, absenteeism, and productivity since these could be statistically verified based on case study data. The research team still assumed it took 35 weeks to achieve half of the improvement when

considering the learning curve effects. The B/C ratios were estimated based on different percentages of craft workers completing training to certified-plus levels. Finally, the study estimated that the training cost includes \$0.10 per worker-hour for basic on-site training, which is based on the rates of funding used by Companies A and B, and the CII Model Plant paid all the costs for advanced off-site certification training, which includes:

- Employer costs: \$0.15 per worker-hour
- Individual worker tuition cost: \$75 per quarter (10 weeks)

Assuming the training program is implemented in the CII Model Plant project, the expected cost savings and benefit-cost ratios are listed in Table 7.

Table 7. B/C Ratios Using Consolidated Data from Companies A & B for the CII Model Plant Estimate (2006\$)

	100% Certified- Plus	80% Certified- Plus	50% Certified- Plus	30% Certified- Plus
Estimated Productivity Improvement	\$664,364	\$531,491	\$332,182	\$211,061
Estimated Turnover Reduction	\$5,749	\$4,600	\$2,875	\$1,725
Estimated Absenteeism Reduction	\$25,185	\$20,148	\$12,592	\$7,555
Total Benefits (\$)	\$695,299	\$556,239	\$347,649	\$220,341
Training Cost (\$)	\$235,239	\$214,962	\$184,546	\$164,269
Benefit-Cost Ratio	3.0	2.6	1.9	1.3

The research team found that the longer craft workers are engaged in projects, the higher probability of greater B/C ratios since the training benefits increase with the increased craft worker duration on the project. By contrast, under the original CII Model Plant, craft workers left the project earlier and achieved only a small proportion of their potential improvement from craft training.

The above B/C estimates used a number of assumptions for the analyses. Although these assumptions are detailed in CII Research Report 231-11, the reader should understand that the above analyses are based on the accuracy of the research team's survey as well as data identified from two CII construction firms. Next, the estimates assume that the skill level of all craft workers begins at the same starting point, which is a significant simplification compared to the reality on most projects. Furthermore, a number of the baseline costs are based on previous research efforts and industry data. Actual baseline costs will likely vary by company. Finally, these estimates assume that no outside funding sources are used to pay for the cost of training. To the extent that governmental sources through scholarship and grants can help bear some of the costs in addition to the craft workers bearing some of the costs themselves, the B/C estimates would increase.

Although difficult to model, the research found evidence that craft workers employed in a "community" where craft training is prevalent will significantly improve their performance compared to craft workers engaged in a single project training effort. Under this scenario, craft workers may receive training from their former employers or from a community training organization. Since the craft workers are assumed to work and receive training continuously in a "community," they can achieve their maximum performance improvement and maximize their benefits on the community of projects. This scenario would be typical of a union training environment, although it could also be achieved in an open-shop environment.

Other research has found positive returns on training as well. As shown in Table 8, the estimated B/C ratio to craft training has ranged from 1.38:1 to 7:1. More details about the studies included in Table 8 are discussed in the research report. Considering the positive returns on training identified by the research team and other research efforts, the business case for craft training is significantly strong.

Table 8. B/C of Craft Training: What Other Efforts Have Found

Study	B/C Ratio
"Return on Apprenticeship Training Investment" by the Canadian Apprenticeship Forum, 2006.	1.38:1
"An Assessment of Implementation Requirements for the Tier II Construction Work force Strategy" Dissertation by Mike Pappas, The University of Texas at Austin, 2003.	2.8:1 – 3.1:1
"How Does Training Pay Off?" by Dr. Robert F. Cox and Dr. R. Raymond Issa, University of Florida, 2003.	1.9:1 – 7:1
"The Tier I Work Force Management Strategy: Concept and Application" Dissertation by Stefanie Brandenburg, University of Texas at Austin, 2004.	2.7:1

Business Case for Craft Training: A Craft Worker’s Perspective

As mentioned, the most significant barrier in conducting a formal craft training program is the lack of new craft workers entering into the program. An attractive business case is needed for the craft workers in order for training to be effective. Utilizing existing data sources, the research team identified a number of benefits.

Increased Pay and Annual Income

- Craft workers in a formal training program that involves formal craft certification levels experience significantly greater wage progressions than other craft workers. For example, across all construction craft workers, a recent CII analysis showed that every 100 hours of training is associated with an increase of 10 cents in the hourly wage of craft workers. Electricians had the highest payoff, with an increase of one dollar in their hourly

wage associated with each 100 hours of training. On the other hand, in areas where the worker may become “certified-plus” in accordance to the NCCER certification standards and be recognized for their certification by their employers, a craft worker can receive an additional \$2.00 per hour wage increase. Wage progressions among union apprentices to journeymen are even greater.

Facilitated Career Development

The research team found evidence that formal craft training will improve craft workers’ career satisfaction and improves their skill and knowledge in comparison to craft workers that are not involved in a formal training program.

Increased Career Satisfaction

- Analysis of data from the CII Work Force View of Construction Productivity Research Team revealed significant correlation between a craft worker’s pride in his/her job and the availability of additional training and certification on the project.
- An increase in total training hours is positively related to increased career satisfaction. For example, according to recent CII data, the average formal training hours of those who indicated they were satisfied with their job in construction were 1.8 times higher than the number of hours of those who were not satisfied with their job.

Increased Skill and Knowledge

- According to data from the National Craft Assessment and Certification Program (NCACP), craft workers receiving formal training had higher passing rates on written tests in the NCACP than craft workers with no formal training.
- Most workers sense that a lack of training adversely impacts their career growth. They are attracted to training because it provides hope for career progression.
- Workers gravitate to companies that offer training.

Increased Social Status

- Most people aspire to a higher social status. Unfortunately, many young individuals do not view construction as a path to higher status among their peers; nevertheless, there is a clear relationship between pay and social status. Therefore increasing a craftworker's wages through training should have a positive impact on the individual's social status.

Craft training benefits for individual workers are summarized in Table 9.

Table 9. Summary of Craft Training Benefits for Individual Workers

Craft Training Benefits	Details	Source
Increased Pay and Annual Income	<ul style="list-style-type: none"> • A craftworker achieving NCCER written certification typically receives an additional \$1/hr wage and additional \$1/hr for performance certification. Greater hourly wage progressions are experienced in union apprenticeship programs. • Every 100 hours of training can increase a craftworker's hourly wage by 10 cents. 	Case Studies and CII RT182
Facilitated Career Development	<ul style="list-style-type: none"> • Increased career satisfaction • Increased craft skill and knowledge • Workers are attracted to training because it provides hope for career progression. • Workers gravitate to companies that train. 	Case Studies, CII RT215, CII RT182, and NCACP Data
Increased Social Status	<ul style="list-style-type: none"> • Training can increase wages, which in turn raises social status. 	Case Studies

Every generation of workers has a different set of values. While pay manages to rise to the top of that set for most generations, its importance and the rank of the remaining values fluctuate. Workers get older, less geographically mobile, more skilled in IT, and more concerned about work-life balance. A business case that encourages such a worker to seek training and enter into the construction industry must present a complete employment value proposition. Its elements must include:

- Pay
- Social status
- Benefits
- Work environment
- Career path

In a formal craft apprenticeship program, the benefits of training in terms of pay are obvious. The craft worker moves from a typical rate of 50 percent of a journeyman's wage in the first year of training to 100 percent after final certification. Studies show that in locations where union wage rates prevail, this can provide a craft worker with an annual income approaching or exceeding that of the average college graduate. However, where open-shop wages prevail, the pay argument for craft training is more problematic. Statistically, 100 formal craft training hours might result in an average of a \$0.08 per hour wage increase for some trades to as much as an average \$1.00 per hour wage increase for the electrical trades. Depending on the cost to the craft worker, the payback period in the first case might be 10 to 30 years and the rate of return might be only one to two percent, whereas in the second case the payback period might be less than a year and the rate of return could be as much as 50 percent. (It is likely that the average young individual's planning horizon for making economic decisions is no more than a few years.) In areas where the craft worker may become "certified-plus" and receive a \$2.00 per hour wage increase, the incentive is extremely convincing, if honored by subsequent employers. Even if not, it may still be worth the effort to the craft worker to get upgrade training, but the case to the craft worker is less convincing. Again, it is clear that a coordinated approach on the part of the employers results in a win-win situation for all. When employers break ranks, incentives decline for them and for the craft workers.

Evidence exists that benefits do not play a strong role in attracting young craft workers, and even as construction craft workers age, they tend to rely on permanently employed spouses to provide health insurance and pension benefits. A high per diem, however, will attract construction.

Most craft workers, sensing that lack of training will negatively impact their career growth, are attracted to training because it provides hope for a career path and progression. Survey results from an earlier CII study as well as common sense support this assertion. Human resource managers know that craft workers gravitate to companies that train.

Status may become an attractor again if craft workers begin to be paid more and live with the same quality as the university-educated professional and if young people translate the current fad for home-improvement shows to a personal vision of a career path. Until then, however, there is not a strong business case to be made for construction craft training based on social status.

Construction can be a negative and hostile work environment for women and to some extent for minorities. This is a major stumbling block to making a business case for training to over half of the potential work force. The issue must be addressed. It is also still a relatively unsafe work environment compared to other industries. Ironically, this helps the business case for safety and other types of training.

Business Case Conclusion

The results indicate a high return on training if craft workers are given the opportunity not only to become engaged in craft training but to progress through a formal craft training program. The longer that craft workers are trained, the greater the benefits accrue to the company, project, and craft worker. While the estimates indicate that larger projects have the potential to experience greater B/C ratios through increased craft worker duration on their project and hence longer periods of training, smaller projects can also experience significant B/C ratios. Companies primarily engaged in small projects can easily increase their B/C ratio if a core work force is employed from project to project and if this work force is continually trained.

A community approach to training the craft work force through partnership between industrial owners and contractors and their organizations, rather than relying on individual company training efforts, can also produce significant benefits to community stakeholders. Community training efforts are common in the union sector, but exist in the open-shop sector too. For example, Houston area companies associated with the Houston Business Roundtable (HBR) and the Associated Builders and Contractors (ABC) have collaborated in their training efforts by supporting a community approach to craft work force development and recruitment through the Construction and Maintenance Education Foundation (CMEF).

Conclusions and Recommendations

This research was funded by CII, NCCER, and CURT. Its primary objective was to quantify the business case for craft training. Although craft training exists, more is needed. Undoubtedly, what prevents many organizations from investing in training is the lack of a clear, well-defined business case to justify their effort. As described in this report, most of the surveyed companies conducting training are not measuring the effectiveness of their training efforts. Other conclusions can be made about current construction craft training efforts in the United States and Canada:

- **Significant benefits to craft training can be achieved through a sufficient sole project effort.** Survey and industry data indicate that a positive B/C ratio can range from 1.3:1 to 3:1. The benefits will increase with the craft workers' duration in a training program.
- **Offering meaningful training can help attract and retain craft workers to one's company and to the industry.** In addition to the tangible benefits of increasing a craft worker's salary, training also improves a craft worker's job satisfaction.
- **Craft training is where safety was years ago.** Decades ago, owners became more involved in construction safety, and the industrial construction industry witnessed significant improvement. Likewise, evidence shows similar improvement in craft training is possible when the owner becomes involved and mandates that craft training and certification be provided.
- **Most companies do not measure the effectiveness of craft training, but it can be done.** Suggested metrics for training results include improvements in absenteeism, turnover, productivity, safety, and rework.
- **Owners are paying for training on union projects, but rarely pay for training on open shop projects.** On union projects, it is an accepted requirement that training/apprenticeship cents

per hour contributions are paid by owners and contractors. Although some formal training programs are funded through cents per hour contributions in the open shop sector, this is a relatively rare occurrence. Unfortunately, on many open shop projects where training/apprenticeship contributions are an option, owners question why they should be funding the training and why it should not simply be considered the contractor's responsibility to provide a qualified work force.

- **The benefits to training do not occur at once.** Some of the training payoffs occur immediately, such as improved safety, reduced absenteeism, and reduced turnover. Others will take more time to allow an increase in craft skill, such as increased productivity and reduced rework. While these benefits produce tangible results, perhaps the most important benefit is the development of skilled craft workers to meet future demands.

Craft training does exist in the United States and Canadian construction industry, but more is needed. Understanding the business case behind craft training should motivate industry leaders, business managers, plant managers, policy makers, and other decision makers to invest in craft training, not only for the sake of their company's profit margins but for the viability of the industry as well. To help increase craft training efforts, the research team recommends the following:

- Owners should require craft training and certification on larger projects.
- Owners who have plants in areas where industry is concentrated should require training on all construction and ongoing maintenance projects (e.g., U.S. Gulf Coast).
- Contractors should provide comprehensive employment packages that include competitive wage, training, and benefits.
- Contractors need to participate in an established, confidential database on training certifications (e.g., NCCER).
- Measuring the benefits of training should be common.
- Owners should mandate craft certification under common training standards.

Appendix:

Training Best Practices Checklists

The following training checklists serve several purposes, including for use as a:

- Basis for awards encouraging work force development (HBRT)
- Basis for pre-qualification and/or contract award (CURT)
- Basis for benchmarking and metrics programs for self-improvement (Tier I and Tier II metrics from UT Austin)
- Starting point for implementation of a program.

This appendix provides four checklists. The checklists outline the responsibilities of each stakeholder to help achieve an optimal learning environment for improved project performance. The practices they recommend are based on the work of the research team and on other research and experience.

The *Owner's Checklist* may be used as a basis for prequalification of contractors, for contractor work force development awards, or as a checklist for building or improving training efforts. The *Employer's Checklist* provides a list of practices that should help a contractor implement the most effective training program possible. The *Trainee's Checklist* provides pointers to help apprentices and other trainees make the most of their training experiences. The *Journeyman's Checklist* provides journeymen guidance in their mentoring and training role toward trainees and apprentices.

If 80 percent of these boxes are not checked after the exercise, the reader should re-evaluate craft training.

Owner's Checklist

This is a basis for pre-qualification of contractors, as criteria for contractor work force development awards, or as a checklist of issues to cover if directly engaged in construction or improving training efforts.

Do you?

- Provide support on all construction and maintenance projects
- Use craft training checklists to pre-qualify contractors
- Ensure that entry-level workers or apprentices are encouraged on your sites in order to offer access for new recruits to the industry
- Support image enhancement of craft workers and the construction industry
- Support recruiting from high school, community college, and technical institutes
- Advocate for government support of training
- Incorporate language in your contracts requiring training
- Require more than 80% craft skill certification on your projects

Employer's Checklist

This will help a contractor implement the most effective training program possible.

- Do you participate in workforce training? If yes, elaborate on cents-per-hour contribution, percent of workforce covered, and specific training programs. _____

- Do you have a written craft workforce-management program? If yes, elaborate on roles and responsibilities of those involved, and the procedures for evaluating how well the program works.

- Do you have formal classroom training? If yes, elaborate on facilities, hours, and percent of time per year spent in classroom training for apprentices and percent spent for upgrade training, etc. _____

- Do you provide or help facilitate financial support for craft workers for the hours they spend in formal classroom training?
- Do you have a written mentoring program for OJT, with training and incentives for mentors?
- Do you have a written structured jobsite (OJT) training program?
- Do you use training material developed by the industry in the union sector or by NCCER?
- Are elements of your training program approved by a professional organization or vendor? If yes, elaborate on the organizations and/or vendors.

- Do you assess new hires? If yes, elaborate on the methods and types of assessment. _____

- Do you utilize pay or bonus incentives for formally certified craft progression? If yes, elaborate on dollars per hour, or percent of journeyman level wages, or other schemes. _____

- Do you participate in record keeping for certifications of craft persons at a regional or national level beyond the boundaries or hiring databases of your own firm? If yes, in which programs do you participate? _____

- Do you offer access to craft supervisors for training in leadership, administrative, and site management skills? If yes, elaborate on your program. _____

- Do you publish and communicate to your craftworkers a clear career progression program?
- Do your workers have a good understanding of the career progression program?
- Do you have formal hiring and retention preferences for employees in craft training? If yes, how are they implemented?

- Is continued craft training required and supported for certified journeymen?

- Do you measure the benefits of your training? If so, what metrics do you use?
- Do you share your workforce development policies with your employees? If so, how? _____

Trainee's Checklist

This will help apprentices make the most of their learning experiences and define the responsibilities of the trainee in the training process. In some cases, the elements of this checklist can be used by employers to assess workers and to provide feedback to them. It may also be included in your employee handbook.

- Do I attend all formal training sessions?
- Do I follow the recommended training and certification schedule?
- Do I ask questions of journeymen I work with, especially when I don't understand something?
- Have I connected with my assigned mentor(s)?
- Do I listen to those who are trying to teach me?
- Do I handle failure in a constructive way?
- Am I a team player?
- Do I provide the best product and work in return for my wages?
- Do I keep my apprenticeship records up to date?
- Am I seeking opportunities to learn new things?
- Do I work safely?
- Am I satisfied with the work I am doing and do I keep a positive attitude?
- Am I creative and do I demonstrate initiative on my job site?
- Do I demonstrate respect for my co-workers?

Journeyman's Checklist

This will help journeymen make the most of the training and apprenticeship experiences and define the responsibilities of the journeyman as a mentor in the training process. In some cases, the checklist can be used by employers to assess journeymen and to provide feedback to them. It may also be included in the employee handbook.

- Do I work safely?
- Am I a positive role model for my apprentices?
- Do I share my knowledge and experience with apprentices?
- Do I demonstrate respect for my co-workers and site supervisory people?
- Do I provide constructive feedback to my apprentices?
- Am I patient with the apprentice when he/she makes mistakes?
- Do I show pride and passion for my trade?
- Do I encourage my apprentice to follow the recommended craft progression?
- Do I show the apprentice how to do a task, then allow the apprentice to do it while I watch carefully, and then do I provide constructive feedback?

Notes

Construction Industry Craft Training Research Team

Bruce Buffaloe, WorleyParsons

Richard Carter, Fluor Corporation, Co-Chair

Dan Christian, Victaulic, Co-Chair

William Fehling, Air Products and Chemicals

John B. Frame, Southern Company

* Robert W. Glover, The University of Texas at Austin

* Paul M. Goodrum, University of Kentucky

* Carl T. Haas, University of Waterloo

Robert C. Heath, Rohm and Haas

Robert Helper, Aker Kvaerner

Gary Hunter, Ontario Power Generation

Thomas M. James, Zachry Construction

Dickie Jones, Fluor Corporation

Al Mikolas, Baker Concrete Construction

Jack Prestwood, Tampa Electric Company

Randy Tomlinson, Dow Chemical

Shahram H. Vaziri, University of Waterloo

Yinggang Wang, University of Kentucky

Donald E. Whyte, National Center for Construction Education and
Research

* Principal authors

Editor: Rusty Haggard

The Construction Industry Institute®
The University of Texas at Austin
3925 W. Braker Lane (R4500)
Austin, Texas 78759-5316
(512) 232-3000
FAX (512) 499-8101

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